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# Quality Work of Life Analysis and its Influence on the Implementation of Patient Safety Goals in Hospitals in Makassar City

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## ABSTRACT

**Objective** - This research purpose was to analyse the influence quality of work life towards the organizational commitment, also the organizational commitment towards the implementation of patient safety goals in the hospital in Makassar.

**Design/methodology/approach** - This research was an analytical survey with cross-sectional approach. The data were analyzed using Spearman correlation test to see the correlation between variables. The sample used in this research was 541 nurses from three hospitals in Makassar City.

**Findings** - This study showed that the total score of nurses' quality of work life was correlated towards organizational commitment  $p=0.001$  with correlation coefficient 0.0428, and also between organizational commitment and the implementation of patient safety goals  $p=0.038$  with correlation coefficient 0.089. In conclusion, improvement in nurses' quality of work life will have a positive correlation towards organizational commitment. Then with good organizational commitment will have positive correlation towards the implementation of patient safety goals in hospital.

**Originality/value** - This study was conducted in three class B hospitals that have different characteristics related to the impact of quality of work life on the implementation of patient safety goals.

**Keywords:** *Quality of work life, organizational commitment, patient safety*

## INTRODUCTION

The National Health Insurance (NHI) is an Indonesian government program and stated in Law number 40 of 2004 about Social Security System (SSS). This program is a part of the implementation of Universal Health Coverage in Indonesia. The program aims to provide health care benefits and financial protection for its participants. Implementation of the program run by the Social Security Agency (SSA) for Health and this Agency cooperates with various health facilities, including hospitals. Hospitals that work with SSS must meet the quality standards of SSS or standards

of hospital accreditation. Therefore, health services to NHI participants need to pay attention to the quality of service, focusing on patients safety aspects, the effectiveness of every action, and the suitability of the care to patient's needs<sup>1</sup>.

Patient safety in hospital has become a serious global issue. Since the launch of the World Health Organization (WHO) patient safety program, currently about 140 countries struggling with unsafe service challenges<sup>2</sup>.

The realization of patient safety practices in hospitals, is strongly influenced by the organizational commitment and the role of human resources in providing services. Human resources are a significant factor to improve the quality of hospital services. Nurses are one type of human resources in health care systems around the world<sup>3</sup>. Health workers who work in hospitals are responsible to improve the quality of hospital services

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in patient safety risk management<sup>3</sup>. The measurement of organization's quality of work is done by assessing the result of team performance or the performance of the existing personnel within the organization. According to the Agency for Healthcare Research Quality, to develop patient safety, there must be a good work environment that enables the profession in the hospital to share information related to patient safety issues, then take corrective actions. Work environment condition is one of the factors that affect the safety<sup>4</sup>.

Another factor associated with the implementation of patient safety is organizational commitment. The low commitment of health workers could cause many losses to the organization. Organizational commitment is one of the working attitudes that has attracted the attention of scientists and practitioners in the field of Human Resource Management, because of its impact on the performance of employees and organizations<sup>5</sup>. Research conducted at Sanglah Hospital, Bali shows that nurses who commit less to work, potentially 25 times unable to properly implement patient safety<sup>6</sup>. Thus a lack of commitment can indicate the poor implementation of patient safety in hospital. Hospital patient safety is an applied system to prevent injuries from medical treatment, and treatment errors through a risk assessment system, identification and management of risk factors, incident reporting and analysis, learning ability and follow-up of incidents and implementation of solutions to minimize incidence of risk.<sup>7,8</sup>

Hospitals are labor-intensive, capital-intensive and technology-intensive institutions that require expertises and high skills in maintaining patient safety. Patient safety in hospitals is a serious global issue, and an approach is needed to improve the quality of patient care and safety. This study aims to analyze the effect of quality of work life on organizational commitment and the influence of organizational commitment to the implementation of patient safety goals in three hospitals in Makassar.

## MATERIALS AND METHOD

### Study Design

This research is an analytical survey with cross sectional approach. Data were analyzed using Spearman correlation test to see the effect among variables that is quality of work life, organizational commitment and implementation of patient safety goals at three hospitals

in Makassar city.

### Sampling

The population of this research are nurses at three hospitals in Makassar City namely Hasanuddin University Hospital, Makassar District General Hospital and Stella Maris Hospital. Sampling technique was purposive sampling and as many as 541 nurses were chosen as sample.

### Measurements

The research instrument is a questionnaire adopted from Brooks and Anderson (2005) which assesses the quality of work life of the nurses in four dimensions: work life, work design, work context and work world.

## RESULTS

This study aims to determine the effect of quality of work life on organizational commitment and the influence of organizational commitment to the implementation of patient safety goals in three hospitals in Makassar. For Characteristics of respondents by age, most respondents (64.9%) or as many as 351 are in the age range 20-30 years, and the least are in the age range above 50 years as many as 6 respondents (1.1%). This data shows that most of the respondents are 20-30 years old. Based on the length of work in hospital, number of respondents who have been working less than 5 years are 331 respondents (61.2%), while respondents who have been working over 5 years are 210 respondents (38.8%). This indicates that most of the respondents have been working in hospital less than 5 years. As for gender, male respondents were 89 respondents (16.5%), while female respondents were 452 respondents (83.5%). This shows that most of the respondents are females. Viewed from marital status, most of the respondents or as many as 331 respondents (61.2%) have been married, while the least number are widow / widower is 7 respondents (1.3%). This indicates that most of the respondents are married.

On the status of employment, as many as 181 respondents (33.5%) are public servant, while respondents who were in contract status as much as 360 respondents (66.5%). This shows that most of the respondents are contract employees. For the level of education, most of the respondents are graduates of professions / ners amounted to 199 respondents (36.8%), while the least is graduated from Master of Nursing

amounted to 5 respondents (0.9%). This shows that most of the respondents are graduated of profession / ners. In terms of monthly income, most of respondents or as many as 360 respondents (66.5%) are in the income range Rp. 1.500.000-2.500.000, while the least in the income range > 5,000,000 as many as 8 respondents (1.5%). This shows that most of the respondents have income on the range of Rp. 1.500.000-2.500.000.

The patients safety in the hospital is strongly

influenced by the quality of work life, organizational commitment and patient safety implementation in the hospital. Quality of work includes the dimensions of work life, work design, work context and the world of work. While the organizational commitment consists of three dimensions: affective commitment, sustained commitment and normative commitment.

The results of the analysis of research variables can be seen in the following table:

**Table 1. Distribution of Quality Dimensions of Quality of Work Life**

Dimension	n	Min	Max	Mean±SD
Working life	541	11	24	18.36±2.12
Work Design	541	15	30	22.19±1.96
Work Context	541	43	72	54.43±5.24
Work World	541	9	20	13.76±1.67
<b>Total</b>	<b>541</b>	<b>91</b>	<b>139</b>	<b>108.76±8.31</b>

Source: Primary Data

Based on Table 1, it is known that the lowest minimum and maximum value and the lowest deviation standard on the distribution of the dimensions of the QWL is on the dimension of Work World, while the highest is on the work context.

**Table 2. Distribution of the Dimension of Organizational Commitment**

Dimension	N	Min	Max	Mean±SD
Affective Commitment	541	17	30	22.73±2.10
Continuous Commitment	541	10	29	21.73±2.50
Normative Commitment	541	12	25	19.05±1.89
<b>Total</b>	<b>541</b>	<b>41</b>	<b>80</b>	<b>63.47±5.08</b>

Data in table 2 shows that the lowest minimum value on the dimension of organizational commitment is on the sustainable commitment. On the maximum value and the lowest deviation standard is the normative commitment while the lowest is affective commitment.

The minimum value of the implementation variable of the patients safety goals is 17, the maximum value is 32 and the mean ± standard deviation of  $17.39 \pm 1.43$ . It is also known that the standard deviation measurement shows the average amount of data variability of the results of this study that is equal to 1.43.

**Table 3. Correlation Analysis of Work Quality Dimension of Work Life with Organizational Commitment**

Variable/Dimension	Organizational Commitment	Working Life	Work Design	Work Context	Work World
Organizational Commitment	1				
Working Life	.212**	1			
Work Design	.301**	.317**	1		
Work Context	.342**	.335**	.354**	1	
Work World	.333**	.191**	.231**	.555**	1

\*\*p<0.01 (Source: Primary Data)

It can be seen from table 3, all dimensions contained in the variable quality of work life has a correlation with organizational commitment variables. On the dimensions of working life is known that the coefficient value of correlation is 0.212 so it has a very weak relationship. While on the dimension of work design, work context and Work World, the coefficient value of correlation respectively for 0.301, 0.342 and 0.333 so those dimension have strong relationships.

**Table 4. Correlation Analysis for Dimension of Commitment with the Implementation of Patient Safety Goals**

Variable	Implementation of Patient safety Goals	Affective Commitment	Continuous Commitment	Normative Commitment
Implementation of Patient Safety Goals	1			
Affective Commitment	.013	1		
Continuous Commitment	.158**	.358**	1	
Normative Commitment	.025	.425**	.338**	1

\*\*p<0.01

Table 4 shows that Continuous commitment is the only variable which has correlation with the implementation of patient safety goals. And only the dimension of continuous commitment that has a correlation with the implementation of the patients safety goals with a correlation-coefficient value of 0.158. It means that although there is a relationship between continuous commitment and the implementation of the patient safety goals, The relationship was very weak.

**Table 5. Correlation Analysis of Quality of Work Life with Organizational Commitment**

Variable	Quality of Work Life	Organizational Commitment
Quality of Work life	1	.0428*
Organizational Commitment	.0428*	1

It is found that the Spearman's correlation coefficient is .0428. It means that the correlation between quality of work life with organizational commitment is strong enough.



**Table 6. Correlation Analysis of Organizational Commitment with The Implementation of Patient safety Goals**

Variable	Implementation of Patient safety Goals	Organizational Commitment
Implementation	1	.089*
Organizational Commitment	.089*	1

The Spearman's correlation coefficient between Implementation and organizational commitment is .089. Which means the correlation is very weak.

## DISCUSSION

The quality of work life in this study is analysed from 4 dimensions, namely: 1) work life, 2) Work Design, 3) work context and 4) the world Brooks and Anderson, 2014. The result shows that in general, the quality of nurses' work life is good. However, on work design dimension, the nurses felt they did not have a strong autonomy to make decisions regarding on the delivery of services to patients. In terms of work context and the world of work was also found that nurses could not find work in hospitals with the same salary and benefits. This means that although there are still problems in some dimensions of quality of work life, the nurses do not have much choices.

Robbins and Judge (2011) classify organizational commitments into three dimensions: affective commitment, ongoing commitment, and normative commitment. The results show that sustainable commitment is still low, in particular the commitment involvement based on the costs incurred due to workers leaving the organization.

This can be seen from respondents' answers that they could easily leave the hospital, they were not worried about the possible consequences they could suffer if they quit working at the hospital. The fact gives an indication that the nurses' sustainable commitment is still low, and so is the normative commitment.

The results shows that there is a correlation between quality of work life with organizational commitment ( $p = 0.001$ ) with correlation coefficient 0.0428, and between organizational commitment to the implementation of patient safety goals ( $p = 0.038$ ) with correlation coefficient 0.089. This is in line with the research result conducted by Nousin Kamali (2014) indicating a

positive and significant relationship between work life with organizational commitment at the Provincial Office of Guilan Province, Iran.

Khan<sup>13</sup> stated that organizational commitment can be the result of a good quality of work life. Therefore, by applying the quality of effective working life within an organization will build on the organization's organizational commitment. A company or organization should pay attention to the quality of employee work life to improve employee performance.

High quality of work life, will create high organizational commitment. Employees with a high commitment will have a positive impact on the organization. For instance, it could improve the performance of the hospital in the implementation of patient safety goals in the hospital.

The result showed a positive correlation between quality of work life and commitment. The emphasis of quality work can contribute not only in building an effective organization, but also in facilitating training and human resource development activities<sup>9</sup>. Although the patient safety training will certainly contribute to the implementation of patient safety, this study also found that only 62.3% of employees who have attended patient safety training.

Good performance is a step towards the achievement of the organizational goals. Therefore, more efforts are needed to improve organizational performance. Negin, Omid and Ahmad, asserted that organizational commitment can improve employee performance and improve the overall organizational competitiveness. This is in line with Atmojo who examined employees of electricity in Tobing companies who examined plantation company employees, indicating a positive

and significant influence between organizational commitment with employee performance. Employee performance is a recording of the work obtained by certain employees through activities within a certain time frame. According to performance indicators have seven points, namely quality of work, quantity of work, knowledge, job adjustment, reliability, employment relationship and also including work safety concerning how employee attention to safety<sup>10-12</sup>.

Aketch et al<sup>12</sup> states that the concept of quality of work life provides a positive emotional reaction to the behavior of individuals in doing a job. A good quality of work life can improve the performance of an organization, specifically the performance of nurses in performing nursing care in the hospital. Therefore, quality of work life is a major issue that deserves organizational attention. This refers to the idea that the quality of work life is considered capable of increasing the participation and contribution of members or employees to the organization<sup>13-15</sup>.

## CONCLUSION

The results of this study indicate that there is a strong relationship between the quality of work life with organizational commitment but found a weak relationship between organizational commitment with the implementation of patient safety goals.

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**Conflict of Interest :** None

## REFERENCES

1. President Regulation of Republic Indonesia No. 12 Year 2013 About Health Insurance. 2013.
2. WHO. 10 Fact on Patient Safety. Geneva; 2014.
3. Mohamed, Mohamad M, Sultan U, Abidin Z, Quality MS, View L. Measuring The Quality of Nursing Work. In: 2nd International Conference on Management. 2016. p. 1018–28.
4. WHO. Human Factors in Patient Safety Review of Topics and Tools. Geneva; 2009.
5. Robbins SP. Organizational Behavior: Concept, Controversies, Applications. 8th ed. Prentice Hall; 1998.
6. Krisnawati KMS. The Relationship of Motivation and Work Commitment of The Nurse with The Implementation of Patient Safety in Intensive Care of RSUP Sa. Universitas Udayana; 2016.
7. Cascio W. Managing Human Resources, Productivity, Quality of Work Life Profits. Eight Edit. Mc. Graw Hill International Edition; 2010.
8. Depkes. National Guidelines of Patient Safety in Hospital. Jakarta: Health Department of Republic Indonesia; 2006.
9. Taher F. Variations of quality of work life of academic professionals in. 2013;
10. Atmojo M. The Influence of Transformational Leadership on Job Satisfaction, Organizational Commitment, and Employee Performance. International Journal of Business Studies. 2012;5(2).
11. Sukri Palutturi, Andi Zulkifli, Aminuddin Syam, Stang, Muliana, Alias, & Hamzah . (2017). The Key Challenges and Recommendations for Healthy Cities Implementation of North Kolaka, Indonesia. Indian Journal of Public Health Research & Development, 8(2).
12. Rosmala Nur, Nikmah Utami Dewi, Khairunnisa and Anwar Mallongi, 2017. Golden standard feeding and the risk of 25-60 month-old underweight children in Central Sulawesi, Indonesia. Asian J. Clin. Nutr., 9: 104-110.
13. Muhammad Awal, Ridwan Amiruddin, Sukri Palutturi and Anwar Mallongi, 2017. Relationships Between Lifestyle Models with Stroke Occurrence in South Sulawesi, Indonesia. Asian Journal of Epidemiology, 10: 83-88. DOI: 10.3923/aje.2017.83.88 URL: <http://scialert.net/abstract/?doi=aje.2017.83.88>
14. Aketch J. Effects of Quality of Work Life on Job Performance: Theoretical Perspectives and Literature Review. J Soc Sci. 2012;1(5):383–8.
15. Khan, M.A. Influence of Quality of Work Life on Organizational Commitment Among Clerical Staff. Asia Pacific Journal of Research I. 2015; (XXV), 106-113

# Cost Effective Analysis on the Implementation of Clinical Pathway in Anwar Makkatutu Hospital, Bantaeng District, South Sulawesi, Indonesia

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## ABSTRACT

**Introduction:** The National Health Insurance (JKN) has been implemented in Indonesia since 2014, aimed to achieve Universal Health Coverage (UHC) by the year 2019. It allows the need for systems that can reduce losses for patients and hospitals through INA-CBGs. The participant number of health facilities that join with Social Health Insurance (BPJS) increased significantly. The implementation of JKN during 2014-2015 faced the problem with limited funding. These situations has leded hospitals to take effective action as quality-cost control by using clinical pathway as a guide of medical treatment for patient. Therefore, this study will analyze comprehensively, about the availability, loyalty, conformity, and cost effectiveness after the implementation of clinical pathway.

**Method;** This study used qualitative approach. Data was collected through observations, in-depth interviews, document reviews, and also Focus Group Discussion (FGD). Respondents were selected purposively, consist of medical and managerial staff. This study was a pilot project which was conducted in Bantaeng district Hospital, one of public hospital in South Sulawesi

**Results;** This study found that, Bantaeng District Hospital still did not implement clinical pathway up to date in the first month of the implementation. Currently, only 3 out of 5 cases was assess which already have clinical pathway guidance since August because the availability of cases between June and October. The effectiveness of cost analysis still lack because the less of multidisciplinary participation among medical personnel, lack of leader driven strategy in arrangement process, also less of awareness and socialization about the availability of clinical pathway document within medical personnel in the initial stage of implementation.

**Conclusions;** Quality-cost control system through clinical pathway implementation can reduce the Medical Errors, Length of Stay, Unnecessary Expenditure, also increasing Satisfaction and Quality of service. Therefore, the hospital needs to provide clinical guidance through clinical pathway document to ensure patients to get the required services according to their condition and the cost accordance to the treatment received by the patients.

**Keywords:** *Cost Effective Analysis, Clinical Pathway, Hospital*

## INTRODUCTION

Health services in Indonesia have entered a new era since the government of the Republic of Indonesia

enacted the National Social Security System (SJSN) organized by the Social Security Agency (BPJS). Several efforts need to be done to implement INA-CBGs package in hospitals. Firstly, A clear understanding of hospital management along with medical professionals and all hospital staff on the concept of INA-CBGs and improve patient-oriented services are required. Secondly, Increasing the efficiency of health service costs can be

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done by 1) adherence to clinical pathway and standard operating procedures of the hospital, 2) prioritizing National Formulary and compendium on drug services and medical devices; 3) efficiency in input, process and output levels of service Building service teams, standardizing pharmaceutical and supporting uses, and distributing services with remuneration methods.

Therefore, in order to support the implementation of INA CBGs, clinical pathway becomes a very important guide in health services provided to patients. Clinical pathway is also a key requirement of quality and cost control especially in cases that potentially deplete large resources. This has been supported by several studies that have been conducted in several countries around the world.

Study conducted by Li, et al<sup>1</sup> reported that an integrated clinical pathway system significantly reduces medical errors and patient lengths of stay, so that medical quality can be effectively improved. Another study conducted by Huang, et al<sup>2</sup> shows the benefits of the implementation of clinical pathway that is to reduce the average length of stay, reduce hospitalization expenses, improve patient satisfaction and improve service quality. Implementation of clinical pathway according to Roymeke and Stummer<sup>3</sup> also helps doctors, nurses and therapists to disseminate and evaluate of treatment processes<sup>4</sup>. Markey et al<sup>5</sup> in his study of Clinical Pathway Implantation Effects on total hospital costs in Thyroidectomy and Parathyroidectomy patients showed a decreased in Length of Stay (LOS) in patients treated according to clinical pathway, as well as each case costs that had a decreased average.

Nurfarida et al<sup>6</sup> in her study in Dr. Sardjito Yogyakarta reported that the clinical pathway implementation stage has not been effective. From the filling of the form it can be seen that clinical pathway only 33.11%. Similarly, Maidin et al<sup>7</sup> reported that that an average of 50% of health workers are not adherent to clinical pathway in the hospital and still found complaints from patients regarding services and financing. Therefore, the objective of this study are to evaluate the efficiency of a clinical pathway implementation from identification, planning, implementation, until evaluation in one of public hospital in Makassar.

## MATERIALS AND METHOD

A qualitative research was employed, with monitoring of prevalence and retrospective data collection. The study has a comprehensive observation by using system approach from input, process, output, and outcome. We included patients admit at the Bantaeng Hospital (second-level hospital) from various diagnoses (3 specialist cases) and excluded those cases with complication.

Data was collected through observations, in-depth interviews, document reviews, and also Focus Group Discussion (FGD). Respondents were selected purposively, consist of medical and managerial staff, and insured patients. This study was a pilot project which was conducted in Bantaeng district Hospital, one of public hospital in south Sulawesi.

## RESULTS

### Description Analysis

A total of 11 medical specialist unit in Bantaeng Hospital was initially screened and only 3 met with the inclusion criteria which included one month patients on June as control group and on October as study group Table 1.

**Table 1. Description of patients excluded from each study group**

	June	October	Total
Chronic Heart Failure	12	12	24
Dengue Hemorrhagic Fever	25	25	50
Non-Hemorrhagic Stroke	9	9	18
Number	46	46	92

### Identification of Clinical Pathway

Identification of medical specialist services and clinical pathway documents available in Bantaeng hospital were identified at initial stage. There are 11 medical specialist services in hospitals Bantaeng consists of internal medicine physician, pediatrician, oncologist, obstetrician, neurologist, ophthalmologist, dermatologist, ENT, psychiatrist, nutritionist, and cardiologist (no one clinical pathway document are

available). Based on the identification and results of the Focus Group Discussion with the specialist doctors group, only 8 met the inclusion criteria as well as in the following table 2;

**Table 2. Description of patient included from each medical specialist unit**

No	Medical Specialist	Diagnose	Total
1	Internal medicine physician	acute renal failure hypertension	2
2	Pediatrician	diarrhea dengue fever typhus	3
3	Obstetrician	preeclampsia	1
4	Neurologist	stroke	1
5	Ophthalmologist	cataract pterygium glaucoma	3
6	ENT	OMSK OMSA	2
7	Psychiatrist	Schizophrenia	1
8	Cardiologist	acute heart failure	1
	<b>Total</b>		<b>14</b>

In addition, based on interview with the head of the medical committee and the head of medical record installation in the hospital, we found some evidence related to the availability of clinical pathway in the hospital. Procurement of clinical pathway documents has been carried out since early 2017, by conducting workshops to doctors at each SMF to arrange clinical pathways within the framework of accreditation plans to be implemented by 2017. However, it was only on August that a clinical pathway 5 cases of disease as mentioned above.

Therefore, the principle of leader driven strategy is one of the important principles in the preparation of clinical pathway. The effectiveness of the clinical pathways can only be obtained if the pathway is based on a leader-driven strategy, because otherwise there will be many obstacles such as mentioned by Guinane<sup>8</sup> : the team members who run the pathway were limited, this

arises because the pathway has not been considered to be important to the hospital; Each section developed their own pathway, consequently the optimum result has not been achieved . It seem that pathway did not become part of everyday clinical services.

### **Implementation of Clinical Pathway-Medical Personnel Compliance**

Based on post-implementation evaluation, it appears that the implementation of clinical pathway in the first month (October) has not been fully implemented like the availability of clinical pathway form in the medical record related to the filling action, supporting service and medicine, to monitor compliance level, and the average of filling equipment. This has been confirmed by the head of the medical record installation. He reported that there was limited communication between the medical record and the medical committee. It sees that the compliance to clinical pathway was not fully implement in first month, because of the form were not available. There was also no clear coordination system between medical committee and medical record installation for auditing in hospital. The number of non-compliance to the type of service still were not be able to measured quantitatively at this stage.

### **Effectiveness of Clinical Pathway Implementation**

Four servicespoint medical action, supporting services (laboratory, radiology, chemotherapy and so on) drug services, and average Length of Stay were included. Patient medical record document that has been used as data sources and filled by medical personnel. The result data of service level is measured by comparison of medical service history, medical support, drug administration and patient's LOS from the three cases of disease being sampled, to document clinical pathway that has been compiled and legalized in this hospital.

Table 3 shows compliance based on cases that have been observed through patient medical record, before and after the implementation of clinical pathway.

**Table 3. Conformity of Service After Implementation Clinical Pathway in General Hospital Prof. Andi Makkatutu Bantaeng, October 2017**

Diagnose	Medical Treatment		Diagnostic Treatment		Medicine	
	C	Non-C	C	Non-C	C	Non-C
Chronic Heart Failure	5	7	8	4	8	4
Dengue Hemorrhagic Fever	4	21	10	15	10	15
Non-Hemorrhagic Stroke	4	5	6	3	2	7

The table above shows that inconsistencies in the examination of medical support services, and drug delivery were existed. This is consistent with the results of a medical record study that shows thoroughly outline the average non-adherence to support services, and drug delivery.

**Tabel 4. Mean LOS Based Disease Cases Prior to Clinical Pathway Implementation**

Number	Unit	Diagnose	LOS Average	
			Before	After
1	Internal medicine physician	CHF	5	5
2	Pediatrician	DHF	3	4
3	Neurologist	NHS	3.5	5

Based on the initial assessment, there has not been a significant change in average LOS of 3 cases patients in RSUD Bantaeng.

#### Cost Effectiveness After Clinical Pathway Implementation

The results of cost effectiveness measurement were used for Cost Effective Analysis by performing a comparison between total financing of patient care of one month (June) before implementation and October (after implementation). Therefore, based on the results of the preliminary assessment, and beginning of the first month, the average difference in case service costs that are sampled can be seen in table 5below.

**Tabel 5. Deviation of Cost of Care Between Patient Before and After Clinical Pathway Implementation**

Number	Unit	Diagnose	Average Deviation of Cost of Care (USD)
1	Internal medicine physician	CHF	0.67
2	Pediatrician	DHF	0.75
3	Neurologist	NHS	4.15

## DISCUSSION

The implementation process of clinical pathway in this study involved the hospital practitioners include director, and medical personnel. Identification phase of cases/sickness treatment was conducted by Focus Group Discussion with the leaders and medical personnel in

each service, including specialist doctor in early of July. The selection of cases of the disease were based on three criteria's, such as the disease with the highest number of cases, cost and which cases became a featured of the hospital. Previous studies reported that clinical pathway implementation in some disease with potentially high cost such as stroke, schizophrenia, oestroporic hip

fracture, can improve the quality of service<sup>9-12</sup>.

Drafting the documents of the clinical pathway based on strategies were controlled by leaders (leader driven-strategy). This results consist end with previous studies conducted by Guinane<sup>8</sup> which indicates that a member of the team who runs pathway only slightly, because clinical pathway has not been considered an important in organization. In addition, the involvement of the non-paramedic personnel in clinical services is required. Involving multidisciplinary professional background such as doctors, nurses, nutritionist, pharmacist, and accounting and admission have been performed in this study. Clinical pathway should be part of clinical services, including how to document it.

Previous studies has indicated that the application of the clinical pathway could reduce the time of patient care at the hospital. Uchiyama et al<sup>13</sup> concluded that outpatient examination pre surgery is a major factor in the decline in the length of stay in hospital with clinical pathways. On the other hand, the decline of the old hospital care when applying clinical path<sup>14</sup>. Most of the research on the application of the clinical pathway was a cohort study using the historical control group.

Lack of understanding on clinical pathway among medical personnel to provide services based on correspondence between clinical diagnosis and insurance diagnosis has been identified as one of the determinants of low compliance<sup>15,16</sup>. The effectivity of services are important factors to improve patient satisfaction<sup>17</sup>. Patients in the clinical pathway groups had higher satisfaction than those in the control groups, shorter length of hospital stay and lower hospital cost. Patients received better medical service and more resources. Few studies have focused on the patient satisfaction. It seems that the survey were conducted at the end of hospitalization in order to obtained a more valid results<sup>18</sup>

Yanagi et al<sup>18</sup> found that the application of the clinical pathway reduced the total costs, but increased the costs per day, thereby reduce the cost of hospitalization per patient and increase the profit per bed. In the costs analysis none of the included studies mentioned or investigated the resources and the costs of the development and implementation of clinical pathways. low-volume hospitals would benefit less from implementing clinical pathways<sup>19</sup>.

## CONCLUSIONS

The complexity on clinical pathway process and multiplicity factors affecting outcome and quality of care might be a great challenge for hospital nowadays to increase quality both to control cost of care in National Health Insurance Era in Indonesia.

Even though clinical pathway implementation run effectively for both identification and implementation step, there were still some limitations. First, there was a lack of multidisciplinary approach and lack of awareness within medical personnel including for leader and also senior doctors. Activities such as audit and monitoring of clinical pathway implementation, control medical personnel compliance and communication system between medical committee and medical record installation are the key of successfulness of clinical pathway implementation in the future.

**Conflict of Interest:** Authors declare that no conflict of interest within this publication

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## REFERENCES

1. Weizi Li, Kecheng Liu, Hongqiao Yang and Changrui Yu. Integrated clinical pathway management for medical quality improvement based on a semiotically inspired systems architecture. *European Journal of Information Systems* (2014) 23,400–417
2. Huang D, Song X, Tian J, Cui Q, Yang K. Effects of clinical pathways in stroke management: a meta-analysis. *Neurol Asia*. 2015;20(4):335-42
3. Romeyke T, Stummer H. 2012. High quality at low cost - How can a clinical pathway contribute towards reconciling this apparent contradiction? *IOSRPHR*. 2012;2(6):10-20.
4. Wijayanti FER, Lamsudin R, Wajdi F. Analysis of clinical pathways with BPJS between public and private hospitals. Surakarta: Universitas Muhammadiyah Surakarta, 2016.
5. Markey, Donna W; McGowan, Jim; Hanks, John B; Van Heerden, Jon A; et al. The effect of clinical pathway implementation on Total Hospital Costs

- for Thyroidectomy and Parathyroidectomy Patients. *The American Surgeon*; ProQuest 2000. pg. 533. Department of Surgery, University of Virginia Health System, Charlottesville. Virginia
6. Nurfarida, Yoga, B. H., Agusno, M. Service Effectiveness During The Application Of Clinical Pathway For Schizophrenia In Sardjito Hospital Yogyakarta. Yogyakarta, Fakultas Kedokteran Universitas Gadjah Mada, 2014.
  7. Maidin et al. Analysis of the effectiveness of INA\_CBGs service package for patient recovery in hospital unhas, BPJS-Kesehatan, 2015.
  8. Guinane, Cs.. *Clinical Care Pathways; Tools and Method for designing implementing and analyzing efficiebt care practice*. New York: Mc Graw-Hill. 1997
  9. Panella, M “Reducing clinical variations with clinical pathways: do pathways work?”. *Int J Qual Health Care*. (2003). 15 (6): 509–521
  10. Pinzon, Rizaldy, Sugianto, Laksmi Asanti, Kriswanto Widy. *Clinical Pathway In Acute Stroke: Do The Pathways Work*. *Jurnal Manajemen Pelayanan Kesehatan* 2009. Vol 12 ( 20 – 23).
  11. Hernández, N.Sanches, P. Sáez-López, S. Paniagua-Tejo, J.A. Valverde-García. Results following the implementation of a clinical pathway in the process of care for elderly patients with osteoporotic hip fracture in a second level hospital. *Rev Esp Cir Ortop Traumatol*. 2016;60(1):1---11
  12. Pulubuhu, D.A.T., Evans, K., Arsyad, M., Mallongi, A. Understanding the perspectives of village leaders and institutions in transforming social conflict into peace and health. *Indian Journal of Public Health Research & Development*, March 2018, Vol. 9, No. 3
  13. Uchiyama K, Takifuji K, Tani M, Onishi H, Yamaue H. Effectiveness of the clinical pathway to decrease length of stay and cost for laparoscopic surgery. *Surg Endosc* 2002;16: 1594-1597.
  14. Pamella M, Marchisio S, Di Stanislao F. Reducing clinical variations with clinical pathways: do pathways work? *Int J Qual Health Care* 2003;15:509-521.
  15. Agiwahyunto, Prevention Efforts Difference Clinical Diagnosis And Diagnosis Insurance With The National Health Insurance Program (JKN) Implemented In Service Bpjs Health Studies In Rsud Kota Semarang. *Jurnal Manajemen Kesehatan Indonesia*, 2016.
  16. Noer Bahry Noor, Ridwan Amiruddin, Muhammad Awal, Sukri Palutturi and Anwar Mallongi, Proxy model of comorbidities with stroke incident in South Sulawesi. *Pak. J. Nutr.*, 2017. 16: 857-863.
  17. Zhang. The application of clinical pathways in laparoscopic cholecystectomy. *Hepatobiliary Pancreat Dis Int* , 2014. Vol 13 , No 4.
  18. Yanagi K, Sasajima K, Miyamoto M, Suzuki S, Yokoyama T, Maruyama H, et al. Evaluation of the clinical pathway for laparoscopic cholecystectomy and simulation of short-term hospitalization. *J Nippon Med Sch* 2007;74:409-413.
  19. Rotter T, Kugler J, Koch R, Gothe H, Twork S, van Oostrum JM, et al. A systematic review and meta-analysis of the effects of clinical pathways on length of stay, hospital costs and patient outcomes. *BMC Health Serv Res* 2008;8:265.



# Analysis of Inhibition Mechanism in Aluminum Corrosion Using Magnesium Citrate

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## ABSTRACT

Research has been conducted with the title Analysis of Mechanism of Inhibition on Aluminum Corrosion Using Magnesium Citrate. The method used in this research is the experimental method through using linear polarization resistance which has the chance to be patented and offered to companies producing materials made of aluminum. By using this methods the effort is to extends the inhibitor type of the magnesium salt of citrate and to explains the mechanism of reaction of aluminum corrosion inhibition to the corrosion rate in acidic atmosphere. The results achieved in this study are to have the magnesium citrate can inhibit corrosion of pure aluminum at 60 ppm, acidic atmosphere (pH 3), temperature 25°C. The efficiency of magnesium citrate inhibition using linear polarization resistance was 89.36%, the reflective spectral FTIR spectrometry showed that aluminum with magnesium citrate inhibitors that in the 3000-1750 cm<sup>-1</sup> spectrum (OH-group Al<sub>2</sub>O<sub>3</sub>), 1380-1100 cm<sup>-1</sup> (AlO<sup>-</sup>) groups, 1000-950 cm<sup>-1</sup> (C = O) groups, and 800-600 cm<sup>-1</sup> (O-Mg groups), high performance liquid chromatography (HPLC) analysis and UV spectrometry analysis obtained respectively by inhibitor adsorbed on the aluminum surface of 0.0495 mol and 0.0610 mol of magnesium citrate for each 1 g of 100 mesh aluminum powder, the optical microscopy (MO) analysis showed that by the addition of magnesium inhibitor from the anion of amphiphole citrate to pure aluminum then on the aluminum surface corrosion of formed wells does not appear or in other words its existence can be prevented

**Keywords :** *Mechanism Inhibition, Aluminum Corrosion, Magnesium Citrate.*

## INTRODUCTION

The decrease in metal quality due to interaction with the environment is known as corrosion. The corrosion-resistant nature of a metal is a parameter to be considered in choosing a metal that can be used in a construction, industrial equipment or daily necessities. Some metals such as steel, copper, zinc, aluminum and alloys, aluminum has an advantage, especially in terms of corrosion resistance (in a neutral atmosphere), lightweight, rigid, and easily shaped, so aluminum metal meets the requirements for use as an aircraft construction, industrial equipment, household

appliances to food / beverage packaging<sup>1</sup>. Aluminum and alloy have corrosion resistant properties due to the formation of protective pasifation thin layers. Aluminum corrosion forms an Al<sub>2</sub>O<sub>3</sub> layer, the coating is formed spontaneously on the metal surface, because the metal has an inhomogeneous chemical composition. The Al<sub>2</sub>O<sub>3</sub> layer is stable in the environment of pH 4 to pH 9 (Diagram of the pH-potential system in the aluminum-water equilibrium at 25°C<sup>2,3</sup>).

Nyoman and Isdiriyani<sup>4</sup>, have reported sodium benzoate, a concentration of 60 ppm, pH 3 is used in aluminum alloys, the inhibitory efficiency is 70% but has not yet reported how its inhibition mechanism. Sato F and Newman R.C<sup>5</sup> potassium tartart salt with a concentration of 60 ppm, pH 3 was used as an inhibitor of pure aluminum, its inhibition efficiency was 71% but no further study of the mechanism of inhibition. Potassium tartrate is an anodic inhibitor which is an amphiphilic organic compound that is an organic salt whose anions

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have polar and non-polar groups. Amphytiest organic salts such as potassium and calcium from anions of amphiphilic citrate and stearate are anodic inhibitors as well as environmentally friendly. Citric acid has the chemical formula  $C_6H_8O_7$  and the molecular formula is  $CH_2(COOH)COH(COOH)CH_2(COOH)$  (relative period = 221). Another name for citric acid is 2-hydroxy 1,2,3 propanicarboxylic acid.

The polarization or deviation of the equilibrium potential here is the same as the combined anode polarization of the metal and the polarization of the cathode in its environment. This polarization difference represents the potential difference between the cathode and the anode, which can be measured by the calomel elektoda (reference electrode). Due to the potential difference gives rise to electron transfer that produces an electric current. The amount of electric current that flows can be measured with platinum eletrode (auxiliary electrode). The corrosion process has 3 main phenomena: electrochemical, polarization and pacifism<sup>1</sup>.

## MATERIALS AND METHOD

Methods in this study were conducted experiments in the laboratory with polarization. Subsequent

conditions to aluminum metal were corrosion tested by linear polarization resistance method to determine the corrosion rate. In addition, morphologic examination of aluminum surfaces is performed before it is corroded and after corrosion with the addition of inhibitors.

## RESULTS AND DISCUSSION

### 1. Analysis using Energy Dispersive Analyzer X-ray (EDAX)

Analysis of aluminum by using energy dispersive analys x - ray (EDAX) that its purity is 100%. Aluminum metal has been widely used in industries, so there is a need for special treatment of the medium in which aluminum works to improve its corrosion resistance to the existing environment by inhibitors<sup>6</sup>.

### 2. Corrosion Test using Linear Polarization Resistance

The corrosion test was carried out using linear polarization resistance (Fig. 2), aluminum was introduced into a 1% NaCl 0.1 M HCl medium-aqueous solution, and 60 ppm of magnesium citrate inhibitor was added and the temperature was 25 °C:

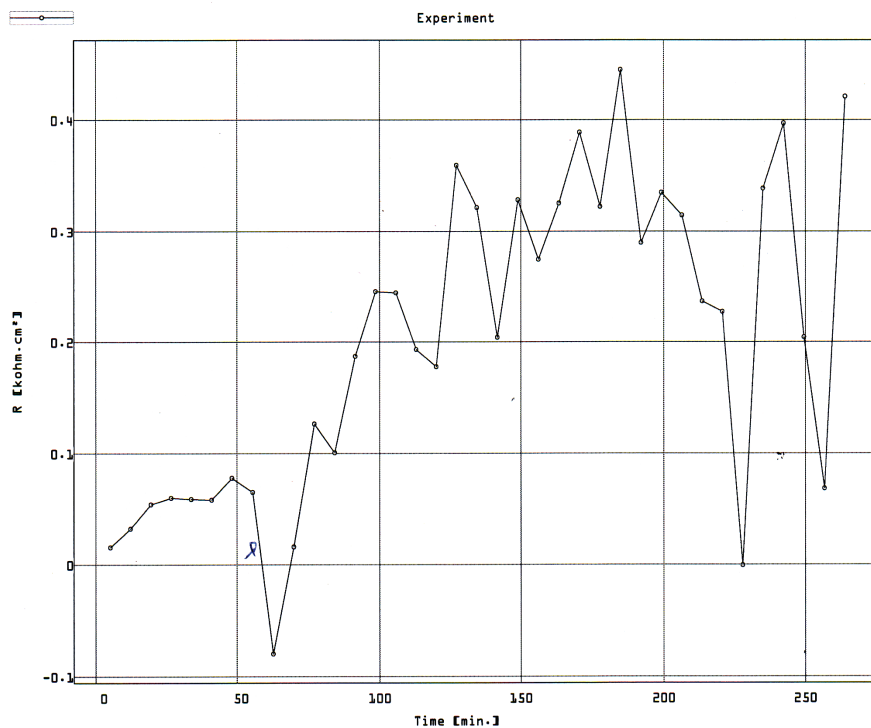


Figure 1. Aluminum corrosion test results with magnesium citrate inhibitor pH 3, temperature 25 °C by using linear polarization resistance.

The inhibition efficiency is 89.36% (Figure 1), so magnesium citrate can be used as an inhibitor of pure aluminum. The use of salts as inhibitors can increase aluminum resistance to corrosion, thus by Lukovits.<sup>17</sup> The efficiency of inhibition can be reduced by increasing corrosivity, concentration, corrosion agent, acidity, and temperature, depending on the type of metal and its environment. Addition of polarization resistance inhibitor ( $R_p$ ) is larger, the corrosion current ( $i_{corr}$ ) is smaller while the corrosion rate is getting smaller. In other words  $R_p$  is inversely proportional to  $i_{corr}$  and corrosion rate. This means that the addition of magnesium inhibitors of the amphiphilic anion citrate can reduce the rate of corrosion, resulting in a slower rate of corrosion in aluminum<sup>8</sup>.

### 3. Analysis using Infra Red Spectrometry (FTIR)

A reflectant FTIR spectrometry analysis was used to compare functional groups that occurred before and after inhibition. Alumina FTIR spectrometry spectrum ( $Al_2O_3$ ) is used as a comparison, shown in Figure 2.

FTIR spectrometry spectra analyze from Table 1 show that the alumina ( $Al_2O_3$ ) of its absorption band at the wave number region  $\nu$  3300-1750  $cm^{-1}$  is thought to be the absorption for the OH-group attached to  $Al_2O_3$ . The absorption band in the waveform region  $\nu$  1100-900  $cm^{-1}$  is thought to be the absorption of the  $AlO^-$  group. The spectrum of FTIR magnesium citrate spectrometry as an inhibitor is shown in Fig. 3 and the data of wave numbers, the shape of the band, the intensity and the associated groups which may be shown in Table 2 below:

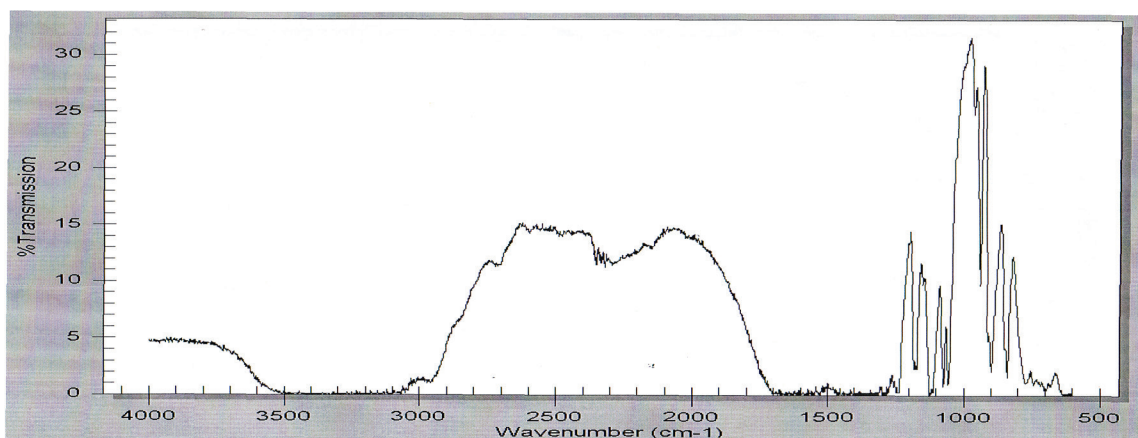


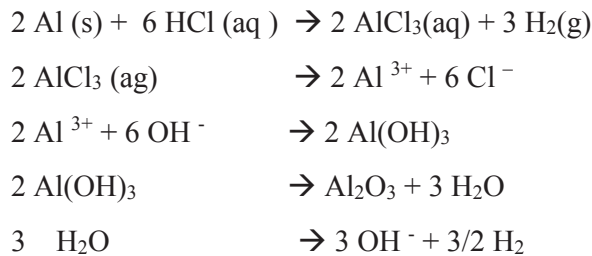
Figure 2. FTIR spectrometry spectrum of aluminum metal with inhibitor 60 ppm calcium citrate pH 3.

FTIR spectrometry analyze from aluminum with magnesium citrate inhibitors showed that the absorption bands in the wave number region  $\nu$  3000-1750  $cm^{-1}$  were thought to be absorber for the OH group attached to  $Al_2O_3$ . The absorption band in the waveform region  $\nu$  1380-1100  $cm^{-1}$  is thought to be the absorption of the  $AlO^-$  group. The medium intensity absorption bands in the wave number region  $\nu$  1000-950  $cm^{-1}$  are thought to be C = O, while the absorption bands in the wave number region  $\nu$  800-600  $cm^{-1}$  are thought to be absorber for the O-Mg group. Based on the data, the functional group before the addition of the inhibitor is a combination of functional groups present after the addition of the inhibitor no new functional group, and only the change in the area of the wave number. From these data the functional group before the plus inhibitor is a combination of functional groups present after the addition of the inhibitor, so there is no new functional group. Amphytiest organic salts

such as magnesium of the anions of amphiphic citrate are anodic inhibitors as well as environmentally friendly. Citric acid has a chemical formula:  $C_6H_8O_7$  and its molecular formula is  $CH_2(COOH)COH(COOH)CH_2(COOH)$  (relative period = 221). Another name for citric acid is 2-hydroxy 1,2,3 propanicarboxylic acid. The magnesium inhibitor of the amphiphilic anion of citrate serves as adsorbant inhibitor on a corrosive aluminum surface thus altering the environmental characteristics by producing a precipitate which protects against ongoing corrosion and renders the corrosion inactive, corrosion of aluminum in acidic environments especially at pH 3 and temperature 25 °C.

### 4. Mechanism of Aluminum Inhibition with Magnesium Citrate :

1. Mechanism of aluminum inhibition with magnesium citrate inhibitors as follows:



2 Mechanism of aluminum inhibition with magnesium citrate inhibitors as follows:

After the aluminum is corroded then this magnesium citrate is injected, this results in the aluminum adsorbed on the aluminum surface shown in Figure 4-5 below:.

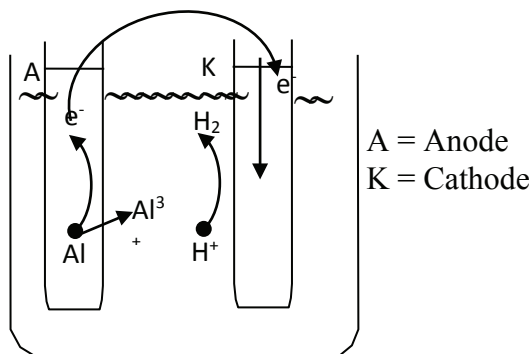
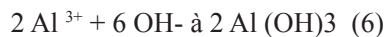
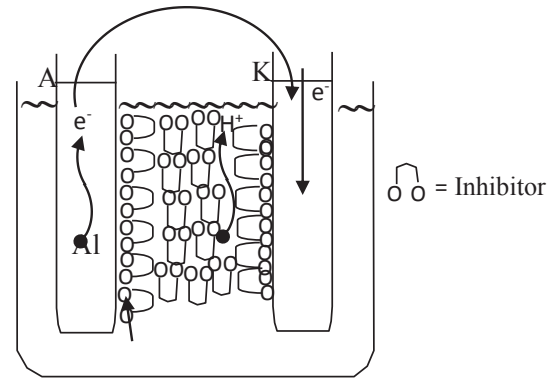


Figure 3. Electrochemical mechanism of aluminum corrosion reaction without inhibitor.

Based on Figure, It shows that on the aluminum anode releases electrons (oxidized), the reaction of  $2 \text{ Al} \rightarrow 2 \text{ Al}^{3+} + 6\text{e}^-$  (2), and at the reduced cathode (accepting electrons), reaction  $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2 (\text{g})$  (4), then in the OH-anode joining  $\text{Al}^{3+}$  to form  $\text{Al}(\text{OH})_3$  as a result of reaction corrosion as follows:



After the inhibitor is injected it is proven that the corrosion rate is decreasing (it can be seen from the results of the TPL in Figure 8. It is assumed that the adsorption of the aluminum metal surface resulted from injected or inserted magnesium citrate inhibitor With the coating on the aluminum surface, the reaction at 1-6 will be inhibited, so that the corrosion reaction becomes obstructed, as seen in Figure below:



Adsorption is evidenced from the analyze KCKT + MO

Figure 4. Electrochemical mechanism of aluminum corrosion reaction with inhibitor magnesium citrate.

5. Analysis by using High Performance Liquid Chromatography (HPLC) with magnesium citrate inhibitor on 1% NaCl medium 0.1 M HCl without aluminum  $\lambda_{\text{max}}$  210 nm.

Analysis from HPLC obtained concentrations of magnesium citrate inhibitor samples in 1 g of 100 mesh aluminum powder. This shows that adsorption on the aluminum surface is 0.0495 mol of magnesium citrate inhibitor in each 1 g of 100 mesh aluminum powder. The calculations show that magnesium ions are strong to inhibit aluminum.

6. Analysis using Spetrometry Ultra Violet (UV)

Analysis with UV spectrometry, magnesium citrate inhibitor with medium 1 % NaCl 0,1 M HCl  $\lambda_{\text{max}}$  226,5 nm without aluminum, can be seen in Figure 6 below:

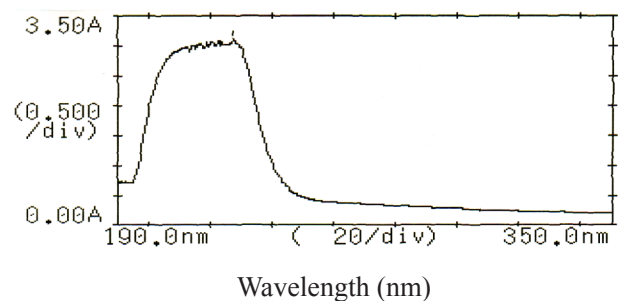
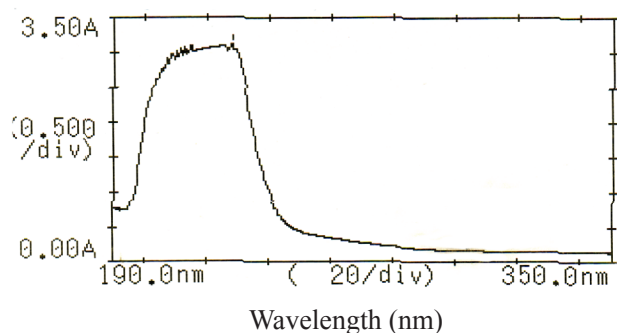


Figure 5. Chromatogram of magnesium Citrate with 1 % NaCl 0,1 M HCl

Measurements using UV spectrometry, aluminum with calcium citrate inhibitor with medium 1% NaCl 0.1 M HCl  $\lambda_{\text{max}}$  227.0 nm, can be seen in the following Figure 7:



**Figure 6. Chromatogram of calcium citrate solution with 1% NaCl 0.1 M HCl in the presence of aluminum.**

Analysis from UV spectrometry obtained the concentration of data samples was 0.0610 mol of magnesium citrate inhibitor in each 1 g of 100 mesh aluminum powder. This shows that the adsorption on the aluminum surface is 0.0610 mol of magnesium citrate inhibitor in each 1 g of 100 mesh aluminum powder. These results suggest that magnesium citrate inhibitors may be used as inhibitors. This is in line with previous research conducted by Tiurlina Siregar<sup>9</sup> that sodium citrate of the amphiphic organic anion may inhibit aluminum metal. In line with the study, magnesium citrate can inhibit aluminum metal, this is because the anion of citrate has two strong enough coordination covalent bonds to adsorb on the aluminum surface.

#### 7. Analysis by using Optical Microscope (MO)

Analysis of aluminum surfaces before and after injected inhibitors using an

#### Optical Microscope (MO)

The surface of pure aluminum there are small holes whose growth is relatively short. These small holes usually form corrosion pitting (pitting corrosion). Corrosion of wells may occur on metal surfaces in direct contact with moist air, generally metal having a passive layer and without the presence of inhibitors.

The pure aluminum surface after the addition of a medium solution (1% NaCl 0.1M HCl) is increasingly evident in pitting corrosion. In this study to prevent the occurrence of corrosion of wells used inhibitors. With the addition of magnesium citrate inhibitor to pure aluminum then on the surface of the formed pitting corrosion does not appear or in other words its existence can be prevented<sup>10,11</sup>. This happens because the calcium citrate has 2 covalent bonds of money coordination strong enough to block the corrosion of aluminum

(adsorption on the aluminum surface).

## CONCLUSION

Magnesium citrate can inhibit corrosion of pure aluminum at a concentration of 60 ppm, acidic atmosphere (pH 3), temperature 25°C. The efficiency of magnesium citrate inhibition using linear polarization resistance was 89.36%. Reflective spectral FTIR spectrometry showed that aluminum with magnesium citrate inhibitors showed that in the 3000-1750  $\text{cm}^{-1}$  spectrum (OH-group  $\text{Al}_2\text{O}_3$ ), 1380-1100  $\text{cm}^{-1}$  (AlO-) groups, 1000-950  $\text{cm}^{-1}$  (C = O) groups, and 800-600  $\text{cm}^{-1}$  (O-Mg groups), high performance liquid chromatography (HPLC) data and UV spectrometry analyze obtained respectively by inhibitor adsorbed on the aluminum surface of 0.0495 mol and 0.0610 mol of magnesium citrate for each 1 g of 100 mesh aluminum powder, the optical microscopy (MO) analysis showed that by the addition of magnesium inhibitor from the anion of amphiphole citrate to pure aluminum then on the aluminum surface corrosion of formed wells does not appear or in other words its existence can be prevented.

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## REFERENCES

1. Bradford.S.A, Corrosion Control, John Wiley & Sons LTd, New York. 2002.
2. Pourbaix.M, Atlas of Electrochemical Equilibria in Aqueous Solutions, National Association of Corrosion Engineers, Houston, Texas, USA. 2004.
3. Anwar Mallongi, Irwan and A.L. Rantetampang, Assessing the mercury hazard risks among communities and gold miners in artisanal buladu gold mine, Indonesia. Asian J. Sci. Res., 2017. 10: 316-322.
4. Nyoman.S and Isdiryanti, Corrosion Control by Sulfate Resucing Bacteria Using Na-Benzoate Inhibitor, Master Thesis, Chemical Engineering Department, ITB, Bandung. 2000.
5. Sato.F and Newman.R.C., Mechanism of Activation

- of Aluminum by Low Melting Point Elements: Part 1-Effect of Zinc on Activation of Aluminum in Metastable Pitting, *Journal of Corrosion Science Section*, 2008, 955-963.
6. Liu.X.F, Huang.S.J, and Gu.H.C., Corrosion Protection of an Aluminium Alloy with Nontoxic Compound Inhibitors in Chloride Media, *Journal of Corrosion Science Section*, 2002, 826-833.
  7. Lukovits.I, Corrosion Inhibitors-Correlation Between Electronic Structure and Efficiency, *Journal of Corrosion Science Section*, 2001, 3-8.
  8. Anwar Mallongi, Veni Hadju, Ruslan La Ane, Agus Bintara Birawida, A.L. Rantetampang, Moehammad Iqbal Sultan, M. Nadjib Bustan, Hasnawati Amqan, Noer Bahri Noor and Apollo,. Assessing the Target Hazard Risks of Cadmium Pollutant due to Consumption of Aquatic Biota and Food Snack Among School Children in Tallo Coastal Area of Makassar. *Research Journal of Toxins*, 2017. 9: 1-7. DOI: 10.3923/rjt.2017.1.7 . URL: <http://scialert.net/abstract/?doi=rjt.2017.1.7>
  9. Tiurlina Siregar,. Study of Corrosion Rate and Mechanism of Pure Aluminum Inhibition Using Sodium Citrate, *Journal of Chemistry*, ISSN 1907-9850, Vol. 7 N0.1 January 2013, unud.ac.id
  10. Mallongi, A., P. Pataranawat and P. Parkian,. Mercury emission from artisanal buladu gold mine and its bioaccumulation in rice grain, Gorontalo Province, Indonesia, *Adv. Mater. Res.*, 2014. 931-932: 744-748
  11. Sukri Palutturi, Andi Zulkifli, Aminuddin Syam, Stang, Muliana, Alias,& Hamzah. The Key Challenges and Recommendations for Healthy Cities Implementation of North Kolaka, Indonesia. *Indian Journal of Public Health Research & Development*, (2017). 8 (2).

# The Analysis of Hearing Loss and Deafness of Elderly with Indonesia Version of Hearing Handicap Inventory for the Elderly-Screening (HHIE-S)

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## ABSTRACT

Hearing loss can occur in all age groups. This study aims to analyze the relationship of hearing loss and deafness with the HHIE-S (hearing handicap inventory for the elderly-screening) version of Indonesia in the elderly. This research was conducted by analytical cross sectional to 72 elderly people. Each sample filled the HHIE-S questionnaire and performed audiometric, tympanometric, and auto acoustic emission (OAE) tests. The results showed that HHIE-S version of Indonesia had better or more sensitive value in assessing severe hearing loss (98.2%) than mild-to-moderate hearing loss (49.6%). The HHIE-S questionnaire as a diagnostic test in the elderly with severe hearing loss-very severe has a sensitivity of 89.6%, specificity of 40.0% and 86.1% accuracy.

**Keywords:** elderly, HHIE-S, diagnostic tests

## INTRODUCTION

The elderly is someone who reaches the age of 60 years and over, based on Law No. 13 of 1998 on the welfare of the elderly. Globally, the elderly population is predicted to continue increasing. The elderly population in Indonesia is predicted to rise higher than the elderly population in the world after 2100.

The elderly usually suffer from age-related diseases such as immune, musculoskeletal, visual, proprioceptive, cardiovascular and central nervous system impairment. Approximately 25-50% of the elderly population suffers from hearing loss resulting in decreased quality of life<sup>1</sup>.

Hearing loss is loss of hearing in one or both ears. Furthermore, hearing loss is different from deafness. Hearing loss means losing some of the ability to hear from one or both ears. Deafness means the absolute loss of listening ability from one or both ears<sup>2</sup>. Hearing loss can occur in all age groups. Hearing loss is a serious

problem most often encountered by someone because it can cause interference in communicating while socializing. There is a need to screen for hearing loss especially in old age to know the level of hearing loss that occurs, although they say there is no problem with their hearing

Lee and Kim in his research in Korea in 2010 found an association between age and sex against decreased hearing thresholds at an advanced age. The average hearing-threshold value decreases by 1 dB annually at the age of 60 years or older and there is a significant difference in the threshold loss at frequencies 4 and 8 KHz between males and females<sup>3</sup>.

Previous research by Jupiter<sup>4</sup>, which conducted hearing screening at an advanced age by comparing several screening methods using pure tone, HHIE-S, pure tone plus HHIE-S and by using DPOAE. The results showed that DPOAE can be used as screening at an advanced age.

Based on the background above, the authors are interested in conducting research that aims to analyze the relationship of hearing loss and deafness with an HHIE-S (healing handicap inventory for the elderly-screening) version of Indonesia in the elderly.

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## MATERIALS AND METHOD

### Study Location and Time

This study was done for the elderly at Posyandu Lansia Tamalanrea Health Center Makassar and Tresna Werdha Gauma Baji Social Institution. The study was conducted in December 2017.

### Study Design and Variables

This study is an analytic observational study with cross sectional approach. The variables are: independent variables (hearing loss or deafness), dependent variables (quality of life: HHIE-S), and controlled variable (the elderly)

### Population and Sample

The target population is all  $\geq 60$  elderly in Posyandu Lansia Tamalanrea Health Center Makassar and Tresna Werdha Gauma Baji Social Institution. Affordable population of the study is  $\pm 60$  years old elderly in Elderly Posyandu Puskesmas Tamalanrea Makassar and Tresna Werdha Gauma Baji Social Institution. Samples were taken with consecutive sampling technique in accordance with inclusion and exclusion criteria that have been determined by the author until the required number of samples has been fulfilled.

### Data Collection Method

Elderly  $\geq 60$  years old patients who are willing to follow the research signed the informed consent then

underwent the examination. Furthermore, HHIE-S questionnaire was given in Indonesian version, then performed examination of pure tone audiometric examination, tympanometry and otoacoustic emission. The results obtained are recorded and analyzed.

### Analysis Data Technique

All obtained data are grouped according to data purpose and type. Data analysis was done with SPSS 25.

## RESULTS

An analytic observational study was conducted using cross sectional approach to analyze the relationship of hearing loss and deafness with HHIE-S (healing handicap inventory for the elderly-screening) Indonesian version in elderly with and without risk factor. The study was conducted on elderly at Posyandu Lansia Tamalanrea Makassar Health Center and Tresna Werdha Gauma Baji Social Institution in December 2017.

During the study period, we got sample of 72 elderly people, consisting of 27 men and 45 women. From sample distribution based on audiometric examination and HHIE-S with mild-to-moderate hearing loss (26-60 dB) audiometry of 42 people, people with normal HHIE-S 7 people, mild-moderate 33 people, severe 2 people. Severe hearing loss - very severe (61 -  $\geq 80$  dB) audiometry of 25 people, mild-to-moderate HHIE-S 1 person, severe 24 people.

**Table 1 Comparison degree of hearing loss based on audiometry compare with HHIE-S**

Audiometri	HHIE-S		
	Normal (0-8)	Mild-moderate (10-24)	Severe (26-40)
Normal (5)	5	-	-
Mild-moderate (42)	7	33	2
Severe – very severe (25)	-	1	24

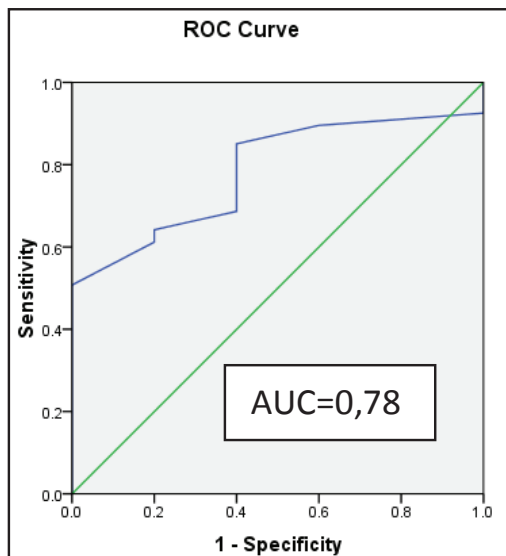
Distribution of samples based on Audiometric, OAE and HHIE-S examinations showed that elderly people with hearing impairment based on Audiometric examination were 67 samples, OAE 65 samples, HHIE-S 63 samples (appendix, Table 2).



**Table 2. Audiometric examination results**

Result of Examination	Frequency	
	n	%
Audiometric		
Normal	5	6,9
Hearing Impairment	67	93,1
OAE Examination		
Normal	7	9,7
Hearing Impairment	65	90,3
HHIE-S Examination		
Normal	9	12,5
Hearing Disorders	63	87,5

Area under the curve (AUC) HHIE-S examination of Indonesia version was 0.784 with intervals of 0.635 - 0.933 and 95% significance. Diagnostic examination with an AUC value of 0.784, means there are 78.4% or if there are 100 patients studied then as many as 78 patients who will provide the correct conclusions in determining the presence or absence of hearing loss based on audiometry on the population.



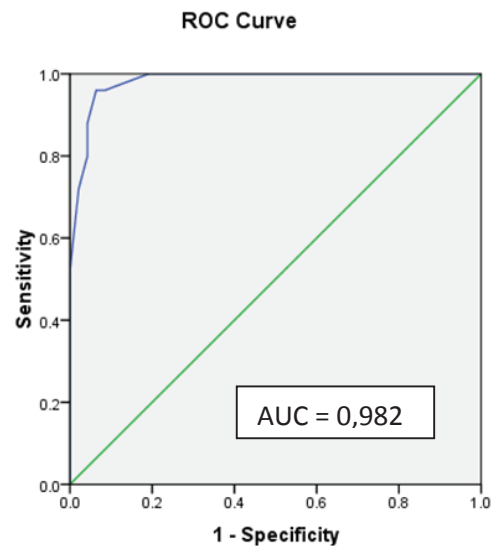
**Figure 1. ROC Curve on HHIE-S Indonesian Version of Elderly Patients with Hearing Loss Based on Audiometric Results**

Based on sample distribution, there were 60 samples (83,3%) with HHIE-S result of handicap of hearing loss

and audiometric result with hearing loss. And 3 samples (4.2%) with HHIE-S result of handicap hearing loss but normal audiometric results.

From the analysis of ROC curve, it was found that the area under the curve (AUC) of HHIE-S examination Indonesia version of 0.496 with intervals of 0.268 - 0.723 and 95% significance. Diagnostic examination with an AUC value of 0.496, meaning that there are 49.6% or if there are 100 patients studied then as many as 50 patients will provide the correct conclusions in determining mild-moderate hearing loss based on audiometry in that population.

From the analysis of ROC curve, it was found that the area under the curve (AUC) of HHIE-S examination Indonesia version of 0.982 with intervals of 0.959 - 1.005 and 95% significance. Diagnostic examination with AUC value of 0.982, means that there are 98.2% or if there are 100 patients studied then as many as 98 patients who will give the correct conclusions in determining hearing loss is very heavy-weight based on audiometry in that population.



**Figure 2. ROC Curve on HHIE-S Indonesian Version of Elderly Patients**

with Hearing Loss severe-very severe Based on Audiometric Results

Based on the ROC curve and the AUC value it can be seen that the Indonesian version of HHIE-S has a better or more sensitive value in assessing severe hearing-impairment (98.2%) than mild-to-moderate hearing loss

(49.6%).

Area under the curve (AUC) HHIE-S examination of Indonesia version was 0.936 with intervals of 0.855 - 1.018 and 95% significance. Diagnostic examination with an AUC value of 0.936, means there are 93.6% or if there are 100 patients studied then as many as 94 patients will provide the correct conclusions in determining hearing loss based on OAE in the population.

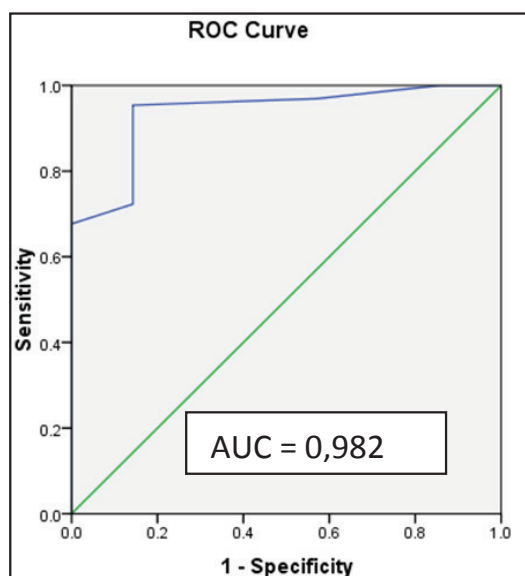


Figure 3. ROC Curve on HHIE-S Indonesian Version of Elderly Patients with Hearing Loss Based on OAE Results

Based on the sample distribution obtained from 65 samples (90.3%) with HHIE-S handicap hearing loss with OAE results also with hearing loss. And 6 samples (8.3%) with HHIE-S handicap hearing loss but normal OAE results.

Table 3 Table 2x2 HHIE-S Indonesian version and OAE according to cut-off point  $\geq 1$

Variabel		HHIE-S Versi Indonesia				Total	
		+ ( $\geq 9$ )		- ( $< 9$ )			
		(n)	(%)	(n)	(%)	(n)	(%)
OAE	+ Hearing Disorder	65	90,3	0	0,0	65	90,3
	- Normal	6	8,3	1	1,4	7	9,7
Total		71	98,6	1	1,4	72	100,0

## DISCUSSION

The present study demonstrates that samples with hearing impairment risk factors have a greater likelihood of having hearing loss compared with no hearing loss risk factors.

This research was done on 72 samples, with age distribution described: 45 females (61,1%), 27 males (37,5%). Age of subject at least 60 years and maximum 90 years. So the ratio between female and male is 2: 1. This is in accordance with a study conducted by Bashiruddin et al<sup>5</sup>, who conducted a study of 63 elderly patients in which a comparison was compared between women and men 2: 1 (female 38 samples and 24 male samples). Hearing loss and deafness in the elderly initially occur at high frequencies, and slowly affects low frequencies. Cochlea apex plays a role in low frequency sound transduction, while high frequency is on the cochlea base. The cochlea sensory cells of the apex are most susceptible to damage to the vascular stria microcirculation because the apex is the farthest region of the cochlea blood supply<sup>6</sup>.

The value of HHIE-S Indonesia version obtained, was an average value of 21.50 ( $\pm 10.703$ ) ranging from 0 to 40. Samples with mild-moderate hearing loss (26-60 dB) of 42 people (58.33%) with distribution score HHIE-S Indonesian version 0-8 as many as 7 people, HHIE-S score Indonesia version 10-24 as many as 33 people and 26-40 score as much as 2 people. While subjects with severe to very severe hearing loss (60 -  $\geq 80$  dB) were 25 people (37.31%) with a HHIE-S score of Indonesian version 10-24 as many as 1 person and Indonesian HHIE-S score of 26-40 dB as many as 24 people.

Based on the ROC curve and the AUC value it can be seen that the Indonesian version of HHIE-S has a better or more sensitive value in assessing severe hearing-impairment (98.2%) than mild-to-moderate hearing loss (49.6%).

In a study conducted by Wibowo et al<sup>7</sup>, of 5 samples with mild hearing loss were found to have no degree of handicap, in 8 samples with moderate hearing loss, 50% had mild-handicap and 50% without handicap. In severe moderate to severe hearing loss of 9 samples, 66.7% had mild-to-moderate handicap, 3 heavy handicap samples, 2 samples with a hearing loss degree all of which had heavy handicaps.

According to a study by Astari<sup>8</sup>, subjects with mild hearing loss (26-40 dB) were 21 people (23.33%) with HHIE-S score distribution of Indonesian version 0-10 for 8 people, HHIE-S score of Indonesian version 12- 24 as many as 12 people and score 26-40 as many as 1 person. Moderate hearing loss (41-55 dB) as many as 45 people (50%) obtained score HHIE-S Indonesian version 12-24 as many as 36 people and score HHIE-S 26-40 dB as many as 9 people. While subjects with severe to severe hearing loss (56-90 dB) as many as 8 people (8.89%) with HHIE-S score Indonesia version 12-24 as many as 4 people and score HHIE-S Indonesian version 26-40 dB as many as 4 people. Subjects with very severe hearing loss (> 91 dB) do not exist.

In the study of Wibowo et al<sup>7</sup>, it was found that there was a relationship between hearing threshold and hearing handicap, the higher the hearing threshold the higher the HHIE-S score. In all samples with severe degree of hearing loss caused severe handicap. This shows similarity only to degree of gravity.

In Astari's<sup>8</sup> study, the Indonesian version of HHIE-S on hearing loss is in cut-off point  $\geq 6$  with 93.24% sensitivity, 93.75% specificity and 93.33% accuracy, and AUC 96.2 %. In addition it also obtained a positive predictive value of 98.6% and a negative predictive value of 75%.

Accuracy of HHIE-S to predict auditory loss based on OAE examination has 100% sensitivity, 14.3% specificity and 91.7% accuracy. This is in contrast to Jupiter's<sup>4</sup> study, where no relationship was found to increase HHIE-S values versus OAE. Of the 65 samples (90.3%) with HHIE-S handicap hearing loss with OAE results also with hearing loss. And 6 samples (8.3%) with HHIE-S handicap hearing loss but normal OAE results.

## CONCLUSION

The investigators concluded that the mean degree of hearing loss with audiometric examination in the elderly on the right and left ear is mild-to-moderate SNHL. The average handicap of hearing loss with HHIE-S examination in elderly is mild-moderate degree. HHIE-S Indonesia version has a better or more sensitive value in assessing severe hearing loss-very severe than mild-to-moderate hearing loss. The investigators recommend that this research is used as a baseline for conducting further diagnostic studies. Based on the results of sensitivity and specificity, HHIE-S Indonesia version can be used for

screening of hearing loss in old age.

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## REFERENCES

1. Roland, P.S. Aging and the auditory vestibular system. In: Bailey, B.J. (ed) Head and Neck surgery – Otolaryngology. Fourth Edition. Vol. Two. Lippincott Williams & Wilkins. Philadelphia. 2006: 2258-60.
2. WHO. Primary Ear and Hearing Care Training Resource, Advance Level. Geneva: Switzerland. 2010.
3. Jurca, A.P.K. et al. Audiologic Profile in Patient Over 60 Years Old. 2002: 1-7.
4. Jupiter. Screening for Hearing Loss in the Elderly using Distortion Product Otoacoustic Emissions, Pure Tones, and a Self-Assessment Tool. *Am J Audiol.* 2009; 18(2): 99-107.
5. Bashiruddin J dkk. Gambaran Audiometri Nada Murni pada Penderita Hearing Disorder Sensorineural Usia Lanjut. *Majalah Kedokteran Indonesia.* 2008: Volume 58. Nomor 8.
6. Syamsiar S. Russeng, Lalu Muhammad saleh, Devintha Virani, Ade Wira Listrianti Latief, Anwar Mallongi., The Investigation of the Lactic Acid Change among employee of national electrical Power Plan. *Indian Journal of Public Health Research & Development,* January 2018, Vol. 9, No. 1
7. Wibowo dkk.. Hubungan ambang dengar dengan nilai Hearing Handicap Berdasarkan Hearing Handicap Inventory for Elderly-Screening (HHIE-S). RS Dr.Saiful Anwar. Malang. . *ORLI* 2010: Vol. 40 No.2.
8. Astari N.L.I.. Uji Diagnostik HHIE-S Versi Indonesia untuk Skrining Hearing Disorder Usia Lanjut. Tesis. Denpasar: Universitas Udayana. 2014.

# Assessment of Lead Contamination on Aquatic Habitat and Street Snacks in Makassar Coastal Area, Indonesia

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## ABSTRACT

Lead can be a poison to the environment which may affects all body systems. Lead can also affect human health especially those who frequently exposed. Lead potentially lowering level of intelligence, growth, loss, causing anemia, and disorder among children as lead is neurotoxin and accumulative. In addition, lead can cause a decrease in the ability of the brain, whereas in adults may cause interference of high blood pressure and other tissue toxicity. Any increase in the levels of lead in the blood of 10 ug / dl led to a decrease in IQ of 2.5 points or 0.975 IQ. The research aims to assess the potential health risk among people who exposed to lead in the coastal area of city of Makassar. We investigate the distribution of toxic lead in Makassar coastal area namely; sea water, sediments, shells and crab. Then investigate lead toxins around coastal such as lead in soil, dust, snacks and air. After create distribution maps lead risks we create analysis of environmental and health risks assessment. Result revealed that the analysis of spatial distribution of Lead in the sediment shows that the high distribution was in station 3 in Mariso districts then coastal Tallo area and the lowest was in Tamalate District. While the analysis of the spatial Pb distribution in mussels seen that the highest distribution Pb was in station 4 of districts Mariso then coastal waters Tallo area and the lowest was in Tamalate District 5.00 to 7.20 mg/g. In conclusion, it revealed the concentration of Lead at all stations of those four districts have exceeded the level of allowed standard and may potentially lead to a hazard both to environment and human being who are living in the surround area.

**Keywords:** Risks Assessment, Exposure frequent, lead poisoning, coastal areas, snack food

## INTRODUCTION

The large amount of Lead disposed to the coastal water environment generate a hazard both to the environment and human being around the coastal. The accumulation of lead in the aquatic biota may become neurotoxin and accumulative which then potentially hazard for the higher consumers including human being as the highest consumer. The specific target of lead poisoning come to young children where lead can cause a decrease in the ability of the brain, whereas in adults it may cause interference of high blood pressure and other tissue toxicity<sup>1</sup>. Study shown that any increase in the

levels of lead in the blood of 10 ug / dl led to a decrease in IQ of 2.5 points or 0.975 IQ scores<sup>2</sup>. Any exposure to air polluted by lead 1 ug / m<sup>3</sup> likely to contribute 2.5 to 5.3 mg / dl in the blood of the person that is in place. Lead is taken into the body is normally 0.3 mg / 100cc per day, if the intake of lead 2.5 mg / day then it took 3-4 years to get the toxic effects. If the intake of lead 3.5 mg / day, it takes only a few years intoxication.

Demographic factors such as housing location, housing physic, a trip to the school and the type of vehicles to the school has a critical influence on blood lead levels. Research conducted by Khidri, et al<sup>3</sup> revealed street children and kindergarten children in Makassar (90%) of which contain concentrations of lead in their blood above the 10% threshold and the other had a lead concentration 10 mg / dl in their blood. The average content of lead in children's blood were examined was

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23,96µg / dl. Research conducted in the city of Ambon by Mulyadi, et al<sup>4</sup> on the transport driver city show that there were 47% of respondents had concentration of lead in their blood exceeds the normal limit of > 40 g / 100 ml and the concentration of hemoglobin below normal was <13 g / 100 ml.

The research from various countries indicate that Indonesia, especially the city of Makassar are not safe from the dangers of lead. Pb may cause symptoms of poisoning vary between children and adults, as well as the source and type of contamination, even low doses of lead toxicity also have permanent effects on children<sup>5-7</sup>. Therefore, comprehensive study of lead needs to be done. Using a spatial analysis of distribution in the environment, determines the health risks of coastal communities of Makassar and build a model of integration of environmental effect relationships of lead on human health. The approach is a solution to make the policy of prevention and prediction of decreased levels of lead, so as not to spread widely and cause health effects, especially a decrease in IQ that would lower the index of children's education is getting worse from year to year.

The effects of heavy metal pollution are very harmful to health. Environmental factors that affect the presence of lead, namely water, soil and air. All these things are very important for human health. For that purpose, the research is conducted in an effort to analyze the pollution level in Makassar coastal area and its health risks. So the research analyzed the concentration of heavy metal of lead in water of good fish, *Anadara* sp. and snacks sold on the roadside along the coastal city of Makassar.

## MATERIALS AND METHOD

### Study Design

This survey method applied two approaches; environmental and risks assessment by using cross sectional design Study: This study dynamics of the correlation between risk factors with effects at the same time and the execution of measurements conducted shortly "point time"<sup>8</sup>.

### Location and Time Research

The location of this research conducted coastal area of Makassar. The choice of location carried out in five districts namely coastal districts, Tamalate, Mariso, Ujung Tanah, and Tallo. These districts represent

nine coastal districts in the city of Makassar, which is indicated exposed to heavy metals lead.

## Environmental Data Collection

### a. Aquatic Sampling Process

Samples of seawater, sediment, shellfish, taken on the basis of the sampling sites have been determined using the Global Positioning System (GPS). We collected samples from eight stations with three repetitions. Seawater samples inserted into the sampling bottle made of plastic with 100 ml, Sediment put into a sterile plastic of 100 grams, and shells to be put into a sterile plastic with 10-15 tail. Furthermore examined levels of lead using AAS method in the laboratory.

### b. Terrestrial sampling process

#### Dust Sample

Measurement of respirable dust using a Personal Dust Sampler (PDS) which contains paper filter that will catch dust that expose to children. This tool is equipped with a pump that will suck the dust out of the air into the filter by using a specific flow rate. Personal Dust Sampler (PDS) is a tool used to measure the concentration of dust among school children, principle of sucking the air with a certain speed (1.7 liters / minute) through a paper filter so that air through the pipeline will be filtered by a filter that has a certain weight. PDS types used in this study are the type SKC-224 models PCXR8. 46 made in Germany.

Soil

Sample

In this study used the land taken from alongside offshore divided into five three stations. Soil sampling at each taken three different locations and at each location were taken three points then at any point in doing the repetitions. Soil samples were taken to a depth of 10 cm - 20 cm. Before taken the land cleared of litter, gravel / rock, grasses, and also roots.

Equipment used to take soil samples comprising: a small shovel, navy (screwdriver), spoons, filters soil (sieve), measuring the depth of the soil (the crossbar), buckets of places to sift the soil, containers for storing soil samples were filtered and some plastic bags to store, samples collected immediately taken to the Health Laboratory Makassar.

### Samples and school food Snacks

School snacks food Samples were taken at eight stations with three repetitions in each district adjacent to the air and soil sampling. street vendors snack were taken with various snack that frequently consumed by communities along who are living surround the coastal area.

## RESULTS

Analysis of the data can be explained that in the city

of Makassar there is considerable industrial watersheds and small scale of home industries, especially the food industry and wood, bamboo and gold shops. Total industry is closely related to the pollution load of the industry.

Table 1 shows that the average lead (Pb) in the water, the sea has different variations, it appears that the average value is highest at the station at districts Tallo 9.04 mg / l, while the lowest in the sub-district station 1 Tamalate 0.12 mg / l.

**Table 1. Distribution of lead in the water, sediment, *anadara* and soil**

No	Variable Stations	St 1 Tmlt	St 2 tmlt	St 3 mriso	St 4 Mriso	St 5 UT	St 6 UT	St 7 TLo	St 8 Tlo
1	Water [mg/ml)	0.12	0.19	0.15	0.13	0.15	0.14	0.17	0.21
2	Sediment (mg /g)	6.03	6.68	8.00	7.97	7.45	7.13	7.77	7.67
3	<i>Anadara</i> (mg/g)	1.22	0.91	2.09	3.03	1.92	1.57	2.90	2.69
4	Soil (mg/g)	16.24	15.17	8.70	15.81	7.12	5.00	37.40	9.04

**Table 2. Distribution of content of Pb Air along the Coastal area of Makassar City, Indonesia**

Location (Districts )	n	Mean	Minimum – Maximum	Deviation standard
Tamalate	8	0,626	0,132 1,204	0,325
Mariso	8	0,493	0,141 1,622	0,474
Ujung Tanah	8	1,191	0,239 2,365	0,812
Tallo	8	1,634	0,863 2,111	0,469

### Spatial Distribution Pattern Pb streets snacks

Table 3 shows that the average lead at hawker has different variations, especially in the districts Tallo, Mariso, and Ujung Tanah. The average value is highest in districts Tallo of 0.958 mg / kg, while the lowest in the districts Mariso of 0.437 mg / kg.

**Table 3. Distribution of Pb content on school snack food in the Basic school**

Location (Districts )	n	Mean	Minimum – Maximum	Deviation standard
Tamalate	8	0.570	0,08 0,99	0,294
Mariso	8	0.437	0,23 0,79	0,345
Ujung Tanah	8	0.658	0,97 1,30	0,309
Tallo	8	0.958	0,20 0,80	0.23

## DISCUSSION

Based on the analysis of spatial distribution of metals in the sediment with pb used kriging interpolation method shows that the highest distribution pattern of Pb was in station 3 around Mariso districts then in Tallo coastal and lowest Pb concentration was in Tamalate District. While the analysis of the spatial distribution of metals in shells with pb method is seen that the distribution pattern of highest Pb was station 4 Mariso districts around the then coastal waters Tallo and lowest districts was Tamalate District.

Based on the analysis of Pb spatial distribution of surface soil shown that high around the station 4 in the district Tallo followed by Tamalatea districts of the coastal and the lowest in Ujung Tanah district. Communities and childhood exposure to lead remains a critical health control problem in the US. Integration of Geographic Information Systems (GIS) into childhood lead exposure studies significantly enhanced identifying lead hazards in the environment and determining at risk children.<sup>9</sup> In addition, Review of the recent literature on GIS-based studies suggests that numerous environmental risk factors might be critical for lead exposure. New GIS-based studies are used in surveillance data management, risk analysis, lead exposure visualization, and community intervention strategies where geographically-targeted, specific intervention measures are taken.<sup>9</sup> Among children in Chicago Public Schools (CPS), the severity of the effects of BLL on reading and math vary by racial subgroup (White vs. Hispanic vs. non-Hispanic Black)<sup>11</sup>

In the government regulation it is mentioned that for the maximum limit of metal contamination Lead (Pb) for processed food is = 0, 25 ppm. When compared with the results of the analysis to four sub-standardized samples but there are some snacks beyond the maximum contamination limit. However, if you still do not pay attention to the aspect of lead pollution (Pb) especially from polluted air and keep consuming large amount of snacks, then lead (Pb) entering through food or drink will go to pharynx and then taken to gastrointestinal tract. Furthermore, lead (Pb) will be stored in the blood that will gradually accumulate.<sup>12-14</sup>

Other factors that influence the presence of Lead contamination (Pb) on food is the direction of the wind. MOH said that due to wind movement, will happen the process of spreading pollutants. Of the 4 samples, 3 of the samples were in close proximity to the open area so that it is in direct contact with the highway. However, wind direction and speed greatly affect the distribution of pollutants. All samples were taken on the side of the road that directly connected to the highway where many motor vehicles passed by. According to Rubhan<sup>11</sup> this becomes an important factor because every 10% of timbale emitted vehicles, will be deposited within 100 m from the highway. The closer the food distance to the traffic light the easier and higher the concentration of lead exposure (Pb).

## CONCLUSION

Based on results it can be concluded that lead levels in snack foods and shell Anadara sp. still qualified. While the concentration of lead in urine students have largely

been ineligible. Recorded about 75% or equivalent with 15 children out of 20 respondents whose lead level (Pb) in their urine is greater or equal to 150 µg / ml.

**Conflict of Interest:** Authors declare no conflict of interest within this study and publication

**Ethical Clearance:** Obtained from Hasanuddin University Ethical committee

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## REFERENCES

1. Anwar Mallongi, Ruslan La Ane and Agus Bintara Birawida,. Ecological risks of contaminated lead and the potential health risks among school children in Makassar coastal area, Indonesia. *J. Environ. Sci. Technol.*, 2017: 10: 283-289.
2. Widowati, dkk.. Efek Toksik Logam Pencegahan dan Penanggulangan Pencemaran. Penerbit C.V ANDI OFFSET. Yogyakarta. 2008
3. Khidri, Kadar Timbal dalam darah Anak-anak di Kota Makassar, (Online), (<http://www.pdpersi.co.id>, diakses 10 februari 2012.
4. Mulyadi,. Pengaruh Logam Berat Timbal (Pb) dalam Darah Terhadap Kadar Hemoglobin pada Supir Angkutan Kota. Tesis tidak diterbitkan, Makassar: Program Pascasarjana.UNHAS. 2007.
5. Hasmi and Anwar Mallongi, Health Risk Analysis of Lead Exposure from Fish Consumption among Communities along Youtefa Gulf, Jayapura. *Pakistan Journal of Nutrition*. 2016. : Volume 15, Number 10, 929-935.
6. Mallongi, A., P. Pataranawat and P. Parkian,. Mercury emission from artisanal buladu gold mine and its bioaccumulation in rice grain, Gorontalo Province, Indonesia, *Adv. Mater. Res.*, 2014: 931-932: 744-748
7. Amran, Stang, and Anwar Mallongi, AIP Conference Proceedings 1825, 020002 (2017); doi: 10.1063/1.4978971
8. Notoatmodjo, Soekidjo. Ilmu Perilaku Kesehatan. Jakarta. Rineka Cipta. 2010
9. Akkus, C., & Ozdenerol, E.. Exploring Childhood Lead Exposure through GIS: A Review of the Recent Literature. *International Journal of Environmental Research and Public Health*, 2014: 11(6), 6314.
10. Blackowicz, M., Hryhorczuk, D., Rankin, K., Lewis, D., Haider, D., Lanphear, B., & Evens, A.. The Impact of Low-Level Lead Toxicity on School Performance among Hispanic Subgroups in the Chicago Public Schools. *International Journal of Environmental Research and Public Health*, 2016: 13(8), 774.
11. Ruhban, dkk. Analisis Hubungan Kadar Timbal Darah dengan Sindrom Agen di Terminal Regional Daya Makassar. Makassar: Universitas Hasanuddin; 2008.
12. Morello-Frosch, R., Zuk, M., Jerrett, M., Shamasunder, B., Kyle, A.D., Understanding the cumulative impacts of inequalities in environmental health: implications for policy. *Health Aff.* 2011 : 30, 879-887.
13. US EPA. Mercury study report to Congress Health Effects of Mercury and Mercury Compounds, vol. V. Environmental Protection agency, Washington (DC), United States, , EPA. 1997:-452/R-97-007.
14. Hasibuan, R dkk. Analisa Kandungan Timbal (Pb) pada Minyak Sebelum dan Sesudah
15. Penggorengan yang Digunakan Pedagang Gorengan Sekitar Kawasan Traffic Light Kota
16. Medan Tahun 2012. Medan : Universitas Sumatera Utara; 2012.



# The Effect of Ginger Soy Milk (Sulehe) Combination on Histopathology of Pancreas and Muscle of Mouse Model of Insulin Resistance

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## ABSTRACT

Type 2 Diabetes Mellitus (T2DM) is a metabolic disease characterized by chronic hyperglycemia and hyperinsulinemia. T2DM is closely associated with the condition of insulin resistance. Insulin resistance is associated with the presence of hyperinsulinemia characterized by a decreased tyrosine kinase enzyme activity and an increased tyrosine phosphatase enzyme activity. One alternative attempt to overcome insulin resistance in T2DM is the administration of soy-based nutrition. Soy milk is one of the processed soybeans containing polysaccharide protein, carbohydrate, fat, vitamin, mineral, fiber, isoflavones and low glycemic index (GI). This study aimed to determine the effect of ginger soymilk (Sulehe) combination on histopathology of pancreas and muscle of mouse model of insulin resistance. This study used true experimental laboratories with Post-Test Only Control Group Design. Selection of subjects for grouping and treatment was done using randomization with 2 control groups, i.e. negative control (pap milk and aquadest) and positive control (DTLF) and 4 treatment groups, i.e. P1 (positive control + soy milk 5000 mg/day), P2 (positive control + ginger 500 mg/kgBW), P3 (positive control + ginger soy milk 2500:250 mg/kgBW) and P4 (positive control + ginger soy milk 5000:500 mg/kgBW). Histopathology of pancreas and muscle was analyzed using HE staining and immunohistochemistry methods. This study used mouse model of insulin resistance induced by a combination of High Fat and Fructose Diet (DTLF) for 16 weeks and low dose of STZ 25 mg/kgBW. The study was approved by the Health Research Ethics Committee No. 687-KEP-UB. The results showed that in the ginger soy milk (sulehe) group, particularly combination II (5000:500 mg/kgBW), was evident to improve the histology of pancreas and muscle to the normal state.

**Keywords:** ginger soy milk, insulin resistance, histopathology of pancreas, histopathology of muscle.

## INTRODUCTION

One underlying factor of insulin resistance is the increase of Free Fatty Acids (FFA) in the plasma. The increased FFA in the plasma will lead to insulin resistance through several mechanisms, such as (1) excessive production of cytokine TNF- $\alpha$  can decrease

insulin sensitivity, thus stimulating the occurrence of insulin resistance, and (2) hyperlipidemia can increase the tyrosine phosphatase enzyme activity that can lead to a decrease in Insulin Signaling activity through protein dephosphorylation of the Insulin Receptor Substrate 1 (IRS1)<sup>1,2</sup>. An increase in blood glucose levels can lead to metabolic disorders and increased free radical production. Free radicals can damage the existing body cells like the liver, kidneys, pancreas and skeletal muscles (if the cells are damaged, the liver, kidneys, pancreas and skeletal muscle functions will decrease). Muscle is the main place of glucose in humans, and approximately 80% of the total body glucose uptake occurs in skeletal muscles. In type 2 diabetic patients, the ability of insulin to stimulate glucose uptake decreases to 50%. Therefore, the main

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place of insulin resistance in type 2 diabetic patients lies in muscle tissue<sup>3</sup>. The glucose uptake into muscle cells is basically insulin dependent through GLUT4. In insulin resistance, the synthesis of impaired muscle glycogen is massively mediated by reduced intracellular glucose translocation<sup>4</sup>. The action of insulin on skeletal muscle fibers takes place through specific membrane receptors coupled with tyrosine kinase activity that eventually lead to glucose uptake by activating GLUT4. Skeletal muscle atrophy occurs in a diabetic state and is associated with a low direct effect of serum insulin. Morphometric studies illustrate the decrease in muscle fiber diameter in diabetic state<sup>5</sup>

A study on the addition of 3% ginger extract on soy milk using spray drying method can increase antioxidant activity 21.67% higher than soy milk without ginger<sup>6</sup>. A scientific study in China in 2004 showed that the addition of ginger juice to soy milk component with a ratio of 1:50 (v/v) was able to increase anti-oxidant activity twice<sup>7</sup>.

## MATERIALS AND METHOD

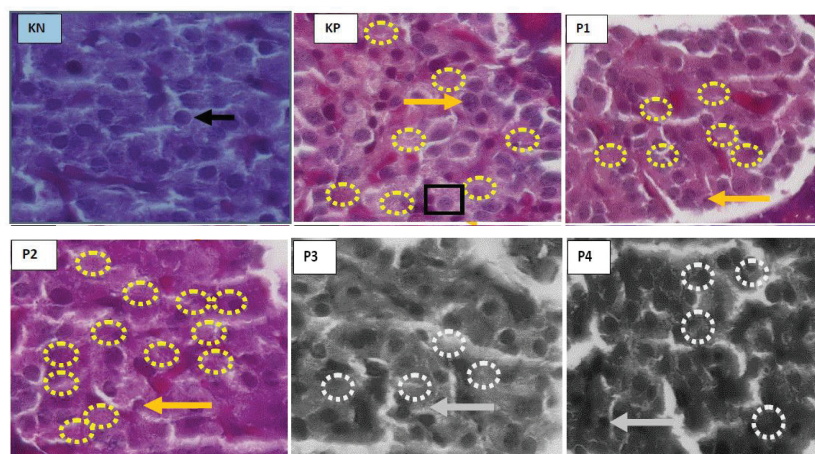
This study was true experimental research with Post-Test Only Control Group Design approach to determine the effect of ginger soy milk (Sulehe) combination on histopathology of pancreas and muscle in mouse model of insulin resistance. The population was healthy 2-3 months Sprague Dawley mice characterized by active movement. This study used a sample of 30 healthy male white mice aged 2-3 months with body weight of 150-200 grams. In this study, the population was divided into six groups, namely negative control (KN), positive control (KP), treatment one (P1), treatment two (P2), treatment three (P3), and treatment four (P4). In each group, the

number of experimental mice (n) was five mice. KN was a group of experimental mice without administration of High Fat and Fructose Diet (DTLF), low dose STZ (streptozotocin) and Ginger Soy Milk. KP was a group of experimental mice with administration of DTLF and STZ without intervention of Ginger Soy Milk. P1 was a group of experimental mice with administration of DTLF and STZ and intervention of Soy Milk dosed at 5000 mg/kgBW/day. P2 was a group of experimental mice with administration of DTLF and STZ with equal dose and intervention of ginger 250 mg/kgBW/day. P3 was a group of experimental mice with administration of DTLF and STZ with equal dose and intervention of ginger soy milk combination dosed at 2500:250/kgBW/day. P4 was a group of experimental mice with administration of DTLF and STZ with equal dose and intervention of ginger soy milk combination dosed at 5000:500/kgBW/day. After four weeks treatment, the experimental mice were dissected and the pancreas and leg muscles were taken for histopathological examination. In this study, the effect of soy ginger milk combination on the improvement of pancreatic and muscle beta cell damage by grouping the cells in each of these tissues into 3 groups: normal cells, hydropic degeneration, and necrosis was assessed.

## RESULTS

### Observation of Pancreatic Organ using Hematoxylin Eosin (HE) Staining

Pancreatic histopathologic observation was done by observing the morphological form of pancreatic tissue structure of mice using HE staining. The results of pancreatic histopathological observation are presented in Figure 1.



**Figure 1. Histopathology of the pancreas.**KN= Negative control, KP= Positive control, P1= induced by DTLF

and STZ and administered by soy milk, P2= induced by DTLF and STZ and administered by ginger, P3= induced by DTLF dan STZ and administered by ginger soy milk combination : 2500 mg : 250 mg/kgBW, P4= induced by DTLF and STZ and administered by ginger soy milk combination: 5000 mg : 500 mg/kgBW ( ) indicates that the distribution of beta cells begins to spread in the central of Langerhans island with almost large cell size, ( ) indicates the change in the form of beta-cell nucleus as the degeneration of beta cells is still occurring. ( ) indicates that there are essentially disappearing cells, caricinical nucleus (HE staining, 40x magnification)

The figure above shows that in KN (negative control) group, there is endocrine cell regularity in Langerhans island with uniform cell shape and proportional cytoplasmic size to nucleus size and no change (normal). The histopathology in KN showed that there is no change in the structure of pancreatic morphology. By using HE staining, it can be seen that the endocrine cell nucleus is purple-colored with a more rounded shape and a clear nucleolus, as well as purple cytoplasm. Meanwhile KP (positive control of insulin resistance) group shows a visible change induced by DTLF, i.e. endocrine cell degeneration. Endocrine cell degeneration is seen in its nucleus that changes to polymorph (not uniform). The changes occurred are described in the form of a change in the smaller endocrine cell nucleus (picnosis), it even began to disappear and only showed empty cytoplasm containing glycogen deposits and enlarging without

nucleus and hyperchromatic cytoplasmic form. This explains that the administration of DTLF can damage pancreatic endocrine cells, especially beta cells, so that insulin secretion into the blood vessels decreases.

In the treatment groups, P1 showed a change in their pancreatic cells. These changes included endocrine cells that began to regenerate into normal shape, although some degenerating endocrine cells and cells with loss of nucleus were found. P2 showed the regeneration process of a number of endocrine cells but not more than P1. A large number of endocrine cells in P2 and many cells with loss of nucleus such as P1 were still degenerated. P3 also showed a change in regeneration to normal form, although some degenerating endocrine cells and cells with loss of nucleus were still found. P4 showed a sign of regeneration into normal form at large amounts compared to P1, P2 and P3. The cells with loss of nucleus were also less than those of P1, P2, and P3.

Observation of Muscle Organ using Hematoxylin Eosin (HE) Staining

Observation of muscle organ using HE staining focused on observing the signs of degeneration and necrosis of muscle cells. Degeneration was characterized by hyaline degeneration, vacuoles, decreased muscle fiber diameter (striation) and macrophage cell infiltration. Necrosis was characterized by the fragmentation of muscle fibers, swollen cell nucleus, and calcification.

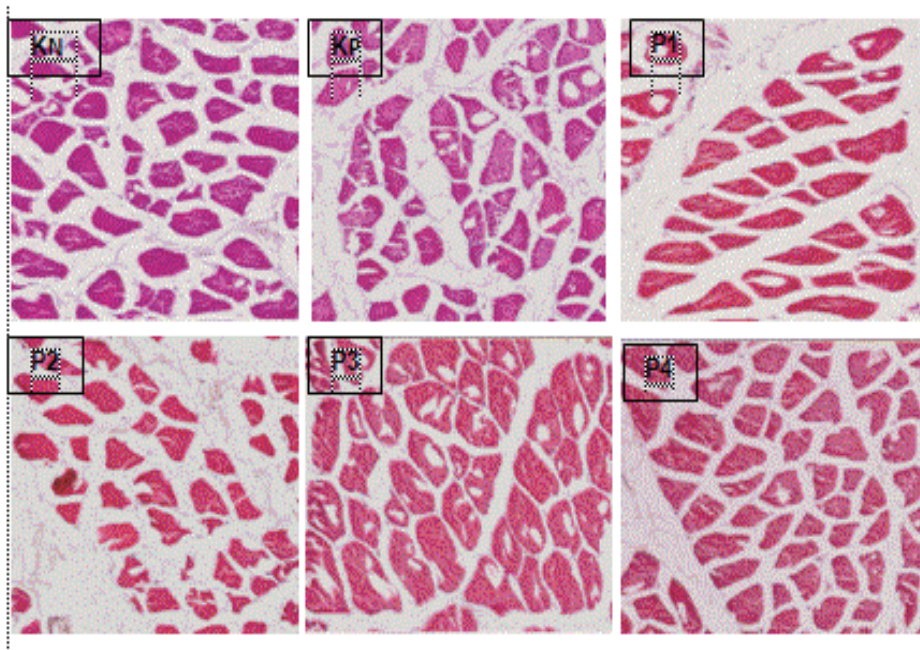


Figure 2. Histopathology of the muscle. KN= Negative control, KP = Positive control, P1= induced by

DTLF and STZ and administered by soy milk dosed at 5000 mg/kgBW, P2= induced by DTLF and STZ and administered by ginger dosed at 500 mg/kgBB, P3 = induced by DTLF and STZ and administered by ginger soy milk combination: 2500 mg : 250 mg/kgBW, P4 = induced by DTLF dan STZ and administered by ginger soy milk combination: 5000 mg : 500 mg/kgBW.

The above figure shows that in the KN group, muscle fibers did not experience pathological changes such as hyaline degeneration, vacuoles, decreased muscle fiber diameter, striation loss, macrophage cell infiltration and muscle fiber fragmentation, swollen cell nucleus and calcification. While in the KP group, a change in the pathology signed by decreased size of muscle fibers was occurred.

## DISCUSSION

### The Effect of Ginger Soy Milk Combination on Histopathology of Pancreatic Beta Cells

In the positive group, the nucleus of the endocrine cell became smaller (picnosis) even began to disappear and only showed empty cytoplasm containing glycogen deposits and enlarging without nucleus and hyperchromatic cytoplasmic form. In addition, clumping cytoplasm indicated protein denaturation, explains that STZ administration can damage pancreatic endocrine cells especially  $\beta$ -cells.

P4 showed maximum improvement with a large numbers of regeneration changes to the normal form. Furthermore, the number of cells with loss of nucleus was found relatively less than in P1, P2 and P3.

Thus, it can be concluded that the active component of combination therapy II is capable to improve  $\beta$ -cells either quantitatively or qualitatively. The potential for improvement in combination therapy II is an important point in relation to the results of the *in silico* study and the analytical path that mention the association of ginger soy milk with PPAR $\gamma$ .

Basically, each active component, both in soy milk or ginger, has potential hypoglycemic effects that have been explored in some previous studies. Isoflavones in soy milk are essential in the regulation of fat in adipocyte tissue including increased adipogenesis and support glucose uptake in adipocyte and muscle tissues through PPAR $\gamma$  regulation<sup>8-11</sup>. Meanwhile, the active component

of ginger as discussed in the 500 mg Ginger treatment model also showed plasma glucose regulation activity through non-PPAR $\gamma$  or PI3K pathways. The regulation of plasma glucose by Ginger is mentioned through its ability to interact with serotonin receptors post-absorption process of ginger in the gastrointestinal tract.

Increased glucose uptake mechanisms during treatment in all observation groups through histologic data validation may be associated with improvement of glucose transport into cells. The pancreatic  $\beta$ -cell function defect is a second disorder after insulin resistance in the pathogenesis of T2DM. Several mechanisms related to pancreatic  $\beta$ -cell dysfunction may be due to chronic hyperglycemia which leads to increased pro-islet amyloid polypeptide (IAPP) synthesis in  $\beta$ -cells. Increased IAPP may induce IL-8 release and progress to macrophage recruitment resulting in increased local inflammatory reactions in the islet<sup>12</sup>.

### The Effect of Ginger Soy Milk Combination on Histopathology of Muscle

Muscle is the main place of glucose in humans, and approximately 80% of the total body glucose uptake occurs in skeletal muscles. In T2DM patients, the ability of insulin to stimulate glucose uptake decreases to 50%. Therefore, the main place of insulin resistance in T2DM patients lies in muscle tissue<sup>3</sup>. The glucose uptake into muscle cells is basically insulin dependent through GLUT4. In insulin resistance, the synthesis of impaired muscle glycogen is massively mediated by reduced intracellular glucose translocation. Skeletal muscle atrophy occurs in a diabetic state and is associated with a low direct effect of serum insulin. Morphometric studies illustrate the decrease in muscle fiber diameter in diabetic state<sup>5</sup>.

Based on the description, this study explored the histology of skeletal muscle tissue in various observation groups. Observation of muscle organ using HE staining focused on observing the signs of degeneration and necrosis of muscle cells. Degeneration was characterized by hyaline degeneration, vacuoles, decreased muscle fiber diameter (striation) and macrophage cell infiltration. Necrosis was characterized by the fragmentation of muscle fibers, swollen cell nucleus, and calcification. The results showed that combination II treatment is almost the same with negative or normal group.

The results showed that in the negative control group, muscle fibers did not experience pathological changes such as hyaline degeneration, vacuoles, decreased muscle fiber diameter, striation loss, macrophage cell infiltration, muscle fiber fragmentation, swollen cell nucleus and calcification. A decrease in muscle fiber diameter occurred in the positive control group could be attributed to the results that the skeletal muscles of the STZ-induced diabetic Sprague-Dawley mice were damaged and discontinuous, experiencing mononuclear cell infiltration between muscle fibers and myofibril damage<sup>13</sup>. A denser incision showing smaller size in the positive control group indicated a change in muscle structure that should necessarily be analyzed related to the function. Based on the concept that muscle tissue is involved as a major organ that plays a role in glucose uptake and data in Figure 2 which suggests that blood glucose levels in the positive control group show the highest value compared to the other group, it is very logical to conclude that changes in the degenerated muscle cell structure also affect the role of plasma glucose uptake.

An overview of histologic analysis results of muscle tissue in the treatment group shows that GINGER alone did not show structurally significant improvement in muscle fiber post-therapy. Conditions seen in the positive control group also occurred in the treatment model of GINGER with a single formula. Meanwhile, in the administration of SOY MILK single formula or in the Combination II showed a larger diameter muscle fiber structure, plasma glucose measurement, and lower number of cells with loss of nucleus, compared to the positive control group. The improvement is precisely visible in the histology with the treatment of SOY MILK 5000 mg and the approximate structure of normal/negative group was clearly seen in the combination of therapy II.

### CONCLUSION

Based on the results above, it can be concluded that the combination therapy II, i.e. ginger soy milk (SULEHE) dosed at 5000:500 mg/kgBW/day can improve the skeletal muscle diameter and the tissue calcification.

**Conflict of Interest:** Authors declare that no conflict of interest within this publication

**Ethical Clearance:** Ethical clearance by University

of Brawijaya Malang

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### REFERENCES

1. Saltiel AR., Kahn CR., Insulin Signalling and the Regulation of Glucose and lipid Metabolism, *Nature* 2001: 414:799-806.
2. Gao Z., Zuberi A., Quon MJ., Dong Z., Ye J., Aspirin inhibits TNF- induced serine Phosphorylation of IRS1 through targeting multiple serin Kinases. *J Biol Chem* 2003: 278:24944-24950.
3. Dipiro, J.T., Talbert, R.L., Yee, G.C., Matzke G.R., Wells, B.G., & Posey, L.M.. *Pharmacotherapy A Pathophysiologic Approach* (8 th ed). New York: McGraw-Hill Companies. 2011
4. Wilcox, Gisela..Insulin and Insulin Resistance. 2005. *Clin Biochem Rev*.May; 2005; 26(2): 19–39.
5. Aughsteen, A.A., A.B. Khair, A.A. Suleiman. Quantitative Morphometric Study of the Skeletal Muscles of Normal and Streptozotocin- Diabetic Rats, *Journal of the Pancreas*, 2006: 7(4): 382- 389.
6. Pramitasari, D., R. Baskoro Katri Anandhito, Gusti Fauza.. Penambahan ekstrak jahe dalam pembuatan susu kedelai bubuk instan dengan metode spray drying: Komposisi kimia, sifat sensoris, dan aktivitas antioksidan. *Biofarmasi*. 2011: Vol. 9, No. 1, pp. 17-25.
7. Zhi, Zhou.. Study on processing technology of coumpound soymilk beverage with ginger juice. *Food Science and Technology* 2004-08.
8. Naaz A., Yellayi S., Zakroczymski MA., Bunick D., Doerge DR., Lubahn DB., Helferich WG., Cooke PS,. The soy isoflavone genistein decreases adipose deposition in mice, *Endocrinology* ; 2003: 144:3315–3320.
9. Dang ZC., Audinot V., Papapoulos SE., Boutin JA & Lowik CW, Peroxisome proliferator-activated receptor gamma (PPARGgamma) as a molecular target for the soy phytoestrogen genistein, *Journal of Biological Chemistry*; 2003: 278:962–967.
10. Bragt MC & Popeijus HE., Peroxisome proliferator-activated receptors and the metabolic syndrome. *Physiological Behaviour*; 2008: 94: 187-197.
11. D'Souza DM, Al-Sajee D, Hawke TJ.. Diabetic myopathy: impact of diabetes mellitus on skeletal

- muscle progenitor cells. *Physiol.* 2013 Dec 20;4:379. doi: 10.3389/fphys.2013.00379.
12. Halban, Philippe A. Kenneth S. Polonsky, Donald W. Bowden, Meredith A. Hawkins, Charlotte Ling, Kieren J. Mather, Alvin C. Powers, Christopher J. Rhodes, Lori Sussel, and Gordon C. Weir. 2014. b-Cell Failure in Type 2 Diabetes: Postulated Mechanisms and Prospects for Prevention and Treatment. *Diabetes Care* 2014;37:1751–1758 | DOI: 10.2337/dc14-0396. OBJECTIVE.
  13. Zhen Zhang, Jing Li, Lei Yang, Rongping Chen, Rui Yang, Hua Zhang, Dehong Cai, and Hong Chen. The Cytotoxic Role of Intermittent High Glucose on Apoptosis and Cell Viability in Pancreatic Beta Cells *Journal of Diabetes Research* 2014, Article ID 712781, 9 pages <http://dx.doi.org/10.1155/2014/712781>.

# The Effect of Plyometric and Resistance Training on Muscle Power, Strength, and Speed in Young Adolescent Soccer Players

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## ABSTRACT

**Objective.** To examine the effectiveness of Plyometric and Resistance Training on muscle power, strength, and speed in Young Adolescent Soccer Players. **Methods.** This is a three-group, randomized, single blinded, controlled trial. A total of 45 soccer players were divided equally into three groups (plyometric, resistance training, and control). Muscle strength, power and speed was measured at baseline and 6 weeks' post training. Data was analyzed using one way ANOVA. **Results.** At the end of the training session (6 weeks), all groups showed statistically significant improvement of muscle power, strength and speed ( $p < 0.05$ ). Plyometric group showed a significantly better improvement on muscle power and speed than the other groups while resistance training group showed better improvement of muscle strength than the other group. **Conclusion.** Plyometric is more effective in improving muscle power and speed in young adolescent soccer players, but resistance exercise is more effective in improving muscle strength.

**Keywords:** *plyometric, resistance exercise, muscle power, muscle strength and speed, soccer players*

## INTRODUCTION

Soccer is a popular game and sport worldwide, favoured by many people, from children to elderly Faruq<sup>1</sup> men and women by Kuper<sup>2</sup> including among Indonesian<sup>3</sup>. The government of Indonesia put special attention to soccer and becomes part of the national curriculum as stated by the Indonesian ministry of education and culture<sup>4</sup>.

Physical training is a process by which an athlete is prepared for the highest-level performance as possible. Training is effective to improve power, strength and speed. One form of training aimed at increasing muscle power, strength and speed is plyometric training. Plyometric (from the Greek plio = more, and metric = to measure) which seeks to improve power output<sup>5</sup>. Plyometric training will likely increase the athlete's ability to tolerate higher eccentric muscle forces and increase the potentials of initial concentric forces. Plyometric is most beneficial for athletes in high-speed and power activities<sup>6</sup>. Plyometric exercises utilise the stretch shortening cycle that consists of a

rapid eccentric contraction followed by an immediate concentric contraction<sup>7</sup>. Plyometric training is a program of high-intensity, high-velocity exercises and effective to increase power output, quick neuromuscular reactions, and coordination. This form of exercise is also recommended to improve athletic performance and reduce the risk of musculoskeletal injury<sup>8</sup>.

Plyometric training such as jump or hop, single leg press, side lung and step up<sup>9</sup>. Plyometric training can be applied to sports such as soccer, basketball, and volleyball<sup>7</sup>. Power is strength expressed at speed (strength  $\times$  speed) and represents very short explosive movements<sup>10</sup>. Strength is the ability of muscle to exert force. Speed is the ability to perform a movement within a short period of time<sup>10</sup>. The aim of this study was to examine the effectiveness of plyometric training on power, strength, and speed of Young Adolescent Soccer Players.

## MATERIALS AND METHOD

Participants

Soccer players who had registered as soccer player on National Sport Committee of Indonesia Papua Branch, were invited to take part in a randomized, controlled study to compare plyometric training and resistance training. Enrolment took place for 6 weeks. Those interested were trained in a National Sport Committee of Indonesia Papua Province. The exclusion criteria were having severe injury such as fracture, sprain ankle grade III or IV, or anterior cruciate ligament injury. All participants provided written, informed consent. The ethic committee of Cendrawasih University approved the study protocol.

### **Design**

The study used a quasi-experimental between-groups design. Participants were assigned randomly to 1 of the 2 groups (intervention group or control group). After random assignment, the groups were balanced based on their age, and pre-test vertical jump, pre-test leg dynamometer, and pre-test 30 run test. Each participant was tested at baseline, completed a 6-week training intervention, and was tested post-intervention. Six weeks of plyometric and 6-weeks training have been shown to be sufficient to elicit performance improvements.

### **Testing Protocol**

Participants completed the vertical jump test, shuttle run test, and 30 metres testing at baseline and post 6 weeks training. Testing was completed in a National Sport Committee of Indonesia, Papua Province gymnasium. All participants performed a standardised dynamic warm-up before testing.

**Vertical jump test.** Vertical jump test was used to measure the muscle power of lower limb. To prepare the vertical jump, the participants stood under it with their feet together and heels on the ground and reached with their dominant arm to measure their standing reach. The participants were instructed to use a movement jump with no extra steps. The participants could swing their arms and were instructed to jump as high as possible and reach for the vanes. To begin the test, the participants stood in an upright standing position. When ready, they flexed the ankles, knees, and hips to make a preliminary downward movement to a self-selected depth, then extended their ankles, knees, and hips to jump vertically. At the top of their jump, the participants hit the vanes. Their vertical jump was measured as the difference between the highest vane hit on their jump and their

standing reach. Participants completed 3 jumps, and the best jump was used for analysis.

**Leg dynamometer test.** Leg dynamometer was used to measure the strength of the lower limb, the ability of the lower limb muscle to exert force. To prepare leg dynamometer, participants wear a waist strap, then stood by bending both knees 45 degrees. The waist strap is attached to the leg dynamometer. After that the participants tried to straighten both legs with the maximum force. Then see the score. Participants are given the opportunity to tried three times and the best score was used for analysis.

**30 meters run test.** 30 meters run test was used to measure the speed, the ability to perform a movement within a short period of time. To prepare 30 meters run test, the participants stands behind the line with front foot just above the start line. On the "start" command the participant runs forward as fast as possible to finish line. Turn on the stopwatch on the "start" command and stop the stopwatch when the runner passes the finish line. Participants are given the opportunity to perform shuttle run twice and the best time was used for analysis.

### **Training intervention**

Soccer players received the same amount of training as the plyometric training over 6 weeks. Each soccer player was trained by 1 physical trainer only according to written prescriptions, each training 2-3 sets x 20-30 repetition, twice a day, six times a week for 6 weeks. Soccer players received plyometric training for lower limb.

### **Plyometric training**

Plyometric training consists of two types, low impact training, and low impact training. Low impact training including skipping, rope jump, low jump and short stride, hops and jumping, jumping in top bench or rope as high as 25-35 cm. High impact training including: standing broad/long jump, Triple jump, high jump and long stride, jumping in top bench or rope as high as 35 cm, drop jump and reactive jump.

### **Resistance Training.**

Resistance training is a modality of exercise that particularly for its role in improving athletic performance by increasing muscular strength, power and speed (Kraemer & Ratamess, 2004). Resistance Training in this



study consists of two specific training, strength training to increase strength and power training to increase power and speed. For specific strength to be gained the exercise programme must have the following components: The weight must be between 75% and 95% of 1RM weight, 2 until 5 repetitions in each set of exercises, 2 until 5 sets of each exercise, 2 until 5 minutes of rest between sets, The speed of exercise should be between 60% and 80% of the maximum speed at which the exercise could be performed.

Power training is an important component of many athletes training programs to provide them with greater force production and at greater speeds. The exercises transfer well to ballistic athletic movements and require good recruitment pattern of the muscles to be effective. A power session should follow these principles: The weight should be moved as quickly as possible through the available range, 3–5 reps per set, 3–5 sets, work at 40–60% of 1RM, 3–5 min rest between sets, A power session needs to be included for at least 6 weeks for advances to be made.

**Table 1. General characteristics of Participants**

Characteristics	PL	RT	CON	P
Age	21.33	21.33	21.33	ns
Height	169.13	169.46	169.53	ns
Weight	66.1	66.2	66.1	ns
Vertical Jump Test	2.133 ± 0.743	1.533±0.516	0.20±0.136	ns
Leg Dynamometer	1.733± 0.457	3.533±2.294	0.667±0.487	
30 meters run test	-0.263 ± 0.192	-0.033±0.049	-0.007±0.009	

Paired t-test (Table 2) showed that there are significant differences ( $p < 0.05$ ) between pre-test and post-test on power, strength and speed in all of groups.

## Outcomes Measure

Primary outcome measures was assessed at baseline and 6 weeks thereafter, respectively. The primary outcome measure was vertical jump test, leg dynamometer, and 30 meters run test.

## Statistical Analysis

The primary analysis was the comparison of vertical jump test, leg press, and 30 metres run test changes from baseline to 6 weeks training. Paired t test to compare changes between baseline and 6-week interventions was applied. Statistically significant was set to  $p < 0.05$ .

## RESULTS

On the general characteristics of the study subjects (Table 1), there was no significant difference among all of group, in terms of age, vertical jump test, leg dynamometer, and 30 metres run test.

**Table 2 Effect of plyometric training on improving power, strength and speed of football players**

Papua

Variables	Pre-test (Mean±SD)	Post Test (Mean±SD)	p*
PL			
Power	56.60 ± 3.501	58.73 ± 3.825	0.000*
Strength	237.93 ± 2.798	240.40 ± 2.787	0.000*
Speed	3.906 ± 0.431	3.602 ± 0.043	0.000*
RT			
Power	41.93 ± 4.697	43.46 ± 4.517	0.000*
Strength	192.93 ± 20.02	196.33 ± 20.457	0.000*
Speed	3.261 ± 0.114	3.258 ± 0.114	0.019*
CON			
Power	49.53 ± 7.249	49.80 ± 7.222	0.041*
Strength	201.66 ± 28.22	202.53 ± 28.39	0.000*
Speed	3.451 ± 0.141	3.443 ± 0.135	0.005*

\* t- test

One way ANOVA test (Table 3) showed that the changes of power, strength and speed are significantly different ( $p < 0.05$ ) between the groups. Plyometric group perform better on power and speed than the Resistance Training group and no added training group.

**Table 3. Differences in the effects of plyometric training on improving power, strength, and speed between the groups**

	PL	RT	CON	p*
Power	2.133 ± 0.743	1.533±0.516	0.00±0.000	0.009*
Strength	1.733± 0.457	3.533±2.294	0.667±0.487	0.003*
Speed	-0.263 ± 0.192	-0.033±0.049	-0.007±0.009	0.000*

\* One-way ANOVA

But Resistance Training group perform better on strength than the plyometric group and no added training group.

## DISCUSSION

Results of this study provide evidence that the plyometric training is more effective in improving power, and speed. But Resistance Training is more effective in improving strength. That is mean plyometric training is effective on improving power, and speed of Papua soccer players, But Resistance Training is more effective in improving strength of young adolescent soccer players. This finding study is in line with McKinlay et al.<sup>12</sup> that plyometric training was more effective in improving jump performance, while free-weight resistance training

was more advantageous in improving peak torque, where the stretch reflex was not involved. This study finding is in line with Bedoya et.al<sup>13</sup> that plyometric training is effective on increase jumping ability, strength and speed.

### Power

Plyometric exercises include strength and speed used for muscle contraction in explosive stretch shorten cycle (SSC) explosive characteristics. This type of exercise involves the movement of SSC to enhance the movement of athletes with short time. The plyometric exercise is an exercise method for developing explosive power, an essential component for muscle performance. Plyometric refers to exercises that are associated with very strong muscle contractions in responding to dynamic loads

dynamically and involve muscle stretching. Conceptual practice of plyometric exercises by Verostanski helps develop a complete neuromuscular system for power movement, not just the contraction<sup>14</sup>. This study finding in line with Hidayat et.al<sup>15</sup> that plyometric is effective on improving power of volleyball player.

### Strength

This study finding in line with Schoenfeld, et.al<sup>16</sup> that resistance training is effective on improving hypertrophy and muscle strength in well-trained men. Resistance training (RT) is the primary mode of exercise for enhancing muscular adaptations. Studies show that regimented resistive exercise can promote marked increases in muscle strength. Current guidelines state that loads of  $\geq 65\%$  1 repetition maximum (1RM) are necessary to elicit favourable increases in hypertrophy, with even higher loads needed to maximize strength. It has been postulated that heavy loading is required to fully recruit higher threshold motor units. Based on this claim, it stands to reason that optimal improvements in strength and hypertrophy can only be accomplished through complete motor unit activation by the use of heavy loads<sup>16</sup>. In heavy resistance training, all muscle fibre get larger (hypertrophy) because motor units are recruited in sequential order by their size to produce high level of force<sup>17-20</sup>.

### Speed

This study in line with Karim et al.<sup>21</sup> that plyometric exercises were effective on improving speed, while countermovement jump was found significantly better than box jump and double leg jump. This study also in line with Beato Marco et.al<sup>22,23</sup> that plyometric and directional training are important and able to give meaningful improvements on power and speed parameters in a specific soccer population.

## CONCLUSION

Plyometric training is more effective on improving power, speed of young adolescent soccer players compared to Resistance Training group and no added training group. But Resistance Training is more effective on improving strength of young adolescent soccer players compared to plyometric training and no added training.

**Conflict of Interest :** None

**Ethical Clearance:** The ethic committee of Cendrawasih University approved the study protocol.

**Source of Funding :** Authors their selves

## REFERENCES

1. Faruq, M. M.. Meningkatkan Kebugaran Tubuh Melalui Permainan dan Olahraga Sepakbola. Surabaya: PT Gramedia Widiasarana Indonesia. 2008.
2. Kuper, S.. Socceromics: Why England Loses, Why Spain, Germany, and Brazil Win, and Why the US, Japan, Australia and Even Iraq Are Destined to Become the Kings of the World's Most Popular Sport: Nation Books. 2014.
3. Handoko, A.. Sepakbola tanpa batas: city of tolerance: Kanisius. 2008.
4. Permendikbud, N. A.. Implementasi Kurikulum. Jakarta: Depdiknas. 2013.
5. Whyte, G., Spurway, N., & MacLaren, D.. The Physiology of Training: Advances in sport and exercise science series. Med Sci Sports Exer, 2006: 37(6), 881-903.
6. Knudson, D.. Fundamentals of biomechanics: Springer Science & Business Media. 2007.
7. Porter, S.. Tidy's Physiotherapy E-Book: Elsevier Health Sciences. 2013.
8. Kisner, C., Colby, L. A., & Borstad, J.. Therapeutic exercise: foundations and techniques: Fa Davis. 2017.
9. Kraemer, W. J., & Häkkinen, K.. Handbook of sports medicine and science, strength training for sport: John Wiley & Sons. 2008.
10. Draper, N., & Hodgson, C. Adventure sport physiology: John Wiley & Sons. 2008.
11. Medicine, A. C. o. S.. ACSM's guidelines for exercise testing and prescription: Lippincott Williams & Wilkins. 2013.
12. McKinlay, B. J., Wallace, P., Dotan, R., Long, D., Tokuno, C., Gabriel, D., & Falk, B.. Effects of Plyometric and Resistance Training on Muscle Strength, Explosiveness and Neuromuscular Function in Young Adolescent Soccer Players. Journal of strength and conditioning research. 2018.
13. Bedoya et.al.. Plyometric training effects on athletic performance in youth soccer athletes: a systematic

- review. *The Journal of Strength & Conditioning Research*, 2015: 29(8), 2351-2360.
14. Hanafi, S.. Efektifitas Latihan Beban Dan Latihan Pliometrik Dalam Meningkatkan Kekuatan Otot Tungkai Dan Kecepatan Reaksi. *Jurnal ILARA*, Volume 1 No. 2(2 Desember 2010), 1-9.
  15. Hidayat et.al.. Pengaruh Latihan Plyometric Depth Jump dan Jump To Box Terhadap Power Otot Tungkai pada Pemain Ekstrakurikuler Bolavoli SMK Teknologi Nasional Malang. *Jurnal Sport Science*, (2018): 7(1).
  16. Schoenfeld et.al.. Effects of low-vs. high-load resistance training on muscle strength and hypertrophy in well-trained men. *The Journal of Strength & Conditioning Research*, 2015: 29(10), 2954-2963.
  17. GG Haff, N. T.. *Essentials of strength training and conditioning* 4th edition. 2016
  18. Amran, Stang, and Anwar Mallongi, AIP Conference Proceedings 1825, 020002 (2017); doi: 10.1063/1.4978971
  19. Robby Kayame, Anwar Mallongi., Relationships between smoking Habits and the Hypertension occurrence among the Adults of Communities in Paniai Regency, Papua Indonesia. *Indian Journal of Public Health Research & Development*, January 2018, Vol. 9, No. 1
  20. Masriadi, Azis, R., Sumantri, E., Mallongi, A. 2018. Effectiveness of non pharmacologic therapy through surveillance approach to blood pressure degradation in primary hypertension patients, Indonesia. *Indian Journal of Public Health Research & Development*, April-June 2018, Vol.9, No.
  21. Karim, Z., Thyegarajan, T., Khairulhalimi, N., Azmi, S., Rahmat, A., Tan, K., & Nadzalan, A.. THE EFFECTS OF THREE DIFFERENT PLYOMETRIC EXERCISES TRAINING ON SPEED AMONG UNDER 12 PENANG NFDP FOOTBALL PLAYERS. *Journal of Fundamental and Applied Sciences*, 2018: 10(5S), 1142-1148.
  22. Beato Marco et.al.. Effects of Plyometric and Directional Training on Speed and Jump Performance in Elite Youth Soccer Players. *The Journal of Strength & Conditioning Research*, Volume 32 (2 February 2018 ), p 289–296.
  23. Saharuddin Ita.. *Journal Of Sport Science And Education (Jossae)* 1 April 2017: Vol: 2,.

# Utilization of Extract Tailings and Cow Manure for Increasing of Soil Quality and Uptake of Micronutrients of *Xanthosoma sagittifolium* (L.) Schott on Sub Optimal Land of Wondama

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## ABSTRACT

*Xanthosoma sagittifolium* (L.) Schott has a great potential to be developed as alternative food, particularly for local Papua people. Taro plants that grow in Teluk Wondama regency, generally can grow in mineral soil with less nutrients and high rain fall, so the nutrient tend to be low due to the wipe of the rain water. The low available nutrients need to be improved by applying integrated nutrient management through the addition of enzymatic nutrient from tailing extract and amelioration of organic matters from livestock manure. Study findings indicated that tailing extract containing micronutrient Cu, Fe, Mn, and Zn can be utilized as nutrition and enzymatic nutrients source that plays a role in electronic transport and as catalyst and activator of enzymatic reactions. The test of optimum fertilizer formula in Taro seeding indicated that organic fertilizer enriched by tailing extract at composition of A2 (95% : 5%) significantly increased the growth of Taro seeding. The sequence of micro nutrient absorption level, which was stated in coefficient of transfer value from soil to Taro was Zn>Cu>Mn>Fe.

**Keywords:** Micronutrient, Taro, transfer coefficient, manure, tailing.

## INTRODUCTION

Taro plants are one of the important staple foods for local Papua people, but recently the position of Taro plants begin to be displaced by sweet potato Rumawas, 2004<sup>1</sup> and imported rice. Taro is a semi-aquatic submerged plant even though it is usually referred to as upland taro<sup>2</sup>. Taro plants growing in Regency of Wondama Bay commonly grow in suboptimal land with less nutrients, and with high rainfall that reduce the available nutrients. The application of balanced fertilizing concept by utilizing tailing extract and livestock manure as enzymatic nutrient source and ameliorant in the mineral soil, will increase the plant growth and quality of Taro tuber. Solid manure, or livestock manure in solid form that have been composed as nutrient source, particularly N for plant and can improve the chemistry, biology, and physics of the soil.

Tailing waste present in tailing sedimentation area ModADA and ADA, is included in the contract area of PT Freeport Indonesia (PTFI), with total area of 45.000 Ha<sup>3</sup>. The tailing waste contains macro and micro nutrients with great potentials as plant nutrients which can be utilized as nutrition in agriculture widely. According to the results of nutrient status analysis for the tailing material derived from sedimentation area of ModADA, the N status is low, whereas the P, K, Mg, Zn and B are classified as fairly marginal. The nutrients of Ca, Fe, Cu, Mn, Mo and Ni are categorized as enough<sup>4-8</sup>.

This study was aimed to increase the production in quantity and quality of Taro tuber growing in suboptimal land through the application of formulated fertilizer from tailing extract as nutrient and enzymatic nutrient source, and livestock manure as ameliorant material.

## MATERIALS AND METHOD

### Analysis of Soil Properties

The soil samples from the study area of Wondama

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Bay were collected of representatives site. The soil samples were dried and crushed, and then passed through on 2 mm sieve to be used in determination characteristics of chemical and physical of soil fertility status by analysis of samples in Soil Laboratory. The analysis of chemical properties include of pH (Piper, 1967), C-organic, Walkley & Black,<sup>9</sup> Total-N (Kjeldah method), P-available (Bray I), Base cations ( $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{K}^+$ ,  $\text{Na}^+$ ), CEC ( $\text{NH}_4\text{OAc}$ , pH 7), and also base saturation (BS),  $\text{Al}^{3+}$  and  $\text{H}^+$ . The analysis of physical properties include of texture (sand, silt, and clay).

#### ***The treatment method of Extracted Tailing (referring to previous research by Mangallo et al.<sup>4</sup>***

The first step was the extraction of macro and micro nutrients from tailing source as enzymatic nutrient source for Taro plant growth. The tailing sample was extracted with extraction method as follow: Incubation with HCl 2% for 24 hours with soil to solvent ration 1:10. The result was then incubated with ammonium citrate 2% for 24 hours and then filtered. The macro nutrient and enzymatic nutrient contained in the tailing extract were analyzed by the instrument of AAS.

## **RESULTS AND DISCUSSION**

### **Fertility status, Chemical and Physical Properties of Baseline Soil in Wondama**

The chemical and physical properties of baseline soil at the depth of 0-20 cm in study location, Wondama, West Papua, was presented in Figure 1. Soil reaction (pH) ranged from 4.7 - 5.0 (highly aciditic and aciditic), C-organic content 1.99 - 2.16%, C-organic (low - moderate), total-N was 0.28 - 0.29%, N (moderate), with C/N ratio of 7 (low). Low ratio of C/N means that the organic matter have been decayed and decomposed, whereas high C/N ratio means the decomposition process of organic matter is in progress.

There is a significant correlation between % BS and soil reaction (pH). A decrease in BS will be followed by a decrease in pH value. Decerasing of BS is generally caused by loss of calcium ( $\text{Ca}^{2+}$ ) or other base cations ( $\text{Mg}^{2+}$ ,  $\text{K}^+$ ,  $\text{Na}^+$ ). Consequently, the soil pH also decreases because the base cations are replaced by hydrogen ( $\text{H}^+$ ) and aluminium ( $\text{Al}^{3+}$ ). Base cations of  $\text{Ca}^{2+}$  and  $\text{Na}^+$  were low, at the level of 2.99-5.99 cmol/kg and 0.22-0.28 cmol/kg, respectively, whereas  $\text{Mg}^{2+}$  was moderate (1.34-1.84 cmol/kg), and  $\text{K}^+$  was very

high (1.08-2.12 cmol/kg). Acid cations ( $\text{Al}^{3+}$ ,  $\text{H}^+$ ) were in relatively low to moderate concentration (0.71-1.34 me/100g and 0.06-1.33 me/100g). Low pH value tended to cause the BS percentage varied from medium to high (49.43%-70.52%). Base saturation (BS) and pH were highly influenced by CEC. When CEC was high due to the domination of base cations ( $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{K}^+$ ,  $\text{Na}^+$ ) in the soil, the BS percentage was also high.

According to the physical properties of the soil, most of the studied location land were dominated by sand particle ((47.2% - 54.7%), followed by silt particle (25% - 28.5%), and clay particle (21.3% - 25.8%). Value of CEC is highly determined by organic colloid contained in organic matter of soil, and clay colloid derived from secondary clay mineral as the result of decomposition of primary mineral decays easily. Overall, the CEC value was very low, ranging from 12.29-14.10 cmol/kg. This condition as the cause of low-medium C-organic content, as well as the clay particle.

According chemical and physical properties in study location, Wondama was classified as Inceptisol<sup>10</sup>. Inceptisol is a young soil, but more developed compared to entisol. This type of soil shows the layering and soil structure have been formed, and the available nutrient elements are adequate. Inceptisol is newly developed soil type and have had horizon below the characterizer. The type of soil has essential nutrient reserve needed for plant growth from the easily decayed mineral.

#### ***The treatment combination of fertilizer formula to the availability of micro-nutrients in soil***

The treatment of combined formulated fertilizer at different compositions was intended to study the chemical characteristics of the soil and macro or micro nutrients availability required by the plant to grow.

Micronutrients are essential elements needed by plants in very small quantities<sup>11,12</sup>. The availability of micro nutrients ( $\text{Fe}^{2+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Zn}^{2+}$ ) in the soil in study location indicated that  $\text{Mn}^{2+}$  level remained within normal level, whereas  $\text{Cu}^{2+}$  and  $\text{Zn}^{2+}$  were in low concentration, so they positioned in critical threshold for plant growth need<sup>13</sup>. However, after the application of formulated fertilizer when plant reached the age of 2 MAP (month after planting), the need of micro nutrient increased compared to before planting.

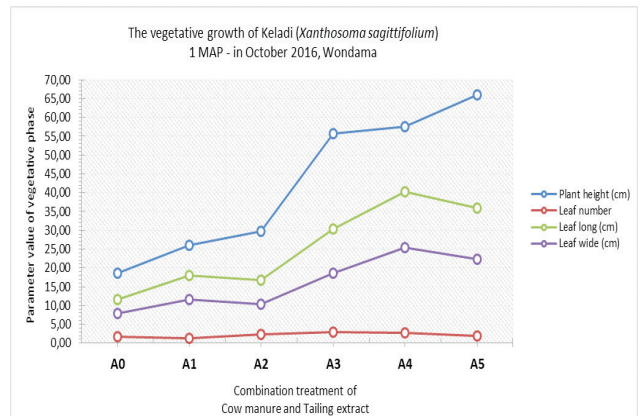
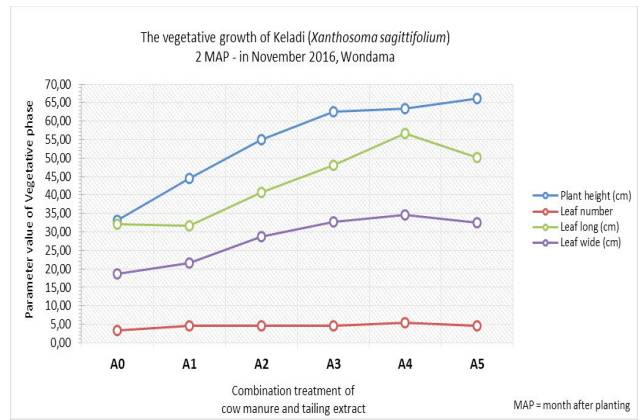
Soil reaction (pH) significantly affected the solubility

and availability of nutrients and phytotoxicity potential of a metal. Soil solution at low pH favors the free metal cation and anion protonation, whereas high pH favors the formation of carbonate or hydroxyl complex. Therefore, the availability of micro nutrients and toxic ions in soil solution as cations will increase with the increased soil acidity. Conversely, the availability of anion nutrients will increase with the increase of alkalinity. However, when the soil solution is dominated by metal cations with equal charge, the  $Fe^{2+}$  will be easily available compared to  $Mn^{2+}$ , because the mobile properties in  $Mn^{2+}$  which is available later than the  $Fe^{2+}$ .

The treatment combination of fertilizer formula to the availability of micro-nutrients ( $Fe^{2+}$ ,  $Mn^{2+}$ ,  $Cu^{2+}$ ,  $Zn^{2+}$ ) in plant tissue of *Xanthosoma sagittifolium*

The vegetative growth of Taro plant during three months of observation included the parameters of plant height (cm), number of leaves, length of leaves (cm), and width of leaves (cm). The application of combined fertilizer formula at different compositions to study the vegetative growth of plant at age 1-3 MAP (month after planting) is presented in Figure 3-5.

The treatment with combined formulated fertilizer included A0, A1, A2, A3, A4, and A5. The observed variables during the vegetative stages included plant height, number of leaves, length of leaves, and width of leaves. For the treatment of combined formulated fertilizer A1 and A2, the plant growth showed an increase during vegetative stage and reached optimum growth in A3, whereas for the treatment without combined formulated fertilizer (A0, Control) the plant growth was very slow during the vegetative stage. The vegetative growth tended to decrease in A4 and A5. This is due to N, P, K and C-organic nutrients contained in the formulated fertilizer had met fulfilled the plant need during vegetative growth stage.

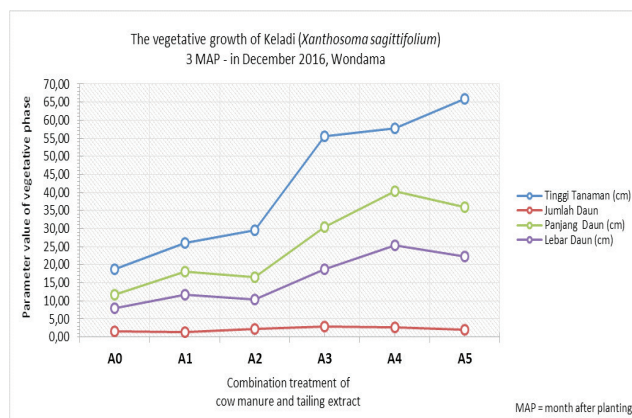


**Figure 1,2,3. The vegetative growth of *Xanthosoma sigittifolium* at 1 - 3 MAP on Suboptimal Land of Wondama**

Carbon, oxygen, and hydrogen are precursors in the development of plant body tissues, which can be obtained in the form of  $H_2O$  (water),  $H_2CO_3$  (Carbonic acid), and  $CO_2$  from the air. According to initial data on soil fertility status in studi location, it was observed that base cations  $Mg^{2+}$  and  $K^+$  is inversely proportional  $Ca^{2+}$  and  $Na^+$ . This phenomenon is frequently found in mineral soils with lower pH (acid). In addition, cations with equal valences (+2 or +1) in soil solution tended to have competition in occupying space, resulting in higher level for one compared to the other.

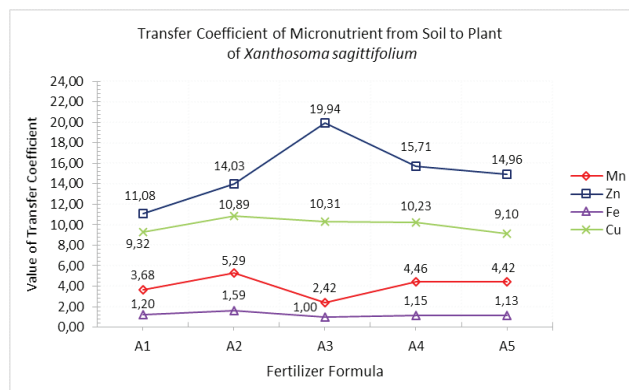
With the application of formulated fertilizers, it can be seen that vegetative growth of the Taro plant can fulfill its macro nutrient need from cow manure, and its micro nutrients from tailing extract. Figure shows that the application of combined formulated fertilizers A3 is the optimum condition for vegetative growth of Taro plants.

Transfer Coefficient of Micro Nutrient from the Soil to Taro plant



Iron acts as a catalyst in the formation of chlorophyll as well as an oxygen carrier in the nodules of legumes<sup>14</sup>. Study results indicated that the value of transfer coefficient for iron transfer from soil to Taro plant ranges from 1.00 to 1.59, with the following sequence A2>A0>A1>A4>A5>A3. The lower transfer coefficient value for iron compared to other micro nutrients (Zn, Cu, Mn) is affected by the characteristics of the iron as immobile mineral Monreal *et al.*,<sup>15</sup> and antagonist to other micro nutrients, particularly Mn. To reduce the effect, we can use organic matter as chelating agent to stabilize the iron ions.

According to Havlin *et al*<sup>16</sup> the manganese adequacy in plant is 20-500 ppm. This indicated that the treatment with formulated fertilizers in all combinations can fulfill the adequacy of manganese nutrients in Taro plant.



**Figure 4. Transfer Coefficient of Micronutrient from soil to plant of *Xanthosoma sagittifolium***

Copper is an activator of several enzyme systems in plant and plays a role in the formation of chlorophyll. Transfer coefficient value of copper mineral from the soil to Taro plant ranged from 8.03 to 10.98 with the sequence: A2>A3>A4>A1>A5>A0. The concentration of copper in Taro plant with treatment of formulated fertilizer in all combination was 5-20 ppm, indicating that the application of formulated fertilizer in all combination could not fulfill the Cu adequacy for Taro plant.

Zinc is a micro nutrient highly required by the plant. Zinc plays a role as enzymatic metal component or as functional and structural cofactor of most enzymes<sup>15</sup>. Transfer coefficient value of zinc is 6.90-19.94 with the following sequence A3 > A4 > A5 > A2 > A1 > A0. However, unlike the other metal ions such as copper, iron, and manganese, zinc is a divalent cation ( $Zn^{2+}$ ) without valence change and therefore it does not have redox activity in a plant. This affect the absorption of

$Zn^{2+}$  from the soil to the plant, so the transfer coefficient value of Zn was higher compared to micro nutrients Cu, Mn, and Fe. The high absorption of Zn is also affected by the lower concentration of divalent cation such as  $Ca^{2+}$  in the soil<sup>17</sup>. Zinc concentration in Taro plant with the treatment of formulated fertilizers in all combination ranged between 17.4-47.49 ppm.

## CONCLUSIONS

Combination of formulated fertilizers A1 and A2 indicated increased plant growth during vegetative stage and reached optimum growth in A3, whereas the plants without treatment (A0, control) the growth was very slow. The vegetative growth tended to decrease in A4 and A5. The optimum formulated fertilizer in Taro seedlings indicated that formulated organic fertilizer had been enriched with tailing extract in composition A2 (95% : 5%) and significantly can increase the Taro seedlings growth. The sequence of micro nutrient absorption level as expressed by transfer coefficient value from the soil to plant was Zn > Cu > Mn > Fe. The lower concentration of divalent cation, namely  $Ca^{2+}$  in the plant influenced the  $Zn^{2+}$  absorption level.

**Ethical Clearance:** Obtained from University of Papua

**Conflict of Interest :** None

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## REFERENCES

1. Rumawas, F.. Ubi-ubian Sebagai Salah Satu Pangan Spesifik Lokal dan Strategi Pengembangannya di Provinsi Papua. Proceedings of the National Workshop on Local Specific Food Utilization of Papua. Cooperation between University of Papua and Government of Papua, 2004.
2. Mat, N., Hamzah, Z., Maskin, M., & Wood, A.K.. Mineral uptake by Taro (*Colocasia esculenta*) in swamp agroecosystem following gramoxone® (paraquat) Herbicide spraying. Journal of Nuclear and Related Technologies (2006): 3: 59-68.
3. PTFI.. Rencana Tahunan Lima Tahun Pertama (1999-2003). Reklamasi Daerah Pengendapan



- Tailing. PT Freeport Indonesia. 1998.
4. Mangallo, B., Taberima, S., & Musaad, I.. Effectiveness of Cattle Manure and Extract Tailings as Ameliorant and Nutrition on Sago Growth. *International Journal of Applied Environmental Sciences* (2015): 10(5).
  5. Taberima, S., & Sarwom, R.. Status of macro and micro nutrients from deposited tailings in reclamation area, PT Freeport Indonesia, Timika. *Journal of Degraded and Mining Lands Management*, (2016): 3(3), 565-576.
  6. Noor, N.B., Daud, A., Amansyah, M., Mallongi, A.. Affectivity dose of *Acorus calamus* (Sweet flag) to reduce the ammonia in hospital wastewater. *Journal of Environmental Science and Technology*. 2017
  7. Mallongi, A., Bustan, M.N., Juliana, N., Herawati, Risks Assessment due to the Exposure of Copper and Nitrogen Dioxide in the Goldsmith in Malimongan Makassar, *Journal of Physics: Conference Series* 2018.
  8. Birawida, A.B., Selomo, M., Mallongi, A., Potential hazards from hygiene, sanitation and bacterium of refill drinking water at Barrang Lompo island (water and food safety perspective), *IOP Conference Series: Earth and Environmental Science*. 2018.
  9. Walkley, A. & Black, C.A.. An examination of the degtjareff method for determining the soil organic matter and a proposed modification of the chromic acid titration method. *Soil Science* (1934): 37: 29-38.
  10. Soil Survey Staff.. *Key to Soil Taxonomy Twelfth Edition*. United States Department of Agriculture Natural Resources Conservation Service. USA. 2014.
  11. Shuman, L.M.. *Micronutrient Fertilizers*. *J. Crop Prod.*, (1999): 1: 165-195.
  12. Alam, S. M. & Raza, S.. *Micronutrient Fertilizer*. *Pakistan Journal of Biological Science* (2001): 4(11).
  13. BPT.. *Analisis Kimia Tanah, Tanaman, Air dan Pupuk*. Badan Penelitian dan Pengembangan Tanaman Pertanian. Bogor. 2010.
  14. Morris, D.R., Leoppert, R.H., & Moore, T.J.. *Indigenous Soil Factors Influencing Iron Chlorosis of Soybean in Calcareous Soils*. *Soil Sci. Soc. Amer. J.*, (1990): 54: 1329-1336.
  15. Monreal, C. M., DeRosa, M., Mallubhotla, S. C., Bindraban, P. S. & Dimkpa, C.. *The Application of Nano technology for Micronutrients in Soil-Plant Systems*. VFRC Report 2015/3. Virtual Fertilizer Research Center, Washington, D.C. (2015): 44 pp.
  16. Havlin, J. L., D. Beaton, S. L., Tisdale, & Nelson, W. L.. *Soil Fertility and Fertilizers: An Introduction to Nutrient Management (7<sup>th</sup>edn.)*. Pearson Prentice Hall. New Jersey. 2005.
  17. Alloway, B. J.. *Zinc in soil and crop nutrition (2<sup>nd</sup> edn.)*, Published by IZA and IFA Brussels, Belgium and Paris, France. 2008.

# A Review : Worldwide Medicinal Plants For Typhoid Fever

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## ABSTRACT

Typhoid fever, an enteric disease caused by *Salmonella typhi*, plays an important role of global health matter, contributing to the economic encumbrance in most developed countries. Even more, antibiotic resistance has ensued in *Salmonella enterica* infection. These health problems have proposed a broad struggle towards more study for new source of antimicrobial products especially from medicinal plants due to more profitable. This study reviews medicinal plants related to the typhoid fever and their mechanisms of antimicrobial action. The investigation for this review were established via the databases PubMed, Google Scholar, online Science Direct, Science and Technology Index. Practically 26 medicinal plants from 23 families used for typhoid fever in worldwide countries were reported. Most of them are originated from African continent, Pakistan and India. Antisalmonella activity was mostly identified by in vitro (MIC and MBC). Generally, the chemical compounds contained in the plants are alkaloid, flavonoid, saponin, tannin, phenols, glycosides, steroid and terpenoid. Their mechanisms of actions are mediation of solute transport inhibition in membranes, affecting the phospholipid membranes of bacterial cell wall, inhibiting nucleic acid synthesis and inducing microbial cell membrane disruption. These results redound to the alternative and complementary medication of typhoid fever.

**Keywords:** Typhoid Fever, *Salmonella typhi*, antimicrobial resistance, medicinal plants, complementary and alternative medicine.

## INTRODUCTION

Typhoid fever is a systemic illness caused by *Salmonella typhi*, which included in the Global Burden of Disease 2010<sup>1</sup>. Antibiotic resistance has occurred in *Salmonella enterica* infection, at first (1980s) to the classic first-line drugs from several different countries<sup>2</sup>. Since 20<sup>th</sup> century, transmission of *S.typhi* strains leading resistance to antimicrobials<sup>3</sup>. Previous study reported that multidrug-resistance (MDR) salmonella showed real evidence of hospital cost impact<sup>4</sup>. These health problems have encouraged a worldwide endeavor against more research for new provenience of antimicrobial materials

especially from medicinal plants due to cheaper cost, higher activity and minimal side effects<sup>5</sup>. This article reviews medicinal plants related to the typhoid fever therapy and mechanisms of action against *S.typhi*. The investigation for this review were established via the databases PubMed, Google Scholar, online Science Direct, Science and Technology Index. The document relevant analyzed and included in the study.

Medicinal plants are traditional medicine vitality, where approximately 44 percent of world population use them mostly in developed countries<sup>6</sup>. The utilization of medicinal plants in most developing countries as a primary effort for maintaining health has been considerably monitored by UNESCO<sup>7</sup>. In addition, an extension trust on the medicinal plants benefit in pharmacology industry has been expanded to the extraction and widely traded as drugs and chemotherapeutics<sup>8</sup>.

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Several drugs frequently use medicinal plants to extract their active ingredients, like in case of antibiotics, laxatives, blood thinners and anti-malarial medications<sup>9</sup>. Presently, data on the antimicrobial activity of numerous plants, so far considered empirical, have been scientifically proved, with the increasing number of reports on pathogenic microorganisms resistant to antimicrobials. Active compounds derived from plants may potentially control microbial growth in various conditions and in the specific disease treatment<sup>9</sup>. Medicinal plants can make a significant endowment to WHO's programme by the year 2000, that all peoples, worldwide, will lead a sustainable socioeconomic productive life<sup>10</sup>. Trade in medicinal plants is evolving in capacity and in exports. In South Africa, likewise, some 500 species are commercialized trade products<sup>10</sup>.

Typhoid fever is caused by *Salmonella typhi* and perennially be an evident public health issue in developing countries mainly in sub-Saharan Africa<sup>11</sup>. The ordinary antimicrobial drugs are becoming more unprepared to the population in Africa due to increased expenses<sup>12</sup>. Cases of resistance to the currently used antibiotics have been encountered with *S.typhi*, especially for the three first line antimicrobials (chloramphenicol, ampicillin and co-trimoxazole)<sup>13</sup>. Furthermore, chloramphenicol has been withdrawn from the trading due to its side effect in medullary toxicity<sup>14</sup>.

## MATERIALS AND METHOD

Nowadays, matching to the literature, many researchers concentrate on finding plant-derived medicines<sup>10</sup> and search for therapeutic agents from natural sources for the treatment of typhoid fevers<sup>14</sup> because medicinal plants had been reported to be safe and without side effect<sup>15</sup>. This review was conducted using systematic literature search on the worldwide medicinal plants for typhoid fever in the databases PubMed, Google Scholar, online ScienceDirect, Science and Technology Index, and Portal Garuda. The search keywords included "Salmonella typhi", "Salmonella typhi, typhoid fever and antimicrobial resistance", "Medicinal plants for typhoid fever", "anti-salmonella activity of plants" etc.

## RESULTS AND DISCUSSION

### Anti-Salmonella of Worldwide Medicinal Plants

Populations worldwide have used traditional

medicine based on natural<sup>16</sup>. There is an enhancement utilize of herbal medicines globally with trust that they are always secure and without side effect because they are from natural ingredients<sup>17</sup>.

Medicinal plants are mostly used in Africa, they are *Aloe trigonantha* L.C. Leach, *Crinum purpurascens*, *Paulliniapinnata* Linn, *Cleistropholis patens* Benth, *Emilia coccinea*, *Cymbogogoncitratu*s, *Carica papaya*, *Zea mays*, *Telfariaoccidentalis*, *Cassia eucalyptus*, *Mangiferaindica*, *Morindalucida*, *Ocimumgratissimum*, *Anthocleistavogelii*, *Anthocleistadjalonensis* and *Cassia petersiana*. Leaf latex of *Aloe trigonantha* L.C. Leach contains aloesin and anthrone (structurally related to anthraquinone), as well as *Cassia petersiana*. Previous study showed that the anthraquinones affect the phospholipid membranes of bacterial cell wall resulting in perturbations of the phospholipid membranes of bacterial cell wall<sup>18</sup>. Leaf extract of *Crinum purpurascens* comprises  $\beta$ -D -glucopyranoside of sitosterol which are active against *S.typhi* and *S.paratyphi B* and classified as bactericidal agents (ratio MBC/MIC  $\leq$  4)<sup>14</sup>. The methanol extracts of the leaves and stems of *Paulliniapinnata* Linn containing (3 $\beta$ )-3-O-(2'-Acetamido-2'-deoxy- $\beta$ -D-glucopyranosyl) oleanolic acid, demonstrated antibacterial activities against *S.typhi* (MIC = 0.781-1.562  $\mu$ g/ml) by inducing the proliferation of leucocyte and lymphocytes in the body<sup>19</sup>. Saponin fraction of stem bark extract of *Cleistropholis patens* Benth was active against *S.typhi*<sup>20</sup>. Composite of *C.citratus* leaves, *C. papaya* leaves, and *Zea mays* silk had inhibitory activity at 0.02 to 0.06 mg/ml while composite of *C.papaya* roots, *M.indica* leaves, *Citrus limon* fruit and *C. citratus* leaves had bacterial activity at 0.06 to 0.25 mg/ml<sup>21,22</sup>. In Ivory Coast, the flowers of *Thonningiasanguinea* are used for the therapy of salmonellosis. Recent studies have shown inhibition of the multi drug resistant strain *Salmonella enteritidis* by the crude aqueous extract of *Thonningiasanguinea*. The secondary metabolites screening of the flowers extract of *Thonningiasanguinea* have shown the existence of saponins, quinons, polyphenols which are known to take possession of antibacterial activities<sup>23</sup>. Still from Africa, *Cassia eucalyptus*, which is revealed by the Nupes of Bida in Nigeria to be effective in typhoid fever medication, conceives alkaloid, tannin and saponin<sup>24</sup>. The study of *Telfairiaoccidentalis* indicated the presence of saponins, alkaloids, tannins, phenolics and denoted an antibacterial activity on *S.typhi* ((MIC and MBC

values of 5.0mg/ml)<sup>21</sup>. *Mangiferaindica* (mango) leaves<sup>25</sup>, *Camelia sinensis*<sup>26</sup>, *Anthocleista vogeli*<sup>27,28</sup>, *Anthocleista djalonensi*<sup>27,29</sup>, *Cassia petersiana*<sup>30,31</sup>, *Morinda lucida*<sup>32</sup>, *Ocimum gratissimum*<sup>32</sup> have been reported for inhibitory effect against *S.typhi*. *C.petersiana* conceives alkaloids, flavonoids, cardiac glycosides, antraquinones, anthocyanins, polyphenols, triterpenes, steroids, saponins, tannins and phlobatannins, anthraquinones and phlobatannins<sup>30,31</sup>. *Pleopeltispolylepis* is a fern used in the traditional Mexican medicine to treat typhoid fever. Aerial parts extracts of *P.polylepis* showed antibacterial activity against both Gram-positive and negative bacteria<sup>33</sup>. Then, the resident in Pakistan used several medicinal plants to cure typhoid fever, they are *Capparis decidua* Edgew., *Ficus carica* Forssk., *Syzygiumcumini* L., *Ziziphusjuzuba* Mill. Previous study notified that *Capparis decidua*, *Ficus carica*, *Syzygiumcumini*, and *Ziziphusjuzuba* had potent antibacterial agent against *E. coli*, *S. typhi*, and *P. aeruginosa* which comprising respectable quantity of tannins, flavonoids, steroids, alkaloids, and saponins<sup>34</sup>. Root extract of *Baptisiatinctoria* has been established to be potent medicine for typhoid treatment<sup>35</sup>. From India, medicinal plants reported effective for typhoid fever were *Fagoniacretica* and *Ocimum basilicum*<sup>36,37</sup>.

A total of 26 different worldwide medicinal plants belonging to the 23 families were reported for typhoid fever. Most of them are originated from African continent, India and Pakistan. The parts of medicinal plants used as antisalmonella are leaves, barks, roots, flowers, fruits, seeds and aerial parts. Antisalmonella activity is mostly identified by in vitro (MIC and MBC). Generally, the chemical compounds contained in the plants are alkaloid, flavonoid, saponin, tannin, phenols, glycosides, steroid and terpenoid; and also in narrow count are oleanolic acid, oleic acid, eicosyl ester, linoleic acid and eugenol.

Several Natural Chemical Compounds of Medicinal Plants and Their Probable Mechanism of Antimicrobial Action.

The mechanism of action by which some medicinal plants exert their antibacterial is not well studied<sup>18</sup>. Many mechanisms of antimicrobial action of phytochemicals have been argued by different researchers, contended that phytochemicals may act by impeding microbial growth, leading cellular membrane disturbances, disruption certain microbial metabolic processes, modulation of signal transduction or gene expression pathways<sup>38</sup>. This study reviews probable mechanism of action of chemical

compound contained in medicinal plants. Saponins might confer by revamping the permeability of cell walls and consequently exert toxicity on all organized tissues and by integrating with cell membranes to obtain cell morphology changes leading to cell lysis<sup>30,37</sup>. Polyphenols such as gallic acids act possibly by binding to bacterial dihydrofolate reductase enzymes, inducing topoisomerase IV enzyme-mediated DNA cleavage and bacterial growth stasis, mediation of solute transport inhibition in membranes and affect the phospholipid membranes of bacterial cell wall<sup>18,38</sup>. The antimicrobial properties of alkaloids probably occur by inhibiting nucleic acid synthesis, the type II topoisomerase enzymes and respiratory system<sup>39,40</sup>. The antimicrobial effect of tannins have been demonstrated to bind cell walls of ruminal bacteria, thereby inducing bacterial stasis and protease activity, inducing topoisomerase IV enzyme-mediated DNA cleavage and inhibition of oxidative phosphorylation<sup>30,31,37</sup>. Flavonoids are synthesized by plants in response to microbial infection. Their antimicrobial activity is probably due to their potential to form complexes with extracellular and soluble proteins as well as the complexation with bacterial cell walls, thereby inducing microbial cell membrane disruptions<sup>30,37</sup>.

## CONCLUSION

The results of the present review showed that 26 worldwide medicinal plants belonging to 23 families have been reported as antimicrobial for typhoid fever. There were five chemical compounds explained their mechanism of action. These results redound to the alternative and complementary medication of typhoid fever and drug discovering of antisalmonella from worldwide medicinal plants. Further research is greatly necessary for characterization of chemical compound or secondary metabolite product of these medicinal plants and investigation their mechanism of action.

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## REFERENCES

- Murray CJ, Vos T, et al. Disability adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 380:2197–2223.
- Crump J.A, Sjölund K. M, et al. Epidemiology, Clinical Presentation, Laboratory Diagnosis, Antimicrobial Resistance, and Antimicrobial Management of Invasive Salmonella Infections. *ClinMicrobiol Rev* doi:10.1128/CMR. 2015 : 00002-15, pp. 902-36.
- Rowe B, Ward LR, Threlfall EJ. Treatment of multiresistant typhoid fever. *Lancet* 1991; 337:1422.
- Barnass S, O'Mahony M, et al. The tangible cost implications of a hospital outbreak of multiply-resistant salmonella. *Epidem. Inf.* (1989), 103, 227-234 Printed in Great Britain.
- Mahesh B, Satish S. Antimicrobial activity of some important medicinal plants against lant and human pathogens. *World J Agric Sci.* 2008.;4:839–43.
- Davidson-Hunt I. Ecological ethno botany: stumbling toward new practices and paradigms. *MASA J.* , 2000 : 16:1–13.
- UNESCO. Culture and Health, Orientation Texts – World Decade for Cultural Development 1988 – 1997. Document CLT/DEC/PRO – 1996, Paris, France, pgs. 129.
- UNESCO. Terminal Report: Promotion of Ethno botany and the Sustainable Use of Plant Resources in Africa. Document FIT/504-RAF-48, Paris, France, 1998: pgs. 60.
- Singh R. 2015. Medicinal plants: A review. *Journal of Plant Sciences* 2015; 3(1-1): 50-55.
- Lucy Hoareau and Edgar J. DaSilva, Medicinal plants: a reemerging health aid. Division of Life Sciences UNESCO.
- Gatsing D, Mbah JA, et al. An antisalmonellal agent from the leaves of *Glossocalyx brevipes* Benth (Monimiaceae). *Pakistan Journal of Biological Sciences* 2006; 9(1): 84-87.
- Gatsing D, Nkeng PEA et al. Antisalmonellal properties and acute toxicity study of *Erythrina klainei* Pierre (Fabaceae) bark extracts and fractions. *Res Rev Biosci* 2007b. : 1(1):35–41
- Cheesbrough M. *Medical Laboratory Manual for Tropical Countries: Microbiology.* ELBS Edition; 1991: pp. 196-205.
- WHO. Research Guidelines for Evaluating the safety and efficacy of herbal medicines. Manila. Meeting of the working group on the safety and efficacy of herbal medicine/ World Health Organization, Geneva. 1992.
- Karo M, Tambaip T, Hatta M, et al. A Mini Review of Indonesian Medicinal Plants for Vulvovaginal Candidiasis. *Rasayan J. Chem.* 2017. :Vol. 10, No. 4, 1280-1288.
- TuanDo Q, Bernad P. Reverse pharmacognosy: a new concept for accelerating natural drug discovery. Elsevier : 2006.
- Awodele, O, Daniel A, et al. Study on pharmacovigilance of herbal medicines in Lagos West Senatorial District, Nigeria. *International Journal of Risk & Safety in Medicine*, 2013. :vol. 25, no. 4, pp. 205-217.
- Megeressa M, Bisrat D, et al. Structural elucidation of some antimicrobial constituents from the leaf latex of *Aloe trigonantha* L.C. Leach. Megeressa et al. *BMC Complementary and Alternative Medicine* (2015) 15:270 DOI 10.1186/s12906-015-0803-4.
- Lunga P.K, Gatsing D, et al. Antityphoid and radical scavenging properties of the methanol extracts and compounds from the aerial part of *Paulliniapinnata*. SpringerPlus, 2014. :3:302.
- E b i H Y P E R L I N K “[https://www.ncbi.nlm.nih.gov/pubmed/?term=Ebi%20GC%5BAuthor%5D&cauthor=true&cauthor\\_uid=11180528](https://www.ncbi.nlm.nih.gov/pubmed/?term=Ebi%20GC%5BAuthor%5D&cauthor=true&cauthor_uid=11180528)” GC, KamaluHYPERLINK “[https://www.ncbi.nlm.nih.gov/pubmed/?term=Kamalu%20TN%5BAuthor%5D&cauthor=true&cauthor\\_uid=11180528](https://www.ncbi.nlm.nih.gov/pubmed/?term=Kamalu%20TN%5BAuthor%5D&cauthor=true&cauthor_uid=11180528)” TN. Phytochemical and antimicrobial properties of constituents of “OgwuOdenigbo”, a popular Nigerian herbal medicine for typhoid fever. *Phytother Res.* 2001 Feb;15(1):73-5.
- Nkwo-AkenjiHYPERLINK “[https://www.ncbi.nlm.nih.gov/pubmed/?term=Nkwo-Akenji%20T%5BAuthor%5D&cauthor=true&cauthor\\_uid=12201022](https://www.ncbi.nlm.nih.gov/pubmed/?term=Nkwo-Akenji%20T%5BAuthor%5D&cauthor=true&cauthor_uid=12201022)” T, NdipHYPERLINK “<https://www.ncbi.nlm.nih.gov/pubmed/?term=Ndip%20>

- R%5BAuthor%5D&cauthor=true&cauthor\_uid=12201022” R, et al. Anti-Salmonella activity of medicinal plants from Cameroon. *Cent Afr J Med*. 2001 Jun;47(6):155-8.
22. Krisna KL, Paridravi M, et al. Review on Nutritional, Medicinal and Pharmacological Properties of Papaya (*Carica papaya* Linn.). *Natural Product Radiance*, 2008: Vol.7 (4), pp. 364-73.
  23. N’guessan J D, Coulibaly A, et al. Antibacterial activity of *Thonningiasanguinea* against some multidrug resistant strains of *Salmonella enterica*. *African Health Sciences* 2007; 7(3):155-158.
  24. Waage SK, Hedin PA. Biologically-active flavonoids from *Gossypium arboreum*. Elsevier :Phytochemistry, Volume 23, Issue 11, 1984, Pages 2509-2511.
  25. Evans CE, Bansa A, Samuel OA. Efficacy of some nupe medicinal plants against *Salmonella typhi*: an in vitro study. *J of Ethnopharmacology*, Volume 80, Issue 1, April 2002, Pages 21-24.
  26. Ciraj AM, Sulaim J, et al. Antibacterial activity of black tea (*Cameliasinensis*) extract against *Salmonella* serotypes causing enteric fever. *Indian J Med Sci*. 2001. : 55(7):376-81.
  27. Ateufack G, Nguielefack TB, et al. Antiulcer effects of the aqueous and organic extracts of the stem bark of *Anthocleista vogelii* in rats. *Pharmaceutical Biology* 2006. 44(3): 166–171.
  28. Anyanwu HYPERLINK “https://www.ncbi.nlm.nih.gov/pubmed/?term=Anyanwu%20GO%5BAuthor%5D&cauthor=true&cauthor\_uid=26432351” GO, Nisar-ur-Rehman, et al. Medicinal plants of the genus *Anthocleista*--A review of their ethnobotany, phytochemistry and pharmacology. *J Ethnopharmacol*. Elsevier Ireland Ltd . 2015 Dec 4;175:648-67.
  29. Jensen, SR, Schripsema, J, Chemotaxonomy and pharmacology of *Gentianaceae*. In: Struwe, L. & Albert, V. (Editors). *Gentianaceae - Systematics and Natural History*. Cambridge University Press, United Kingdom. 2002.: pp. 573–631.
  30. Gatsing D, Adoga GI. Antisalmonellal Activity and Phytochemical Screening of the Various Parts of *Cassia petersiana* Bolle (*Caesalpinaceae*). *Research Journal of Microbiology* 2007.: 2(11):876-880.
  31. Bosch, CH. *Sennapetersiana* Bolle Lock. Record from Protabase. Prota, Netherlands. 2007.
  32. Akinyemi HYPERLINK “https://www.ncbi.nlm.nih.gov/pubmed/?term=Akinyemi%20KO%5BAuthor%5D&cauthor=true&cauthor\_uid=16093235” KO, Mendie HYPERLINK “https://www.ncbi.nlm.nih.gov/pubmed/?term=Mendie%20UE%5BAuthor%5D&cauthor=true&cauthor\_uid=16093235” UE, et al. Screening of some medicinal plants used in south-west Nigerian traditional medicine for anti-*Salmonella typhi* activity. *J Herb Pharmacother*. 2005;5(1):45-60.
  33. Contreras Cárdenas AV, et al. Antimicrobial, cytotoxic, and anti-inflammatory activities of *Pleopeltis polylepis*. 2016.
  34. Shad A, Ahmad S, et al. Phytochemical and Biological Activities of Four Wild Medicinal Plants. Hindawi Publishing Corporation Scientific World Journal, Article ID 857363, 7 pages. 2014.
  35. Puri D, Bhandari A. *Fagonia*: A Potential Medicinal Desert Plant. *Journal of NPA*, 2014 XXVII (1), pp. 28-33.
  36. Hannan A, Asghar HYPERLINK “https://www.ncbi.nlm.nih.gov/pubmed/?term=Asghar%20S%5BAuthor%5D&cauthor=true&cauthor\_uid=23811447” S, et al. Antibacterial effect of mango (*Mangifera indica* Linn.) leaf extract against antibiotic sensitive and multi-drug resistant *Salmonella typhi*. *Pak J Pharm Sci*. 2013 Jul;26(4):715-9.
  37. Adeola SA, Folorunso OS. Antimicrobial Activity of *Ocimum basilicum* and its Inhibition on the Characterized and Partially Purified Extracellular Protease of *Salmonella typhimurium*. *Research J of Biology* (2012), Vol. 02, Issue 05, pp. 138-144.
  38. Omojate GC, Enwa FO. Mechanisms of Antimicrobial Actions of Phytochemicals against Enteric Pathogens – A Review. *J of Pharmaceutical, Chemical and Biological Sciences* ISSN: 2348-7658; 2014.: 2(2):77-85.
  39. Tominaga K, Higuchi K, et al. In vivo action of novel alkyl methyl quinolone alkaloids against *Helicobacter pylori*. *J Antimicrob Chemother* 2002; 50:547-552.
  40. Cushnie TP, Cushnie B. Alkaloids: An overview of their antibacterial, antibiotic-enhancing and antivirulence activities. *Int J of Antimicrobial Agents* 2014;44(5). DOI: 10.1016/j.ijantimicag.2014.06.001.

# Determinant Factors Analysis of PCC (Paracetamol, Caffein, Carisoprodol) Drug Abuse in Kendari City

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## ABSTRACT

The aim of study was to determine factor of drug abuse of PCC (paracetamol, caffeine, carisoprodol) in Kendari City, 2017. This study was an analytical research with cross sectional study approach. The population in this study were all drug users recorded in the Health Agency of Southeast Sulawesi in 2017 which were 90 people, while the sample in this study was the entire population which was using exhaustive sampling technique. The results of this study with 95% confidence level showed  $RP = 1.481$  with  $CI$  range = 1.037-2,115. The value of  $RP > 1$ , means that respondents with introverted personality were 1.5 times more likely to abuse PCC drugs than those with extroverted personality.  $RP$  value = 3.500 with range  $CI = 1,529-8,012$ .  $RP$  value  $> 1$ , meaning high curiosity respondents were 3.5 times more likely to abuse PCC drugs than those with low curiosity.  $RP$  value = 0.103 with range  $CI = 0,041-0,260$ . The value of  $RP < 1$ , meaning that respondents with high economic conditions were 0.1 times greater risk of abuse of PCC drugs than those with low economic conditions. The range of  $LL$  values  $RP$  (0.041) to  $UL$   $RP$  (0.260) includes a value  $< 1$ , then the risk was protective or not significant. And the value of  $RP = 1.305$  with the range  $CI = 0.857-1.985$ . The value of  $RP > 1$ , means that respondents whose family environment was at risk 1.3 times more likely to abuse PCC drugs than the poor family environment. Advice To the government authorities to increase supervision and enforcement of the law against the circulation of drugs so the affordability of these drugs cannot be easily obtained by everyone.

**Keywords:** PCC drug abuse, personality factor, curiosity, economic condition, family environment.

## INTRODUCTION

The use of drugs ranging from experiment to dependence. Things to know about the types of substances, effects on prevalent doses and over doses, long-term effects, and effects on health<sup>1, 2</sup>. PCC is a type of medicines that contain active ingredients of PCC (paracetamol, caffeine and carisoprodol) those active ingredients have a mechanism of action of different drugs but has a mutually supportive working effects of the drug itself to be synergistic. PCC drug abuse is usually a direct oral user and cause a calming effect, relieve pain and heart disease. But this PCC drug is abused to cause an overdose in its users<sup>3,4</sup>.

The annual report of the United Nations Office on Drugs and Crime (UNODC) 2013 is estimated between 167 and 315 million people or 3.6-6.9% of the world population aged 15-64 years using Drugs at least once a year<sup>5-7</sup>. Based on data from the results of research

conducted BNN with Puslitkes-UI prevalence rate of drug abusers in the year 2014 about 2.18% or about 4,002,228 and in 2015 experienced an increase of 0.2% ie is in the range of 2.20% or about 4,098. 029 people from the total population of 15-59 years<sup>8</sup>

Based on data from Drug Information System application (SIN) the number of successful drug cases disclosed during the last 5 years from year 2012-2016 per year equal to 76,53%. The highest increase in the year 2014 to 2014 is 161.22%, in 2016 the number of narcotics cases successfully revealed is 868 cases, and this number increased 36.05% from the year 2015<sup>9</sup>. While the Health Department data of Southeast Sulawesi Province during the last 2 years user drugs in 2016 as many as 137 people, Southeast Sulawesi Provincial Agency recorded use of Drugs Year 2017 January-October there are 90 cases of drug users and recorded 3 people died, so the remaining drug users recorded to date is 87 people<sup>10</sup>. This study aims to determine the

determinant factors of drug abuse PCC (paracetamol, caffeine, and carisoprodol) in Kendari City in 2017.

**MATERIALS AND METHOD**

The type of research used is analytical research with cross sectional study approach, which aims to determine the determinant factor against PCC drug abuse (paracetamol, caffeine, carisoprodol) in Kendari City

2017. The population in this study were all drug users recorded in the Provincial Health Office of Southeast Sulawesi in 2017 that as many as 90 people [9]. The sample used in this study using non random sampling approach (Nonprobability sampling) with exhaustive sampling technique is the determination of samples in which all the population used as a sample, which is as many as 90 people.

**RESULTS**

**Table 1. Relationship Of Personality Factor With Pcc Drug Abuse In Kendari In 201**

Personality Factor	PCC Abuse				Total		P	RP	CL 95%	
	Positive		Negative		n	%			LL	UL
	n	%	n	%						
Introvert	22	91,7	2	8,3	24	100	0,029	1,481	1,037	2,115
Ekstrovert	13	61,9	8	38,1	21	100				
<b>Total</b>	35	77,8	10	22,2	45	100				

Analysis with Chi Square Test at 95% confidence level can not be done because it does not meet the requirements of Chi Square test, because the number of cells whose expected value <5 reaches more than 20% of the total cell, reaching 25%. the alternative of Chi Square test for 2x2 table is Fisher’s Exact Test. Fisher’s Exact test result obtained p value = 0,029 (p value <0,05),

and value RP = 1,481 with range CI = 1,037-2,115. The value of RP > 1, means that respondents with introverted personality are 1.5 times more likely to abuse PCC drugs than those with extroverted personality. Since the range of LL RP (1,037) to UL RP (2,115) does not include a value of 1, and is also supported with a value of p = 0.029 < α = 0.05, then the risk is significant.

**Table 2. Relationship of curiosity with pcc abuse in kendari in 2018**

Curiosity	PCC abuse				Total		P	RP	CL 95%	
	Positive		Negative		n	%			LL	UL
	n	%	n	%						
High	31	100	0	0	31	100	0,000	3,500	1,529	8,012
Low	4	28,6	10	71,4	14	100				
Total	35	77,8	10	22,2	45	100				



Analysis with Chi Square Test at 95% confidence level can not be done because it does not meet the requirements of Chi Square test, because the number of cells whose expected value <5 reaches more than 20% of the total cell, reaching 25%. the alternative of Chi Square test for 2x2 table is Fisher’s Exact Test. Fisher’s Exact test results obtained p = 0,000 (p value <0.05),)

and RP = 3,500 with range CI = 1,529-8,012. RP value> 1, meaning high curiosity respondents are 3.5 times more likely to abuse PCC drugs than those with low curiosity. Since the LL RP (1,529) to UL RP (8,012) range does not include a value of 1, and is also supported by the value p = 0,000 <math>\alpha = 0.05</math>, then the risk is significant.

**Table 3: Relationship of economical condition with pcc drug abuse in kendari in 2018**

Economical condition	PCC Abuse				Total		P	RP	CL 95%	
	Positive		Negative		n	%			LL	UL
	n	%	n	%						
High	35	89,7	4	10,3	39	100	0,000	0,103	0,041	0,260
Low	0	0	6	100	6	100				
Total	35	77,8	10	22,2	45	100				

Analysis with Chi Square Test at 95% confidence level can not be done because it does not meet the requirements of Chi Square test, because the number of cells whose expected value <5 reaches more than 20% of the total cell, reaching 50%. the alternative of Chi Square test for 2x2 table is Fisher’s Exact Test. Fisher’s Exact test results obtained p value = 0,000 (p value <0.05),)

and the value of RP = 0.103 with range CI = 0.041-0.260. The value of RP <1, meaning that respondents with high economic conditions are 0.1 times greater risk of misuse of PCC drugs than those with low economic conditions. The range of LL values RP (0.041) to UL RP (0.260) includes a value <1, then the risk is protective or not significant.

**Table 4. Relationship of family environment with pcc drug abuse in kendari in 2018**

Family environment	PCC Abuse				Total		P	RP	CL 95%	
	Positive		Negative		n	%			LL	UL
	n	%	n	%						
Good	26	83,9	5	16,1	31	100	0,244	1,305	0,857	1,985
Less Good	9	64,3	5	35,7	14	100				
Total	35	77,8	10	22,2	45	100				

Analysis with Chi Square Test at 95% confidence level can not be done because it does not meet the requirements of Chi Square test, because the number of cells whose expected value <5 reaches more than 20% of the total cell, reaching 25%. the alternative of Chi Square test for 2x2 table is Fisher’s Exact Test. Fisher’s Exact test result obtained p value = 0,244 (p value>

0,05),) and value RP = 1,305 with range CI = 0,857-1,985. The value of RP> 1, means that respondents whose family environment is well at risk 1.3 times more likely to abuse PCC drugs compared to poor family environments. Since the LL RP (0.857) to UL RP (1,985) range includes 1, then the risk is significant.

## DISCUSSION

### **Relationship of Personality Factor with Drug Abuse of Paracetamol, Caffeine, Carisoprodol in Kendari City in 2018**

Personality is the pattern of perception, how to make a relationship and thinking that settles about the environment and oneself and is expressed widely in the context of social life and relationships personal person<sup>[10]</sup>. Each personality will show how a person will behave towards all the stimuli he receives. Because personality is one organized system consisting of attitudes, motives, emotional values, and other responses that are interdependent with one another<sup>11</sup>.

People with extrovert personality types have friendly, sociable, party-loving characteristics, have many friends, and always need others to talk to. They also do not like things or work done separately, because they love the form of cooperation. In addition they also love the crowd and are individuals who are confident and optimistic. In contrast, individuals with introverted personality types have characteristic of not saying much, being shy, introspective, reading rather than associating with others. They also always have a plan before doing something and do not believe the coincidence factor, they also do not like the bustling atmosphere, always think seriously and pessimistic individuals so that it can cause anxiety within himself<sup>12, 13, 14</sup>

The results of previous studies indicate that there are differences in anxiety levels between adolescents with introverted and extroverted personality traits. This is consistent with the theories put forward by Feist, J. and Feist, GJ that personality traits affect not only school success and other long-term outcomes but also the mood experienced by a person. People with high extraversion or extroverted personality will be a pleasant and passionate person (positive feeling), otherwise people with low or introverted extraversion will be a personal worrier and stiff (negative feelings)<sup>15</sup>.

This is in line with previous research which states that one of the internal factors that affect the emergence of stress is the type of personality. The results of this study indicate a significant relationship between the types of personality with the incidence of stress on the co-assistant. With introverted personality types more likely to experience stress than those of a personality extrovert. Individuals who are stressed

if there is a problem or overload demands that the individual cannot adapt to the problem at hand<sup>16</sup>.

Based on previous research, personality factors also affect adolescents in facing a problem so that adolescents do not have the attitude and nature of a firm in addressing or facing a problem. This explains that weakness of personality and lack of self-control by adolescents can result in adolescents easy to fall into negative matters as well as the use of *dextromethorphan*<sup>17</sup>

### **Relationship of curiosity with Drug Abuse of Paracetamol, Caffeine, Carisoprodol in Kendari City in 2018**

Curiosity is a powerful impulse of need, thirst or desire to know, see and motivate the behavior of the study to gain new information derived from the inner uncertainty that causes conceptual conflict within. Curiosity is an emotion related to curious behavior such as exploration, investigation, and learning, evidenced by observations in animal and human species. The term can also be used to denote the behavior itself caused by the emotion of curiosity<sup>18</sup>.

This is in line with previous research of lifestyle factors to be one of the factors that influence drug abuse in adolescents. Lifestyle factors in adolescence can be a great curiosity to try or be curious, a desire for fun, a desire to be accepted in the association, not mentally prepared to deal with social pressure so it is difficult to take a stance to reject the offer of drugs with a firm. The results obtained OR 8.509. In conclusion teenagers with a poor lifestyle will be at risk 8.5 times more likely to use drugs than teenagers whose lifestyle is good<sup>[18]</sup>.

### **Relationship of Economic Conditions with Paracetamol, Caffeine, and Carisoprodol Drug Abuse in Kendari City in 2018**

The economic condition of parents greatly affects the fulfillment of family needs in achieving a prosperous standard of living and achieve maximum health. Revenue affects a person's social status, particularly in the materialistic and traditional societies that value the high economic status of wealth<sup>19</sup>.

Adolescents tend to use illicit drugs and alcoholic beverages to try to eliminate boredom as well as to commit and eliminate their own inner conflicts and also to give the passion and courage of life<sup>20</sup>.

In line with previous research, the income variables have been found to be significantly correlated with the incidence of drug abuse ( $p = 0.042$ ), but not significantly correlated with yearly drug abuse ( $p = 0.083$ ). These results are different from previous research findings that found socioeconomic level not significantly correlated with the risk of drug abusers<sup>21</sup>

### Family Environment with Paracetamol Drug Abuse, Caffeine, Carisoprodol in Kendari City 2018

The family is very influential environment for development of children who are responsible for the inculcation of values and norms in the formation of child behavior. Parents become role models for their children both positive and negative behaviors. The wrong parenting pattern of the parent can cause the child to fall into a deviant act such as smoking, using drugs, promiscuity.

Based on previous research states that family environment, social environment, parental care, night out habit, dislikes advised, dislikes friends behave positively, do not like friends who are religious, prefer to get together with friends and do not like to use free time with to effect on risk behavior of drug abuse<sup>22,23</sup>.

### CONCLUSION

Personality factor is a risk factor affecting against PCC drug abuse, then, Curiosity is a risk factor that affects against PCC drug abuse. In addition economic conditions are a risk factor affecting the abuse of PCC drugs in Kendari City in 2017. however, the family environment is not a risk factor for PCC drug abuse.

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### REFERENCES

1. Wilson MC, Yonette FT, Frederick SS, Bridget FG. Prevalence, Correlates, Disability, and Comorbidity of DSM-IV Drug Abuse and Dependence in the United States: Results From the National Epidemiologic Survey on Alcohol and Related Conditions. *Arch Gen Psychiatry*. 2007;64:566-576
2. Priyanto Farmakologi Dasar. Lembaga Studi dan Konsultasi Farmakologi Atau Leskonfi. . 2008.
3. BPOM RI. PCC *Pracetamol, Caffein, Carisprodol* Berbahaya. 2017
4. Lestari I. Peran Bimbingan Dan Konseling Keluarga Dalam Pemberian Fungsi Preventif Penyalahgunaan Narkoba Terhadap Remaja. *Prosiding SNBK (Seminar Nasional Bimbingan dan Konseling)*. 2017: 1:1. 78-87.
5. UNODC. World Drug Report. Retrieved 18 Oktober, 2017, from <http://www.unodc.org/wdr2016/>
6. Kepolisian Negara Republik Indonesia. Data Peringkat Jumlah Kasus Narkoba, Tahun 2013. Jakarta, Indonesia.
7. BNN RI. *Pencegahan Penyalahgunaan Narkoba Bagi Remaja*. Jakarta: direktorat advokasi deputi bidang pencegahan badan narkotika nasional (2014).
8. Kemenkes RI. Infodatin Anti Narkoba Sedunia. Jakarta: Pusat Data dan Informasi Kementerian Kesehatan (2017)..
9. Dinas Kesehatan Sulawesi Tenggara. Jumlah Kasus penyalahgunaan Narkoba. Dinas Sulawesi Tenggara. Kendari. 2017.
10. Kurniawati D, Yuliatwati R, Hamdani A. Hubungan Antara Keadaan Keluarga Dengan Perilaku Relapse (Kekambuhan) Narkoba Pada Residen. *Promotif: Jurnal Kesehatan Masyarakat*. 2017. : 7: 2. 93-98.
11. Kalra Indiver, Sociodemographic Profile and Pattern of Drug abuse among Patients Presenting to a Deaddiction Centre in rural area of Punjab, *Delhi Psychiatry Journal* 2012 : vol 15 no 2,
12. Abbot V Frances, Use and abuse of over-the-counter analgesic agents, *Journal of Psychiatry and Neuroscience*, 1998: Vol 23, no 1
13. Carisoprodol use and abuse in Norway, A pharmacoepidemiological study, *British Journal of Psychiatry and Neuroscience*, 2007: vol 64 no 2.
14. Putra IGPS, Aryani LNA. Hubungan Antara Tipe Kepribadian Introvert Dan Ekstrovert Dengan Kejadian Stres Pada Koasisten Angkatan Tahun 2011 Fakultas Kedokteran Universitas Udayana <https://ojs.unud.ac.id/index.php/eum/article/view/13098/8773>. 2016.
15. Liem Andrian. Pengaruh media massa, dan teman terhadap perilaku merokok remaja di Yogyakarta. *Jurnal Kesehatan*, (2014): vol 18(1) 41-52

16. Anggreni D., Dampak Bagi Pengguna Narkotika, Psikotropika Dan Zat Adiktif (Napza) Di Kelurahan Gunung Kelua Samarinda Ulu. *eJournal Sosiatri-Sosiologi*. 2015: 3 (3). 37 – 51.
17. Putri AM, Satwika YW. Pengalaman Mantan Penyalahguna Napza Di Usia Remaja Dalam Mencapai. *Jurnal Psikologi*. 2017:4:1. 1-11.
18. Idris M, Salehuddin SN. Faktor - Faktor Yang Mempengaruhi Penyalahgunaan Napza Pada Remaja Di RT/RW 003/004 Kelurahan Inolobu Kecamatan Wawotobi Kabupaten Konawe.(2017): 1-11.
19. Basrowi, Juariyah S. Analisis Kondisi Sosial Ekonomi Dan Tingkat Pendidikan Masyarakat Desa Srigading, Kecamatan Labuhan Maringgai, Kabupaten Lampung Timur. *Jurnal Ekonomi & Pendidikan*, 2010:7: 1. 58-81
20. Barus CP. Sosial Ekonomi Keluarga Dan Hubungannya Dengan Kenakalan Remaja Di Desa Lantasan Baru Kecamatan Patumbak Kabupaten Deli Serdang. 2013.
21. Bar A. Determinan Penyalahgunaan Narkoba pada Pekerja Pengunjung Tempat Hiburan. *Jurnal Kesehatan Masyarakat Nasional* 2007:2 (1). 3-11
22. Mallongi, A., Puspitasari, A., Ikhtiar, M., Arman, Arsunan, A.A. Analysis of risk on the incidence of scabies Personal Hygiene in Boarding School Darul Arqam Gombara Makassar. *Indian Journal of Public Health Research & Development*, April-June 2018, Vol.9, No. 4
23. Pulubuhu, D.A.T., Evans, K., Arsyad, M., Mallongi, A. Understanding the perspectives of village leaders and institutions in transforming social conflict into peace and health. *Indian Journal of Public Health Research & Development*, March 2018, Vol. 9, No. 3

# Correlation between Work Duration of Gas Station Operators With Mucociliary Transport Time, Hair Pb Level, and Nasal Cytogram

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## ABSTRACT

Gas station operators are groups of workers exposed to the risk of dangerous chemical compounds, particularly lead from gasoline and vehicle gas emission that are waiting for a refuelling queue or a vehicle that will depart after completing the refuelling. The research aimed at investigating the correlation between work duration of gas station operators with mucociliary transport time, hair Pb level, and nasal cytogram. The research used the analytic observational method with the cross sectional design, was conducted to the operators of gas station in Tamalanrea and in Gunung Bawakaraeng street from August 2017 until September 2017 with 30 people as total samples. Sample divided into two groups, gas station operator with work duration < 1 year for 15 people and gas station operator with work duration ≥ 1 year for 15 people and each sample was underwent mucociliary transport time examination, hair Pb level examination, and nasal mucosa cytogram examination. The research result indicates that the significant correlation between work duration and mucociliary transport time with p value <0.05 and OR value = 11. There is a significant correlation between work duration and Pb hair level with p value <0.05 and OR value = 9.3. There is no significant correlation between work duration and eosinophil and neutrophil count with p value > 0.05. It can be concluded that the longer work duration as a gas station operator, the higher risk of mucociliary transport time disruption and risk of lead exposure will happen. There is no significant correlation between work duration with nasal cytogram.

**Keywords:** work duration, mucociliary transport time, lead (Pb), nasal cytogram

## INTRODUCTION

Nose and paranasalis sinus are the organs that play an important role as the front line of the body's defence in the lower airway to the microorganism and hazardous materials<sup>1</sup>. Its effectiveness depends on the integrity of mucociliary system called the mucociliary transport system<sup>2</sup>. It consists of ciliary cells of the respiratory

epithelium, mucous-producing glands and mucous membranes produced by goblet cells in epithelial and submucosal seromucinous glands.<sup>3</sup>

According to Waguespack, several conditions which affect mucociliary transport were physiologic factor, air pollution, smoking, congenital disorder, rhinitis allergy, viral infection, bacterial infection, topical drugs, systemic drugs, preservatives, and surgery<sup>4</sup>

Gas station is one of the places where pollution and discharge of gas or waste from vehicles that contained heavy metals such as lead or Plumbum (Pb) occurs, where Pb is the most dominant pollutant in the gas station<sup>5</sup>. Pb level in the air around the gas station is

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likely to be sucked thorough the air or even attached to the body tissue especially the skin (hair)<sup>6</sup>. Analysis of lead in hair has more advantages, because hair has longer memory period and even a permanent result. Head hair grows at an average speed of half an inch (1 inch = 2.54 centimetres) per month. Therefore, three inches of human hair can tell the history of the human body for six months<sup>7</sup>. Gas station position which near the highway makes it easier for officers to be exposed to lead pollutants from the smoke of the vehicles on the highway<sup>8</sup>.

The Regional Environmental Agency has conducted a study about lead level at several points in Makassar in 2013, and the results found that the highest lead level is on the Ratulangi street with 1.319  $\mu\text{g}/\text{Nm}^3$  and the lowest is on Monginsidi street with 0,374  $\mu\text{g}/\text{Nm}^3$ [9]. Based on the results of Makassar Centre for Health and Occupational Safety (COHS) study about air quality monitoring in several points of vehicle's traffic, it can be seen that in the last three years, lead is still polluting Makassar even though gasoline without lead has been applied, however the pollution remains occur. In 2012, concentration of lead in the air was 0.528  $\mu\text{g}/\text{Nm}^3$  and in 2013, concentration of lead in the air became 0.592  $\mu\text{g}/\text{Nm}^3$ <sup>9</sup>.

## MATERIALS AND METHOD

### Location and Time

The study was conducted at Tamalanrea gas station and gas station of Gunung Bawakaraeng street in Makassar, South Sulawesi Province, for 1 month from August 2017 until September 2017.

### Population dan sample

The population is Tamalanrea gas station operators

and gas operators of Gunung Bawakaraeng street in Makassar. Samples are the entire affordable population that met the inclusion criteria.

### Design and sampling

This is an observational analytic study with cross sectional design. Samples were taken at random, every gas station operators who fulfilled the study requirement, the identity will be recorded and then anamnesis and physical examination will be taken. Each samples will undergo mucociliary transport time examination using saccharin test, hair Pb level examination using Atomic Absorption Spectrometry (AAS), and nasal cytogram examination to assess eosinophil and neutrophil.

### Data Analysis Technique

The collected data is processed and presented in the form of tables and graphs. Data processing is analysed with statistical test using SPSS 22.0 version with unpaired t test and significance at the  $p < 0.05$  level.

## RESULTS

An observational analytic study was conducted with cross sectional study design to determine the correlation between work duration of gas station operators with mucociliary transport time, hair Pb level, eosinophil and neutrophil count in nasal mucosa. This study was conducted in Tamalanrea gas station and in Gunung Bawakaraeng street in Makassar, South Sulawesi Province. For 1 month, from August 2017 until September 2017. Samples number are 30 people, divided into two groups, 15 gas station operators with work duration  $< 1$  year and 15 gas station operators for work duration  $\geq 1$  year. The highest number of samples at age 15-23 years old are 23 people (76.7%), 18 women (60%) and 12 men (40%), 10 smokers (33.3 %) and 4 people (13.33%) with atopic history. (Table 1)

**Table 1. Sample Characteristics**

Categories	Frequency (n)	Percentage (%)
Age		
15 – 25 years old	23	76,7
26 – 35 years old	7	23,3
Gender		
Men	12	40,0
Women	18	60,0

Cont... Table 1. Sample Characteristics

Work duration		
< 1 year	15	50,0
≥ 1 year	15	50,0
Smoking history		
Yes	10	33,3
No	20	66,7
Atopic history		
Yes	4	13,33
No	26	86,67

Source : Primary Data, 2017

Unpaired t test result showed a significant correlation between mucociliary transport time with work duration < 1 year and ≥ 1 year with p value=0,01 (p<0.05). There are 4 people in a group with work duration < 1

year (13.33%) who experienced the disorder, 11 normal people (36.67%), and mean value 8.48 (SD±4.49). while in the work duration ≥ 1 year group, there are 3 normal people (10%), 12 people (40%) experienced the disorder and mean value 14.68 (SD±3.39). (Table 2)

Table 2. Comparison of mucociliary transport time (MTT) with work duration in gas station operators

Categories	Mucociliary Transport Time (MTT)				Mean±SD	OR	p
	Disorder		Normal				
	n	%	n	%			
Work Duration < 1 Year	4	13,33	11	36,67	8,48±4,49	11**	0,01*
Work Duration ≥ 1 Year	12	40	3	10	14,21±4,07		

Unpaired t test, \*\* Chi square test

Comparison of Pb level analysis in the gas station operators with work duration between < 1 year and ≥ 1 year using unpaired t test demonstrated a significant correlation with p value=0.001 (p<0.05). There is 1 person (3,33%) in work duration < 1 year group with abnormal Pb level, 14 normal people (46.67%) and mean value 6.45 (SD±2.14). In work duration ≥ 1 year group, there are 6 people (20%) with abnormal Pb level, 9 people (30%) with normal Pb level and mean value 10.92 (SD±1.89). (Table 3)

Table 3. Comparison of Pb Level in Gas Station Operators in Makassar

Categories	Lead Level (Pb)				Mean±SD	OR	p
	Not Normal		Normal				
	n	%	n	%			
Work Duration < 1 Year	1	3,33	14	46,67	6,45±2,14	9**	< 0,001*)
Work Duration ≥ 1 Year	6	20	9	30	10,92±1,89		

\* Unpaired t test, \*\* Chi square test

Comparison of eosinophil count in nasal mucosa analysis in the gas station operators in Makassar with work duration between < 1 year and  $\geq$  1 year using fisher test shows no significant correlation with p value  $p=0,29$  ( $p>0,05$ ). There is 1 person (3,33%) in work duration

< 1 year group with abnormal eosinophil count and 14 people (46,67%) with normal count. In work duration  $\geq$  1 year group, there are 3 people (10 %) with abnormal eosinophil count and 12 people (40%) with normal eosinophil count. (Table 4)

**Table 4. Comparison of eosinophil and neutrophil count of nasal mucosa in gas station operators**

Categories	Eosinophil				p	Neutrophil				p
	Normal		Not Normal			Normal		Not Normal		
	n	%	n	%		n	%	n	%	
Work Duration < 1 Year	14	46,67	1	3,33	0,29*	12	40	3	10	0,21*
Work Duration $\geq$ 1 Year	12	40	3	10		9	30	6	20	

\*Fisher test

The result of fisher test analysis shows no significant correlation between neutrophil in nasal mucosa of gas station operators in Makassar with p value=0,21 ( $p>0,05$ ). There are 3 people (10%) in work duration < 1 year with abnormal neutrophil count and 12 normal people (40%). In work duration  $\geq$  1 year group, there are 6 people (20 %) with abnormal neutrophil count and 9 people (30%) with normal neutrophil count. (Table 4)

## DISCUSSION

The major sample characteristics according to age is 15-23 years old with 23 people (76.7%), With the plenty amount of women than men, i.e. 18 people (60%). Munir D, 2010 stated that there was no significant difference in MCT time based on gender<sup>10</sup>. The influence of age and gender on MCT time is still not known clearly. Some researchers say that age and gender have no effect on the speed of mucociliary transport. Prijanto, 2002 suggested that nasal mucociliary transport is related to age, i.e. older age has a slower mucociliary transport rate than younger age. This is due to the possibility that older people are more exposed to air pollution<sup>11</sup>.

The result of mucociliary transport time (MTT) comparison analysis between gas station operators with work duration <1 year and  $\geq$  1 year showed a significant correlation by using unpaired t test with p value = 0.01 ( $p < 0.05$ ) and mean value 8.48 (SD  $\pm$  4.49) for work duration <1 year group, and in work duration  $\geq$  1 year group, the mean value was 14.68 (SD  $\pm$  3.39). In work

duration <1 year group, there are 4 people (13.33%) who experienced the disorder, this may be caused by the history of smoking and allergies. However, in the work duration  $\geq$  1 year group there are 3 normal people (10%), this may be caused by the use of maximum protective equipment and immune system of the operators.

Smoking can affect mucociliary transport time. This is due to the ciliostatic effects of tobacco smoke. Prolongation of mucociliary transport time may be caused by a decrease in the amount of cilia or mucus viscoelasticity changes. In addition, increased mucociliary transport time was also associated with an increase in smoking duration where subjects who smoked more than 5 years had a slower mucociliary transport time<sup>12</sup>. In the case of a very long rhinitis allergy, elongation of mucociliary transport time occurs and associated with alternation in nasal mucus flow features<sup>13</sup>

The result analysis of Pb level in gas station operator in Makassar between work duration <1 year and  $\geq$  1 year shows significant correlation by using unpaired t test with p value = 0.001 ( $p < 0.05$ ) and mean value 6.45 (SD  $\pm$  2.14) while mean value 10.92 (SD  $\pm$  1.89) for work duration  $\geq$  1 year group. In work duration <1 year group there is only 1 person (3.33%) with abnormal level of Pb, this may be due to the lack use of protective equipment, food and drinks or other factors. Poisoning caused by Pb metal compounds can occur due to the metal compounds entering the body. The process entry of Pb in the body



can be through several routes, such as food and drink, air, permeation or penetration of the membrane or skin layer<sup>6</sup>.

In the work duration  $\geq 1$  year group there are 9 people (30%) with normal Pb level, this may be due to the Threshold Limit Level of Pb at the gas station in Makassar below the mean value and there are 6 people (20%) with abnormal Pb level. Gas station operators who do not use protection equipment such as masks and gloves are susceptible to exposure of lead particles that came out directly from the gas waste-pipes and inhaled gasoline vapour at a higher rate compared to operators using protective equipment<sup>6</sup>.

The results of fisher test analysis showed no significant correlation of work duration with eosinophil and neutrophil count in nasal mucosa of gas station operators in Makassar, where  $p = 0,29$  ( $p > 0,05$ ) for eosinophil and  $p = 0,21$  ( $p > 0,05$ ) for neutrophil. Zachariah 2015, suggested that there is no significant correlation between the mass of work with eosinophil and neutrophil. Neutrophils are short-lived cells with a half-life in the blood between 6 - 7 hours and lifespan between 1-4 days in connective tissue. Neutrophils form a defence against the invasion of microorganisms, especially bacteria. Neutrophils are active phagocytes against small particles and are called as microphages to differentiate them from macrophages which are larger cells. Eosinophils can survive in the blood circulation for 8-12 hours, and last longer about 8-12 days in the tissue if there is no stimulation<sup>14</sup>

## CONCLUSION

There is a significant correlation between work duration of gas station operators with mucociliary transport time and Pb level. The longer the work duration of gas station operators are, the higher risk to have slower mucociliary transport time and risk of lead exposure.

There is no significant correlation between work duration with eosinophil and neutrophil.

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## REFERENCES

1. Mangunkusumo E, Soetjipto D. Sinusitis. Dalam Buku Ajar Ilmu Kesehatan Telinga Hidung Tenggorok Kepala dan Leher. Edisi Ke-7. Fakultas Kedokteran Universitas Indonesia. Jakarta. 2016.
2. Adams GL, Boies LR, Higler PA. Boeis buku ajar penyakit THT, Edisi 6, Jakarta, 2015.: 173-89.
3. Dhingra PL. Disease of Ear, Nose and Throat, 9<sup>th</sup> edition 2014.
4. Weguespack R. Mucocyliari clearance patterns following endoscopic sinus surgery, laryngoscope, 1995.: 105: 1-40
5. Roza, V., Mirna, I., & Anita, S. Korelasi Konsentrasi Particulate Matter (PM10) di Udara dan Kandungan Timbal (Pb) Dalam Rambut Petugas SPBU di Kota Pekanbaru. Jurnal Dinamika Lingkungan Indonesia. 2015. : Volume 2. No. 1. Hal. 52-60.
6. Palar H. Pencemaran dan toksikologi Logam Berat. Edisi 5, Rineka Cipta, Jakarta, 2012. : 10-92
7. Sanna EL, Vargiu I, Rossetti E, Vallascas, Floris G. Corelation between blood and hair lead levels in boys and girls of Sardinia (Italy). Journal of Anthropological Sciences. 2007; 85: 173-81
8. Badan Lingkungan Hidup Sulawesi Selatan. Data Evaluasi Kualitas Udara Perkotaan. Makassar. 2013.
9. Fardiaz Srikandi. . Polusi Air & Udara. Cetakan Ke-14. Penerbit Kanisius. Yogyakarta. 2014.
10. Munir, D. Waktu Bersihan Mukosiliar pada Pasien Rinosinusitis Kronis. Majalah Kedokteran Indonesia. 2010. : Vol. 60, No. 11.
11. Prijanto S. Roestiniadi. Nasal Mucocilliary Transpor Of Patients Attending Patients Departement Of Teh Dr. Soetomo Hospital. *Orli*; XXIII. 1992.
12. Baby MK, et al. Effect of cigarette smoking on nasal mucociliary clearance: A comparative analysis using saccharin test. Lung India. 2014.
13. Hermelingmeier KE, et al. Nasal irrigation as an adjunctive treatment in allergic rhinitis: A systematic review and meta-analysis. American Journal of Rhinology & Allergy. 2012.
14. Zachariah K. The correlation between formaldehyde exposure and nasal swab eosinophil and neutrophil in tire cord industry workers. Majalah Kedokteran Indonesia. .2015

# Frangipani Aromatherapy Oil in the Massage of Labor First Stage Reduced Events Perineum Ruptur Spontan at the Labor

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## ABSTRACT

**Background:** Labor is a physiological event, but midwifery care is required to avoid complications in the mother and fetus. Midwifery care is given during labor to reduce the incidence of perineum rupture. Primiparous are considered most at risk of spontaneous perineum rupture. Perineum rupture may result in bleeding.

The aim of this research is to know the influence of frangipani aromatherapy oil in the first stage of labor massage on maternal perineum condition.

Research type Quasi-Experimental Design with posttest control group design. The sample size was 80 people, divided into 2 treatment groups and 40 respondents respectively. Sampling technique used Consecutive sampling. Data is recorded on the observation sheet. Univariate and bivariate data analysis "Mann-Whitney". The results showed perineum conditions in the treatment group mostly did not experience laceration perineum, while the control group most respondents suffered perineum injury level one. Mann-Whitney test result obtained 399.000 with value  $p = 0,000$ , indicating there is the influence of aromatherapy frangipani in the first stage of labor massage to perineum condition at level of significance  $p < 0,05$ . The conclusion of research that there is the influence of aroma of frangipani therapy in the first stage of labor massage to perineum condition

**Keywords:** *massage, aromatherapy, frangipani, first stage, labor*

## INTRODUCTION

Childbirth is a physiological event, but care should be given to the midwifery well to prevent maternal and fetal complications. Midwifery care is given during labor to reduce the incidence of perineum rupture. Perineum rupture occurs in almost all of the first labor, and not infrequently in subsequent labor<sup>1</sup>. primiparous are considered most at risk for spontaneous perineum rupture<sup>2</sup>. The new paradigm with Normal Birth Care, primiparous is no longer an indication of episiotomy<sup>3</sup>. Perineum rupture may result in bleeding according to the degree of laceration that occurs. In perineum rupture of degree 1 and 2 rarely occurs bleeding, but at degree 3 and

4 it often leads to bleeding and infection complications<sup>4</sup>.

Approximately 90% of the causes of maternal deaths in Indonesia occur at the time of delivery. Post partum bleeding accounts for 40% as the main cause. Post partum bleeding, among others, occurs because of a tear in the birth canal including the perineum is the second cause of postpartum hemorrhage, after uterine atony. Episiotomies are not routinely performed because of the increased risk of bleeding and infection. Efforts to prevent perineum rupture can be done by regulating the expulsion of the head, shoulders and the entire body of the baby using birth help with the technique of Normal Birth Care, supported by policy ministry of health number 786 /SK/VII/1999 about Normal Birth Care <sup>5</sup>.

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Results of research in Birth Clinic Panjawi Sukoharjo Surakarta in 2015 found 60% of primiparous maternal respondents normally suffered perineum

injury<sup>6</sup>. Efforts that can be done so that mothers can pass the process of natural labor, not using drugs, is the authority of the midwife with the techniques of massage and aromatherapy<sup>7</sup>. Aromatherapy is a complementary therapy in midwifery practice using essential oils from the smell of plants to improve the physical and emotional conditions. Frangipani is one of aromatherapy that have character and benefit to increase concentration, spirit, joy, confidence, relaxation, reduce fear, depression, panic, relaxes muscle and skin<sup>8</sup>. In research that have been done, found no allergy to aromatherapy oil frangipani<sup>9</sup>.

Based on the above background researchers are interested to examine the effect of aromatherapy aroma frangipani therapy in the first stage of labor delivery to the mother's maternal perineum condition. In general, this study aims to determine the effect of aromatherapy aroma frangipani therapy in the first stage of labor massage on the perineum at the Puskesmas Pembantu Dauh Puri Denpasar and Midwife Practice Gusti Ayu Widiasih Gianyar Bali Year 2016.

## MATERIALS AND METHOD

This research is Quasi-Experimental Design type, posttest control group design with propective approach. Non probability sampling technique, consecutive sampling type. The study was conducted from June to

October 2016. Research subjects of maternity mother at Puskesmas Pembantu Dauh Puri Denpasar and Midwife Practice Gusti Ayu Widiasih Gianyar. Inclusion criteria: first delivery mother, cervical uterine active phase, cooperative maternity, while pregnant antenatal classes, fetal position of the head, estimated fetal weight 2,500 grams to 4,000 grams, willing to be respondents. Data collected primary data. The treatment and control groups were determined using a simple random system. The sample size of 80 respondents was divided into 2 groups, each group was 40 respondents. Treatment group of 40 people performed massage with palms and fingers on thoracic 10, 11, 12 and lumbal 1 using aromatherapy frangipani oil, while control group 40 people performed massage using virgin coconut oil (VCO) without aromatherapy. After respondents were given back massage treatment, then observed the condition of the perineum after the baby was born, then recorded on the observation sheet. Data analysis techniques include univariate and bivariate analyzes using "mann-witney", hypothesis testing through drawing conclusions based on p value at 95% confidence level.

## RESULTS

Data collection was conducted from July to October 2016 with the following results:

**Table 1. Characteristics of Respondents Research The Effect of Frangipani Aromatherapy in First Stage Labor Massage to Perineum Conditions at Puskesmas Pembantu Dauh Puri and Midwife Practice GAW Gianyar**

No	Characteristics	Control Group		Treatment group	
		f	%	f	%
1.	Education				
	Basic	15	37.50	14	12.5
	medium	24	60.00	26	65.00
	high	1	2.50	0	0
	total	40	100	40	100
2.	age				
	<20 years /> 35 years	2	5.00	1	2.50
	20-35 years	38	95	39	97.5
	total	40	100	40	100
3.	work				
	work	35	97.50	36	90.00
	Does not work	5	12.0	4	10.00
	<b>total</b>	<b>40</b>	<b>100</b>	<b>40</b>	<b>100</b>

Table 1 shows, the distribution of respondents in each type of education and age between the control group and the treatment is almost the same. The highest frequency of respondents in both groups was secondary education. The age distribution of respondents in both groups was in the range of 20-35 years. Based on work, almost all respondents in both groups work.

**Table 2. Perineal state**

condition of the perineum	Control Group		Treatment group	
	f	%	f	%
intact	5	12.50	23	57.50
level 1 wound	28	70.00	17	42.50
level 2 wound	7	17.50	0	0
<b>total</b>	<b>40</b>	<b>100</b>	<b>40</b>	<b>100</b>

Based on table 2 above it can be seen that the respondents in the treatment group more than half of the perineum condition intact, whereas in the control group the majority of respondents suffered perineum injuries level 1, and a small percentage of wound level 2.

The data normality test by Kolmogorov-Smirnov or Shapiro-Wilk test was performed before bivariable analysis. The test results obtained data is not normally distributed, thus can be done nonparametrik analysis with Mann-Whitney test.

Effect of frangipani aromatherapy in the first stage of labor massage on Perineum Conditions

**Table 3. Result of Influence Analysis of Frangipani Aromatherapy In First Stage Labor Massage Against Perineum Conditions**

condition of the perineum	n	level of perineal wound			Mann-Whitney	p
		0	1	2		
Control group (without aromatherapy)	40	5 (12.50%)	28 (70.00%)	7 (17.50%)	399.000	0,000
Treatment group (aroma therapy frangipani)	40	23 (57.50%)	17 (42.50%)	0 (0%)		
Total	80	18	45	7		

Table 3 shows the condition of perineum in the maternity group who received frangipani aromatherapy in the first half of labor massage I had half of the wound perineum 0 (intact), while the maternity group who did not get the aroma of frangipani therapy in the first stage of labor massage were injured perineum level 1 (70%). Mann-Whitney test result obtained 399.000 with value  $p = 0,000$ , indicating there is influence of aroma of frangipani therapy in the first stage of labor massage to perineum condition at level of significance  $p < 0,05$ .

## DISCUSSION

Based on the results of research on the characteristics of respondents that the characteristics of maternal education most of the educated medium meaning from the level of education has exceeded basic education. This allows the mother to be able to receive information related to the delivery process well. The level of education may affect the maternal psychosocial to the preparation, expectation and care it will undergo<sup>11</sup>. The respondent's age in the control and treatment groups is mostly at the age of 20 to 25 years. Age is one of the factors that affect one's experience. Age is indirectly associated with labor because it affects a person's emotions and affects the mother's expectation of care during labor<sup>12</sup>.

1. Perineum wound conditions in maternity women who performed massage in the first stage of labor using aroma oil frangipani therapy and without aroma therapy.

The condition of perineal wound in the maternity group that performed the massage using frangipani aromatherapy was more than half (57.50%) the condition of perineum intact, there was no injury level 2, while in control group most (70%) had perineum wound level 1, and a small fraction (17.50%) suffered level 2 wounds.

The results of this study showed that most of the respondents who received massage with frangipani aroma oil had better elasticity of the perineum muscles compared to those without massage therapy. The combination of massage and the use of frangipani-scented oil effectively provides a relaxant effect on the mother because it can simultaneously prevent or inhibit pain impulses derived from the cervix and corpus uteri and provide a relaxant effect of the relaxant compounds contained by frangipani<sup>13,14</sup>. Massage performed on the area torakcic 10,11,12, and lumbar 1 can decrease labor pain. Labor pain arises as a result of uterine contractions that cause cervical dilatation, cervical thinning, decreased head, and decreased blood flow causing tissue oxygen deprivation. This is in accordance with the results of research in Purwokerto that there are significant differences before and after the massage of labor pain during the first stage active phase<sup>15</sup>. The results of this study support the theory that emphasis and rubbing can prevent or inhibit pain impulses derived from the cervix and corpus uteri using the theoretical basis of gate control so that the pain felt by the mother is reduced<sup>16,17</sup>.

The pain felt by the maternal mother is reduced as a relaxant effect contained by frangipani such as triterpenoid and relaxant amyryn elements<sup>18</sup>. This is consistent with the theory that aroma therapy is a complementary therapy in midwifery practice using essential oils from the frangipani / jepun to improve physical and emotional condition<sup>19</sup>. Frangipani fragrances enter the nasal cavity through the inhalation so that it will be recorded by the brain as a sense of smell, then the smell will be transmitted as a message to the olfactory center, delivering it to the limbic system which is then sent to the hypothalamus to be processed and may affect the psychological and emotional conditions of the maternal mother<sup>14</sup>.

2. Effects of aroma therapy frangipani in the first stage of labor massage against the condition of the perineum

Birth care based on evidence based obstetrics, one of which is not routine episiotomy. In this regard pregnancy care also aims to prepare the condition of perineum to be elastic so that when stretching at the second stage of labor does not have tears. Combination in the thoracic region of 10,11,12, and lumbar 1 using frangipani aroma therapy gives rise to a feeling of relaxation. The resulting odor response stimulates the work of brain cells to secrete enkephalin that acts as a natural pain reliever and produces a feeling of calm<sup>14</sup>.

Perineal condition in maternal group who received aroma of frangipani therapy in the first half of labor massage I had half of the wound perineum 0 (intact), while the maternity group who did not get the aroma of frangipani therapy in the first stage of labor massage mostly had perineal injury level 1 (70%). Mann-Whitney test result obtained 399.000 with value  $p = 0,000$ , showing there is influence of aroma of frangipani therapy in the first stage of labor massage to perineum condition at level of significance  $p < 0,05$ .

In this study most of the conditions of intact perineum found in maternal women who performed massage using frangipani aroma therapy. The aroma of frangipani therapy that creates a sense of calm stimulates the brain area called *raphe* nucleus to secrete serotonin secretion, thus causing feelings of relaxation, muscle tension decreases, so the muscles become more flexible. It is explained that giving aromatherapy stimulates the autonomic nervous system that controls the movement of

the respiratory system and blood pressure<sup>20</sup>. Giving aroma therapy frangipani make mothers more comfortable, calm, decreased muscle tension including pelvic and perineum pelvic muscles, so the muscles become more flexible. Mother will be able to better control the breath when casting. During labor the circle of muscles around the vagina enlarges allowing the baby to be born, when the muscles are in good condition will be very flexible to enlarge and return to their original size without injury, the delivery will be faster, convenient and easier<sup>21-23</sup>.

The flexibility and strength of the pelvic floor muscles accompanied by the strength and mental tranquility of the maternal mother, gives a good effect on the condition of the perineum after the birth of the baby<sup>19</sup>. Mothers who relax in the maternity more able to control the impulse to move well, so the perineum gets a chance to stretch slowly while giving birth to the fetus. Maximum flexibility of the muscles and relaxation then the baby's birth process will run slowly and controlled, if the pelvic muscles are stiff and the contractions too strong, the baby will be too quickly out of the uterus that can damage the perineal muscles that are just below the pelvis, muscle which cannot relax can also prolong the time of expenditure this results in pelvic muscular and neuromuscular damage<sup>22-24</sup>.

**Ethical Consideration:** This study was approved by the ethics Committee of Medical Faculty of Udayana University / Sanglah General Hospital Denpasar Bali

**Conflict of Interest:** The investigator have no conflicts of interest to disclose

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## REFERENCES

1. Saifuddin, AB., Ilmu Kebidanan, PT. Bina Pustaka Sarwono Prawirohardjo, Jakarta. 2009.
2. Schmit, T., Albert C., Andriss B., Moutafoff C., Oury JF., Sibony O. Identification of Women at High Risk for Severe Perineal Lacerations. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 2014: pages 11-15. DOI: 10.1016/j.ejogrb.2014.08.031
3. JNPK-KR, Maternal & Neonatal Care. Buku Acuan Asuhan Persalinan Normal. Departemen Kesehatan Republik Indonesia, 2008.
4. Monteiro, VDC, Pereira GM, Aquar RA, Azevedo RL, Correia JMD, Reis ZS. Risk factors for severe obstetric Perineal Lacerations. *Int Urogynecol J*. 2016 Jan; 27 (1):61-7. doi: 10.1007/s00192-015-2795-5. Epub 2015 Juli 30
5. JNPK-KR/POGI. Asuhan Persalinan Normal. Jakarta. JHPIEGO. 2012.
6. Yuliaswati, E., Gambaran Responden Dengan Robekan Perineum Di RB. Panjawi Sukoharjo. *Jurnal GASTER Vol. XII No. 2 Agustus 2015*.
7. Simkin, P., et.al. Nonfarmakologi Relief of Pain During Labor, Systematic Review of five Methods. *Am J Obstet Gynecol* 186 (5 suppl Nature) 2007:S 131-59
8. Luo, TZ., Huang, M.L., Xia, H.A., and Zeng, Y.C. Aromatherapy for Laboring Women: A Meta-Analysis of Randomized Controlled Trials. *Open Journal of Nursing*, 4, 163-168. <http://dx.doi.org/10.4236/ojn.2014.43011>. 2014.
9. Sriasih, dkk., Pengaruh Massage Menggunakan Minyak Aromaterapi Frangipani terhadap Intensitas Nyeri Persalinan di Puskesmas Pembantu Dauh Puri tahun 2015, Laporan Penelitian, t.p. 2015
10. Suyatra IP. Jepun, Flora Usadha Berkhasiat Mulriguna, Ini khasiatnya. ([www.jaewapos.com/radar/uploads/baliexpress/news/2017/09/05/jepun-flora-usadha-berkhasiat-multiguna-ini-khasiatnya\\_m\\_1751.jpeg](http://www.jaewapos.com/radar/uploads/baliexpress/news/2017/09/05/jepun-flora-usadha-berkhasiat-multiguna-ini-khasiatnya_m_1751.jpeg)). Diunduh tanggal 10 januari 2018.
11. Brucki2 SMD, Valle LER. The influence of educational status on motor performance and learning: a literature review. *Fisioter Pesq*. 2014;21(3):297-304 DOI: 10.590/1809-2950/43521032014
12. Deeks A., et all. Lombard C., The effects of gender and age on health related behaviors , *Michelmores #1 BMC Public Health v.9; 2009 PMC2713232*
13. Dixon, L., Skinner, J., Fourior M. The emotional and hormonal pathways of labour and birth: integrating mind, body and behaviour. *New Zealand College of Midwives • Journal* 48. <https://www.midwife.org.nz/> diakses tanggal 30 Agustus 2017
14. Dobetsberger, C. And Buchbauer, G. 2014. Flavour and Fragrance Journal, 2011, 26, 300-316. DOI 10.1002/ffj.2045
15. Handayani R., Winarni W., Sadiyanjto. Pengaruh Massage Effleurage Terhadap Pengurangan Intensitas Nyeri Persalinan Kala I Fase Aktif Pada

- Primipara Di Rsia Bunda Arif Purwokerto Tahun 2011. *Jurnal Kebidanan* Volume 5 no 1 Juni 2013
16. Haghighi NB., Masoumi, SZ., and Kazemi F. Effect of Massage Therapy on Duration of Labour: A Randomized Controlled Trial. *J Clin Diagn Res.* 2016 Apr; 10 (4): QC12-QC1
  17. Maryunani, A. Nyeri dalam Persalinan. Jakarta: Trans Info Medika. 2010
  18. Megawati, Satrya WDS. Minyak Atsiri dari kamboja kuning, putih, dan Merah dari Ekstraksi dengan N-Heksana. *Jurnal Bahan Alam Terabrukan.* Vol. 1 No.1 juni 2012: 25-31
  19. Smith, C.A., Collins, C.T., And Crowther, C.A. Aromatherapy for pain management in labour (review). The Cochrane Collaboration. John Wiley & Sons. <https://www.thecochranelibrary.com>. 2011.
  20. Mitchell. T., Dhany, A., and Foy, C. The Impact of an Aromatherapy and Massage Intrapartum service Upon Use of Analgesia and Anaesthesia in Women in Labour; A Retrospective case Note Analysis. *Journal of Alternative and Complementary Medicine:* <http://dx.doi.org/10.1089/acm.2011.0254>
  21. Syamsiar S. Russeng, Lalu Muhammad saleh, Devintha Virani, Ade Wira Listrianti Latief, Anwar Mallongi. The Investigation of the Lactic Acid Change among employee of national electrical Power Plan. *Indian Journal of Public Health Research & Development*, January 2018, Vol. 9, No. 1
  22. Ali B, Al-Wabel NA, Shams S, Ahamad A, Khan SA, Anwar F. Essential oils used in aromatherapy: A systemic review. *Asian Pacific Journal of Tropical Biomedicine.* 2015;5(8):601-611. doi: 10.1016/j.apjtb.2015.05.007
  23. Ambartana, I.W., Mallongi, A., Gumala, N.M.Y., (...), Kencana, I.K., Widarti, I.G.A.A. The effectiveness of nutritions ergogenic modified to the local endurance of Pamong Praja Police personnel in Denpasar. *Indian Journal of Public Health Research and Development* , 2018.
  24. Khanahmadi, S. *International Journal of Women,s Health and Reproduction Sciences* Vol. 1. <http://www.ijwhr.net> doi:10.15296/ijwhr.2013.01

# Traditional Balinese Youth Groups as Peer Educator to Improving Knowledge and Attitude Adolescents about Reproductive Health in South Denpasar

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## ABSTRACT

The high level of pre-marital sexual behavior and marriage of children in Indonesia is caused by the lack of adolescent knowledge about reproductive health. Adolescents prefer to discuss with peers compared with parents and teachers. Health education activities by peers have been largely school-based, but still rarely involve teenagers in the community. The purpose of this study is to know the effectiveness of Traditional Balinese Youth Groups (*Sekaa Teruna Teruni / STT*) as peer educators to improve adolescent knowledge and attitude about reproductive health. The research method was conducted with One Group Pre-test Post-test design. Before the counseling, as many as 42 members of STT were trained by health professionals using module media. Furthermore, they provided counseling to 210 randomly selected adolescents from 14 region (*Banjar*) in South Denpasar. Counseling using booklet media. Pre-test and post-test knowledge and attitude about reproductive health are done by using questionnaire. The training of STT members on reproductive health showed an increase in knowledge (p-value = 0.000) and attitude (p-value = 0.000) RR 95% CI (1.651-4.415). After adolescence is given counseling by peer educators, there is increased knowledge (p-value = 0.000) and attitude (p-value = 0.000) RR 95% CI (2.575-4.217). The results show that *Sekaa Teruna Teruni* is very effective as peer educator of reproductive health. Next, there needs to be ongoing training for the empowerment of STT as peer educators in various health programs.

**Keywords:** *Traditional Balinese Youth Groups, peer educators, knowledge, attitude, reproductive health*

## INTRODUCTION

Adolescence is often regarded as a bridge between childhood and adulthood where a number of significant changes occur in a relatively short time<sup>1</sup>. Adolescents are residents in the age range of 10-19 years and youth of the age group of 15-24 years<sup>2</sup> According to the Regulation of the Minister of Health of the Republic of Indonesia No. 25 of 2014 adolescents are residents in the age range 10-18 years<sup>3</sup>. According to the National Family Planning Board of Indonesia (BKKBN), teenagers are young people, 10-24 years of age<sup>4</sup>.

In the world estimated number of adolescents 1.8 billion or one quarter of 7.3 billion world population. In developing countries, 50% of the population is under 18 years old<sup>5</sup>. In the Asia-Pacific region, teenagers account for 60% of the world's teen population or comprise 750 million teenagers aged 15 to 24<sup>6</sup>. Indonesia is a developing country with a high population of teenagers. The number of adolescents in Indonesia is 61.83 million people or about 24.53 percent of the 252.04 million population of Indonesia with male teenagers greater than women<sup>7</sup>. Bali as one of the provinces in Indonesia has a fairly high number of adolescents. By 2018 Bali Province has 10-24-year-olds as many as 893,920 people or 22.97% of the population in Bali is 3,890,757 people<sup>8</sup>.

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Adolescence is a period of rapid growth and sexual maturation. At this time there is an acceleration of physical changes, cognitive, social, emotional and



interpersonal changes. Teenagers have great curiosity, try and experiment. Teenagers seek to identify themselves, among others, their identity in the sexual field so that adolescents and sexual urges are interconnected and difficult to separate<sup>9-11</sup>.

Every year in the world, about 15 million girls get married before the age of 18, and 90% of births for girls aged 15 to 19 years occur in marriage<sup>12</sup>. In Indonesia, the prevalence of marriage in childhood has more than doubled in the last three decades but is still one of the highest in the East Asia and Pacific region. According to the National Social and Economic Survey (Susenas) conducted by the Central Bureau of Statistics (BPS) among married women aged 20-24 years, 25 percent married before the age of 18 years<sup>13</sup>.

Under age marriage may occur due to unwanted pregnancy resulting from premarital sexual intercourse<sup>14</sup>. Many factors that cause teens to have premarital sex that result in unwanted pregnancies include lack of knowledge and attitudes about reproductive and sexual health<sup>15,16</sup>. In Indonesia, based on Indonesia Health Demographic Survey in 2012 it is found that adolescent knowledge about reproduction health is not adequate<sup>17</sup>. Young men and women discuss with most peers about reproductive health compared with parents and teachers<sup>18</sup>.

To improve adolescent knowledge about reproductive health, health education needs to be done. The well-known and effective method of health education in improving adolescent knowledge, attitudes, and attitudes about reproductive health and sexuality is the method of peer education<sup>19</sup>. In Indonesia, peer educator training has been largely based on schools or students at junior and senior high school levels but has not used much of the social organization of adolescents in the community. One of the social organization of youth development that grows and develops on the basis of social awareness and responsibility of society is *Sekaa Teruna Teruni (STT)*. This collection or organization comes from, by, and for the community, especially the younger generation, both men and women in the village or adat communities.

## MATERIAL AND METHOD

The research design by One Group Pre-test Post-test method to measure the change of knowledge and attitude of adolescent about reproductive health before (pre-test) and after (post-test) is given counseling by

STT as a peer educator. A total of 42 members of STT came from 14 regions in Denpasar Pedungan area Bali was given 2 days training. Training materials on peer educators and reproductive health with training media using reproductive modules. Training was provided by health professional from Public Health Center IV South Denpasar.

The next stage, peer educators provide counseling to peers by using a media booklet that contains about adolescent growth, anatomy and physiology of adolescent reproductive organs, fertility and pregnancy, reproductive equipment maintenance, and premarital sexual intercourse and myths about health reproduction. One peer educator gives counseling to 5 people. The total number of teenagers given counseling as many as 210 people.

## RESULTS

**Table 1 Results of Differentiation Analysis of Peer Educator Knowledge**

### Reproduction Before and After Training

No		Before Training (n = 42)	After Training (n = 42)	
1	Mean	24.14	28.31	
2.	Median	25.00	28.50	p value = 0.000
3.	Modus	26	29	(<0.05)
4.	Std Deviation	2.455	1.405	
5.	Range	10	6	
6.	Minimum	18	24	
7.	Maximum	28	30	

There is an increase in average scores of respondents' knowledge before and after training. Mean before training 24.14 to 28.31. Minimum value changed from 18 to 24 after training Maximum score obtained by respondents also increased from 28 to 30 after training. The result of T-test analysis found that there is a significant difference between pre-test and post-test with a p-value of 0.000 (<0.05) means that there is an influence of training to peer educator knowledge about reproduction health.

**Table 2. Results of Differentiation Analysis of Peer Educator Attitudes toward Health**

Reproduction Before and After training

No	Attitude	Favorable	Unfavorable	RR (95% CI)
1.	Before training (n = 42)	17 (40.5%)	25 (59.5%)	2,700 (1,651-4,415)
2	After training (n = 42)	27 (64.3%)	15 (35.7%)	P-value 0.001

Prior to the training, the value of favorable attitude amounted to 17 people (40.5%), while after training increased to 27 people (64.3%). From the results of chi-square test listed in table 3, the difference in attitude values before and after training with the p-value of 0.001 (<0.05), RR 95% CI (1.651-4.415) or in other words there is a significant effect of training on adolescent attitude about reproductive health.

**Table 3. Distribution of Youth Characteristics**

No	Respondent's Characteristics	Amount (n = 210)	%
1.	Age		
	a. Early adolescents (11-14 years old)	16	7.6
	b. Middle adolescence (15-17 years)	76	36.2
	c. Late adolescence (18-20 years)	118	56.2
2.	Education		
	a. Graduated from elementary school	27	12.9
	b. Graduated from junior high school	64	30.5
	c. Graduated from high school	103	49.0
	d. Graduated Higher Education	16	7.6
3.	Sex		
	a. Male	132	62.9
	b. Female	78	37.1

Based on table 3, most of the respondent age is in the age range of late adolescents of age between 18-20 years as much as 56.2%, the highest education is high school graduation as much as 49.0% and male sex as much as 62.9%.

**Table 4. Youth Knowledge About Reproductive Health Before and After counseling by Peer Educators**

No		Knowledge Before Counseling (n = 210)	Knowledge After Counseling (n = 210)
1.	Mean	16.85	18.20
2.	Median	17.00	18.00
3.	Mode	17	18
4.	Std Deviation	1.482	1.034
5.	Range	9	4
6.	Minimum	11	16
7.	Maximum	20	20

The Mean before training 16.85 to 18.20. Before paired t-test, the normality test with Kolmogorov Smirnov test is obtained p-value  $<0.05$  ( $\alpha = 0.05$ ) so that the data is not normally distributed. Subsequent tests to determine the differences of knowledge before and after the counseling by peer educators conducted Wilcoxon test.

**Table 5. Results Effect of Peer Educators' Counseling Analysis on Knowledge**

Teens About Reproductive Health

No	Knowledge	Good	Enough		p value
1	Before Counseling (n = 210)	194 (92.4%)	16 (7.6%)	Negative ranks = 0 Positiv ranks = 16 Ties = 194	0.000 ( $<0.05$ )
2.	After Counseling (n = 210)	210 (100%)	0		

Wilcoxon test results obtained the p-value of 0.000 ( $<0.05$ ) which means there are significant differences in knowledge before and after counseling.

**Table 6. Results of the Peer Education Counselors' Analysis of Youth Attitudes**

About Reproductive Health

No	Attitude	favorable	Unfavorable	RR (95% CI)	p-value
1.	Before counseling (n = 210)	101 (48.1%)	109 (51.9%)	<b>3,295</b> <b>(2,575-4,217)</b>	<b>0.000</b> <b>(<math>&lt;0.05</math>)</b>
2.	After counseling (n = 210)	145 (69%)	65 (31%)		

The result of chi-square test shows that there is the difference of attitude of adolescent before and after giving counseling by peer educator with p-value 0.000 ( $<0.05$ ), RR 95% CI (2,575-4.217). There is an increase in adolescent attitude that is favorable after being given counseling by peer educators.

## DISCUSSION

The training of STT as a peer educator in the Working Area of Public Health Center IV South Denpasar shows the result there is an increase in average score of respondent knowledge before and after training. Training also enhances STT's attitude toward reproductive health. The results of this study are supported by research conducted by Adegbenro, Adeniyi, & Oladepo (2006) which states that training improves knowledge and attitude towards reproductive health (20). Training by health professionals has been shown to increase the knowledge and attitude of

adolescent girls about reproductive health<sup>21</sup>. Research on the empowerment of STT by providing training on reproductive health is also done in Bengkala Village, Buleleng Regency, Bali in 2016. Training provided to STTs who are deaf-mute can improve knowledge about reproductive health<sup>22</sup>. Reproductive health awareness programs can also improve adolescent knowledge, attitudes, and behavior about reproductive health<sup>23</sup>.

Prior to the counseling by peer educators, the number of adolescents with a good knowledge level of 194 people (92.4%) increased to 210 (100%) after being given counseling. A total of 16 adolescents experienced an increase in knowledge from the level of knowledge enough to the level of knowledge either with an average score of 16 to 18 after being given counseling. In addition to knowledge, there is an increase in adolescent attitude is favorable after being given counseling by peer educators. Prior to the counseling, the number of favorable adolescents was 101 (48.1%), whereas after

counseling increased to 145 (69.0%). Although there are still teenagers with unfavorable attitudes, this research has shown there is an increase in adolescent knowledge and attitudes about reproductive health after being counseled by STT as peer educators.

Many studies have shown that peer educators can improve adolescent knowledge and attitudes about reproductive health<sup>24,25</sup>. Peer education also shows its influence on improving health information in other social and age groups<sup>26</sup>. A peer educator is someone who belongs to the group as the same member, but who receives training and special information so that this person can bring or maintain positive behavior change among group members<sup>27</sup>. Peer educators can help raise awareness, provide accurate information, and help their friends develop skills to change behavior<sup>28</sup>. The level of trust and comfort between peer educators and their groups facilitates a more open discussion of sensitive topics. Peer educators can act as role models of attitudes and behavior toward their peers<sup>29,30</sup>.

STT as a social organization exist in Balinese society is a place of interaction between adolescent so that know each other and can influence each other. By getting to know each other then communication at the time of counseling about reproduction health can take place openly and the process of discussion run smoothly. According to the researchers, this condition that supports so STT effectively becomes peer educators for adolescents in the region/banjar area in Bali.

## CONCLUSION

After training on reproductive health, peer educators' knowledge and attitudes have improved. Furthermore, *Sekaa Teruna Teruni* (STT) can play well as peer educators in giving counseling to adolescent peers about reproduction health. There is increasing knowledge and attitude of adolescent more favorable after given counseling. This shows that STT very effectively as peer educator related health reproduction health. Given there are still teenagers who have not favorable to reproductive health then still need to be counseling. Furthermore, to be able to increase the role of STT as peer educator hence need to do regular training.

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**Ethical Clearance:** Ethical clearance was obtained

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## REFERENCES

1. Mindmatters. Adolescent Development. In Australia: Departement of Health; 2012. p. 1–20. Available from: [https://www.mindmatters.edu.au/docs/default-source/learning-module-documents/j4383\\_mm\\_module-2-1-2-modulesummary-v7.pdf](https://www.mindmatters.edu.au/docs/default-source/learning-module-documents/j4383_mm_module-2-1-2-modulesummary-v7.pdf)
2. World Health Organisation. World Health Organization, Adolescent health and development [Internet]. Searo. 2017. Available from:
3. Menteri Kesehatan Republik Indonesia. Peraturan Menteri Kesehatan Republik Indonesia Nomor 25 Tahun 2014 Tentang Upaya Kesehatan Anak [Internet]. Jakarta: Menteri Kesehatan Republik Indonesia; 2014. p. 28. Available from: <http://kesga.kemkes.go.id/images/pedoman/PMK No. 25 ttg Upaya Kesehatan Anak.pdf>
4. BKKBN. Pedoman Pengelolaan Pusat Informasi dan Konseling Remaja/Mahasiswa (PIKR/M) [Internet]. Jakarta: Badan Keluarga Berencana Nasional; 2012. Available from: <http://kesra.jatengprov.go.id/file pdf/pikrm.pdf>
5. Das Gupta M, Engelman R, Levy J, Luchsinger G, Merrick T, Rosen JE. State of World Population 2014 The Power of 1,8 billion Adolescents, Youth and the Transformation of the Future [Internet]. Unfpa. New York; 2014. 136 p. Available from: [https://www.unfpa.org/sites/default/files/pub-pdf/EN-SWOP14-Report\\_FINAL-web.pdf](https://www.unfpa.org/sites/default/files/pub-pdf/EN-SWOP14-Report_FINAL-web.pdf)
6. Asia YIN. Regional Overview : Youth In Asia and The Pasific [Internet]. 2012. Available from: <http://www.un.org/esa/socdev/documents/youth/fact-sheets/youth-regional-escap.pdf>
7. Badan Pusat Statistik. Statistik Pemuda Indonesia tahun 2014 [Internet]. Susilo D, Chamami A, Handayani NB, editors. Jakarta: adan Pusat Statistik; 2014. 215 p.
8. BPS. Badan Pusat Statistik Provinsi Bali. Denpasar Bali: BPS Provinsi Bali; 2014.
9. Cantwell ZM. Developing Adolescents: A Reference for Professionals. Vol. 2, American Journal of Evaluation. Washington, DC: American

- Psychological Association; 2002. 11-17 p.
10. Unicef. Adolescence An Age of Opportunity [Internet]. Unicef. 2011. 137 p. Available from: [www.unicef.org](http://www.unicef.org)
  11. UNFPA, UNESCO, WHO. Sexual and Reproductive Health of Young People in Asia and The Pasific. A Review of Issue, Policies and Programmes [Internet]. Melbourne, Australia: Burnet Institue; 2015. Available from:
  12. WHO. Adolescent pregnancy [Internet]. 2018. Available from: <http://www.who.int/en/news-room/fact-sheets/detail/adolescent-pregnancy>
  13. Statistik BP. Kemajuan yang Tertunda : Analisis Data Perkawinan Usia Anak di Indonesia. Jakarta: Badan Pusat Statistik Indonesia; 2016.
  14. Utomo, Iwu D., Utomo A. Adolescent Pregnancy in Indonesia : A Literature Review. World Popul Day [Internet]. 2013;1–11.
  15. Kuberan D, Rushender R, Kumar GD. Knowledge and attitude about reproductive and sexual health among higher secondary school students in a taluk of Tamil Nadu. 2017;4(10):3568–75.
  16. Bazarganipour F, Ph D, Foroozanfard F, Taghavi SA, Ph D. Evaluation of Female Youth Educational Needs about Reproductive Health in Non-Medical Students in the City of Qom. 2013;7(2):67–72.
  17. BKKBN, BPS, Kemenkes. Survei Demografi dan Kesehatan Indonesia 2012. Jakarta; 2013.
  18. Kemenkes. Situasi Kesehatan Reproduksi Remaja. Jakarta; 2016.
  19. Maley M. Peer Education for Adolescent Reproductive and Sexual Health [Internet]. New York: ACT for Youth Center of Excellence; 2017. Available from: [http://www.actforyouth.net/resources/rf/rf\\_peer-ed\\_0317.pdf](http://www.actforyouth.net/resources/rf/rf_peer-ed_0317.pdf)
  20. Adegbenro C a., Adeniyi JD, Oladepo O. Effect of training programme on secondary schools teachers' knowledge and attitude towards reproductive health education in rural schools Ile-Ife, Nigeria. Vol. 10, African Journal of Reproductive Health. 2006. p. 98–105.
  21. Malleshappa K, Krishna S, Nandini C. Knowledge and attitude about reproductive health among rural adoles- cent girls in Kuppam mandal : An intervention study. 2011;22(3):305–10.
  22. Kurniati DPY, Suariyani NLP, Listyowati R, Mangunsong F, Pratomo H, Harahap RM, et al. Pemberdayaan Kelompok Sekaa Teruna Teruni Sebagai Pendidik Sebaya (Peer-Educator) Kesehatan Reproduksi Di Desa Bengkala, Kabupaten Buleleng, Bali. In: Konas IAKMI XIII [Internet]. Makassar; 2016. Available from: [https://www.researchgate.net/profile/Desak\\_Kurniati/publication](https://www.researchgate.net/profile/Desak_Kurniati/publication)
  23. Madeni F, Horiuchi S, Iida M. Evaluation of a reproductive health awareness program for adolescence in urban Tanzania-A. *Reprod Heal J.* 2011;8(21):1–9.
  24. Polat S. Peer Training Increases the Level of Knowledge on Sexual and Reproductive Health in Adolescents. 2012;58(2).
  25. Puluubu, D.A.T., Evans, K., Arsyad, M., Mallongi, A. 2018. Understanding the perspectives of village leaders and institutions in transforming social conflict into peace and health. *Indian Journal of Public Health Research & Development*, March 2018, Vol. 9, No. 3
  26. Rosmala Nur, Nikmah Utami Dewi, Khairunnisa and Anwar Mallongi, 2017. Golden standard feeding and the risk of 25-60 month-old underweight children in Central Sulawesi, Indonesia. *Asian J. Clin. Nutr.*, 9: 104-110.
  27. Chandra-mouli V, Lane C. What Does Not Work in Adolescent Sexual and Reproductive Health : A Review of Evidence on Interventions Commonly Accepted as Best Practices. 2015;3(3):333–40.
  28. UNICEF. Peer education: Life skills [Internet]. 2015. Available from: [http://www.unicef.org/lifeskills/index\\_12078.html](http://www.unicef.org/lifeskills/index_12078.html)
  29. Abdi F, Simbar M. The Peer Education Approach in Adolescents- Narrative Review Article. Vol. 42. 2013. p. 1200–6.
  30. Enos Henok Rumansara, Anwar Mallongi, 2018., Tenggeng Dance Case as a Free sex Media in Lani People Culture and its Impact on the transmission of sexually transmitted Diseases and HIV / AIDs. *Indian Journal of Public Health Research & Development*, January 2018, Vol. 9, No. 1

# The Spatial Pattern and Risk Factors of Leprosy Occurrence in Barru, Indonesia

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## ABSTRACT

At this time 13 provinces and 147 districts/cities with a prevalence rate of more than 1/10,000 population, one of which is Barru South Sulawesi province where the discovery of a case in 2015 year as many 25 people (prevalence of 1.5/10,000 population). This research aimed (1) to investigate the spatial spread pattern of leprosy patients using Geographic System Information (GIS) and (2) to describe the risk factors correlated with the leprosy incidences in Barru Regency in 2013-2015. This research type was a descriptive/analytical survey with the cross-sectional design. The research was conducted in Barru Regency to find out the cases of leprosy patients which was 1/100,000 people. The samples comprised all the leprosy patients in Barru Regency in 2013-2015. The data collection was carried out using observation and interviews. The data were analyzed using statistically using SPSS program and the spatial analysis used ArcView GIS version 10.1. The research results indicated of the leprosy disease in Barru Regency in 2013 was random in the entire sub-districts area, while in 2014 and 2015 was clustered, the map buffer distance between the residences of the lepers were approximately still within the radius of 2-6 km and the health centers. The individual characteristics of the leprosy were about >29 years old: 79.3% in 2013, 64% in 2014 and 73.1% in 2015, male gender: 69% in 2013 and 52% in 2014: race/ethnicity: 100% Buginese in 2013-2015, poor knowledge: 100% in 2013, 88% in 2014 and 92.3% in 2015, bad personal hygiene: 82.8% in 2013, 68% in 2014, BCG vaccine reception 72% in 2013 & 2014 and 53.8% in 2015, and ≤2 years of contact time: 19% in 2013, 72% in 2014 and 69.2% in 2015. Socio-economic characteristics of patients who had in average low education: 100% in 2013, 96% in 2014 and 96.2% in 2015, job with risks: 100% in 2013, 96% in 2014 and 96.2% in 2015, income less than UMR: 100% in 2013 & 2015 and 92% in 2014. The conditions of the patients homes being in average fairly damp, fairly lighted, and having ventilations still met the requirement as prescribed by Kepmenkes, RI No. 29/Menkes/SK/VII/1999.

**Keywords:** *leprosy, spatial analysis, risk factors*

## INTRODUCTION

Leprosy is one of the infectious diseases that is still a public health problem, where some areas in Indonesia Prevalence Rate is still high and the problems posed are very complex. The problem is not only from the medical point of view but extends to the socio-economic, cultural, security and social security issues<sup>1</sup>. Factors that play a role in the transmission of leprosy is the age factor in which children are more sensitive compared to 3: 2 adults, the more males infected by leprosy than women. Race affects the incidence of leprosy where

in the black race the incidence of tuberculosis form is higher in white skin is more likely to type lepromatosa. People living in poverty usually have poor health, due to high occupational exposure due to occupant density, inadequate food or unhealthy working environment<sup>2,3</sup>. Level of knowledge as one part of the behavior with the process of transmission and healing in people with leprosy, people who have a high knowledge of leprosy will certainly try to distance itself from the factors that can be a source of transmission of this disease. In addition, knowledge of the disease must also be in line with the behavior of one's hygiene in everyday life<sup>4</sup>.

A long-term child in a leprosy endemic area also has a greater chance of making contact with an infectious type of leprosy patient<sup>5-8</sup>.

In 2014, the number of new leprosy cases in Indonesia is 17,025 people. The new case finding figures make Indonesia ranked third in the world after India and Brazil. Data 2014 shows that 83% of new cases are MB (Multi Basiller) cases, 9% of cases of disabled level 2, and 11% of child cases. Currently 13 provinces and 147 districts / cities with a prevalence rate of more than 1 / 10.000 inhabitants (Ministry of Health RI, 2016). In South Sulawesi, the leprosy situation is similar to the National pattern, where the number of patients and the prevalence rate per 10,000 population decreased significantly from year to year. The number of new leprosy cases registered in South Sulawesi in 2012 is 1,115 people, 685 men and 430 women. Patients new leprosy PB (Pausi Basiler) aged 0-14 years as many as 19 people, 11 men and 8 women. Patients with new leprosy PB of 171 people, 95 men and 76 women. While new patients MB (Multi Basiler) age 0-14 years as many as 48 people, 27 men and 21 women. New lepers MB  $\geq 15$  years as many as 896 people, 563 men and 333 women<sup>9,10</sup>.

The findings of data collection results / performance indicators of MSS in the district of Barru, reported that the discovery of new cases of leprosy patients in 2013 as many as 29 people with leprosy prevalence rate of 1.7 / 10.000 population, as many as 2014 25 people with leprosy prevalence rate of 1.5 / 10.000 population, and, in 2015 as many as 26 people with leprosy prevalence rate of 1.5 / 10.000 population. Leprosy prevalence rate in Barru Regency from year 2013-2015 is still high and not on target of Ministry of Health RI, which is more than 1 / 10.000 population. Until the end of 2015, leprosy data processing in Barru Regency is still limited in the form of tables and graphs and no mapping yet. Mapping the spread of disease is important, especially mapping the spread of infectious diseases and infectious diseases. By using spatial analysis, it is not only to know the pattern of disease distribution, high risk areas and disease risk factors regionally, but to find the cause or source of disease transmission so that the controlling and cutting of the disease chain can be done correctly<sup>11</sup>. Based on these facts it supports the authors to conduct research on spatial distribution patterns of leprosy patients using GIS and describe the risk factors associated with leprosy cases in Barru regency in 2013-2015.

## MATERIALS AND METHOD

### Location and Research Design

The study was conducted in Barru District with the discovery of leprosy cases of more than 1 / 100.000 population. The sample in this research is all leprosy patients in Barru Regency in 2013-2015. This type of research is a descriptive survey with cross sectional study design.

### Population and Sample

The population of subjects in this study is all data reports of leprosy patients in Barru regency in 2013-2015. While the population of the object is the home environment where the resident population of the subject studied. Subject sample in this study all leprosy patients both lepers Multi basilar (MB) and Pausi basilar (PB) in Barru District in 2013-2015.

### Data collection technique

Data about environmental condition, socioeconomic and characteristic of respondent related to leprosy incident are primary data obtained by questionnaire through interview, direct observation and measurement. Determination of coordinate house of leprosy patient, place of health service and mapping of surrounding area of environment done by using GPS Receiver.

### Data analysis

Data on the environmental, socioeconomic conditions and the characteristics of respondents related to leprosy events were analyzed by statistical analysis using SPSS program and spatial analysis using Arc GIS program version 10.1.

## RESULTS

From the map can be seen the distribution of leprosy patients in Barru regency per year and kecamatan, in the year 2013 there are 6 districts that become the leprosy spread, Tanete Riaja Sub-district 9 points, Barru District 8 dots, Pujananting and Tanete Rilau sub-point, District Soppeng Riaja as much as 3 points and District Mallusetasi as much as 1 point. In 2014, there are 7 districts where leprosy is distributed, Barru Sub-district with 10 points, Tanete Riaja and Tanete Rilau Sub-districts of 5 points each, Pujananting Sub-district with 2 points, Balusu, Soppeng Riaja and Mallusetasi Sub-districts of 1 point. In 2015, there are 5 sub-districts

where leprosy is distributed, Barru Sub-district with 9 points, Tanete Rilau Sub-district 7 Point, Tanete Riaja Sub-District and Balusu Sub-district with 4 Point, and Pujananting Sub-District 2 points. Results based on individual characteristics of leprosy patients in Barru regency 2013-2015 can be seen in Table 1.

Individual Characteristics	2013		2014		2015	
	n	%	n	%	n	%
<b>1. Age</b>						
Risk (15-29 year)	6	20.7	9	36.0	7	26.9
Not risk (>29 year)	23	79.3	16	64.0	19	73.1
<b>2 sex</b>						
Male	20	69.0	13	52.0	13	50.0
Female	9	31.0	12	48.0	13	50.0
<b>3. Ras/ethnic</b>						
(bugines & Madura)	29	100.0	25	100.0	26	100.0
(other)	0	0	0	0	0	0
<b>4. Knowledge</b>						
Risks	29	100.0	22	88.0	24	92.3
Not risk	0	0	3	12.0	2	7.7
<b>5. Vaccination of BCG</b>						
Risks	16	55.2	7	28.0	12	46.2
Not Risks	13	44.8	18	72.0	14	53.8
<b>6. Personal hygiene</b>						
Worse	24	82.8	17	68.0	20	76.9
Good	5	17.2	8	32.0	6	23.1
<b>7. Contac duration</b>						
Risks (>2 year)	10	34.5	7	28.0	8	30.8
Not ( $\leq$ 2 year)	19	65.5	18	72.0	18	69.2

Table 1. Description of Individual Characteristics of Leprosy Patients

Results based on socio-economic factors of leprosy patients in Barru regency 2013-2015 can be seen in Table 2.

Table 2. Description of Socio-Economic Leprosy in Barru District

Socioeconomic Factors	2013		2014		2015	
	n	%	n	%	n	%
<b>1. Education</b>						
Low	29	100.0	24	96.0	25	96.2
High	0	0	1	4.0	1	3.8
<b>2. Occupation</b>						
Risks	29	100.0	24	96.0	25	96.2
Not Risks	0	0	1	4.0	1	3.8
<b>3. Income</b>						
Less (< Rp.2.000.000)	29	100.0	23	92.0	26	100.0
Enough ( $\geq$ Rp.2.000.000)	0	0	2	8.0	0	0

Results based on environmental factors of leprosy patients in Barru 2013-2015 can be seen in Table 3.



House environment	2013		2014		2015	
	n	%	n	%	n	%
<b>1. Humidity</b>						
(<40% or >60%)	11	37.9	5	20.0	11	42.3
(40%-60%)	18	62.1	20	80.0	15	57.7
<b>2. Temperature</b>						
(<18 <sup>0</sup> C or > 30 <sup>0</sup> C)	28	96.6	22	88.0	24	92.3
(18 <sup>0</sup> C-30 <sup>0</sup> C)	1	3.4	3	12.0	2	7.7
<b>3. Lighting</b>						
(< 60 lux)	10	34.5	9	36.0	10	38.5
(≥60 lux)	19	65.5	16	64.0	16	61.5
<b>4. Ventilation</b>						
(<10% wide of floor)	11	37.9	11	44.0	10	38.5
(≥ 10% wide of floor)	18	62.1	14	56.0	16	61.5

Table 3. Description of the Home Environment of Leprosy Patients in Barru District

## DISCUSSION

This study shows that the distribution pattern of leprosy patients in Barru District is random and clustered as well as some risk factors of individual, socio-economic and environmental characteristics related to leprosy. The number of leprosy patients from 2013-2015 tends to remain, in 2013 as much as 29 points with the prevalence of leprosy of 1.7 / 10.000 population, in 2015 as much as 25 points with leprosy prevalence rate of 1.5 / 10.000 population and in year 2015 as many as 26 points with leprosy prevalence rate of 1.5 / 10.000 population. The pattern of leprosy spread in Barru Regency in 2013 is randomly distributed in all sub-districts whereas in 2014 and 2015 the distribution of leprosy cases is clustered in Barru. The District of Barru occupies the first level of cases of most leprosy cases, this is because Barru District is a densely populated district capital district and many migrants both from within the region and from outside the district.

The buffer result shows that in more than 6 km distance from puskesmas there are 3 patients (2013) and each 2 patients (2014 & 2015) in Tanete Riaja sub-district, while most other patients are still more than 2-6 km from nearest health center. This means that leprosy patients in Barru District are still within reach to health care facilities. According to Rohmad<sup>12</sup>, access to health-care facilities is closely linked to the discovery of leprosy patients, the closer and easier accessible healthcare facilities will allow people to obtain health

information and regularity in taking medicines and the further distance health services will slow people to get information health and regularity in taking medication.

Leprosy is chronic because leprosy bacteria take 12-21 days to divide and have an average incubation period of 2-5 years and even more than 5 years. The sex of the lepers is more common in men than women, the results of which are in line with Suparyanto's<sup>3</sup> and Saragih<sup>13</sup> studies, suggest that lepers are more male than female, this is because more contact many in men compared to women. All leprosy sufferers have Bugines ethnicity where in Indonesia, ethnic Madurese and Bugines suffer more leprosy than other ethnic. Level of knowledge of most lepers are categorized as risky (low knowledge). The results of this study are in accordance with Green theory which states that a person with high knowledge is more likely to behave well in the field of health in this case preventing the disability of his family who suffer from leprosy<sup>14</sup>. BCG vaccination in leprosy patients in 2013 showed the average respondent did not get the vaccine while in 2014 and 2015 the average has been getting the vaccine. The results of a study in Malawi in 1996 showed that giving a single dose of BCG vaccine could provide 50% protection, and the dosing area could provide protection against leprosy up to 80%<sup>3</sup>. Personal hygiene most lepers are categorized bad because of the low knowledge of respondents to behave well on their personal health. In line with the Yuniarasari<sup>4</sup> study, respondents with poor hygiene have a 5.333 times

greater risk of leprosy than those who have good personal hygiene. The duration of contact from the results showed that the average leprosy patient had no history of contact with other leprosy patients. The results of this study are in line with the Yuniarasari<sup>4</sup> study, that there is no long contact relationship with leprosy occurrence ( $p = 0.703 > \alpha 0.05$ ).

Description based on socio-economic factors of leprosy patients in Barru regency 2013-2015, leprosy educational level is categorized as low educated (not finished primary school, junior high). Patients with low levels of education tend to be slow to seek treatment so slowly to be diagnosed with leprosy so that most of those who come to seek treatment have been included in MB type leprosy grouping or even come in disability<sup>13</sup>. The work of lepers is categorized in risky occupations (construction workers, laborers, masons, workshop workers, tailors, transport workers, maids, farmers and fishermen). The results of this study are in line with the results of the Yuniarasari<sup>4</sup> study, which shows that there is a relationship between the type of work and the incidence of leprosy. Leprosy patients have on average less than UMR. The results of this study are in line with the results of research Rohmad<sup>12</sup>, that the income of leprosy patients in Rembang Regency less than the UMR in Rembang.

Description of the environment of leprosy patients in Barru regency in 2013-2015 shows that the average humidity of chamber patients still meet health requirements according to Kepmenkes that is between 40% -60%, if below 40% or above 60% can be a good medium for bacteria. Room temperature of the patient does not meet the health requirement according to Kepmenkes that is below 18C or above 30C. The incidence of leprosy is usually high in hot and humid tropical and subtropical regions<sup>15,16</sup>. Room lighting average patients meet health requirements according to Kepmenkes that is  $\geq 60$  lux. Sunlight has the properties of killing bacteria, especially the bacteria *M. tuberculosis* and leprosy. Houses that do not enter the sun have a risk of suffering from tuberculosis as well as leprosy 3-7 times compared to the house entered the sun. The average patient ventilation meets the health requirement according to Kepmenkes that is  $\geq 10\%$  of the floor area. The Faturrahman<sup>17-19</sup> study, which resulted in poorly ventilated respondents, had a 4.3 times greater risk of leprosy than a well-ventilated respondent.

## CONCLUSIONS AND RECOMMENDATIONS

The pattern of distribution of leprosy patients in Barru Regency in 2013 is shaped randomly in all sub-districts whereas in 2014 and 2015 the spread of leprosy cases is clustered in Barru Regency. The buffer map of the distance between the dwelling of the lepers is within a radius of 2 to 6 km from the health centre of Barru District. Based on individual characteristic risk factors, leprosy patients in Barru District are more than 29 years old, more males than females, all have bugines races / ethics, low average knowledge and poor personal hygiene, most get BCG vaccinations, and the average length of contact is less than 2 years.

**Conflict of Interest:** Authors declare that there is no conflict of interest within this research and publication paper

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## REFERENCES

1. Ministry of Health, R.I, Kementerian Kesehatan Republik Indonesia. Pedoman Nasional Pengendalian (2012): 3 (2): 12-16
2. Siregar. Saripati Penyakit kulit. Jakarta: EGC. (2005)
3. Suparyanto. Pengobatan Dan Kecacatan Penyakit Kusta/ Leprosi (Skripsi). Jakarta: Fakultas Kedokteran Universitas Indonesia. (2012)
4. Yuniarasari Y. Faktor risiko yang berhubungan dengan kejadian kusta (studi kasus di wilayah kerja puskesmas gunem dan Puskesmas sarang kabupaten rembang tahun 2011) (Skripsi). Semarang: Universitas Negeri Semarang
5. Awaludin. Beberapa Faktor Risiko Kontak Dengan Penderita Kusta Dan Lingkungan Yang Berpengaruh Terhadap Kejadian Kusta Pada Anak. Semarang: Universitas Diponegoro. (2004)
6. Rismawati D. Hubungan Antara Sanitasi Rumah Dan Personal Hygiene Dengan
7. Kejadian Kusta Multibasiler. Unnes Journal of Public Health (2013): 2 (1).
8. Birawida, A.B., Selomo, M., Mallongi, A, Potential

- hazards from hygiene, sanitation and bacterium of refill drinking water at Barrang Lompo island (water and food safety perspective), IOP Conference Series: Earth and Environmental Science. 2018.
9. Palutturi, S., Sahiddin, M., Ishak, H., & Hamzah. Community Motivation and Learning to Pay the National Health Insurance Contribution Asian Journal of Scientific Research, (2018): 11(2), 276-286.
  10. Profil Kesehatan Provinsi Sulawesi Selatan. Diakses 3 Maret 2016. Dari:
  11. [http://www.depkes.go.id/resources/download/profil/PROFIL\\_KES\\_PROVINSI\\_2012/2](http://www.depkes.go.id/resources/download/profil/PROFIL_KES_PROVINSI_2012/2)
  12. 6\_Profil\_Kes.Prov.SulawesiSelatan\_2012.pdf.
  13. Said, M., Yunus, R., & Palutturi, S. Increasing Inpatient Service Quality of Using Quality Function Deployment Method in Nene Mallomo Hospital of Sidrap Regency, Indonesia. Indian Journal of Public Health Research & Development, (2018): 9(4).
  14. Achmadi U. F. Manajemen Penyakit Berbasis Wilayah. Jakarta: PT. Rajagrafindo
  15. Persada. (2012)
  16. Rohmad. Analisis Spasial Kejadian Penyakit Kusta di Kabupaten Rembang Tahun
  17. 2012 (Skripsi). Surakarta: Fakultas Ilmu Kesehatan Universitas Muhammadiyah.
  18. Saragih R. A. dkk. Epidemiologi Penyakit Kusta Di Kecamatan Sui Kakap Kabupaten Kubu Raya Provinsi Kalimantan Barat Tahun 2012 (Skripsi). Pontianak: Fakultas Kedokteran Universitas Tanjungpura.
  19. Notoatmodjo S.. Ilmu Kesehatan Masyarakat : Prinsip-prinsip Dasar. Jakarta: Rineka
  20. Cipta. (2003)
  21. Apriani D. N. dkk. Faktor Risiko Kejadian Penyakit Kusta di Kota Makassar (Skripsi). Makassar: Bagian Epidemiologi Fakultas Kesehatan Masyarakat Universitas Hasanuddin. (2014)
  22. Mallongi, A., Puspitasari, A., Ikhtiar, M., Arman, Arsunan, A.A. Analysis of risk on the incidence of scabies Personal Hygiene in Boarding School Darul Arqam Gombara Makassar. Indian Journal of Public Health Research & Development, April-June 2018, Vol.9, No. 4
  23. Faturahman Y. Faktor Lingkungan Fisik Rumah yang Berhubungan dengan Kejadian
  24. Kusta di Kabupaten Cilacap. Jurnal FKM UNSIL. (2011)
  25. Mallongi, A., Bustan, M.N., Juliana, N., Herawati, Risks Assessment due to the Exposure of Copper and Nitrogen Dioxide in the Goldsmith in Malimongan Makassar, Journal of Physics: Conference Series, 2018.
  26. Antarini, A.A.N., Agustini, N.P., Puryana, I.G.P.S., Wiardani, N.K., Mallongi, A. Identification of microbes, chemical, and organoleptic characteristics towards Teh Wong during Fermentation. Indian Journal of Public Health Research and Development. 2018.

# Analysis of Causes and Impacts of Early Marriage on Madurese Sumenep East Java Indonesia

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## ABSTRACT

Marriage is a great institution to bind two of the opposite sex in one family bond. The occurrence of early marriage In the village of Daandung Atas Sumenep is influenced by several factors driving and causing some impact. The purpose of this study is to describe the factors driving early marriage and to determine the impact of early marriage. The research method used is qualitative research method. The number of respondents 24 couples who married early and 4 community leaders. Data collection was done by interview, observation, and documentation. In analyzing the data using three plots of Miles data reduction, data presentation, and drawing conclusions. The results showed that the factors driving early marriage in Daandung Atas Village are economic, education, parents and customs factors. Early marriage also has an impact on married couples that is often a quarrel because each no one wants to budge, the problem of children and husbands who do not work, and the impact for each parent is when there is an argument on the child then indirectly make each parent's relationship becomes harmonious, while the positive impact is to reduce the economic burden of parents, avoid children from bad deeds and children will learn how to live a family life. The conclusion and suggestion of this research are that early marriage in Daandung Atas village of Sumenep happened because of the driving factor that is the economic factor, education, parents, and customs. And the impact on couples and their parents. Participation of community organizations should be improved to provide counseling on the terms and conditions of marriage is good and right.

**Keywords:** *early marriage, parents, education, economic, customs.*

## INTRODUCTION

The young marriage that society has become has become a habit or tradition that is difficult to abandon. If girls are not married soon, they will become old maids. This encourages most parents in the village to marry off their daughters at a relatively young age<sup>1</sup>.

Indonesia is a country with the second highest percentage of young marriages in the world (ranking 37) second highest in ASEAN after Cambodia. By 2015, there are 158 countries with a legal minimum married age of 18 years and above, and Indonesia is still beyond that <sup>2</sup>. Among women aged 10-54 years, as many as 2.6% married first at the age of fewer than 15 years and 23.9% married at the age of 15-19 years. Married at an early age is a problem of reproductive health because the younger the married age the longer the span of time to reproduce. According to BKKBN <sup>2</sup>, the incidence of

early marriage in East Java Province exceeds the national rate of 53 per 1,000. While the national average number is 48 per 1,000. Meanwhile, according to BKKBN<sup>3</sup> Sumenep regency states almost 60 percent of teenagers in Sumenep regency carry out early marriage in 2015.

Factors that cause early marriage are coercion of parents, promiscuity, curiosity about the world of sex, economic factors, environmental factors, and low education<sup>4</sup>. According to Gibb *et al.*<sup>5</sup> factors causing early marriage are socio-cultural factors, economic pressures, education level, difficulty getting jobs, mass media, religion and views, and beliefs.

Stephenson *et al* <sup>6</sup> describes Individuals who marry in adolescence or young age have shortened adolescence so that the lack of fulfillment of developmental tasks in adolescence and resulting in young marriage is vulnerable to conflicts and problems because not ready to assume

full responsibility as a married couple. It makes young married couples compare between life before marriage and after marriage, because the conflict experienced after marriage was never a young couple before marriage, so this brings young couples prosperous or not in running the role as a young couple in marriage. Prosperity is not gained without effort to achieve it. Differences in conditions between before marriage and after marriage to make couples who married young need to make adjustments to obtain true prosperity in marriage. In addition, events that arise in marriage such as problems or conflicts and how to solve these problems can disrupt the stability of welfare in marriage. Prevention efforts to marry at a young age would be better what if members of the community participate in the prevention of early marriage that is around their neighborhood.

## MATERIALS AND METHOD

Type of this research is qualitative research, variable of research that cause and impact of early marriage. The population of this study are All couples early marriage in the Village Daandung Atas Kangayan Sumenep District as many as 24 couples. Informants in this study consisted of primary informants and informants triangulation. The triangulation informants were community leaders and religious figures of 4 people so that the number of informants as a whole was 28 informants. Sampling technique with purposive sampling. The method used in data collection is in depth interview.

## RESULT AND DISCUSSION

### 1. Factors That Promote Early Marriage

#### a. Economic Factors

The occurrence of early marriage is mostly due to the economic conditions of their families are lacking. They assume that by marrying their children, the burden of the economy will be slightly reduced. Because a married child will be the responsibility of her husband. Even the parents hope after their children get married can help the lives of their parents.

According to Streatfield *et al.*,<sup>7</sup> the occurrence of marriage at a young age because one of them is a family economic problem. Economics is one of the most important factors in the family. In this case, the family's economic function is intended to meet and regulate the economy of family members, especially work and income. To meet the needs of his daily life then a person

or family must have a job. The high low income of a person will affect a person's way of life. The state of a person's economy is weak or less will lead to early marriage. Parents will soon marry off their children, on the grounds that economic life is the main factor is the inability of parents to support their families, so to reduce the burden, they will soon marry off their children. Just as Gibb *et al.*<sup>5</sup> said that the symptoms of young marriage are closely related to the economic value of children Here children have a very big role, where a married child will be able to help the burden of his parents. In addition, the concern of parents of their children who will become an old maiden also encourages early marriage, especially if they see their children have had a boyfriend and fear will do things that are not good, then parents will soon marry off their children.

#### b. Educational factor

The low education between parents and their children is only educated to elementary school, even many who do not go to school at all, then parents will feel happy if their daughter already likes, and parents do not know the result of early marriage.

According to Sabbah-Karkaby<sup>8</sup> states that marriage at a young age means the woman is the highest newly received 9 years of education, education in women affects several things such as education of his children. Educational factors also affect. Most public education is primary school graduates and even many who do not at all school. Lack of knowledge gained will cause their mindset to be narrow, not wanting to think into the future that they know is just now. Likewise, the parents thought that their children had graduated from school, so they immediately sent their children to work to help their parents even if only in the house, and after they did not have other activities so they chose to marry only young<sup>9</sup>.

#### c. Parent Factor

Parents factor is the most dominant factor in the occurrence of early marriage, where parents will soon marry off their children if they see their children have gone big. This is because the level of parent education is low, so the parental mindset was resigned and accept, this resignation then the parents are less understanding of the Marriage Law no. 1 Year 1974. In addition, there are matches between families of each.

They deliberately married his son quickly because he

saw his son was big and has had a lover. Because he did not want his son to go too far and will embarrass his family. So they soon marry off their children, after they marry off their children then they feel that their responsibilities as parents are over. Due to fear of rejecting a person's application, they accepted the application. Because if they reject a proposal or application of a person, then the male family will feel offended, even usually to bring the matter of rank and degree<sup>10</sup>. Moreover, the family including rich families. In addition, because the village community still believes in the custom that if rejecting the application of people it will qualify to be an old maid. Early marriage that happens to her child, fearing that she will become an old maid, it is because she saw many of her neighbors who have married her son, and are afraid that they will be scorned by their neighbors for not yet marrying their children, so they marry off their children at an early age<sup>4</sup>. According to Acharya<sup>11</sup> marriage often occurs because since childhood the child has been married by both parents. That the marriage of children to immediately realize the bonds of kinship between relatives of the bride and relatives of the bride who they have long wanted together, all so that their family relationships do not break. Parents will feel proud if their child is proposed by a richer person, in the hope that his position or social status will increase. In addition, an agreement or agreement to match a child is also a factor driving the existence of marriage

#### **d. Customs Factor**

According to Marshan, *et al.*<sup>12</sup> the stodgy nature of Java people who do not want to deviate from customary provisions. Most villagers say they marry their children so young just because they follow the customs. Parents are afraid to reject an application from the men, then his daughter will get a 'karma' that his daughter could be an old maid. So even if the child is still underage, if there is a proposed to invite to marry, then the parents will receive it by raising the age of their children so they can get married.

## **2.The Impacts That Happen Due To Early Marriage**

### **a. Negative Impact**

#### **1) Impact on married couples**

According to Streatfield, *et al.*<sup>7</sup>, said that disputes between husband and wife are generally caused by things

the main one of which is a dispute concerning financial matters that are too extravagant or a husband who does not surrender his earnings properly to his wife, causing her household life to be unpleasant and harmony of harmony. Lack of knowledge gained by married couples will lead to arguments and even divorce. The high level of population collisions, with the early marriage, the population growth will quickly increase, because after marriage the burden will be husband and wife directly have children.

### **2) Impact parent**

According to Agege., *et al.*<sup>10</sup> marriage relationship between husband and wife is the bond of family unity in society, if bond ties broke, the family will also break. The household will be perfectly organized as long as the needs are expected to be taken seriously, and the household will be completely disorganized if out of the rights and duties of husband and wife. Impact on their respective parents. The occurrence of quarrels in their household will be resulting in a less harmonious household life. Marriage by underage children, they still have childish traits where they are cannot be independent in taking care of his family life. Most of them are married early, still, go with parents so they cannot stand on their own solve the problems they face. If it happens is agreement then each parent will interfere in the finish, this is what will reduce inter-harmony family respectively<sup>11-13</sup>.

### **b. Positive Impact**

The positive impact is to reduce the burden on the parents, prevent adultery, and the child will learn how to support his family. Most of the people of Daandung Atas village marry their children on the grounds to ease the burden of the economy because by marrying their daughters indirectly all the needs of children will be fulfilled by the husband.

Some parents who marry their children at an early age is the reason because their children already have a lover and for fear will later do things that are not desirable such as adultery the parents marry their children. These impacts have never been thought of by those who have an early marriage or their parents. This happens because the lack of knowledge about the meaning of marriage, which they know is only mutual love and marriage, see the fact that the parents will soon marry off his daughter.<sup>14-16</sup>

## CONCLUSIONS

The number of early marriages that occur due to several factors including economic factors, educational factors, parents and factors of customs. Insufficient economic condition so that parents marry their children at an early age in order to reduce the burden of parents, while low educational factors make people less understand the terms and conditions of marriage, then parents factor mostly due to the match and customary factors due to the still belief of society that if a woman refuses an application then she will become an old maid.

Early marriage in Daandung Atas Viillage raises several impacts such as positive impact and negative impact. The positive impact is to help ease the economic burden of parents, prevent adultery among adolescents and can provide teaching to children to have a sense of responsibility and learning to meet the needs of everyday life. While the negative impact is often a dispute that resulted in a quarrel between husband and wife in the daily life of marriage. While the impact on the parents or their families is if there is a dispute or quarrel between the husband and wife are usually the parents of each involved in resolving disputes and indirectly make their relationship less harmonious.

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## REFERENCES

1. Yi, W., Yan-Lin, W., Chun-Min, L., Xu, H., Wen-Jing, H., & Wei-Wei, C..Socio-cultural Determinants of Early Female Marriage and Reproductive Health Outcomes in Eastern Ethiopia. *Journal of Womens Health, Issues and Care*, 2016.
2. BKKBN. Pernikahan Dini Pada Beberapa Provinsi di Indonesia: Dampak Overpopulation, Akar Masalah dan Peran Kelembagaan di Daerah. 2015.
3. BKKBN. Pemantauan Pasangan Usia Subur Melalui Mini Survei. Indonesia, 2016.
4. Ainul, S., & Amin, S.. Early marriage as a risk factor for mistimed pregnancy among married adolescents in Bangladesh. *Asia-Pacific Population Journal*, (2015): 30(1).
5. Gibb, S. J., Fergusson, D. M., Horwood, L. J., & Boden, J. M.. Early Motherhood and Long-Term Economic Outcomes: Findings From a 30-Year Longitudinal Study. *Journal of Research on Adolescence*, (2015): 25(1), 163-172.
6. Stephenson, R., Simon, C., & Finneran, C..Community factors shaping early age at first sex among adolescents in Burkina Faso, Ghana, Malawi, and Uganda. *Journal of health, population, and nutrition*, (2014): 32(2), 161.
7. Streatfield, P. K., Kamal, N., Ahsan, K. Z., & Nahar, Q.. Early marriage in Bangladesh: Not as early as it appears. *Asian Population Studies*, (2015): 11(1), 94-110.
8. Sabbah-Karkaby, M., & Stier, H.. Links between education and age at marriage among Palestinian women in Israel: Changes over time. *Studies in family planning*, (2017): 48(1), 23-38.
9. Delprato, M., Akyeampong, K., Sabates, R., & Hernandez-Fernandez, J..On the impact of early marriage on schooling outcomes in Sub-Saharan Africa and South West Asia. *International Journal of Educational Development*, (2015): 44, 42-55.
10. Agege, E. A., Nwose, E. U., & Odjimogho, S.. Parents' perception on factors of early marriage among the Urhobos in Delta State of Nigeria. *International Journal Of Community Medicine And Public Health*, (2018): 5(2), 411-415.
11. Mallongi, A., Puspitasari, A., Ikhtiar, M., Arman, Arsunan, A.A. Analysis of risk on the incidence of scabies Personal Hygiene in Boarding School Darul Arqam Gombara Makassar. *Indian Journal of Public Health Research & Development*, April-June 2018, Vol.9, No. 4
12. Acharya, D. R., Bhattarai, R., Poobalan, A., Teijlingen, V. E., & Chapman, G.. Factors associated with teenage pregnancy in South Asia. 2014.
13. Pulubuhu, D.A.T., Evans, K., Arsyad, M., Mallongi, A. Understanding the perspectives of village leaders and institutions in transforming social conflict into peace and health. *Indian Journal of Public Health Research & Development*, March 2018, Vol. 9, No. 3
14. Marshan, J. N., Rakhmadi, M. F., & Rizky,

- M..Prevalence of Child Marriage and Its Determinants among Young Women in Indonesia. In Child Poverty and Social Protection Conference. SMERU Research Institute. 2010.
15. Noer Bahry Noor, Ridwan Amiruddin, Muhammad Awal, Sukri Palutturi and Anwar Mallongi,. Proxy model of comorbidities with stroke incident in South Sulawesi. *Pak. J. Nutr.*, 2017: 16: 857-863.
16. Assaad, R., Krafft, C., & Selwaness, I..The Impact of Early Marriage on Women's Employment in the Middle East and North Africa 2017: No. 66. GLO Discussion Paper.



# Working Position Improvement by Adding Supporting Tool Reduced Subjective Complains and Increase Productivity of Weavers in *Tenganan* Village Karangasem Regency

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## ABSTRACT

**Background** Pegringsingan weaving products is a part of handicraft or home industry. They are still confessed at present and produced by simple technology with hand in hand. This activity as a business of income from the most of women in Tenganan village of Manggis sub district, Karangasem Regency. A work position with no planned well and they do not use a tool instruments for helping their working correctly, it is caused a subjective complaints of the workers so the production is not maximally and will cause the productivity of the workers come down. Woven products workers is required a carefulness and neatness of the workers, by long sitting position on the flour covered by something material. It is not aware of this problem into the anatomy and physiology of the workers and they will have a lot of complaint, sick, or pain on their next, hand, low back, anus, thigh, eyes. It is caused static work load frequently, so that they will be to come a decrease activity and low motivation, it's activity and the work is not done efficient and effective.

**Objective** The variable that is measured in this study is decrease workload, subjective complaint, work efficiency (long work), and work productivity.

**Methods** The research has been studied to the sixteen weaving workers that were chosen without rules with treatment by subject program with cross over design, its analyses unit considering group variance. It has been intervened by work positions with supporting tool for instant 'peliper, tinglik, por (supported by sponge), barble, and using eyes glasses and group workers.

**Results** This study is analyzed by t-paired, and there is a significant work load reduction ( $p < 0.005$ ), which is the pulse of the workers come down from 89.62 beats per minutes to be 82.56 beats per minutes ( $\pm 5.60$ ) in the same of the light work load category. The subjective complaints of the work load come down showed significant value ( $p < 0.005$ ) that is from Nordic body map score 56.92 (16.14) to be 28.86 (7.32). By the efficient work 7 hours a day with support tools, it is to be come the productivity increase (0.34%) and work productivity (7.9%) significantly ( $p < 0.005$ ).

**Keywords:** Woven supporting tools; subjective complaint; productivity; Pegringsingan weavings

## INTRODUCTION

*Pegringsingan* weavings is an heritage home industry which combines art and simple technology fully

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produced by hand. To make *Pegringsingan* weavings is the job of some of women in *Tenganan* village, in Manggis sub-district, Karangasem regency. Based on preliminary survey, the weaving process is done by women workers by themselves, starting from making the threads, coloring, and weaving. Weaving is a manual job using muscle power, the body locomotive organs, by sitting on the floor, with simple mat, and legs straight to the front.

An unwell-designed working condition could create subjective complaints, working loads and works can be not efficient, which could caused decreasing in work quality<sup>1,2,3</sup>. Weaving job unconsciously could make a forced pose that is not according to natural pose of the worker, at the end will caused tiredness and or neck pain, shoulder, arms, waist, butt, hips and legs. So the work cannot be done effective and efficiently<sup>4,5</sup>.

Based on preliminary survey, founded that average working artery pulse of the weavers is 84,62 per minutes, and subjective complaints as follows: wrist pain and pain on legs from the knee down average 46,03%, weaken in activities 68,4%, weaken in motivation 38,6%, physical tiredness (after working more than 3-4 hours) 78,2%, complains on eyes 42,5%, complains on fingers 72,4%.

Sitting position on the floor with 90 degree angle between *trunk* and *thigh*, slowly will make the *trunk* stressed out which caused flexi on the lumbar-spinal<sup>1</sup>. With that position for a long period of time, will occurs tiredness and possibly caused the organ degradation<sup>6</sup>.

Through a participatory approach to the workers and operator (*Kelian Banjar Tengah Tegeh Tenganan*), there are some alternatives in order to reduce subjective complaints and the way to increase productivity, such as working position improvement by adding supporting equipment: 1). Using eyeglasses, 2). Using *barbel* on fingers during rest time, 3). Using *tingklik* short stool, 4). Adding kapok cushion on *por* and 5). Using *plipir*. The position improvement alternative by adding supporting equipments was chosen because considered easy to do, also by their request, hence it could reduce subjective complaints and increase productivity.

## MATERIALS AND METHOD

This research is an experimental design with *treatment by subject* in the shape of *cross over design* and the analysis unit is considering group's *variance* not individual *variance*. Research held in *Tenganan* village, in Manggis sub-district, Karangasem regency.

Women weaving workers resides in Tenganan village on the list is 65 persons. From that number sample 18 persons that meet the inclusive criteria is chosen. In this case 16 persons was chosen randomly according to *Pocock* formula<sup>7</sup>.

Data is presented in table and textual form, then processed and analyzed using statistic analysis to test

the normality of productivity and working load, between control and treated ones using *Kolmogorov Smirnov* (KS) test; evaluation of the working duration between control and treated ones using *t*-Paired test; ; evaluation of the working load between control and treated ones using *t*-Paired test.

## RESULTS

Subject's characteristic data after evaluated using KS test, shown that it's normally distributed ( $p > 0.05$ ).

**Tabel 1. Tenganan Pegringsingan Weavers Characteristic**

Variable	Average	Deviation Standard
1. Age (years)	34,81	± 5,10
Height (cm)	158,310	± 7,32
Weight (kg)	59,69	± 4,97
Blood Pressure :		
- Systole (mm Hg)	120	± 0,00
- Diastole (mm Hg)	70	± 7,32,00
Working Experience (years)	15,50	± 7,82

Anthropometry data characteristic of research subjects with calculation of persentil 5, 50 and 95 can be seen in Tabel 2.

**Tabel 2. Persentil 5, 50 and 95 from Anthropometri Data**

	Persentil		
	5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>
Waist width (cm)	32,56	34,14	37,30
Butt width/length (cm)	37,00	38,50	40,00
Leg length from knee to sole (cm)	49,62	52,81	56,00
Feet range from butt to sole (cm)	82,28	88,24	95,48
Leg length from butt to knee (cm)	46,14	50,84	54,02
Length from knee to sole (cm)	46,00	51,50	57,00

Working climate condition consists of Wet Temperature, Dry Temperature, and Relative Humidity, are still in normal range. Working climate condition during the research is shown in Tabel 3. From the Average data of working climate that consists Wet

Temperature, Dry Temperature, and Relative Humidity after evaluated using K.S test, proofed that the data is in normal distribution ( $p > 0.05$ ).

**Table 3. Average Working Climate**

No	Variable	Average $\pm$ Dev.Std
1	Wet Temp ( $^{\circ}$ C)	27,16 $\pm$ 0,81
2	Dry Temp ( $^{\circ}$ C)	28,58 $\pm$ 1,21
3	Relative Humidity (%)	79,66 $\pm$ 1,21

The weaving cloth production using existing position (control) and new one using supporting equipments *peliper*, *por* with foam cushion, using eyeglasses and massaging barbell during rest time (treated) in

this research measured in the width of product ( $\text{cm}^2$ ) of woven cloth produced in 7 hours in a group. The average of production in existing position (control) is 349,68 ( $\pm 111,79$ )  $\text{cm}^2$ , while the average production with supporting equipments position (treated) is 352,12 ( $\pm 112,27$ )  $\text{cm}^2$ . The average product of woven cloth (control and treated) after evaluated using *paired t-test* is significantly different ( $p > 0,05$ ).

Resting pulse per minute, Working pulse per minute, Recovery pulse per minute, and Work pulse per minute in control (weaving in existing old position) and treated (weaving with supporting equipments position *peliper*, *por* with foam cushion, using eyeglasses and massaging barbell during rest time) shown in Tabel 4.

**Table 4. Rest pulse, working pulse, recovery pulse, and Work pulse**

Variable	Control (ppm)	Treated (ppm)	P
	Average $\pm$ S.D	Average $\pm$ S.D	
Resting pulse	80.25 $\pm$ 2.68	80.50 $\pm$ 2.20	0.78
Working pulse	89.62 $\pm$ 3.96	82.56 $\pm$ 5.60	0.01
Recovery pulse	79.75 $\pm$ 4.64	75,31 $\pm$ 4.84	0.00
Work pulse	8.75 $\pm$ 4.55	2,06 $\pm$ 0,85	0.00

ppm = pulse per minute. SD = standard deviation.  $p$  = probability

Productivity incline by changing the working position, from weaving in existing old position (control) in working position using supporting equipments (treated), from above calculation founded that the average control productivity: 5,33 ( $\pm 1,41$ ) is lower than the treated one: 21,96 ( $\pm 0,13$ ). From both productivity value after evaluated using statistic test *t*-Paired shown significant different ( $p < 0.05$ ).

**Table 5. Average Working Productivity of Control and Treated**

Variable	Average ( $\pm$ Std.Dev)	Value $p$
Working Productivity : Control (old working position) Treated (with support equipments)	5,33 ( $\pm$ 1,41) 21,96 ( $\pm$ 0,13)	0.001

Subjective complaints data before and after work measured using *Nordic Body Map*. Average Data and Standard Deviation shown in Tabel 6. Subjective complaints Score of control : 56,92 ( $\pm 16,14$ ) bigger than treated one: 28,86 ( $\pm 7,32$ ) with *t*-Paired test founded  $p = 0,00$  means significantly different ( $p < 0,05$ ).

**Table 6. Average and Standard Deviation of Subjective complaints of Control (C) and Treated (T)**

Variable	Average $\pm$ S.D	P
Subjective Complaints change: Control (old working position) Treated (with support equipments)	56,92 $\pm$ 16,14 28,86 $\pm$ 7,32	0,00

## DISCUSSION

From Subjects characteristic including body weight dan hight, founded that the average body weight 53,19 ( $\pm$  2,07) in the range of 48 kg - 65 kg, average 53,19 ( $\pm$  2,07) kg, while height is in the range of 148 cm - 170 cm, average 153,50 ( $\pm$  2,00) cm. By observing the comparison of that body weight and height, shows that weavers in *Tenganan Pegringsingan* has a normal weight and height or ideal according to *Broca* index, while body weight is ideal when the value is smaller than the height deducted by  $100 \pm$  (the value than times 10%)<sup>8,9</sup>.

Ambient Temperature in *Tenganan Pegringsingan* during research between 08.00 - 17.00 wita is; wet temperature is around  $26^{\circ}\text{C} - 28,50^{\circ}\text{C}$  average  $27,16 (\pm 2,50)^{\circ}$ , dry temperature is around  $27^{\circ}\text{C} - 30^{\circ}\text{C}$  average  $28,58 \pm 3,00^{\circ}\text{C}$ . Topographic of *Tenganan Pegringsingan* is located in high plateau with lush trees, has a lower temperature compared to other research location. Lowest Ambient Dry temperature is  $27^{\circ}\text{C}$  considered comfortable. The lowest threshold is  $21^{\circ}\text{C}$  and the highest is  $30^{\circ}\text{C}$ . Relative Humidity is around 78 % - 81 %, average  $79,66 (\pm 3,00)\%$  is still in comfortable range with threshold of 70% - 80%<sup>10</sup>.

Treatment given to the weavers, by giving working position on a supporting equipment called *peliper*, sit on *tingklik* small stool, *por* (with foam cushion) on the waist, using eyeglasses, and massaging *barbel* during resting time for 5 minutes each time. With those several treatments, the weavers has a chance to reduce their tiredness, because the weight of the body caused by sitting on the floor and the legs to the front rests on the feet in a long period of time, possibly caused cumulative tiredness, and feet organ *degenerative*<sup>1,11</sup>.

Weaving job need accuracy since the tools is operated by each women worker with high sight accuracy. So it

needs eyeglasses to operate, beside to avoid the eyes tiredness it is also to avoid the thread dust get in into their eyes, hence the products become maximum result<sup>4,12</sup>. For one unit of Control Group (C) weavers, founded that average production of cloth daily in existing old position is  $349,68 (\pm 111,79) \text{ cm}^2$ . This is different with the job using new working position, where one unit Treated Group (T) produced  $352,12 (\pm 112,2) \text{ cm}^2$  of cloth. This is mean working with supporting equipments is more effiecient by producing  $2.44 \text{ cm}^2$  of cloth daily or 0.34% compared to old position.

From the research we know the subject's resting pulse is not significantly different ( $p > 0,05$ ) between old working position (control) and working position using supporting equipments (treatment). Old working position (control), average resting pulse is  $80.25 (\pm 2.68)$  pulse per minute, while with working position using supporting equipments (treatment) is  $80.50 (\pm 2.20)$  pulse per minute. It means that subject's resting pulse between both condition (control and treated) relatively the same, or we can say the starting condition (before working) is the same.

Average Work pulse before and after treatment declined by 7.06 pulse per minute (4.1%). With statistic test *t*-Paired founded  $p = 0.01 < 0.05$ . it means subject's working pulse between both condition (control and treated) significantly different, hence the end condition (after working with supporting equipments) is better than the old condition (when on existing working position). This situation shows that weaving job can be objectively seen from physiologic reaction such as working pulse increase, it is not only related to how hard the work is, but also related to accuracy and the frequency accuration<sup>13,14</sup>.

Recovery pulse on subjects with old working position (control) shows decline from average  $79.75 (\pm 4.64)$  to (working position using supporting equipments) average  $75,31 \pm (4.84)$  pulse per minute. It shows that the working load is considered easy, because the lower the recovery pulse, means that the working load being done considered easy or the subject's condition is good, usually when condition is good and the work is easy, so within 5 minutes the recovery pulse is back to normal<sup>15</sup>.

Working productivity on Treated (working position using supporting equipments) is  $23.06 (\pm 14,32)$  and on

Control (old working position) is 6.09 ( $\pm 3,24$ ) shows significant difference ( $p=0.001 < 0.05$ ). This is caused by the decrease of working pulse and also by the increase of product by using supporting equipments. Hence we can say that using the supporting equipments *peliper, por* (with foam cushion, *tingklik*, eyeglasses and massaging *barbell* (during resting time) in this research can boost productivity of weavers in *Tenganan Pegringsingan* up to 60.93%. The ergonomic changes in working position, could increase economic value related to performance, indirectly reduce operational cost that have to spent<sup>16</sup>. In other words, productivity boost means efficiency boost<sup>17</sup>.

The working position with supporting equipments (treated) can reduce subjective complaints of the weaving workers in *Tenganan Pegringsingan* significantly ( $p < 0,05$ ). Before practicing working position with supporting equipments, subjective complaints shown by the value of *nordic body map* up to 56,92%. By practicing working position with supporting equipments, the value of *nordic body map* becomes 28,86 %, that means the subjects felt their working load become easier and the feeling of disturbance can be solved<sup>10,12,18,19</sup>.

### CONCLUSION

The different of working and resting pulse also decreasing from 9.37 pulse per minute that shown light working load, becomes 2,29 pulse per minute which also indicating light working load.

Subjective complaints of the weavers also declined. It shown from the score before using supporting equipments was 56,92%, then becomes 28,86%.

Working duration or time needed to weave is still the same, 7 hours a day, before and after conditioning, hence the efficiency is remain the same.

With the decrease of working load, the same subjective complaints and working duration efficiency, the productivity is increasing 16.97%, because with the decline of working load then the ratio of products (*output*) compared to working load and working duration (*input*) becomes bigger.

**Conflict of Interests:** The authors declare that they have no competing interests

**Ethical Clearance:** Ethical clearance was obtained from the University committee and respondent's approval.

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### REFERENCES

1. Bridger R. Introduction to Ergonomics. New York: Mc. Graw Hill, Inc; 2005.
2. Tangkittipaporn J, Jiangsathaporn W. Musculoskeletal Pain and Mental Agony Reacting to Ergonomic Risks in the Thai Informal Working Environment. J Psychol Res [Internet]. 2017;7(2):73–88. Available from: <http://www.davidpublisher.org/index.php/Home/Article/index?id=29971.html>
3. Dul, J., Weerdmeester B. Ergonomics for Beginners: A Quick Reference Guide, Third Edition. New York: CRC Press, Taylor and Francis Group; 2008.
4. Caires M, Simprini R. Ergonomic risk assessment among textile industry workers using two instruments: Quick Exposure Check and Job Factors Questionnaire. Fisioter e Pesqui [Internet]. 2013;20(3):215–21. Available from: <http://www.scielo.br/scielo.php?pid=S1809->
5. William J. W and Fred, T. Ergonomics assessment of muskelosketal risk factors art Four Mines States, Underground Coal, Surface Copper, Surface phosphate and underground limestone. [Internet]. 2004. Available from:
6. Health and Safety Executive. A pain in your workplace? Ergonomic problems and solutions [http://antarisconsulting.com/docs/guides/unit\\_igc2/element3/A pain in your workplace ergonomic problems solutions \(HSG121\).pdf](http://antarisconsulting.com/docs/guides/unit_igc2/element3/A%20pain%20in%20your%20workplace%20ergonomic%20problems%20solutions%20(HSG121).pdf)
7. Pocock SJ. Clinical Trials A Practical Approach. Jhon Wiles and Son; 2006. 123-125 p.
8. Indrayan, A. Concise Encyclopedia of Biostatistics for Medical Professionals. New York: Taylor and Francis Ltd.; 2017.
9. Sudarmanto IG. Working System With Low Cost Tool Can Reduce Workload And Increase Productivity Of Sand Workers Of Tukad Ayung Bongkasa, Denpasar. Udayana University; 2001.
10. Fernandez. Ergonomics in the workplace [Internet]. Vol. 13, Journal of Facilities. 1995. 20-27
11. Grandjean E. Fitting The Task to The Man: an Ergonomic Approach. 4 th. New York: Taylor and Francis; 2005.
12. Health and Safety Authority. Reducing the Risk

- of Fatigue [Internet]. Health and Safety Authority; 2018. Available from: [http://www.hsa.ie/eng/Publications\\_and\\_Forms/Publications/Latest\\_Publications/Reducing\\_the\\_Risk\\_of\\_Back\\_Injuries\\_on\\_the\\_Farm.78399.shortcut.html](http://www.hsa.ie/eng/Publications_and_Forms/Publications/Latest_Publications/Reducing_the_Risk_of_Back_Injuries_on_the_Farm.78399.shortcut.html)
13. Osborne DJ. Ergonomics at Work. Departement of Psychology University College of Swansea, Jhon Wiley & Sons Ltd.; 2002.
  14. HSE. Ergonomics and human factors at work [Internet]. Health and Safety Executive. 2013. 1-10 p. Available from: <http://www.hse.gov.uk/pubns/indg90.pdf>
  15. Helender M. A Guide to The Ergonomics Of Manufacturing. USA: Taylor and Francis Ltd.; 2005.
  16. Pheasant S. Ergonomics, Work, and Health. London: Mac Millan Academic Profesional Ltd.; 2009.
  17. Syamsiar S, Russeng, Lalu Muhammad saleh, Devintha Virani, Ade Wira Listrianti Latief, Anwar Mallongi., 2018. The Investigation of the Lactic Acid Change among employee of national electrical Power Plan. Indian Journal of Public Health Research & Development, January 2018, Vol. 9, No. 1
  18. Hardjosoedarmo S. Total Quality Management. Jogyakarta: Andi; 2006.
  19. Pheasant S, Alston R. Bodyspace-Anthropometry, Ergonomics and the Design of Work [Internet]. Vol. 24, International Journal of Nursing Studies. 2003. 347-348 p. Available from:

# The Influence of Media Booklet in Behavior Change of Waste Management In Elementary School Students, South Denpasar, Bali

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## ABSTRACT

Community participation is a contributing factor to the success of waste management. Behavioral changes must be instilled from an early age. The Booklet is a suitable medium used for changes in the behavior of elementary school students. The waste sorting material can be more easily explained by using text messages and pictures. Quasi-experimental research with one group pretest and posttest design. The sampling method is Multistage Random Sampling large sample taken for research is 90 people at 65 elementary school in South Denpasar. The instrument of this research is a questionnaire, with data retrieval technique done through interview analysis compare mean paired sample t-test. There is the difference of knowledge, attitude, and action before and after counseling method of self- evaluation by media booklet with a value of ( $p < 0.001$ ).

Health promotion efforts by optimizing the role of School Health Services. For further research can be done research on the role of teachers and parents in health promotion activities

**Keywords:** *Booklet, Behavior, Waste Sorting*

## INTRODUCTION

Waste management is a challenge for governments in developing countries. This is primarily due to increased waste, the burden caused to the government budget as a result of the high costs associated with its management, the lack of understanding of all the factors that affect the waste management phase<sup>1</sup>. Community participation is a contributing factor to the success of waste management. There are many case studies in developing countries that prove that community participation in waste management plays an important role in contributing to the success of the services provided<sup>2</sup>. Community participation has a direct influence on the efficiency of waste management. The municipal authorities have failed to mobilize communities and educate citizens on the basics of handling waste and proper practices to

store them in their own waste at the household, shop and company level<sup>3</sup>.

One effort to improve the knowledge of the community in general and school children, in particular, can be done through Communication, Information, and Education (CIE) program. Submission of materials in CIE program can be done through several methods and media. The media used varies greatly, from the traditional ones, i.e the mouth (oral), the alarm sign (Balinese people called kentongan), the picture, to the modern electronic, television and internet. In the CIE program, media is more effective at conveying information and education, because media is a static medium, prioritizing visual messages, and generally consists of a number of words, images or photographs in the color of a poster, leaflet, brochures, magazines, modules, and pocketbooks. Media booklets have advantages, i.e: (1) Clients can adjust from independent learning; (2) Users can view their content at a leisurely pace; (3) Information can be shared with family and friends, (4) Easy to create,

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reproduced and improved and easily customized; (5) Reduce the need to record; (6) Can be made in simple terms with relatively low cost; (7) Awe (8) Wider capacity; (9) Can be directed to a particular segment<sup>4</sup>. Based on the research of Posmaningsih (2014) in South Denpasar, it is known that 16 (66,67%) of elementary school fulfill the requirement of environmental health quality and 8 (33,33%) do not qualify environmental quality. In addition, there are 15 (62.5%) of elementary school that has waste containers that do not have lids only 10 (41.7%) has a waste disposal while eligible<sup>5</sup>.

The objective of this study was to determine differences in knowledge, attitude and practice waste segregation of students before and after the method of self-evaluation by the media booklet in South Denpasar 2016.

## MATERIALS AND METHOD

This type of research is quasi-experimental research design with one group pretest and posttest design. The study was conducted in Denpasar City from June to October 2016. The study population was elementary school students in South Denpasar. The sample of this research is the students of grade 1 and 2 elementary schools in South Denpasar. The sample selection grade 1 and grade 2, children aged 8 years is a golden period to inculcate the habit. The sampling method is Multistage Random Sampling with stages: first random to school (South Denpasar comprised of 65 elementary schools), then the selected schools conducted random class Proportional Random Sampling method. Large samples were taken for the study were 90 people by using sample size formula pairs category. The instrument used in this study was a questionnaire, with data retrieval technique is done through interviews with elementary school students. Univariate analysis of data with the average value and standard deviation, as well as bivariate analysis to compare the analysis of the mean paired samples t-test.

## RESULTS

In the self-evaluation method extension activities with the media booklet, elementary students were asked to pick through the waste each day. Students undertake

a self-evaluation on the activities undertaken. When respondents were asked to differentiate waste then put stickers "SMILE" in the column provided in the booklet. When respondents forgot to strip the waste then students are expected to put a sticker "SAD".

**Table 1: Frequency Distribution of Motivation of Waste Separation of Primary School Children in South Denpasar 2016**

Motivation	Frequency	%
Knowledge	47	52.2
Suggested	24	26.7
Convicted	6	6.7
Not Understand	13	14.4
<b>Total</b>	<b>90</b>	<b>100</b>

**Table 2: Distribution of Inhibiting Frequency of Elementary School Waste Distribution in South Denpasar 2016**

Motivation	Frequency	%
Misremember	75	83,3
Hectic	11	12,2
Not Understand	4	4,4
<b>Total</b>	<b>90</b>	<b>100</b>

To determine differences in knowledge, attitude and practice waste segregation of students before and after the self-evaluation by the media booklet used statistical analysis of paired samples t-test with a significance of 5%. The results of the analysis as follows:

Differences in knowledge before and after the method of self-evaluation by the media booklet (Table 3)



**Table 3: Statistical Analysis Differences in Knowledge Before and After Self-Evaluation Method On the Booklet Media Elementary School Students in South Denpasar 2016**

Variable	Average	t	p	Confident Interval	
				Lower	Upper
Knowledge Before self-evaluation	4,52 ± 1,567	-26,06	0,00	-3,93	-3,37
Knowledge After self-evaluation	8,17 ± 1,124				

There was an increase in the average value of knowledge of 3.65 points after the extension activity with the value of sig ( $p < 0.001$ ).

Differences attitude before and after the method of self-evaluation with the media booklet (Table 4)

**Table 4: Statistical Analysis Differences Attitude Before and After Self Evaluation Method With Media Booklet On Elementary School Students in South Denpasar 2016**

Variable	Average	t	p	Confident Interval	
				Lower	Upper
Attitude before self-evaluation	11.37± 2,112	-11,20	0,00	-2,87	-11,20
Attitude after self-evaluation	13.80 ± 2,409				

There was an increase in the average attitude value of 2.43 points after the extension activity with the value of sig ( $p < 0.001$ ).

Differences in actions before and after the method of self-evaluation with booklet media (Table 5)

**Table 5: Statistical Analysis of Action Differences Before and After Self-Evaluation Method with Media Booklet for Elementary School Students in South Denpasar 2016.**

Variable	Average	T	p	Confident Interval	
				Lower	Upper
Action before self-evaluation	2.60 ± 0,845	-17,014	0,00	-2,18	-1,73
Action before self-evaluation	4.56 ± 0,705				

There was an increase in the average value of the action amounted to 1.96 points after the extension activity with the value of sig ( $p < 0.001$ ).

## DISCUSSION

Student behavior in schools remains a concern for

teachers and administrators. So classroom management practices to prevent bad behavior are needed<sup>6</sup>. The role of teachers is very large to change student behavior. Health communication is needed with the aim of changing health behaviors that ultimately increase the degree/health status as a result of the health communication

program. The benefits of health communication are increasing the need for products / services; communicate how to properly utilize the product / service; stimulate the occurrence of changes in health-related behavior; and contributing to improved health<sup>7</sup>.

Booklets have several advantages that can be learned at any time because the design is book-shaped and contains relatively more information than the poster<sup>8</sup>. The display of picture books as an extension media is more interesting than lecture method, because it has also been through the process of extracting information from their peers so that it is more suitable to the student's needs<sup>9</sup>. The media booklet is effectively used to increase knowledge compared to lectures<sup>10</sup>. The power of persuasion or the influence of a message depends largely on what media the communicator chooses to transfer messages or health information.<sup>4</sup>

The booklet should contain evidence-based information that students can understand. The availability of booklets is very important, as it allows people to get information at home tailored to their convenience. This home-based knowledge support is as useful as any other medical treatment.<sup>11</sup> In fact, the success of the smallest behavioral changes in health promotion programs is influenced by people's tobacco. The future of behavior change and health promotion is through the implementation of a comprehensive strategy to enable people to have a healthier lifestyle. The comprehensive strategy includes the following points: (1) behavior change approach; (2) a strong policy framework that creates a supportive environment; and (3) empowering the community to better control the decision of a healthy lifestyle<sup>12</sup>. The creation of this booklet is to strengthen the potential of pregnant women and their family members and to promote health conditions. This booklet is a support for professionals and pregnant women to overcome the doubts and difficulties that permeate pregnancy and the birth process<sup>13</sup>.

The participation of experts in booklet evaluation greatly influences the quality of content. The development of booklets, it is intended to overcome the hegemony that has been established in health education. The expectations of the participants, who have different knowledge and interests in relation to who describes the educational material are considered important in the process of developing educational resources<sup>14,15</sup>.

Picture stories can improve the knowledge of students and 5th grade elementary school students. Research Tariani, Paramastri, and Citraningsih which indicates that the booklet as a media supporting health promotion can increase knowledge about prevention of dengue fever by eradicating mosquito breeding. The results of this study indicate that knowledge can give effect to the change of attitude and action. Good knowledge of a change will change a person's behavior becomes more permanent. Punishment can also change behavior. Primary school children need guidance from a more mature person in planting the concepts of knowledge, attitude and behavioral change. The role of parents, siblings, teachers to always remind students is needed for changes in knowledge, attitudes and actions of elementary students. Grade 1 and 2 children still in Golden Period are very dependent on the adults around them.

There are also factors that inhibit the respondents to make efforts to waste management. Inhibiting factors are categorized into three categories: forgetful, busy and ignorant. This is seen in the research process where there is an increase in the waste segregation measures by students from the first, second and third weeks. Each week reinforcement is done to remind students how good waste management is by using booklet media. If students judge themselves negatively it will cause the desire to make changes to get a positive point. Giving rewards and punishment will strengthen the change in student behavior. The reward and punishment model can be designed by the school as an application for health promotion efforts in the school setting. The success of health education in the community depends on the learning component<sup>16,17</sup>.

Waste management and recycling are more influenced by economic factors than environmental protection awareness. Behavior change measures should provide an estimated cost benefit to be gained. Waste management and recycling programs must adapt to institutional / school conditions. Future research should focus on ways to locate and use existing institutions for recycling programs<sup>18</sup>. Another factor in reinforcing factors is the economic benefits felt by the community in changing a behavior. Incentives are one of the most important factors to increase people's motivation. The incentive theory states that human behavior arises because it is caused by both reward and punishment. Various methods were developed to intervene in human behavior

to be more environmentally friendly. Women tend to participate more actively in domestic waste management activities based on a given program. Information backed by economic and environmental reasons can change a person's behavior on the waste. Information on activities undertaken and public confidence in the ability to carry them out should be clear, avoid possible conflicts and ensure the success of the activities<sup>20-23</sup>.

### CONCLUSION

There is a difference of knowledge, attitude, and action before and after counseling method of self-evaluation by media booklet with the value of sig ( $p < 0.001$ ).

**Conflict of Interest :** None

**Ethical Clearance:** obtained from The University committee and respondent agreement

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### REFERENCES

1. Andrea Flower, John W. McKenna, R. L. B., & Colin S. Muething, Ramon Vega, J. Effects of the Good Behavior Game on Challenging Behaviors in School. *Review of Educational Research*, (2014): 84(4), 546–571.
2. Syazwina, F., Shukor, A., Mohammed, A. H., Abdullah, S. I., & Awang, M. A REVIEW ON THE SUCCESS FACTORS FOR COMMUNITY PARTICIPATION IN SOLID WASTE MANAGEMENT, (Icm), (2011): 963–976.
3. Asnani, P. U.. SOLID WASTE MANAGEMENT. *Indian Infrastructure Report*, 3(2006), 160–189.
4. Hapsari, C. M., Komunikasi, P. I., & Petra, U. K.. EFEKTIVITAS KOMUNIKASI MEDIA BOOKLET “ANAK ALAMI” SEBAGAI MEDIA PENYAMPAI PESAN GENTLE BIRTHING SERVICE. (2012)
5. Posmaningsih, D. A. A., Purna, I. N., & Notes, N.. KESEHATAN LINGKUNGAN SEKOLAH DASAR DI KECAMATAN DENPASAR SELATAN TAHUN 2014
6. Lilliana Abarca Guerreroa, GerMaas, W. H.. Solid waste management challenges for cities in developing countries. *Waste Management, ScienceDirect, Elsevier*, (2013): 33(1), 220–232.
7. MR Rasmuson, RE Seidel, WA Smith, E. B.. Communication for child survival. Washington, D.C., Academy for Educational Development [AED], Communication for Child Survival [HEALTHCOM], 1988 Jun. Viii, 144 P., June
8. Kemm, J., & Close, A.. Health promotion theory and practice. Houndmills: Macmillan Press. (1995)
9. Widajanti, L. (2009). Pengaruh Komik Makanan Jajanan Sehat dan Bergizi untuk Meningkatkan Pengetahuan dan Sikap Anak Sekolah Dasar. *The Indonesian Journal of Public Health*, 2009: 6(1), 19–23.
10. Ana, V., Setyawati, V., Herlambang, B. A., Kesehatan, F., & Dian, U. (n.d.). Model Edukasi Gizi Berbasis E-booklet untuk Meningkatkan Pengetahuan Gizi Ibu Balita, 86–94.
11. Naqvi, A. A., Hassali, M. A., & Aftab, M. T.. Development of Evidence-Based Disease Education Literature for Pakistani Rheum atoid Arthritis Patients. *Diseases*, (2017): 5,27, 1–8. <http://doi.org/10.3390/diseases5040027>
12. Laverack, G.. *Health Promotion*, (2017): 10–13. <http://doi.org/10.3390/challe8020025>
13. Reberte, L. M., Luisa, A., & Gomes, Z.. Process of construction of an educational booklet for health promotion of pregnant women 1. *104 Rev. Latino-Am. Enfermagem*, (2012): 20(1), 101–108.
14. Echer IC.. The development of handbooks of health care guidelines. *Rev.Latino-Am.Enferm*, (2005): 13 (5), 754–7.
15. Pulubuhu, D.A.T., Evans, K., Arsyad, M., Mallongi, A. Understanding the perspectives of village leaders and institutions in transforming social conflict into peace and health. *Indian Journal of Public Health Research & Development*, March 2018, Vol. 9, No. 3
16. Setiawati, S., & Dermawan, A. C. Proses Pembelajaran Dalam Pendidikan Kesehatan. (2008).
17. Mallongi, A., Puspitasari, A., Ikhtiar, M., Arman, Arsunan, A.A. Analysis of risk on the incidence of scabies Personal Hygiene in Boarding School Darul Arqam Gombara Makassar. *Indian Journal of Public Health Research & Development*, April-June 2018, Vol.9, No. 4
18. Hamad, C. D., Bettinger, R., & Cooper, D.. USING

- BEHAVIORAL PROCEDURES TO, (1980): 10(2), 149–156. <http://doi.org/10.2190/5TL9-EPP9-XKV1-3KJT>
19. de Young, R.. Promoting Source Reduction Behaviour : The Role of Motivational Information. *Environmental and Behaviour*, (1993): 25(1), 70–85.
  20. Sukri Palutturi, Cordia Chu, Ji Young Moon, & Eun Woo Nam. A Comparative Study on Healthy City Capacity Mapping: Indonesia and Korea. *The Social Sciences*, .(2015): 10(6), 848-854.
  21. Birawida, A.B., Selomo, M., Mallongi, A , Potential hazards from hygiene, sanitation and bacterium of refill drinking water at Barrang Lompo island (water and food safety perspective), IOP Conference Series: Earth and Environmental Science. 2018.
  22. Robby Kayame, Anwar Mallongi., Relationships between smoking Habits and the Hypertension occurrence among the Adults of Communities in Paniai Regency, Papua Indonesia. *Indian Journal of Public Health Research & Development*, January 2018, Vol. 9, No. 1
  23. Rosmala Nur, Nikmah Utami Dewi, Khairunnisa and Anwar Mallongi, Golden standard feeding and the risk of 25-60 month-old underweight children in Central Sulawesi, Indonesia. *Asian J. Clin. Nutr.*, 2017: 9: 104-110.

# Environmental Analysis Related to Pulmonary TB Incidence in Work Area of Puskesmas Kaluku Bodoa Makassar City

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## ABSTRACT

Pulmonary Tuberculosis is an infection disease caused by Mycobacterium tuberculosis. TB disease is a world health problem and Indonesia is the country with the highest number of TB cases in the world after India. The purpose of this study was to determine the environmental factors associated with the incidence of Pulmonary TB in the Working area of Kaluku Bodoa public health center makassar city in 2018. This study was a quantitative research with case cross sectional study approach using Chi-Square. The population in this study were patients who had performed sputum test and registered in TB.03 register book at Puskesmas Kaluku Bodoa in July-December 2017 which amounted to 102 respondents and the study sample as many as 81 respondents. The sampling technique of this research used Simple Random Sampling. Data collection using documentation, questionnaire and univariate and bivariate analysis. The results showed that there are three variables related to pulmonary tuberculosis incidence that is density variable of occupant with p-value = 0,027, ventilation area with p-value = 0,045, and sunlight exposure with p value = 0,007. While the variable is not related to the incidence of Pulmonary TB is the temperature variable with the result p-value = 0.230.

**Keywords :** Puskesmas, Incidence of Pulmonary TB, Environment

## INTRODUCTION

TB is a bacterial disease that most commonly affects lungs<sup>1</sup>. Tuberculosis pulmonary disease is caused by the bacterium Mycobacterium tuberculosis, with the incidence rate in Indonesia ranks third after China and India and attacks all age groups of society<sup>2</sup>. Tuberculosis remains one of the world's deadliest communicable diseases<sup>3</sup>. A person having TB annually infects 10 people; two out of them can develop active form of TB<sup>4</sup>. Tuberculosis (TB) is an infectious disease caused by bacterial infection of Mycobacterium tuberculosis. Source of transmission of TB patients BTA (acid-resistant bacteria) is positive through the spittle of the

sputum that issued. TB disease is the biggest health problem in the world after HIV, so it should be taken seriously. Until now, there is no country that is free of TB. According to World Health Organization (WHO) data, the 2016 Global Tuberculosis Report estimates that by 2015 there will be 10.4 million new cases of tuberculosis or 142 cases / 100,000 populations, with 480,000 multidrug-resistant cases. Indonesia is the country with the second largest number of new cases in the world after India. Although the number of deaths from tuberculosis decreased by 22% between 2000 and 2015, tuberculosis remains the 10th leading cause of death in the world by 2015<sup>5</sup>. Indonesia is the country with the fourth highest prevalence<sup>6</sup>.

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Most of what we know about the natural history of tuberculosis and the effect of environment factors on the disease comes mainly from studies conducted in developed countries over the last 60 years<sup>7</sup>. Environmental factors play an important role in poor

transmission and confusion strongly support the active and development of Mycobacterium tuberculosis bacteria well<sup>8</sup>. While factors inherent in the environment such as the area of ventilation, density, temperature and lighting.

Puskesmas Kalukubodoa is a puskesmas in Makassar City Working Area which has the highest total of TB cases in Makassar city in 2016 that is 131 cases<sup>9</sup>. Based on the description above, it is necessary to conduct a research to find out the environmental factors related to the incidence of pulmonary tuberculosis in the working area of Kalukuboda Puskesmas Makassar City 2018. The result is expected to be used as a consideration in preparing the step-step intervention and for planning the more effective and efficient lung TB control.

## MATERIALS AND METHOD

This research is an observational analytic research using Cross Sectional approach. This research was conducted in Kaluku Bodoa Health Center Working Area for 1 month that is April 2018. The population in this research is patient who has done sputum test and listed in book register TB.03 at Puskesmas Kalukubodoa on July - December 2017.

The population in this study amounted to 102 people. The sample in this research is 81 respondents. The sampling technique in this study used simple random sampling or random sampling. This research instrument used in data collection is a questionnaire to obtain information about the characteristics of respondents, roll meters to measure the area of ventilation, thermohygrometer to measure room temperature and Lux meter to measure natural lighting.

## RESULTS

**Tabel 1. Relationship between occupancy density and Pulmonary TB incidence in Work Area of Puskesmas Kaluku Bodoa Makassar City 2018**

Occupancy density	Pulmonary TB incidence				Total		P Value
	BTA Positive		BTA negative				
	n	%	n	%	n	%	
Not meet requirement	19	51,4	18	48,6	37	100	0,027
Meet requirement	11	25,0	33	75,0	44	100	
Total	30	37,0	51	63,0	81	100	

**Tabel 2. Relationship between Ventilation Area and Pulmonary TB Incidence in Work Area of Puskesmas Kaluku Bodoa Makassar City 2018**

Ventilation Area	Pulmonary TB incidence				Total		P Value
	BTA Positive		BTA Negative				
	n	%	n	%	n	%	
Not meet requirement	27	43,5	35	56,5	62	100	0,045
Meet requirement	3	15,8	16	84,2	19	100	
<b>Total</b>	<b>30</b>	<b>37,0</b>	<b>51</b>	<b>63,0</b>	<b>81</b>	<b>100</b>	

**Tabel 3. Relationship between Room Temperature and Pulmonary TB Incidence in Work Area of Puskesmas Kaluku Bodoa Makassar City 2018**

Suhu Ruangan	Pulmonary TB incidence				Total		P Value
	BTA Positive		BTA Negative				
	n	%	n	%	n	%	
Not meet requirement	26	41,3	37	58,7	63	100	0,230
Meet requirement	4	22,2	14	77,8	18	100	
Total	30	37,0	51	63,0	81	100	

**Tabel 4. Relationship between Natural Lighting with Pulmonary TB Incidence in Work Area of Puskesmas Kaluku Bodoa Makassar City Year 2018**

Natural Lighting	Pulmonary TB incidence				Total		P Value
	BTA Positive		BTA Negative				
	n	%	n	%	n	%	
Not meet requirement	24	50,0	24	50,0	48	100	0,007
Meet requirement	6	18,2%	27	81,8	33	100	
<b>Total</b>	<b>30</b>	<b>37,0</b>	<b>51</b>	<b>63,0</b>	<b>81</b>	<b>100</b>	

## DISCUSSION

Relationship between density and incidence of Pulmonary TB

The density of the inhabitants in the home is one factor that can increase the incidence of pulmonary TB disease and other diseases that can be contagious. The density of the inhabitants of the house can affect health, because if a densely populated house can lead to the transmission of disease from one human being to another.<sup>10</sup>

Residential density is the ratio of the floor area of the house to the number of occupants or family members in the toilet. In health decree no 829 / Menkes / SK / VII / 1999 on housing health requirements, it is mentioned that occupancy densities of more than or equal to 8m<sup>2</sup> per person are categorized as not solid.<sup>11</sup>

The results cross-table analysis indicate number of pulmonary tuberculosis patients who have the density of

occupants qualified more than in patients with pulmonary tuberculosis who have the density of occupants are not eligible. It shows that the area of respondent's house is still proportional to the number of its inhabitants so that oxygen demand is fulfilled. This can be possible because of other factors that influence so that despite having the density of the occupants are eligible, can still be affected by pulmonary TB disease. Because according to epidemiological triangle theory (host, agent, environment), besides environmental conditions there are also host and agent factors that can influence the incidence of Pulmonary TB. Host factors that can affect are immune conditions and also the habits of the respondent's life.

Of 81 respondents in the work area Puskesmas Kaluku Bodoa Makassar City Chi-Square test obtained p value = 0.027 (p <0.05) then H<sub>0</sub> rejected and H<sub>a</sub> accepted, which means there is a significant relationship between the density of residents with the incidence of TB Lungs. The results of this study are in line with Malelak,

et al., 2017 study in Marauke District Hospital which concludes that there is a significant relationship between density and incidence of pulmonary tuberculosis, where respondents who have dense occupancy density have 4.69 times more risk of pulmonary tuberculosis compared with respondents whose occupancy density is not solid.<sup>12</sup>

This research is also in line with research by Rohayu, et al., In 2016 at Puskesmas Kadatua Kabupaten Buton which states that Respondents who have unsuitable occupancy density have an 8 times higher risk for Positive BTA Positive TB compared to respondents who have occupancy density meet requirement. Because the range of values at the level of confidence (CI) = 95% with lower limit (lower limit) = 1.39 and upper limit (upper limit) = 46 does not include the value of one, with  $p(0.039) < 0.05$  then  $H_a$  accepted or  $H_0$  is rejected so it can be concluded that the risk is significant.<sup>13</sup>

The research that is not in line with this research is Amalaguwan, et al., Research in 2017 in Kendari City showed that statistical test results obtained OR value of 0.730 with lower limit value range OR = 0.152 and upper limit (upper limit) OR = 3.492 at confidence interval (CI) = 95% includes one value. If  $OR < 1$  or  $OR > 1$  and CI range include value 1 then the research variable is not a risk factor then the risk is not significant. Thus the density of occupancy is not a risk factor for pulmonary TB incidence in pulmonary tuberculosis patients in the work area of Puuwatu Puskesmas.<sup>8</sup>

#### **Relationship between Ventilation Area and Pulmonary TB Incidence**

Ventilation is an attempt to satisfy the pleasant and healthy atmosphere of human beings. Peraturan Menteri Kesehatan of the Republic of Indonesia no 1077 / Menkes / Per / V / 2011 said that the air exchange is not eligible can lead to the growth of microorganisms, resulting in disruption to human health. In addition, the area of ventilation that does not meet the health requirements will lead to obstruction of the process of air exchange and sunlight into the house, as a result of tuberculosis germs in the house can not come out and participate inhaled with air respiration.

The results of this study, on 81 respondents in the Work Area Puskesmas Kaluku City of Makassar using Chi-Square test obtained  $p$  value = 0,045 ( $p < 0.05$ ) then  $H_0$  rejected and  $H_a$  accepted which means there is a

significant relationship between ventilation area with the incidence of Pulmonary TB . The results of this study are in line with the research of Prihanti, et al in 2015 in Malang which states the existence of significant influence of ventilation area to the incidence of Pulmonary TB.<sup>14</sup>

The research that is not in line with this research is Ibrahim I research in 2017 which shows that from 60 respondents obtained the group of respondents with occupancy that has good ventilation as much as 45 (68.3%) of respondents, and respondents with poor ventilation of 19 ( 31.7%) of respondents. The result of statistic test obtained by value  $p$  value 1,000 PR 1,167 95% CI 0,393-3,468 so that can be concluded there is no significant relationship between house ventilation factor with the incidence of pulmonary tuberculosis.<sup>15</sup>

#### **Relationship between Room Temperature and Pulmonary TB Incidence**

Temperature is the heat or cold air expressed in units of a certain degree. Temperature referred to this research is the temperature in the room where respondents often spend their time, which is measured directly using a temperature measuring device with a measurement at a time. Temperatures are grouped into two categorical categories that are not eligible and qualified. In this research, it was found that respondents that the room temperature did not meet the criteria were 63 respondents (77.8%) compared to respondents whose room temperature fulfilled the requirement of 18 respondents (22.2%). It shows that the temperature of the room in the respondent's house is not categorized in a good room temperature because it has not been said to meet the requirements of 18oC-30oC. This is because homogeneity or the proportion of pulmonary tuberculosis occurrence between eligible and unqualified temperatures has almost the same distribution.

The results of this study, on 81 respondents in the work area Puskesmas Kaluku City of Makassar using Chi-Square test obtained  $p$  value = 0.230 ( $p > 0.05$ ) then  $H_0$  accepted and  $H_a$  rejected which means there is no significant relationship between room temperature with the incidence of TB Lungs. According to the researchers, the absence of a temperature relationship with the incidence of Pulmonary TB due to measurements performed without a time-based and only one measurement so that the results obtained can be homogeneous measurements. Whereas according to



the theory of good measurement is not only done only one measurement or time, because the temperature in the morning is different from the temperature during the day.

### Relationship between Lighting with Pulmonary TB incidence

Lighting in question is the lighting of sunlight, because sunlight has the power to kill bacteria, has been investigated and proven by Robert Kock, he has proved that any sunlight can kill germs in a fast or slow time. Sufficient sunlight is an important factor in human health because sunlight can kill bacteria that are not good for the human body in the home one of them bacteria *Mycobacterium Tuberculosis*.

The results of this study, on 81 respondents in the work area Puskesmas Kaluku City of Makassar using Chi-Square test obtained p value = 0.007 ( $p < 0.05$ ) then  $H_0$  rejected and  $H_a$  accepted which means there is a significant relationship between the natural lighting of the room with the incidence of TB Lungs. The results of this study are in line with research conducted by Rohayu, et al., In 2016 at Puskesmas Kadatua Buton District stated that respondents who have unqualified lighting have a 9 times greater risk for pulmonary TB AFP positive compared with respondents who have fulfilled enrichment requirement. because the range of values at the level of confidence (CI) = 95% with lower limit (lower limit) = 1.64 and upper limit (14.59) does not include the value of one, with  $p (0.021) < 0.05$  then  $H_a$  accepted or  $H_0$  is rejected so it can be concluded that the risk is significant.<sup>13,14</sup>

The research is not in line with the research that is Ibrahim I research, in 2017 in Tidore City which shows that from 60 respondents obtained respondents group with occupancy that has a good sun lighting as much as 38 (63.3%) respondents, and respondents with less lighting either as much as 22 (36,7%) of respondents with p value = 0,422 and OR = 1.784 value means  $p > \alpha (0,005)$ , so it can be concluded there is no significant relationship between sunshine factors with the incidence of Pulmonary TB, the survey results show the condition of light in the respondent's home is still quite good.<sup>15-17</sup>

### CONCLUSION

There is a relationship between density of residents with the incidence of Pulmonary TB in the Work Area

Puskesmas Kaluku Bodoa Makassar City 2018 with p value = 0.027, there is correlation between ventilation area with incidence of Pulmonary TB in Work Area of Puskesmas Kaluku Bodoa Makassar City 2018 with p value = 0,045 and there is no relation between room temperature with incidence of Pulmonary TB in Work Area of Puskesmas Kaluku Bodoa 2018 with p value = 0,230 and there is a relationship between natural lighting with the incidence of Pulmonary TB in the Work Area of Puskesmas Kaluku Bodoa 2018 with p value = 0,007.

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### REFERENCES

1. Ivanovs,A. Analysis of Risk Factors for the Prevalence of Tuberculosis in Latvia. Rigas Stradina Universitate (RSU). 2016.
2. Herman,et al.. Behavior of Tuberculosis Pulmonary Disease Prevention in South Sulawesi, Indonesia.Indian Journal of Public Health Research&Development. 2018: 9(4)
3. Meca,A,A., et al. Environmental Factors Related to Pulmonary Tuberculosis in HIV-Infected Patients in the Combined Antiretroviral Therapy (cART) Era. PloS ONE 2016:(11)
4. Narasimhan, P., Wood, J., Chandini, R. M. & Mathai, D.. Risk Factors for Tuberculosis. Pulmonary Medicine, 6 January, Volume 2013, pp. 1–11.
5. Dinas Kesehatan Kota Makassar. Health Profile of Makassar City 2016. Makassar. 2017.
6. Oktavia, S., Mutahar,R., Destriatana,S. Analysis of Risk Factors for Pulmonary TB Incidence in Work Area Health Kartapati Palembang. Jurnal Ilmu Kesehatan Masyarakat. 2016.
7. Lienhardt C. From exposure to Disease: The Role of Environment Factors in Susceptibility to and Development of Tuberculosis. University Bloomberg School of Public Health. 2001: 23(2)
8. Amalaguswan., Junaid., Fachlevy, A.F. Analysis of Risk Factors of Pulmonary TB incidence in the Work Area of Puuwatu Health Center Kendari City

2017. Jimkesmas. 2017: 2(7).
9. Dinas Kesehatan Kota Makassar. Health Profile of Makassar City 2016. Makassar. 2017.
  10. Patiro, L.A., Kaunang, W.P.J., Malonda, N.S.H. Risk Factors of Pulmonary Tuberculosis Occurrence in Tuminting Public Health Working Area. 2017. :9(3).
  11. Riskesdas. Riset Kesehatan Dasar Agency for Health Research and Development Ministry of Health Indonesia. Jakarta. 2013.
  12. Rohayu, N., Yusran, S., Ibrahim, K. Risk Factors Analysis of Positive Pulmonary TB AFB at Pesisir Community in Kadatua Puskesmas Working Area South Buton Regency 2016. 1(3).
  13. Prihanti, G.S., Sulistiyawati., Rahmawati, I. Risk Factors Analysis of Pulmonary Tuberculosis. 2015:11(2).
  14. Muhammad Awal, Ridwan Amiruddin, Sukri Palutturi and Anwar Mallongi, 2017. Relationships Between Lifestyle Models with Stroke Occurrence in South Sulawesi, Indonesia. *Asian Journal of Epidemiology*, 10: 83-88. **DOI:** 10.3923/aje.2017.83.88
  15. Masriadi Idrus, Anwar Mallongi and Juliani Ibrahim, 2017. Surveillance system model for pulmonary tuberculosis suspected in Pangkep region, Indonesia. *Curr. Res. Tuberculosis*, 9: 1-7.
  16. Ibrahim, I. Faktor yang Influencing Pulmonary TB Incidence in Tidore City Region. *Global Health Science*. 2017:Volume 2 Issue 1
  17. Kenedyanti, E., Sulistyorini, L. Mycobacterium Tuberculosis Analysis and Physical Condition of House with Lung Tuberculosis Occurrence. *Jurnal Berkala Epidemiologi*. 2017:5(2). 152-162.

# Reduce Violent Behavior Schizophrenia: A New Approach Using LT (Laughing Therapy) and DRT (Deep Relaxation Therapy)

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## ABSTRACT

Violent behavior is one example of mental disorders that often occur in people's lives. Based on a preliminary study for 3 months (January, February, March) in 2018 showed that 50-60% of patients treated at Wijaya Kusuma were violent patients. The purpose of this study was to analyze the differences in the effectiveness of DRT and LT in patients with violent behavior. For that, the next investigator is expected to compare the use of other complementary therapies more effective in patients with violent behavior.

This research method used Two group pre-test-post-test design. The population in this study were patients with violent behavior in the Wijaya Kusuma room. The sample was taken using simple random sampling with 112 respondents and divided into respiratory relaxation therapy group and laughing group therapy. With the independent variables of deep breathing relaxation therapy and laughter therapy and the dependent variable of patients with violent behavior. The instrument in this research is observation RUFA. Data were analyzed using paired t-test and continued with independent t-test with significance value  $\alpha < 0,05$ . The result of paired t-test statistic for deep breathing relaxation therapy was obtained ( $p\text{-value} = 0,001 < 0,05$ ) and light therapy group obtained the result ( $p = 0,001 < 0,05$ ). While independent test t-test shows significant value  $p\text{-value} = 0.370 > 0.05$ . It can be concluded that there is an effect of deep breathing relaxation therapy and laughter to patients with violent behavior, but there is no significant difference between patients with violent behavior given deep breathing relaxation therapy and given laughter therapy.

**Keywords:** *LT (Laugh Therapy), DRT (Deep Relaxing Therapy), Violent Behavior, T-Test*

## INTRODUCTION

Schizophrenia has been associated with heightened stress responsivity in adolescence that precedes onset of psychosis. We now report that multiple stressors during adolescence in normal rats leads to deficits in adults analogous to that seen in schizophrenia patients. Although mental health problems are not regarded as a disorder that causes death directly. However, such disturbances can lead to the inability of individuals in the work and the inaccuracy of individuals in behaving

that can disrupt groups and communities and can hamper development because they are not productive <sup>1</sup>

WHO estimates there are about 450 million people in the world experiencing mental health problems. In the general population there are 0.2 - 0.8% of schizophrenia patients and of the 120 million population in Indonesia there are approximately 2,400,000 mentally ill children Basic health research (Riskesdas) in 2013 shows that people with severe mental disorders in Indonesia with prevalence of 1.7 per mil with DI Yogyakarta, Aceh, South Sulawesi, Bali and Central Java as the city with the most severe mental disorder, while East Java is located just below the province of Central Java with a prevalence of 2.2 per mile. Based on a preliminary study on September 2nd, 2015 at WK room of Mental Hospital of Menur Surabaya, the patient data of violent

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behavior during the last 3 months since June, July and August are as follows. Factors causing violent behavior are predisposing factors consisting of psychological, biological and socio-cultural factors and precipitation factors originating from clients and the environment<sup>2,3</sup>

As psychotic relapses and consequent risk of aggressive behaviour are often associated with a poor compliance, purpose of the present manuscript is to give an overview of the available data about the use of depot antipsychotics for the management of violence in patients with schizophrenia. Violent behavior has physical, psychological, social, and spiritual impacts on the victims and also affects the whole family and community system. Events that reflect violent acts such as murder, riots, arson, beatings, and torture. The violent action causes the sufferer to harm others. Violent actions that will cause patients to tend to have a destructive attitude, anger and resulted in the emergence of violent behavior if it cannot be controlled<sup>4</sup>

Violent behavior gets a variety of therapies from group therapy to individual, the therapies are given

are also beneficial for mental disorders. There is also a laughing therapy, laughter therapy is a therapy to achieve joy in the heart that is issued through the mouth in the form of laughter or a smile that adorns the face, feelings of a loose and happy heart, a broad chest, smooth blood circulation that can prevent disease and maintain health<sup>5</sup>

Given the many impacts of aggressive behavior on teenagers, parents should be able to overcome this by giving more attention and direction to teenagers to express their feelings through better things. Effective training of methods for dealing with conflict on an ongoing basis is essential and beneficial to aggressive children such as creating a non-aggressive environment, developing empathy, and punishment. Of course, the above things are expected to reduce teenagers violent so that teenagers can control themselves and not behave aggressively. In addition, aggressive behavior can also be prevented by preventing children if they will vent their anger with aggressive behavior, treat children patiently, should not be aggressive when children do aggressive behavior, teach children how to get along well, limit friends mingle, create an atmosphere of togetherness in the family<sup>5,6</sup>

## MATERIAL AND METHOD

The research method used in this study used research type *pre-experimental: two group pre-test-post-test design*.

The dependent variable in this study is the violent behavior of 15 patients. The sampling technique used is *simple random sampling*. Analysis for pre and post using *paired t-test and independent test*

## FINDINGS

**Table 1 behavior of violence before and after given (Deep Relaxing Therapy)**

Code Respondent	PRE	Description	POST	Description
TR01	10	Medium	7	Light
TR02	8	Medium	8	Medium
TR03	9	Medium	7	Light
TR04	8	Medium	8	Medium
TR05	12	Medium	12	Medium
TR06	8	Medium	7	Light
TR07	9	Light	8	Medium
TR08	9	Medium	7	Light
TR09	5	Lightweight	4	Light
TR10	10	Medium	9	Medium

**Cont... Table 1 behavior of violence before and after given (Deep Relaxing Therapy)**

TR11	10	Medium	8	Seda ng
TR12	13	Medium	13	Medium
TR13	8	Medium	6	Light
TR14	8	Medium	6	Light
TR15	4	Medium	3	Lightweight
Mean±SD:	8.73 ± 1.41		7,53 ± 1.12	

**Table 2 of patient's violent behavior before and after LT is given ( Laugh Therapy)**

Code Respondent	PRE	Description	POST	Description
TT01	9	Medium	6	Light
TT02	8	Medium	7	Light
TT03	12	Medium	12	Medium
TT04	9	Medium	8	Medium
TT05	9	Medium	9	Medium
TT06	2	Lightweight	1	Light
TT07	5	Lightweight	4	Lightweight
TT08	6	Lightweight	5	Light
TT09	9	Medium	7	Lightweight
TT10	7	Lightweight	6	Lightweight
TT11	9	Medium	7	Lightweight
TT12	6	Lightweight	4	Light
TT13	10	Medium	8	Medium
TT14	6	Lightweight	2	Lightweight
TT15	10	Medium	8	Medium
Mean±SD:	7.80 ± 2 , 22		6,27 ± 1,76	

## DISCUSSION

Based on the results of research in space Wijaya Kusuma Mental Hospital Menur Surabaya obtained the data of respondents as many as 30 people and divided into 2 groups of 15 respondents entered the relaxation breath in the group and 15 respondents entered the LT (Laugh Therapy) group. In the DRT (Deep Relaxing Therapy) group, prior to therapy, the number of violent behavior patients with moderate category amounted to 13 people (86.7%), while the light was only 2 people (13.3%). In the LT (Laugh Therapy) group, prior to

therapy, the number of patients with moderate violent behavior was 9 (60%), while the light category was 6 (40%).

Based on gender demographic data, the respondents showed that in the respiratory relaxation therapy group, most of the respondents were male (12%) and only 3 (20%) were female. While in the laughter therapy group most of the respondents were male (9) (60%) and 6 (40%). This shows that gender is one of the risk factors for violent behavior. In accordance with the statement

of Kaplan & Sandock stating that the risk factor for violent behavior is male gender. The process of cognition, emotion, behavior and unconsciousness can interact causing a person to feel bad about themselves or produce negative relationships with others. After adjusting for age, socioeconomic status, severity of disease and psychiatric history, the quality of sleep of the experimental group improved, with the results at posttest achieving significance. Heart rate variability parameters were also significantly improved<sup>8</sup>. This is reinforced by research conducted a total of 62 (79.5%) of male sex respondents and only 16 (10.5%) of female respondents. Men more often or easily experience psychiatric disorders violent behavior, according to Soejono's theory that men tend to experience frequent changes in the role and decreased social interaction and job losses. This is often the cause of men who experience mental disorders due to<sup>7,8</sup>

Age over 25 years is a mature age with a fairly complex problem so it is one of the risk factors of violent behavior. Basic health research mentions the prevalence of emotional mental disorders such as depression and anxiety in people aged 26-35 years to reach 9.6% of this shows people living in emotions and psychiatric conditions problematic. This is because at this age personality problems often appear so widespread and complex<sup>7</sup>

From the characteristics of educational background, the researcher got the result that respondent of DRT group with the highest educational background with the number of 6 people (40%) while in the LT group most of the respondents have SD education background with 5 people (33,3% ). A low level of education in a person will make the person susceptible to anxiety. Anxiety occurs because the individual cannot solve the problem well, the higher the level of education will affect the ability to think. The formation of one's actions is based on behavior, behavior based on knowledge will be more lasting than behavior that is not based on knowledge<sup>7,8</sup>

From the respondents' occupation data on the DRT group in the researcher get the result. Work is a very affect a person's self-concept, especially on the role of individuals. A person who does not have a job may affect the self-concept which is influenced by self-ideal and self-esteem. Ideal self is the individual's perception of his behavior, tailored to the ideals, hopes, and desires to be achieved. But the self-ideal of the unemployed will

decrease because the individual feels that he or she is unable to make ends meet, and feels unsuccessful so that the individual feels anxious and inferior, the individual will feel that he has low self-esteem, is not recognized, able to face life in controlling him. Individuals become negative thinking, thus making social relationships become maladaptive. suggests Frustration occurs when the desire of individuals to achieve a failure that will cause a situation that will encourage individuals to behave aggressively. Example: Job Loss<sup>7,8,9</sup>

After DRT was given to 15 respondents of DRT group experienced a decrease in the moderate category to 7 people (46.7%) before therapy was 13 people (86.7), while the light category increased to 8 people (53.3%) before therapy was given 2 people (13.3). Thus the effectiveness of DRT in reducing violent behavior in violent behavior patients is good enough, effective, efficient and easy to do alone. By doing this exercise the body will respond to expand blood vessels, improve alveoli ventilation and provide a feeling of calm and comfort. In theory, relaxation is basically related to the working system of the human nerves, which consists of the central nervous system and autonomous<sup>10</sup>

Relaxation of breath in stimulating the body to release endogenous opioids is endorphin and enkephalin. The release of endorphin hormone can strengthen the immune system, keep brain cells young, fight to age, decrease aggressiveness in human relationships, boost spirits, endurance, and creativity<sup>11,18</sup>. While 15 subsequent respondents who get LT, before given the respondents Laughter is the best antidote to stress, cheap, and easy to do. Laughter is one of the best ways to relax muscles. Laughter widens the blood vessels and sends more blood to the ends and to all the muscles throughout the body. One good round of laughter also reduces the levels of stress hormones, epinephrine and cortisol. It can be said that laughter is a form of dynamic meditation or relaxation LT is useful to suppress the secretion of epinephrine and multiply the secretion of endorphin, so the feeling of being peaceful<sup>12</sup>. Another benefit is the freshness and comfort, because when laughing the muscles will relax and the blood circulation smoothly so that the needs of oxygen fulfilled. This makes the client's emotional state improve so as to suppress the desire to anger. there is the influence of laughter therapy in controlling patient of violent behavior<sup>7,14</sup>

There is no significant difference between DRT and

LT in violent behavior patients. Based on the results of the test indicate that the group of DRT and LT there is an influence to the decrease of violent behavior but not too significant, it can be seen from the result of paired T-Test in breath DRT and LT with p-value equal to 0.000. If we look at the distribution of pre-post differences between the DRT group and LT it has a difference in the mean value of DRT group in 1.20, while in the LT group 1.53. After the Independent T-Test was conducted, there was no significant difference between the two therapies. The DRT technique not only causes a calming effect but also calms the mind. Therefore some relaxation techniques such as a deep breathing can help to improve the ability to concentrate, self-control, decrease emotions, and depression<sup>7, 15,16</sup>. So it can be said that DRT can help reduce violent behavior in patients violent behavior.

### CONCLUSION

Based on the results of data analysis research that has been done, it can be concluded things as follows:

There is influence before and after the provision of deep breath relaxation therapy in patients, violent behavior can be derived with DRT in space Wijaya Kusuma Mental Hospital Menur Surabaya. There is influence before and after giving LT to a patient of violent behavior in space of Wijaya Kusuma Mental Hospital of Menur Surabaya. There is no difference in the effectiveness of DRT and LT in violent behavior patients in the Wijaya Kusuma Mental Hospital Menur Surabaya.

**Conflict of Interest:** The Author (s) declare that they have no conflict of interest

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**Ethical Clearance:** This study was approved by the institutional review board of Menur Mental hospital Surabaya The research received a certificate from the hospital ethical permission.

### REFERENCES

- Gomes FV, Grace AA. Adolescent Stress as a Driving Factor for Schizophrenia Development-A Basic Science Perspective. *Schizophr Bull.* 2017;1;43(3):486-489.
- Health Research (Riskesmas). Agency for Health Research and Development Ministry of the Republic of Indonesia in 2013. 2013 Retrieved from:<http://www.labdata.litbang.depkes.go.id/riset-badan-litbangkes/menu-riskesmas/menu-riskesmas/374-rkd-2013.pdf>
- Joseph, Iyus. *Nursing Soul*. 3th ed. Bandung: Refika Aditama. 2010
- Murray PR, Rosenthal KS, Kobayashi GS, Pfaffler MA. *Medical microbiology*. 4th ed. St Louis: Mosby; 2002
- Buoli M, Rovera C, Esposito CM, Grassi S, Cahn W, Altamura AC. The use of long-acting antipsychotics for the management of aggressiveness in schizophrenia: a clinical overview. *Clin Schizophr Relat Psychoses.* 2018;67:89
- Seddig D, Davidov E. Values, Attitudes Toward Interpersonal Violence, and Interpersonal Violent Behavior. *Front Psychol.* 2018;9:604.
- Rahman. The effect of laughter on aggressive behavior decline Undergraduate (S1) thesis, University of North Sumatra. 2013;172
- Yuhanda, Dea, et al. The effectiveness of deep breathing relaxation and laughter therapy in controlling violent behavior in patients with violent behavior in RSJD Dr. Amino Gondo Hutomo Semarang <http://pmb.stikestelogorejo.ac.id/ejournal/index.php/ilmukeperawatan/article/view/210>. 2013;
- Chien HC, Chung YC, Yeh ML, Lee JF. Breathing exercise combined with cognitive behavioural intervention improves sleep quality and heart rate variability in major depression. *J Clin Nurs.* 2015;24(21-22):3206-14.
- Rosenthal LJ, Byerly A, Taylor AD, Martinovich Z. Impact and Prevalence of Physical and Verbal Violence Toward Healthcare Workers. *Psychosomatics.* 2018 ;78;pii: S0033-3182(18)30218-4.
- Kelliat, BA. *Mental Health Nursing*. 4<sup>th</sup> ed. Jakarta: EGC. 2012
- Nengah Sumirta et al. Relaxing Breath In Control Of Angry Clients With Violent Behavior. <http://poltekkesdenpasar.ac.id/files/JURNAL%20GEMA%20KEPERAW/JUNI%202014/Nengah%20Sumirta,%20dkk.pdf>. 2013;45-47
- Kataria, M. *Laugh for No Reason*. 4<sup>th</sup> ed. Jakarta: PT. Gramedia Pustaka Utama. 2010
- Yokogawa M, Kurebayashi T, Ichimura T, Nishino

- M, Miaki H, Nakagawa T. Comparison of two instructions for deep breathing exercise: non-specific and diaphragmatic breathing. *J Phys Ther Sci.* 2018;30(4):614-618
15. Noble DJ, Goolsby WN, Garraway SM, Martin KK, Hochman S. Slow Breathing Can Be Operantly Conditioned in the Rat and May Reduce Sensitivity to Experimental Stressors. *Front Physiol.* 2017;30;8:854.
16. Yuksel H, Cayir Y, Kosan Z, Tastan K. Effectiveness of breathing exercises during the second stage of labor on labor pain and duration: a randomized controlled trial. *J Integr Med.* 2017;15(6):456-461.
17. Szczygieł E, Blaut J, Zielonka-Pycka K, Tomaszewski K, Golec J1, Czechowska D, Masłoń A, Golec E. The Impact of Deep Muscle Training on the Quality of Posture and Breathing. *J Mot Behav.* 2018 ;50(2):219-227
18. Cernes R, Zimlichman R. Role of Paced Breathing for Treatment of Hypertension. *Curr Hypertens Rep.* 2017;19(6):45.



# The Efficacy of Physiotherapy Combination Technique on Pain and Functional Independence of People with Lumbar Disc Herniation

(Physiotherapy Combination Technique: A Conservative Treatment for Lumbar Disc Herniation)

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## ABSTRACT

**Background.** The physiotherapy combination technique is a modified physiotherapy technique by combining several techniques such as proprioceptive neuromuscular facilitation, neural mobilization, core stabilization and neuromuscular technique. **Objective.** To examine the effectiveness of the physiotherapy combination technique on pain intensity and function of people with lumbar disc herniation. **Method.** A total of 44 patients with lumbar disc herniation is randomly assigned to assigned to physiotherapy combination technique and standard physiotherapy groups. Pain was measured using the visual analogue scale (VAS) and function were measured using the Oswestry disability index (ODI) at baseline and after 4 weeks. **Results.** At the end of therapy (4 weeks), both groups showed improvement of ODI compared with baseline. The ODI revealed a significantly better improvement in the physiotherapy combination technique than in the standard physiotherapy group. **Conclusion.** As compared with standard physiotherapy, the physiotherapy combination technique is effective in improving pain and function of people. The physiotherapy combination technique improves pain and function in people with lumbar disc herniation.

**Keywords:** *physiotherapy combination technique, lumbar disc herniation pain, function, randomized controlled trial*

## INTRODUCTION

Lumbar disc herniation (LDH) is a common condition in adults and can impose a heavy burden on both the individual and society. It is defined as displacement of disc components beyond the intervertebral disc space.<sup>1</sup> In an analysis of patients enrolled in the intervertebral disc arm of the Spine Patient Outcomes Research Trial (SPORT), Cummins et.al<sup>2</sup> reported that the average age of patients with a herniated disc was 41 years, and the diagnosis was slightly more common in males than females (57% versus 43%, respectively).

Clinical presentation of disk protrusion and herniation can vary widely but can occur as a result of tears of the annulus fibrosus, causing acute back or neck pain or radicular pain if there is herniation of the nucleus pulposus.<sup>3</sup> Pain and disability from a herniated disc can usually be treated successfully with surgical and non-surgical.<sup>4, 5</sup> Non-surgical treatments for symptomatic

lumbar disc herniation are typically implemented for at least 6 weeks with good results.<sup>6</sup> and has similar outcomes with patients who had surgery after 12 months follow up.<sup>7</sup>

The treatment of lumbar disc herniation, like many conditions of the spine, has come under increased scrutiny in this era of value-based health care delivery. In response, there has been an increase in cost-effectiveness research in this area. Studies have demonstrated that surgery is cost-effective for the treatment of symptomatic lumbar disc herniation using a traditional open approach. Such research is limited for specific conservative treatment options as well as alternative surgical approaches to treating this condition, such as the minimally invasive approach.<sup>8</sup> Svensson et al<sup>9</sup> reported that McKenzie therapy can be recommended as a first choice of treatment for patients with lumbar disc herniation since 50% of the patients centralized as soon as two weeks after start of treatment.

The main symptoms of lumbar disc herniation include radicular pain, sensory loss, muscle weakness<sup>10</sup> monoradicular pain, unilateral ankle reflex decrease, unilateral muscle weakness.<sup>11</sup> Physical therapy programs are often recommended for the treatment of pain and restoration of functional and neurological deficits associated with symptomatic disc herniation.<sup>12</sup> There are a number of exercise programs for the treatment of symptomatic LDH, such as activity as usual, aerobic activity (e.g., walking, cycling), directional preference (McKenzie approach), flexibility exercises (e.g., yoga and stretching), proprioception/coordination/balance (medicine ball and wobble/tilt board), motor control and strengthening exercises.<sup>13</sup> Motor control exercises (MCEs) or stabilization or core stability exercises are a common type of therapeutic exercise prescribed for patients with symptomatic LDH. MCEs are designed to re-educate the co-activation pattern of abdominals, Para spinals, gluteal, pelvic floor musculature and diaphragm.<sup>14, 15</sup>

Physiotherapy combination technique is a combination of several physiotherapy/exercise technique such as lumbar extension exercise, neural mobilization, core stability exercises, nerve mobilization, proprioceptive neuromuscular facilitation (PNF), and neuromuscular therapy. As this is a new, modified and combination of several technique, no studies has been conducted regarding the effectivity of this technique on people with lumbar disc herniation.

The aim of this study was to compare the effect of the physiotherapy combination technique versus standard physiotherapy in patients with lumbar disc herniation.

## MATERIALS AND METHOD

### Patients

Patients who had diagnosed with lumbar disc herniation based on clinical presentation and confirmed by magnetic resonance imaging (MRI) were invited to take part in a randomized, controlled comparison of physiotherapy combination technique and standard physiotherapy treatment. Enrollment took place for 6 months. Those interested were treated in a private physiotherapy clinic. The exclusion criteria were having back surgery before, orthopedic conditions like spinal stenosis or spondylolisthesis, chronic pain disorders of the musculoskeletal system, defined neurological disease, or psychiatric disorders. All participants

provided written, informed consent.

The ethic committee of Hasanuddin University approved the study protocol.

### Therapy

Physiotherapy combination technique group. Patients in the physiotherapy combination technique group received 12 treatment session over 4 weeks. Each patient was treated by 1 physiotherapist only according to written prescriptions, each treatment session lasting 30-60 minutes.

Standard physiotherapy group. Patients in the standard physiotherapy group received the same amount of treatment as the physiotherapy combination technique group over 4 weeks. Each patient was treated by 1 physiotherapist only according to written prescriptions, each treatment last 30-60 minutes. Patients received isometric strengthening exercise for the back and hip extensors and the abdominal muscles, and stretching exercises for shortened muscles, respectively.

### Randomization and blinding

Block randomization (SAS) was performed. Group allocation was provided in sequentially numbered, sealed opaque envelopes. Baseline data were collected by one of the authors at the private physiotherapy clinic. Thereafter the author 1) documented the date and time of opening of the envelope, 2) signed it, and 3) finally opened the envelope. He handed out the treatment instructions and explained them to patient and organized, if necessary, the respective therapy. A trained physiotherapist who was unaware of the treatment allocation and the primary aims of the study collected all follow-up data. The authors who was not actively involved in the clinical examination supervised assessment.

### Outcomes Measure

Primary and secondary outcome measures were assessed at baseline and 4 weeks thereafter, respectively. The primary outcome measure was VAS and the ODI.<sup>16</sup>

### Statistical Analysis

The primary analysis was the comparison of ODI changes from baseline to 4 weeks on an intention-to-treat basis (with the last observation carried forward where necessary) between the physiotherapy combination technique and the standard physiotherapy group.

Wilcoxon test to compare changes between baseline and 6 interventions was applied. Mann Whitney was used to compare changes between groups. Statistically significant was set to  $p < 0.05$ .

**Ethical Clearance:** The protocol of this study was reviewed and approved by the Ethical Committee of Faculty of Medicine, Hasanuddin University.

## RESULTS

### Baseline evaluation

A total of 50 consecutive patients were enrolled. Of these 44 patients (88%) completed the protocol. All 6 dropouts did so soon after the first session. Their characteristics were not apparently different from those who completed the study. Patients characteristics at baseline and mean follow-up times were comparable between groups (Table 1).

**Table 1. General characteristics of Participants**

	Intervention	Control	P
Age, Mean (SD)	53.15(13.55)	49.75(13.580)	ns
Gender, male (%)	12(60%)	11(55%)	ns
VAS; Mean (SD)	9.90(0.31)	9.95(2.24)	ns
Oswestry Disability Index Functional Independence Baseline; Mean (SD)	77.90(8.6)	78.10(5.93)	ns

Primary analysis. At the end of treatment (4 weeks), the VAS score of physiotherapy combination technique patients was significantly better than that of the standard physiotherapy patients. Similarly, ODI score of physiotherapy combination technique patients was also significantly better than that of the standard physiotherapy patients.

Secondary analysis. Within-group analysis showed significant improvements of VAS and ODI in both group at the end of treatment compared with baseline (Table 2).

**Table 2 Effect of QMT on the reduction of pain and improving functional independence of people with disc herniation**

	Pretest	Post Test	P*
<b>Intervention</b>			
• Pain; Mean (SD)	9.90(0.31)	2.85(0.59)	$P < 0.01^*$
• Functional Independence; Mean (SD)	77.90(8.6)	6.80(7.82)	$P < 0.01^*$
<b>Control</b>			
• Pain; Mean (SD)	9.95(2.24)	4.95(0.61)	$P < 0.01^*$
• Functional Independence; Mean (D)	78.10(5.93)	44.60(9.36)	$P < 0.01^*$

\* Wilcoxon test

On the general characteristics of the study subjects (Table 1), there was no significant difference between the intervention group and the control group, in terms of age, gender, Oswestry Disability Index (pain and functional independence). Wilcoxon test or paired t-test (Table 2) showed that there are significant differences ( $p < 0.05$ ) between pretest and posttest on pain, and functional independence in both groups.

**Table 3 Differences in the effects of QMT on the decline of pain and functional independence between the groups**

	Intervention	Control	P*
• Pain; Mean (SD)	7.05(0.61)	5(0.56)	P< 0.01*
• Functional Independence; Mean (SD)	71.1(9.96)	33.50(11.05)	P<0.01*

\* Mann-Whitney test

The Independent t test or Mann-Whitney test (Table 3) showed that the changes of pain, and functional independence are significantly different ( $p < 0.05$ ) between the groups with intervention group perform better than the control group.

### DISCUSSION

To our knowledge, this is the first randomized clinical trial to test the effectiveness of the physiotherapy combination technique on patients with lumbar disc herniation. Results of this study provide evidence that physiotherapy combination technique on patients with lumbar disc herniation results in a more pronounced improvement than standard physiotherapy. Physiotherapy combination technique is effective on decreasing pain and improving functional independence of people with disc herniation.

The results of the study show that combination of neural mobilization technique, PNF and NMT significantly improving pain, mobility and stability, and functional independence in patients with LDH grade 1, 2 and 3 without surgery.

Nerve mobility increases the elasticity of the nerve so that the pain decreases.<sup>17</sup> PNF improves muscle flexibility, mobility, stability and reduced motion pain.<sup>18</sup> Core stability improves stability of abdominal and back muscle, NMT reduces pain, improves discus position and improves soft tissue flexibility.<sup>19</sup>

The finding in this study is in line with several studies on the effectivity of each individual technique on lumbar disc herniation and low back pain. The combination of lumbar extension exercise and mechanical traction has been reported to improve pain and function.<sup>20</sup> The lumbar stabilization exercise was reported to improve pain and function<sup>21</sup> as well as mobility and stability of the sacroiliac joint in LDH patients. These kinds of movements not only improved proprioception sense, they also had positive effects on lumbar disc function

recovery.<sup>22-24</sup>

The neural mobilization has also been shown to improve pain<sup>18, 23</sup> and function<sup>18</sup> in LDH patients.

The abdominal muscle strengthening using PNF has been shown to improve pain and function in chronic LBP patients.<sup>24-25</sup> Proprioceptive neuromuscular facilitation (PNF) reduces the load on vertebral bodies when performed in prone, side-lying, and sitting positions. Isometric and isotonic exercises can be performed in neutral positions to prevent damage.

In younger obese LBP patients, PNF also shown to improve pain.<sup>24-26</sup> When PNF combination patterns are applied, the ability of skeletal muscles to trigger tensile force that is swiftly obtained at an early period greatly contributes to neural responses, not adaptive changes in the muscles themselves. Such proprioceptive responses to stimuli lead to repetitive contraction of the muscles, causing concurrent contraction of the rectus abdominis, oblique abdominal, and transversus abdominis muscles. Consequently, concurrent contraction of the spinal stabilization muscles occurs, and muscle strength is increased, raising internal abdominal pressure and strengthening the trunk, helping functional movement of the human body, greatly affecting an increase in lumbar flexibility and a reduction of low back pain. The neuromuscular therapy has been reported to improve symptoms of sciatica.<sup>19, 27, 28</sup>

The limitation of this study was its limitation of generalization as it is only in one center. The application of this study result to other centers other than private clinic such as hospital should be taken with care as the characteristics of patients who visits private clinic may be difference from those who go to hospital. The blinding of therapists and patients is difficult in this study as both patients and therapist aware with the nature and purpose of this study. The assessor can be blinded because the assessor is not aware with the purpose and nature of this study.

## CONCLUSION

Physiotherapy combination technique is more effective on decreasing pain and improving functional independence of people with disc herniation compared to standard physiotherapy.

**Conflict of Interest:** The authors certify that they have no affiliation with organization that may benefit financially or non-financially from the subject discussed in this study

**Source of Funding:** The is a self-funded study.

**Ethical Clearance:** Obtained from University Committee

## REFERENCES

1. Yang H, Liu H, Li Z, Zhang K, Wang J, Wang H, et al. Low back pain associated with lumbar disc herniation: role of moderately degenerative disc and annulus fibrous tears. *International journal of clinical and experimental medicine*. 2015;8(2):1634.
2. Cummins J, Lurie JD, Tosteson T, Hanscom B, Abdu WA, Birkmeyer NJ, et al. Descriptive epidemiology and prior healthcare utilization of patients in the spine patient outcomes research trial's (sport) three observational cohorts: disc herniation, spinal stenosis and degenerative spondylolisthesis. *Spine*. 2006;31(7):806.
3. Goodman CC, Fuller KS. *Pathology-E-Book: Implications for the Physical Therapist*: Elsevier Health Sciences; 2014.
4. Atlas SJ, Keller RB, Wu YA, Deyo RA, Singer DE. Long-term outcomes of surgical and nonsurgical management of lumbar spinal stenosis: 8 to 10 year results from the maine lumbar spine study. *Spine*. 2005;30(8):936-43.
5. Shin J-S, Lee J, Lee YJ, Kim M-r, Ahn Y-j, Park KB, et al. Long-term course of alternative and integrative therapy for lumbar disc herniation and risk factors for surgery: a prospective observational 5-year follow-up study. *Spine*. 2016;41(16):E955-E63.
6. Simon J, Conliffe T, Kitei P, editors. *Non-operative management: An evidence-based approach*. *Seminars in Spine Surgery*; 2016: Elsevier.
7. Choi H-S, Kwak K-W, Kim SW, Ahn SH. Surgical versus conservative treatment for lumbar disc herniation with motor weakness. *Journal of Korean Neurosurgical Society*. 2013;54(3):183.
8. Patel SA, Wilt Z, Gandhi SD, Rihn JA, editors. *Cost-effectiveness of treatments for lumbar disc herniation*. *Seminars in Spine Surgery*; 2016: Elsevier.
9. Svensson GL, Wendt GK, Thomeé R. The occurrence of centralisation of pain after Mckenzie therapy for patients with MRI-verified lumbar disc herniation and long-standing pain. *Physiotherapy*. 2015;101:e876-e7.
10. Rajagopal TS, Marshall RW. *Microdiscectomy*. *European Surgical Orthopaedics and Traumatology*: Springer; 2014. p. 557-80.
11. Genevay S, Courvoisier DS, Konstantinou K, Kovacs FM, Marty M, Rainville J, et al. Clinical classification criteria for radicular pain caused by lumbar disc herniation: the radicular pain caused by disc herniation (RAPIDH) criteria. *The Spine Journal*. 2017;17(10):1464-71.
12. Brötz D, Küker W, Maschke E, Wick W, Dichgans J, Weller M. A prospective trial of mechanical physiotherapy for lumbar disk prolapse. *Journal of neurology*. 2003;250(6):746-9.
13. Kim Y-S, Park J, Shim JK. Effects of aquatic backward locomotion exercise and progressive resistance exercise on lumbar extension strength in patients who have undergone lumbar discectomy. *Archives of physical medicine and rehabilitation*. 2010;91(2):208-14.
14. Akuthota V, Ferreiro A, Moore T, Fredericson M. Core stability exercise principles. *Current sports medicine reports*. 2008;7(1):39-44.
15. Shamsi MB, Sarrafzadeh J, Jamshidi A. Comparing core stability and traditional trunk exercise on chronic low back pain patients using three functional lumbopelvic stability tests. *Physiotherapy theory and practice*. 2015;31(2):89-98.
16. Fairbank JC, Pynsent PB. The Oswestry disability index. *Spine*. 2000;25(22):2940-53.
17. Chaitow L, DeLany J. *Clinical Application of Neuromuscular Techniques, Volume 2 E-Book: The Lower Body*: Elsevier Health Sciences; 2011.
18. Ahmed N, Khan Z, Chawla C. Comparison of

- Mulligan's spinal mobilization with limb movement (SMWLM) and neural tissue mobilization for the treatment of lumbar disc herniation: a randomized clinical trial. *J Novel Physiother.* 2016;6:1-9.
19. Jayasingh P, Thomson RJ. Efficacy Of Neuromuscular Therapy In Patients With Chronic Low Back Pain. *International Journal of Ayurveda and Pharma Research.* 2017;5(9).
  20. Gagne AR, Hasson SM. Lumbar extension exercises in conjunction with mechanical traction for the management of a patient with a lumbar herniated disc. *Physiotherapy theory and practice.* 2010;26(4):256-66.
  21. Ye C, Ren J, Zhang J, Wang C, Liu Z, Li F, et al. Comparison of lumbar spine stabilization exercise versus general exercise in young male patients with lumbar disc herniation after 1 year of follow-up. *International journal of clinical and experimental medicine.* 2015;8(6):9869.
  22. Antarini, A.A.N., Agustini, N.P., Puryana, I.G.P.S., Wiardani, N.K., Mallongi, A. Identification of microbes, chemical, and organoleptic characteristics towards Teh Wong during Fermentation. *Indian Journal of Public Health Research and Development* 2018.
  23. Jeong D-K, Choi H-H, Kang J-i, Choi H. Effect of lumbar stabilization exercise on disc herniation index, sacral angle, and functional improvement in patients with lumbar disc herniation. *Journal of physical therapy science.* 2017;29(12):2121-5.
  24. Ambartana, I.W., Mallongi, A., Gumala, N.M.Y., Kencana, I.K., Widarti, I.G.A.A. The effectiveness of nutrition ergogenic modified to the local endurance of Pamong Praja Police personnel in Denpasar. *Indian Journal of Public Health Research and Development* 2018.
  25. Kim B-R, Lee H-J. Effects of proprioceptive neuromuscular facilitation-based abdominal muscle strengthening training on pulmonary function, pain, and functional disability index in chronic low back pain patients. *Journal of exercise rehabilitation.* 2017;13(4):486.
  26. Park K, Seo K. The effects on the pain index and lumbar flexibility of obese patients with low back pain after PNF scapular and PNF pelvic patterns. *Journal of physical therapy science.* 2014;26(10):1571-4.
  27. Pulubuhu, D.A.T., Evans, K., Arsyad, M., Mallongi, A. Understanding the perspectives of village leaders and institutions in transforming social conflict into peace and health. *Indian Journal of Public Health Research & Development*, March 2018, Vol. 9, No. 3
  28. Syamsiar S, Russeng, Lalu Muhammad saleh, Devintha Virani, Ade Wira Listrianti Latief, Anwar Mallongi. The Investigation of the Lactic Acid Change among employee of national electrical Power Plan. *Indian Journal of Public Health Research & Development*, January 2018, Vol. 9, No. 1

# Effectiveness of Risk Reduction (RR) and Risk Avoidance (RA) Approach to Reduce Risk Behavior in the Senior High School Student in Denpasar City and Palangka Raya City

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## ABSTRACT

Adolescent as the age group that is vulnerable to health problems associated with risky behavior. This study aimed to compare the effectiveness of the Risk Avoidance (RA) and Risk Reduction (RR) approach with reproductive health standard program to reduce students risk behavior in three high schools in Bali and Palangkaraya. Study design was quasi experimental study with pretest posttest control group design. Respondents who enrolled in the study were students at the level 10 to 12 in Denpasar and Palangka Raya, using RA and RR approach. A total of 132 respondents in Denpasar who are willing to be involved and subsequently drawn to 105 respondents, or as many as 35 students per school. There was a significant relationship between the provision of intervention RR, RA and controls with gender, the level / grade, the age of the respondents; and an increasing attitude that supports abstinence and self-efficacy in the treatment group RR, RA and controls on pretest and posttest ( $p < .05$ ). We need to do an intensive coordination with the school and the policy maker for the continuity of the promotion and prevention program for adolescent.

**Keywords:** *adolescent, risk avoidance, risk reduction, reproductive health program*

## INTRODUCTION

The negative effects of unsafe sexual behavior can increase the risk of adolescents experiencing pregnancy and contracting sexually transmitted infections / STIs<sup>1-4</sup>. Globally it was estimated that as many as 47% of high school students had sexual intercourse, about 40% did not use condoms during the last sexual intercourse, and 15% had four or more sexual partners<sup>2,5,6</sup>.

Intervention in the form of a comprehensive Risk Reduction (RR) behavior promotion can prevent or reduce the risk of pregnancy, Human Immunodeficiency Virus (HIV), and other STIs. The RR intervention program effectively decreases sexual activity and enhances the protection of sexual behavior in adolescents, whereas

the effectiveness of the abstinence program remains inconclusive because the outcome or effect is still highly varied<sup>7</sup>.

This study will evaluate the effectiveness of the standard program in school-based (Center for Information and Communication of Reproductive Health of Youth and National Narcotics Agency in the form of the AIDS and Drugs Student Group) compared with Risk Avoidance (RA) and Risk Reduction (RR) interventions. RA materials include: abstinence or abstinence until marriage, while RR materials include abstinence efforts plus comprehensive sexual education<sup>1,6-8</sup>. According to the research by Lucin in Palangkaraya found that barriers of utilization to the Center for Information and Communication of Reproductive Health of Youth among adolescent were embarrassment, lack of time, less communicative officer, and unstandardized room for counseling<sup>9</sup>. The problem formulation is: whether RR and RA programs can reduce adolescent risk behavior compared to the standard program in Denpasar City and

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The aim of this study is to compare the effectiveness of RR and RA programs with standard programs of Center for Information and Communication of Reproductive Health of Youth and National Narcotics Agency in the form of the AIDS and Drugs Student Group between pretest and posttest to decrease risky behavior of adolescents in Bali and Palangka Raya. This research is expected to provide theoretical and practical benefits, especially for the youth themselves, for educators and those responsible for designing sexual and reproductive health programs for school-based adolescents.

The design of this study is quasi-experimental, ie non-randomized pretest posttest with control group design by providing intervention in the form of providing school-based reproductive health programs at 10 to 12 high school students in Denpasar and Palangkaraya using RA and RR materials, compared to Center for Information and Communication of Reproductive Health of Youth and / or National Narcotics Agency in the form of the AIDS and Drugs Student Group. The schools involved were selected randomly and subsequently treated, whether the RA, RR, and standard programs were selected randomly as well. The treatment groups in the form of RR intervention were at public senior high school 4 at Denpasar City and public senior high school 3 at Palangka Raya, RA treatment group at public senior high school 5 Denpasar City and public senior high school 2 Palangka Raya City, and control group in the form of standard programs were public senior high school 2 Kota Denpasar and public senior high school 1 Palangka Raya City.

## MATERIALS AND METHOD

The large sample formula used according to Lemeshow et al, for the sample size of the students of public senior high schools with 95% confidence level,  $\beta = 0.15$ . The difference of mean values between the two groups was 1.8 with the standard deviation of 2.8, so that

the sample size was obtained:

$$n = \frac{2 \left( \frac{\sigma}{\mu_1 - \mu_2} \right)^2 \left( Z_{\alpha} + Z_{\beta} \right)^2}{\left( \frac{\sigma}{\mu_1 - \mu_2} \right)^2}$$

Sample in the study was divided into two groups and treated differently, and there was one control or comparison group to enforce the internal validity of the study (Kerlinger, 2003).

The research variables include: independent variables, intermediate variables, and dependent variables.

Univariate, bivariate, and multivariate analyzes used independent analysis of t-test, chi square and one way anova. Analyzes were conducted for assessing changes in knowledge, attitudes, parental values or normative beliefs, self-efficacy and perceptions of contraceptive use / condom during the last sexual intercourse between the respondents before and after the intervention. Data analysis through data entry steps, coding, cleaning and statistical analysis.

## RESULTS

This research is done by giving explanation in advance to the selected team to collect the data, the next respondent is given informed consent without coercion. The researcher ensures the confidentiality of the data obtained as well as the identity of the respondent. Ethical clearance has been issued by the Ethics Committee of the Faculty of Medicine, Udayana University, Denpasar.

The schools involved in this study were public senior high school 2, 4 and 5. Meanwhile, the schools involved in Palangka Raya were public senior high school 1, 2 and 3. The respondents were not homogeneous according to gender, grade and age characteristics ( $p > .05$ ). Table 1 describes the characteristics of respondents in three public senior high schools in Denpasar City and in Palangka Raya.



**Table 1. Number of respondents by characteristics and intervention in three public senior high schools in Denpasar City and Palangka Raya City, year 2015 (N = 210 people)**

	RR (n=70 people)		RA (n=70 people)		Control (n=70 people)		<i>p-value</i>
	n	%	n	%	n	%	
Gender							
Male	38	54.3	49	70.0	35	50.0	0.041*
Female	32	47.7	21	30.0	35	50.0	
Grade							
10	30	42.9	17	24.3	23	32.9	0.017*
11	39	55.7	50	71.4	39	55.7	
12	1	1.4	3	4.3	8	11.4	
Age (year)							
14	6	8.6	2	2.9	5	7.1	0.004**
15	31	44.3	25	35.7	31	44.3	
16	32	45.7	39	55.7	22	31.4	
17	1	1.4	4	5.7	12	17.1	

There are differences in pretest scores based on dependent variables (knowledge, attitudes supporting abstinence, known peer norms, self-efficacy to reject premarital sex, perceptions of condom use or contraception at last sex, perceptions of avoiding pregnancy, and peer behavior known ( $p < .05$ ), as described in Table 2.

**Table 2. Differences in pretest scores in the RR, RA and control groups in Denpasar City and Palangka Raya City (2015).**

Variables	Pretest (N=210 people)				
	Mean	Sd	Mean diff	95% CI	<i>p-value</i>
Knowledge:					
RR	8.88	1.62	0.06	-0.52-0.63	0.847
RA	8.51	1.55		-0.89-0.26	
Control	8.82	2.02	-0.31		0.289
Attitude toward abstinence:					
RR	50.26	1.58	1.41	0.69-2.13	0.001***
RA				0.52-1.96	
Control	48.84	3.01	1.24		
Peer normative believe:					
RR	6.91	0.28	0.20	0.03-0.36	0.021*
RA	6.87	0.44		0.01-0.32	
Control	6.71	0.70	0.16		0.069

**Cont...Table 2. Differences in pretest scores in the RR, RA and control groups in Denpasar City and Palangka Raya City (2015).**

Self efficacy:					
RR	16.08	4.02			
RA	16.67	3.34	2.46	0.95-3.96	0.002**
Control	13.63	5.82	3.04	1.53-4.54	0.001***
Avoiding pregnant:					
RR	6.97	0.16			
RA	6.98	0.11	0.27	0.01-0.14	0.035*
Control	6.83	0.65	0.16	0.02-0.28	0.021*
Condom use:					
RR	25.06	3.61			
RA	24.66	3.11	1.76	0.44-3.07	0.009**
Control	23.3	4.88	1.36	0.04-2.67	0.043*
Peer behavior:					
RR	24.97				
RA	24.40	1.23	2.13	1.37-2.88	0.001***
Control	22.84	1.84	1.84	0.90-2.41	0.001***
		1.66			

Note: \*p < .05; \*\*p < .01; \*\*\*p < .005

There were significant differences in posttest scores on the knowledge component (p < .001), peer norms (p < .001), perceptions of condom use (p < .05), and known peer behavior (p < .001) which is shown in Table 3 below.

**Table 3. Differences in posttest scores in the RR, RA and control groups in Denpasar City and Palangka Raya City (2015)**

Variables	Posttest (N=210 people)				
	Mean	Sd	Mean diff	95% CI	p-value
Knowledge:					
RR	8.88	1.65	0.90	0.44-1.35	
RA	9.00	1.51	1.06	0.60-1.51	0.001***
Control	7.94	1.31			0.001***
Attitude toward abstinent:					
RR					
RA	50.78	1.52	0.57	-0.01-1.4	0.052
Control	50.47	1.80	0.26	-0.32-0.83	0.381
	50.21	1.84			

**Cont... Table 3. Differences in posttest scores in the RR, RA and control groups in Denpasar City and Palangka Raya City (2015)**

Peer normative believe:					
RR	6.93	0.25	0.23	0.09-0.36	0.001***
RA	6.88	0.43			0.008**
Control	6.70	0.49	0.18	0.04-0.32	
Self efficacy:					
RR	18.63	2.60	-0.40	-1.24-0.44	0.354
RA	18.38	3.04	-0.64	-1.49-0.20	0.137
Control	19.03	1.84			
Avoiding pregnant:					
RR	6.91	0.40	0.01	-0.11-0.14	0.824
RA	7.00	0.00	0.10	-0.02-0.22	0.120
Control	6.90	0.51			
Condom use:					
RR	24.93	2.87	0.58	-0.26-1.43	0.175
RA	25.34	2.24	1.00	0.15-1.84	0.021*
Control	24.34	2.48			
Peer behavior:					
RR	25.11	1.07	1.47	0.96-1.97	0.001***
RA	24.78	1.37	1.14	0.64-1.64	0.001***
Control	23.64	1.94			

Source: Primary Analysis (2015)

Note: \*p < .05; \*\*p < .01; \*\*\*p < .005

The results obtained on the difference in differences between pretest and posttest in the RR, RA and control

intervention groups found that only attitudes supporting abstinensia and self-efficacy showed a significant relationship (p < .001). Thus, there is an increase in attitudes that support abstinensia and self-efficacy in RR, RA and control treatment on pretest or posttest, and the results are shown in Table 4 below.

**Table 4. Results of Oneway anova Analysis: The relationship between RR, RA, and Control treatment with difference change on the dependent variable (2015)**

Variables	Treatment group				Control		
	RR		RA		<i>p-value</i>		
	Mean	Sd	Mean	Sd	Mean	Sd	
Knowledge	-41.41	1.77	41.08	2.00	-40.90	2.91	0.404
Attitude toward abstinent	0.53	1.52	0.38	2.15	1.37	2.36	0.009**
Peer normative believe	0.01	0.26	0.01	0.39	-0.01	0.82	0.939
Self efficacy	2.54	4.44	1.71	4.24	5.40	5.65	0.001***
Avoiding Pregnant	-0.06	0.37	0.01	0.11	0.07	0.42	0.079
Condom use	-0.13	2.69	0.68	2.97	1.04	3.87	0.090

Note: \*p < .05; \*\*p < .01; \*\*\*p < .005

## DISCUSSION

There are difference of respondent characteristic given by program intervention in the form of RR, RA and control group especially on gender, level / class and age / age of respondent ( $p < .05$ ). According to Chin et al. (2012), that the heterogeneity of the sample is over 50% of the boundary line, thus the substantial or substantial variations of the individuals involved in the study should be tested<sup>7-11</sup>.

There are significant differences in pretest and posttest between several interventions: RR, RA and control groups in Denpasar City and Palangka Raya City, particularly in the knowledge component with  $p < .001$ , attitudes supporting abstinensia in RR interventions with  $p < .005$  and groups of control with  $p < .001$ , self-efficacy to reject premarital sex  $p < .001$ , adolescent perceptions of contraceptive / condom use in recent sex with controls  $p < .05$ , and perceptions of peer behavior in the control group ( $p < .05$ ). The highly significant difference in outcomes for knowledge, attitude, self-efficacy, perceptions of condom use and perceptions of peer behavior are the result of learning and other internal factors. Internal factors include cognitive, gender, genetic and attitude of adolescent<sup>4</sup>. The main health issues in among adolescent in the worldwide include mental health problems, early pregnancy and childbirth, HIV and sexually transmitted infection (STI) and other infectious diseases, violence, unintentional injuries, malnutrition, and substance abuse<sup>5</sup>.

There is a difference between pretest and posttest values in the RR, RA and control groups, particularly in the attitude component supporting abstinensia ( $p < .01$ ) and self-efficacy to reject premarital sex ( $p < .001$ ). These results indicate if not all the expected components change, although there is no statistically significant difference, but there appears to be an increase between pretest and posttest and gives practical meaning. Respondents' knowledge is not the main fact that affects behavior, but better knowledge can improve attitudes, perceptions of peer skills. Statistical results do not always show a direct impact on knowledge to behave<sup>1,4,7,11-13</sup>.

According to the previous study by Viner et al<sup>14</sup>, found that adolescence health affected by social factors (personal, family, community, and national levels), besides developmental effects related to puberty and brain development that leading the new sets of behaviors

and capacities. Structural factors as the strongest determinants of adolescent health in the worldwide, such as income inequality and access to education. Addressing risk and protective factors to decrease risky behavior among adolescence in the social environment at school, community and the most important is in family<sup>15-17</sup>.

## CONCLUSION

There were significant differences in the characteristics of the respondents in the RR, RA and control groups according to gender, grade / grade and age with  $p < .05$ . The pretest results of the RR and RA intervention groups differed from the control group, as did the posttest results. There was a very significant relationship between the provision of RR, RA and control group ( $p < .05$ ), attitude and self-efficacy of respondents ( $p < .005$ ). There is an increase in attitudes that support abstinensia and self-efficacy in RR, RA and control treatment in both pretest and posttest ( $p < .05$ ).

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## REFERENCES

1. Blanc, A. K. & Way AA. Sexual behavior and contraceptive knowledge and use among adolescents in developing countries. *Stud Fam Plan.* 1998;29(2):106–16.
2. Miller, B. C., Benson, B. & Galbraith KA. Family relationship and adolescent pregnancy risk: A research synthesis. *Dev Rev.* 2001;21(1):1–38.
3. Manlove, Jennifer, Ryan, S. & Franzetta K. Patterns of contraceptive use within teenagers' first sexual relationships. *Perspect Sex Reprod Health.* 2003;35(6):246–55.
4. Kirby, D., and Lepore G. Sexual risk and protective factors: factors affecting teen sexual behavior, pregnancy, childbearing and sexually transmitted disease: Which are important? Which can you

- change? Washington, DC: National Campaign to Prevent Teen Pregnancy; 2007.
5. Singh S. Adolescent childbearing in developing countries: a global review. *Stud Fam Plann.* 1998;29(2):117–36.
  6. CDC. Bringing High-Quality HIV and STD Prevention to Youth in Schools: CDC's Division of Adolescent and School Health [Internet]. 2010.
  7. Chin, H.B., Sipe, T.A., Elder, R., Mercer SL et al. The effectiveness of group-based comprehensive Risk-reduction and Abstinence Education interventions to prevent or reduce the risk of adolescent pregnancy, Human Immunodeficiency Virus, and Sexually Transmitted Infections. Two systematic reviews for the g. *Am J Prev Med.* 2012;42 (3):272–94.
  8. Zimmerman MA. Resiliency Theory: A Strengths-Based Approach to Research and Practice for Adolescent Health 1. *Heal Educ Behav.* 2013;40(3):381–3.
  9. Lucin, Y. Pengetahuan, sikap dan perilaku tentang seks pranikah terhadap pemanfaatan Pusat Informasi Konseling Kesehatan Reproduksi Remaja (PIK-KRR) pada remaja di Kota Palangkaraya. Tesis. Universitas Gadjah Mada, Yogyakarta, 2012.
  10. Weed SE. Sex education programs for schools still in question. A commentary on Meta-Analysis. *Am J Prev Med.* 2012;42(3):313–5.
  11. Amuyunzu-nyamongo M, Biddlecom AE, Ouedraogo C, Biddlecom AE, Ouedraogo C, Woog V. Qualitative Evidence on Adolescents' Views of Sexual and Reproductive Health in Sub-Saharan Africa Vanessa Woog Occasional Report No . 16. 2005.
  12. Goesling, B., Colman, S., Trenholm, C., terzian, M., Moore, K., and Trends C. Programs to reduce teen pregnancy, sexually transmitted infections, and associated sexual risk behaviors: A systematic review. United States of America; 2013.
  13. Sipe, T.A., Chin, H.B., Elder, R., Mercer, S.L., Chattopadhyay, S.K., Jacob, V. CPSTF. Methods for conducting community guide systematic reviews of evidence on effectiveness and economic efficiency of group-based behavioral interventions to prevent adolescent pregnancy, Human Immunodeficiency Virus, and other Sexually Transmitted Infections. *Am J Prev Med.* 2012;42(3):295–303.
  14. Viner, R.M., Mozer, E., Denny, S., Marmot, M., Resnick, M., Fatusi, A., and Currie, C. Adolescence and the social determinants of health. *The Lancet.* 2012; 379 (9826): 1641-1652.
  15. Birawida, A.B., Selomo, M., Mallongi, A, Potential hazards from hygiene, sanitation and bacterium of refill drinking water at Barrang Lompo island (water and food safety perspective), IOP Conference Series: Earth and Environmental Science. 2018.
  16. Mallongi, A. and Herawaty,. Assessment of Mercury Accumulation in Dry Deposition, Surface Soil and Rice Grain in Luwuk Gold Mine, Central Sulawesi. *Res. J. Appl. Sci.*, 2015: 10: 22-24.
  17. Muhammad Awal, Ridwan Amiruddin, Sukri Palutturi and Anwar Mallongi. Relationships Between Lifestyle Models with Stroke Occurrence in South Sulawesi, Indonesia. *Asian Journal of Epidemiology*, 2017: 10: 83-88. DOI: 10.3923/aje.2017.83.88

# Socio-Cultural and Behavioral Effects on the Incidence of Anemia in Pregnant Mothers

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## ABSTRACT

This study discusses deeply the effect of pregnant mother behaviors on the anemia incidence. This is a qualitative case study with a purposive sampling, located in Kendari, Southeast Sulawesi. The key informants were pregnant mothers, husbands, midwives and religion and community leaders. The results showed that pregnant mothers visited health services in the second trimester of pregnancy and they did not consume Iron tablets as they experienced side effects like nausea and others. In addition, they believe that consuming Iron tablets can enlarge the fetus and result in hard labor. The study showed that pregnant mothers were exposed to smoking from surrounding people in particular from husbands. Several pregnant mothers still believe to avoid a certain type of food such as Maranga plant, crabs and others. The behaviors such as negligence in the first trimester examination, lack of regular Iron consumption, exposure to smoking and food restrictions during pregnancy can result in anemia and a fetal death. Therefore, the government needs to improve antenatal counseling service and provide socialisation to the healthy behaviors of pregnant mothers in order to prevent anemia.

**Keywords:** *Anemia in pregnant mothers, behavior of antenatal care, Consumption iron tablets and Smoking.*

## INTRODUCTION

Lack of iron is due to deficiency of iron intake from food or poor absorption of iron in the diet. Iron deficiency is due to physiological conditions, such as high demand for iron during pregnancy, blood loss due to accident, post-surgery, menstruation, or chronic and infectious diseases. According to the World Health Organization (WHO), 40 percent of maternal deaths in developing countries are associated with anemia in pregnancy. Most of anemia in pregnancy is caused by iron deficiency and acute hemorrhage. Data from WHO in 2000 showed that the prevalence of anemia among pregnant mothers in the six WHO regions among others working in Southeast Asia the prevalence was 80 percent, in the Eastern Mediterranean 64 percent, in Europe 17 percent, and in Africa 62.7 percent. The results report progress toward achieving the Millennium Development Goals (MDGs) in 2007. Maternal Mortality Rate (MMR) in Indonesia

was still high at about 307 per 100,000 births, which was the highest in Southeast Asia, and anemia contributes to maternal mortality at 50 – 70 percent<sup>1</sup>.

A pregnant mother is one of the most vulnerable groups, especially the nutritional problems of anemia due to iron deficiency. In Indonesia, the prevalence of anemia indicates that there has been a significant decrease in the percentage of anemia in pregnant mothers, from 73.3 percent in 1986 (Survey) to 24.5 percent in 2007<sup>2</sup>.

Associated with maternal health services, the main factor responsible for AKI is the quality of antenatal care. Antenatal Care received by the mother during pregnancy. Iron supplement is one of the prevention strategies and the treatment of nutritional anemia and is the most effective. The high demand for iron during pregnancy was not easily fulfilled from food intake, especially if a low bioavailability. Therefore, it is recommended that Iron supplements, especially in developing countries which is relatively low intakes for iron, need to be given in order to tackle the problem of anemia<sup>3</sup>.

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Smoking is a risk behavior that affects adversely the pregnancy, the mother, fetus, and newborn. Smoking also inhibits the absorption of vitamin B and folic acid (vitamin B9), which plays an important role in the formation of blood<sup>4</sup>. In general it is commonly encountered their specific belief regarding pregnant mothers and an unborn child. Prohibition was usually in the form of diet with the risk which may occur in a pregnant mother. This situation was discussed in<sup>5</sup>. That it was suggested on the dietary restrictions during pregnancy and all equally instrumental in the incidence of maternal anemia pregnant in Kendari. Therefore, the analysis of the behavioral effects (ANC examinations, iron intake, and cigarette smoke exposure) pregnant mothers and social culture of the anemia is an important factor to be studied in the prevention and control of anemia in pregnant mothers in Kendari.

## MATERIALS AND METHOD

In this study, a qualitative method was used with the study case approach (case: anemia pregnant mothers). Key informants were selected by using a purposive sampling technique which is considered to be able to provide an extensive and in-depth information about the effects of behavioral and socio-cultural aspects in the expected role on the incidence of anemia.

## RESULTS

### Examination Pregnancy Antenatal Care (ANC).

From the examination of Antenatal Care, it was found the following phenomena: (1) no pregnancy examination was given to pregnant mothers before the age of three months, (2) the examination of pregnancy was first performed at the age of four to five months of pregnancy, (3) Pregnant mothers still believe "*pamali-pamali*" during pregnancy, for example pregnant mothers should stay inside home when the pregnancy is still young (4) facilities in neighborhood health center is an important determinant of pregnant mothers during their pregnancy is not for the first time (5) the use of contraceptives to be one of the factors that lead to pregnant mothers not checkup in the first trimester (6). Pregnant mothers do not know is pregnant (7) after the first visit of pregnant mothers completed through a period of cravings (8) fear of danger initial examination that causes miscarriage is the reason pregnant mothers late ante natal (9) If the health of officials find no ante natal

maternal early pregnancy, health officials directed that pregnant mothers do visit the neighborhood health center (10) pregnant mothers who visited in early pregnancy are pregnant mothers who do not experience cravings/vomiting (11) pregnant mothers who do not make a visit in early pregnancy is pregnant mothers have cravings/vomiting (12) pregnant mothers who visited the second trimester of pregnancy usually have 5-6 months of pregnancy problems such as malnutrition, including anemia.

With respect to the type of examination ANC given to pregnant mothers found some phenomena. It can be described as follows: (1) At the time comes first, pregnant mothers are directed to do next visit so that progress can be monitored infants, (2) Pregnant mothers are given drugs, vitamins and examined its contents, (3) ANC services for pregnant mothers during pregnancy according to standard antenatal care which includes 10 Q. All examinations of anemia diagnose in pregnant mothers have been carried out except laboratory examination, (4) a clinical examination of anemia usually done through examination of the conjunctiva, if conjunctival pallor then referred for examination in the laboratory hemoglobin, (5) the solution provided midwife for cases of anemia is recommended to drink milk, consumption of Moringa and potato leaves. Other therapies consumption of iron tablets per day increased from 1x1 into 1x2 per day (6) Repair diet is also one of the suggestions for anemia in pregnant mothers.

For the existence of a shaman can be seen in the following phenomena: (1) involvement shaman begins early the first trimester of pregnancy, (2) Treatment given shamans use water, blown-inflatable water use, indication hot shower, and in sequence, (3) the presumption down the content is marked as frequent urination in early pregnancy the before pregnant mothers to quack to get the sequence in the abdomen, (4) Frequent urination during the trimester one common physiological basis for the enlarged uterus and bladder presses, (5) the midwife did not recommend to the shaman in early pregnancy because it can harm the pregnancy, so massaging the stomach in early pregnancy there is no point even endanger the pregnancy because it can cause miscarriage, (6) shamans and midwives already established partnerships with shared contacts and interconnected if there patients who can not be handled by the shaman called midwife

### Compliance with iron Tablets Consumption

The results show the following phenomena; (1) Pregnant mothers do not consume iron supplementation due to the perceived effect is strained neck, uncomfortable feeling, and nausea want to vomit (2) other causes due to forgetting and unpleasant odors, (3) provision of iron tablets given in the first trimester of pregnancy if the mother does not have complaints during one trimester, if the mother had complaints (cravings) then iron supplementation was given later after passing the second trimester of pregnancy (4) on the assumption that pregnant mothers consume supplementation iron can cause the child in the womb enlarged so that pregnant mothers can not take iron tablets regularly (5) education and knowledge factor is a factor that determines compliance with the consumption of iron supplementation.

Health workers in providing information for the consumption of iron is explained some of the following: (1) health officer recommends taking each night and explain the benefits of the consumption of iron tablets (2) The health care provider explains how to consume iron supplementation that is consumed every night before bed and not water consumed with tea or coffee because it can inhibit the absorption of iron (3) health workers explain to pregnant mothers womb iron supplementation of folic acid which is useful for the formation of the fetal brain cells and the formation of red blood cells (4) health workers have also been explained impact if not consume iron supplementation that is prone to bleeding during childbirth (5) factors causing irregular consumption of iron supplementation in pregnant mothers is still low knowledge also health workers who were not optimal in counseling.

### Cigarette Smoke Exposure

It is also found in this study that: (1) pregnant mothers exposed to smoke from their husbands (2) husband Smoking behavior consciously and unconsciously done, even if the wife is pregnant (3) Pregnant mothers know the dangers of smoking for pregnancy and fetus but could not avoid exposure (4) husband know the dangers of smoking for pregnancy and fetus but still smoking around a pregnant wife because of habit (5) there are even pregnant mothers who love the smell of smoke when her husband.

Smoking behavior consciously committed by husbands when their wives are pregnant. Health workers have difficulties in providing education to the husband to pay special attention when his wife was pregnant and was involved in the attempt to rescue a pregnant mother is difficult because pregnant mothers during a visit to a health service center rarely accompanied their husbands.

### Socio-Cultural

The iron deficiency anemia can be caused directly by the abstain from certain foods while pregnant which may worsen Iron anemia. This was usually due to reluctant to eat food other vegetable or animal food for the reasons which are considered to be not rational. In addition to their views on animal foods, economic factors are also the cause of poor diet, where not all people can consume meat at every meal. On the other hand, the need for nutrition during pregnancy increases. This study found that a group of pregnant mothers were absent to Moringa plant and animal groups, stingrays, squid, crab, and octopus.

### DISCUSSION

Anemia in pregnant mothers is usually too late to detect if the mother visit to neighborhood health center in the second trimester or third trimester of pregnancy. First trimester is an important time in a woman's pregnancy. The more immediate prenatal pregnancy disorders detected faster and also more immediate precautions given. Moreover, supplementation of iron tablets should ideally be given early in pregnancy in studies<sup>6-9</sup>. In Ghana, Kenya and Malawi found that mothers who attend ANC aims to monitor the progress of their pregnancy also to check the position of the fetus. Mothers attending Ante Natal Care (ANC) of identify problems during pregnancy, to take drugs, as well as to ensure the health of the pregnancy and infant development. In addition, the initiative was first ANC visit around the sixth or seventh month of pregnancy. The provision of iron tablets to pregnant mothers has become a government program. Iron supplementation given to pregnant mother's as much as one tablet daily for 90 consecutive days during pregnancy. The provision of iron tablets is given from the beginning that in the first trimester of pregnancy if the mother is not going through cravings during pregnancy. But if mothers experience cravings future iron supplementation is given after the completion cravings usually in the second trimester of



pregnancy. Many previous studies have found the hazard of smoking where the carbon monoxide from cigarette smoke can bind to hemoglobin in the blood of pregnant mothers, the distribution of food and food supply to the fetus is interrupted, of course, these conditions are at risk for maternal health and fetal development in Mumbai India<sup>10,11</sup>.

## CONCLUSSIONS

The behavior of pregnant mothers Antenatal Care negligence examination during the first trimester such as being absence in the regularly consuming iron tablet, tarpapering cigarette smoke and various restrictions during pregnancy can result in anemia and effect fetal death. It is recommended that the government needs to continue oily improve the policies of healthy mothers and babies and to increase the counseling and socialization services in particular relating to the behavior of healthy pregnant mothers in order to prevent anemia.

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## REFFRENCES

1. Sukowati F, Red Tablet effectiveness Giving Program for Improvement of Maternal Hemoglobin with Mild Anemia. 2007.
2. Ministry of Health RI. (2008). Basic Health Research report. 2008.
3. Hadju,V.Nutritional Anemia Pregnancy prevention through Holistic Effortsin Preparing Generation Smart, Healthy and Growing Optimal. 2008.
4. Glade, C.B. Complete Guide Your Pregnancy from Sunday to Sunday, Golden Books, Yogyakarta. 2008.
5. Hartati, B. (EMIC concept Symptoms Anemia in Pregnancy (Case Studyon the Coastal Communities Puskesmas Abeli, Kendari. Scientific Journal of Public Health1(1): 2010; 2088-0928.
6. Birawida, A.B., Selomo, M., Mallongi, A , Potential hazards from hygiene, sanitation and bacterium of refill drinking water at Barrang Lompo island (water and food safety perspective), IOP Conference Series: Earth and Environmental Science. 2018.
7. Masriadi, Azis, R., Sumantri, E., Mallongi, A. Effectiveness of non pharmacologic therapy through surveillance approach to blood pressure degradation in primary hypertension patients, Indonesia. Indian Journal of Public Health Research & Development, April-June 2018, Vol.9, No. 4
8. Irwan, Anwar Mallongi,. Model of Hypertension transmission Risks to Communities in Gorontalo Province. Indian Journal of Public Health Research & Development, January 2018, Vol. 9, No. 1
9. Christopher Pell Mail, Arantza Meñaca, Florence Were, Nana A. Afrah, Samuel Chatio, Lucinda Manda-Taylor, Mary J. Hamel, Abraham Hodgson, Harry Tagbor, Linda Kalilani, Peter Ouma, Robert Pool. Factors Affecting Antenatal Care Attendance: Results from Qualitative Studies in Ghana, Kenya and Malawi, Maternal health task force (MHTF), PLOS collection on maternal health year 2. 2013.
10. Subramoney, S. and Gupta, C.P. Anemia in Pregnant Mothers Who Use Smokeless Tobacco, Nicotine & Tobacco Research. 2008. 10 (5); 1462-2203.
11. Muhammad Awal, Ridwan Amiruddin, Sukri Palutturi and Anwar Mallongi, Relationships Between Lifestyle Models with Stroke Occurrence in South Sulawesi, Indonesia. Asian Journal of Epidemiology, 2017: 10:83-88.DOI: 10.3923/aje.2017.83.88 URL: <http://scialert.net/abstract/?doi=aje.2017.83.88>.

# Characteristics of Multi-drug Resistant Tuberculosis (MDR-TB) Patients in Medan City in 2015-2016

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## ABSTRACT

Nowdays, Multi-drug Resistant Tuberculosis (MDR-TB) is increasing both at the global level and Indonesia. Indonesia is ranked the most eight of MDR-TB cases in the world, Medan City is the highest of MDR-TB patients region in North Sumatra. This study aimed to understand the characteristics of MDR-TB patients based on age, sex and residence in Medan City.

The study is a descriptive study using secondary data through the data of E-TB manager, and mapping the patient's residence. The population in this study were all MDR-TB patients in Medan City in 2015-2016 recorded in E-TB Manager as many as 133. Samples were all MDR-TB patients who underwent treatment in 2015-2016 in Medan City. Characteristic data collection based on age, sex and residence was collected through secondary data obtained from E-TB Manager data. Characteristics based on where they lived conducted by mapping with GPS on 21 subdistricts in Medan City. Data were analyzed descriptively.

The result of research that age patients generally productive category and the most aged 45-54 years as many as 30,90%, second largest aged 35-44 years counted of 19,90%. The sex of most patients were male 65,4%. Male were more disobedient to treatment (80%). Age group at most treatment defaulter was group of 45-54 years (33,4%), and the most default of treatment was in the initial phase namely the first 6 months (80%).

Based on the result of mapping of respondent's residence that could be mapped only (78,95%), this was because among other things incomplete address, address which was listed at the time of treatment at Adam Malik Hospital not according to identity card (KTP), temporary address because they lived in their children's or relatives' houses, moved without notifying at the nearest health service. It is suggested generally to the people to prevent transmission of MDR-TB, by taking treatment sensitive TB (category 1) diligently so it is not going to get worse MDR-TB. If they already have MDR-TB they have to be persistent in taking treatment for longer treatment periods, severer of side effects with greater costs, but up to now free MDR-TB financing at the hospital which has determined and for the poor people were also provided with transport funds with certain conditions. To MDR-TB patients it was suggested to provide complete address data and notify if they moved in order to facilitate monitoring them.

**Keywords** : characteristics, multi-drug resistant tuberculosis, MDR-TB, patients, mapping

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## INTRODUCTION

Currently, Multi-drug Resistant Tuberculosis (MDR-TB) is increasing both at the global level and Indonesia. Indonesia is ranked the eight most MDR-TB cases in the world. In 2016 out of 13906 suspect MDR-TB only 1589 who started treatment and 2144 were

MDR/Resistant to Rifampicin-TB<sup>1</sup>

Adam Malik Hospital which is one of the referrals of MDR-TB cases in Sumatra, has started treatment of MDR-TB cases since 2012. In 2015 suspect MDR-TB at Adam Malik Hospital were 738 cases, in 2016 increased to 1719 cases. Of the cases confirmed in 2015 only 131 cases subsequently started treatment only 123 cases (18%). In 2016 cases confirmed decreased i.e 185 cases (11%) and who started treatment as many as 177 cases.

From MDR-TB cases data at Adam Malik Hospital it was known that Medan City is the biggest cases contributor of 154 patients undergoing treatment (2016). Default rate since from 2012 were high enough that out of 13 patients underwent treatment there were 5 patients (38.5 %) were treatment defaulters, in 2013 of 62 patients underwent treatment 10 patients among them (16.1%) were treatment defaulters. In 2014 there were 125 patients underwent treatment, 12 people were treatment defaulters (9.6%). The default rate was still higher than the tolerable rate (5%).

As it was known that MDR-TB cases required long-term treatment, costly, drug side effects ranging from low to high levels. For that much it was needed perseverance treatment from patients. The results of qualitative research conducted by Mutiara and Syarifah about the Development of Compliance Model of Multi-drug Resistant Patients in the Therapeutic Program in Medan City in 2015<sup>2</sup>, indicated that the supporting factors that influenced the patients adhered treatment included patients' knowledge, officers' attitude, the desire or intention to be health. In addition family, neighboring's support, community leaders, support of health personels, workplace support and good communication. The inhibiting factors that affect patients' treatment were side effects, other diseases, poor physical condition, disease severity, non-health personels of TB treatment observers, health facilities and economic.

The results of qualitative research about The Description of Treatment Risk Factors of MDR-TB Patients at Labuang Baji Hospital Makassar City in 2013 showed that the risk factors that patients most complained were side effects, saturated in medication, and cost during treatment. Improvements should be made to the quality of TB and MDR-TB patients services in order to prevent the possibility of patients not

completing treatment<sup>3</sup>.

While research on Risk Factors of Multi-drug Resistant Tuberculosis showed that the risk factors that have been shown to affect the incidence of Multi-drug Resistant Tuberculosis were the low motivation of the patients and irregular treatment. It was required variety of supports, especially from the patients' family and environment in order to motivate MDR-TB patients that the disease could be cured and took treatment regularly<sup>4</sup>.

Similarly, studies on the identification of Multi-drug Resistant Tuberculosis (MDR-TB) risk factors showed that most patients did not take anti tuberculosis drugs (OAT) according to the correct guidance, as a risk factor from the drug. Low visits to primary health care for TB treatment as a risk factor from health program and system<sup>5</sup>.

Further research conducted at Dr. Moewardi hospital, with the number of patients confirmed MDR-TB as many as 114 patients: 56 males and 58 females. The most side effect to gastrointestinal disorders: nausea 79.8%, vomiting 78.9%. Mostly side effects were mild 76.3%. There is an association between a history of TB treatment and renal disorders, between sex and renal impairment and hearing loss<sup>6</sup>.

Due to the low number of patients starting treatment, the high number of default rates, it is necessary to conduct research to understand the characteristics of MDR-TB patients by age, sex and residence. Characteristics of age and sex were analyzed through E-TB Manager, whereas the characteristic of residence location was mapping with GPS. The importance of residence location mapping is to facilitate monitoring so there are no patients loss to follow from treatment, since initial treatment from Adam Malik Hospital until they are returned to the nearest health service to their residence. The problems are MDR-TB cases are increasing, the cases that start treatment are low, the default rate is high. This study describe characteristics of MDR-TB patients by age, sex and residence location.

## MATERIALS AND METHOD

This research was descriptive study using secondary data through E-TB manager data, and mapping of patients' residence location using GPS. The study was conducted in Medan City because the most MDR-TB cases were in North Sumatera. The population in this study were all

MDR-TB patients in Medan City in 2015-2016 recorded in E-TB Manager a total of 133. The samples were all MDR-TB patients underwent treatment in 2015-2016 in Medan City. Characteristic data collection based on age and sex were collected through secondary data obtained from E-TB Manager data. Characteristics based on where they live, it was conducted mapping with GPS on 21 Subdistricts in Medan City. Data were analyzed descriptively.

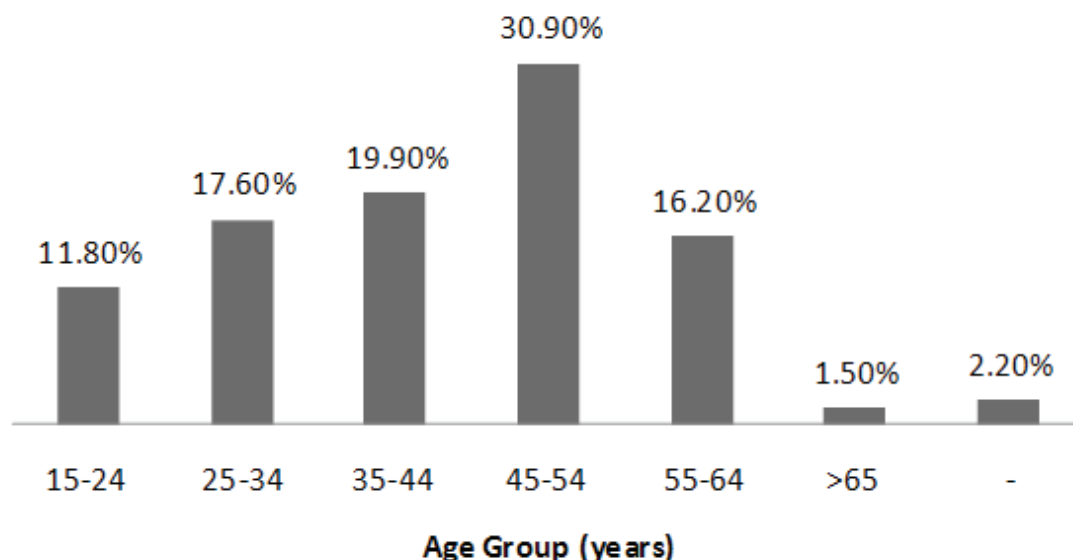
## RESULT AND DISCUSSION

### Characteristics of Patients by Age

It was known that TB cases did not consider at age, sex and social status. The results showed 133 cases of MDR-TB in Medan City, most of them were in the productive age category, although the most were 45-54

years old (30.90%), the second order were aged 35-44 years as much (19.90%). This data were similar to the previous research revealing that MDR-TB patients originated from the productive age group<sup>7,8</sup>.

This condition will have an impact on work productivity, ultimately of course impact on the economy. Economically it is estimated that if an adult TB patient, it will lose the average working time of 3 to 4 months. This condition resulted in the loss of household annual income about 20 - 30%. If he died due to TB, he would lose income about 15 years<sup>9</sup>. Thus, TB is not only an individual problem at all, but it can also affect the family as well as the incidence of poverty due to unemployment. Completely it can be seen in the following diagram:



Source: data E-TB Manager 2015-2016

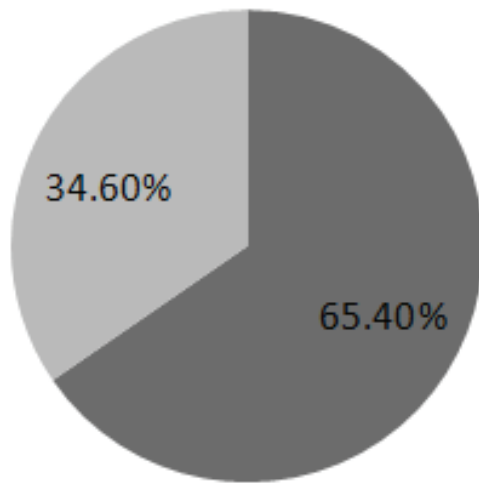
Figure 1. Percentage of MDR-TB Patients by Age Group in Medan City in 2015-2016

### Characteristic of Patients by Sex

The results showed that MDR-TB cases were mostly suffered by male compared to female. This research was not much different from previous research<sup>10</sup>. The high rates of MDR-TB in male can be explained that it was assumed to be related to epidemiological differences, exposure to the risk of infection due to lifestyle such as smoking, occupations exposed to indoor and outdoor pollutants and disease progression.

In addition, the above phenomena were thought to be related to socio-cultural aspects, including health seeking behavior, access to health services and stigma that still distinguish between the both of sexes, in which men in patrilineal society were more preferred<sup>11,12</sup>. The comparison of TB incidents by sex according to WHO is important to assess whether the diagnosis, reporting and treatment of TB in certain sex is better than the other sex. The MDR-TB patients description by sex can be seen in the following diagram:

■ Male ■ Female ■ ■



Source : data from E-TB Manager 2015/2016

**Figure 2. Percentage of MDR-TB Patients by Sex in Medan City in 2015-2016**

**Characteristics Patients by Medicine Compliance**

If the characteristics of respondents were based on the level of compliance then the male were mostly not comply (default) (80%). While the age group with the most default from treatment was a group of 45-54 years as much (33.4%). Generally, most default from treatment was in the early phase i.e the first 6 months (80%).

**Table 1. The Characteristic of MDR-TB Patients Who Comply, Default from Treatment and Died in Medan City in 2015-2016**

	Comply Patients	Defaulter Patients		Total %
	Total	2015	2016	
Total	88			
Sex				
Male	56	2	10	12 80
Female	32	0	3	3 20
Age Group (Year)				
15-24	11	1	1	2 13,3
25-34	11	0	2	2 13,3
35-44	19	1	2	3 20
45-54	29	0	5	5 33,4
55-64	16	0	3	3 20
>65	2	0	0	

**Cont... Table 1. The Characteristic of MDR-TB Patients Who Comply, Default from Treatment and Died in Medan City in 2015-2016**

Treatment Length of Time Before Default from Treatment (Months)				
0-6		2	10	12 80
7-12		0	2	2 13,3
13-24		0	1	1 6,7
>24		0	0	0
Died		8	7	15

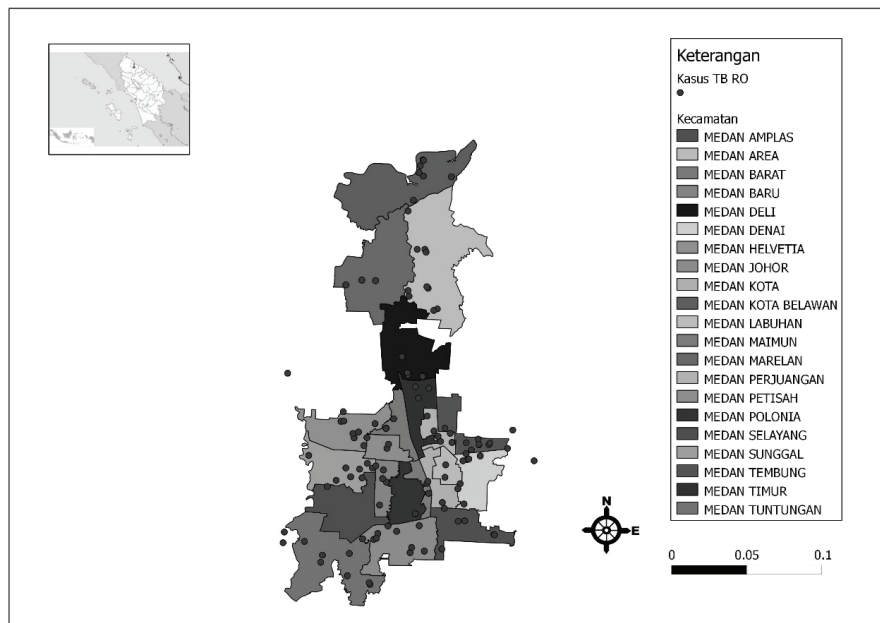
Source : data from E-TB Manager 2015/2016

**Characteristic of MDR-TB Patients by Location in Medan City**

Location is one of the important things in epidemiological studies, for that reason it was done the mapping of MDR-TB patients in Medan City. Data of MDR-TB from 2015 - 2016 in Medan City were 133 cases. Of these number, only 105 (78.95%) were able to be traced and mapped, due to incomplete addresses, the address listed at the Adam Malik Hospital did not match with the identity card (KTP), the temporary address because they lived in their children’s/relative’s house, moved to residence without notifying the nearest health service. This condition certainly resulted how difficult to

reach the patients especially patients with long therapy<sup>13</sup>.

The mapping result showed that the most cases found and mapped are in subdistricts of Medan Belawan, Medan Labuhan and Medan Tuntungan. Medan Belawan and Medan Labuhan are coastal areas where the population mostly have occupations as fishermen, besides these areas are dense and poor. There are 60,024 people in subdistricts are in poor category, the highest is in Medan City, second order is in Medan Labuhan with total poor population 50,051. While Medan Tuntungan is more characterized as the sub-urban community to the mountain area. The results of mapping that has been implemented can be seen in the following figure:



**Figure 3. Distribution of MDR-TB Cases in Medan City**

## CONCLUSION AND SUGGESTION

**Conclusion:** The result of research that age patients generally productive category and the most aged 45-54 years as many as 30,90%, second largest aged 35-44 years counted of 19,90%. The sex of most patients were male 65,4%. Male were more disobedient to treatment (80%). Age group at most treatment defaulter was group of 45-54 years (33,4%), and the most default of treatment was in the initial phase namely the first 6 months (80%).

Based on the result of mapping of respondent's residence that could be mapped only (78,95%), this was because among other things incomplete address, address which was listed at the time of treatment at Adam Malik Hospital not according to identity card (KTP), temporary address because they lived in their children's or relatives' houses, moved without notifying at the nearest health service.

**Suggestion:** It is suggested generally to the people to prevent transmission of MDR-TB, by taking treatment sensitive TB (category 1) diligently so it is not going to get worse MDR-TB. If they already have MDR-TB they have to be persistent in taking treatment for longer treatment periods, severer of side effects with greater costs, but up to now free MDR-TB financing at the hospital which has determined and for the poor people were also provided with transport funds with certain conditions.

To MDR-TB patients it is suggested to provide complete address data and notify if they moved in order to facilitate monitoring them.

**Conflict of Interest:** Authors declare that there is no conflict of interest within this research and publication paper

**Ethical Clearence :** Research has obtained approval from Universitas Sumatera Utara

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## REFERENCES

1. Ministry of Health RI. Directorate General of Disease Control and Environmental Health, DG of Disease Control and Environmental Health, Ministry of Health (Kemenkes RI). National guidelines for tuberculosis control. 2011, 3(7):112
2. Erna M, Syarifah. Development of Compliance Model of Drug Resistance Patients in a Therapeutic Program in Medan City. Research Report. Field. 2015.
3. Munawwarah, Rifaah, et al., Overview of Risk Factors for Treatment of MDR-TB Patients at Labuang Baji Hospital in Makassar City 2013. Retrieved May 15, 2016. <http://repository.unhas.ac.id/bitstream/handle/123456789/5530/JURNAL.pdf?Sequence=1>
4. Reviono, et al. Multidrug Resistant Tuberculosis (MDR-TB): Overview of Epidemiology and Risk Factors Side Effects of Anti Tuberculosis Drugs. Retrieved May 26, 2016. [http://download.portalgaruda.org/article.php?article=324091&val=4804&title=Multidrug%20Resistant%20Tuberculosis%20\(MDR-TB\):%20Tinjauan%20Epidemiologi%20dan%20Faktor%20Risiko%20Efek%20Samping%20Obat%20Anti%20Tuberkulosis](http://download.portalgaruda.org/article.php?article=324091&val=4804&title=Multidrug%20Resistant%20Tuberculosis%20(MDR-TB):%20Tinjauan%20Epidemiologi%20dan%20Faktor%20Risiko%20Efek%20Samping%20Obat%20Anti%20Tuberkulosis).
5. Nofizar, D., et al. Identify Risk Factors of Multidrug Resistant Tuberculosis (MDR-TB). Indonesian Medical Magazine Retrieved May 26, 2016.
6. SR, Dwi Sarwani, et al. Risk Factors Multidrug Resistant Tuberculosis (MDR-TB). Journal of Public Health Vol.8 No.1. Retrieved May 26, 2016. [http://journal.unnes.ac.id/artikel\\_nju/pdf/kemas/2260/2697](http://journal.unnes.ac.id/artikel_nju/pdf/kemas/2260/2697).
7. Hermantoputra, Steven. Karakteristik Pasien Tuberculosis Multi Drug Resistance In Surabaya City, 2009-2013. Thesis Widya Mandala Catholic University Surabaya. 2014
8. Surya, Prima Kemala Gusti. Characteristics of Patients with Pulmonary Tuberculosis With Drug Resistance in MDR Polyclinic TB RSUD Dr Achmad Mochtar Bukittinggi Period October 2013 - July 2015, Thesis of Andalas University. 2016.
9. Lienhardt C, Fielding K, Sillah JS, et al. Investigation of the risk factors for tuberculosis: a case – control study in three countries in West Africa. International Journal of Epidemiology Aug 2005;34(4):914-23.
10. Allotey P, Gyapong M. Gender in tuberculosis research. Int J Tuberc Lung Dis. 2008, 07;12(7):831-6.
11. Ganapathy S, Thomas BE, Jawahar MS, et al., Perceptions of gender and tuberculosis in a South

- Indian urban community. *Indian J Tuberc.* 2008 Jan;55(1):9-14.
12. Masriadi Idrus, Anwar Mallongi and Juliani Ibrahim. Surveillance system model for pulmonary tuberculosis suspected in Pangkep region, Indonesia. *Curr. Res. Tuberculosis*, 2017; 9: 1-7.
  13. Syafri Kamsul Arif, Imtihanah Amri and Anwar Mallongi, Comparison between the effect of the intravenous dexmedetomidine with fentanyl propofol induction dose requirement and the hemodynamic response due to laryngoscopy and tracheal intubation. *Am. J. Drug Discov. Dev.*, 2017. 7: 39-47.



# Evidence of *Rickettsia typhi* in Rat fleas of Various Habitat and the Potential Transmission of Murine Typhus in Banjarnegara, Central Java, Indonesia

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## ABSTRACT

Murine typhus is a zoonotic infectious disease caused by *Rickettsia typhi*, whose transmission is carried out by rat fleas. The climatic and ecologic conditions in Banjarnegara is favorable for maintaining reservoirs and vectors of murine typhus. There has been no report about the occurrence of *R. typhi* in rat fleas. Therefore, we investigated the role of fleas as possible vector of murine typhus in Banjarnegara. During September to Nopember 2017, flea were collected from rats trapping of various habitat in Banjarnegara. Fleas preserved in 70% ethanol were eventually prepared onto slides for identification. Fleas of the same species were pooled by species of small mammal and habitat and then preserved in sodium chloride store at -20°C until evaluated for the presence of *Rickettsia typhi* by polymerase chain reaction. Two flea species were identified: *Xenopsylla cheopis* and *Stivalius cognatus*. *Stivalius cognatus* was collected from *R. exulans* and *R. tiomanicus*. *Rickettsia* spp. was detected in *X. cheopis* (45/88) and *S. cognatus* (3/11). The highest minimum infection rate of *R. typhi* was seen in *X. cheopis* infesting *R. tanezumi* in Kutabanjarnegara village (103.8). The presence of *R. typhi* in *X. cheopis* at residential area of Banjarnegara needs serious attention, as a form of awareness of disease transmission, especially murine typhus.

**Keywords:** *Rickettsia typhi*, rats, fleas, murine typhus, Banjarnegara

## INTRODUCTION

Murine typhus is an acute fever disease caused by *Rickettsia typhi*. The pathogen is maintained in nature by a cycle involving vertebrate hosts and their ectoparasites. The classic cycle of murine typhus involves rats (*Rattus norvegicus* and *R. rattus*) as reservoirs, and their fleas; the oriental rat flea *Xenopsylla cheopis* is the main vector.<sup>1</sup> This suggests that although infection has not yet been reported in humans, *R. typhi* have been detected in rat flea as reported by Joharina *et al.*<sup>2</sup> and Barbara *et al.*<sup>3</sup> The fleas get the infection from rats with rickettsemia maintaining the infection during all his life.<sup>4</sup> Humans

become infected when they visit disease endemic areas infested with rats and acquire infection by inhalation or by self-inoculating infected fleas or flea feces into skin.<sup>5</sup>

Murine typhus is distributed throughout the world, especially in tropical and temperate countries.<sup>6</sup> Indonesia was reported as an endemic murine typhus area.<sup>7</sup> Seroprevalence of *R. typhi* infection has been reported in Jakarta (6.5%),<sup>8</sup> Northern Lampung (29%),<sup>9</sup> Malang (34.7%),<sup>10</sup> Gag Island in Papua (2.1%)<sup>11</sup> and Semarang City (24.04%).<sup>12</sup>

Transmission of zoonotic rickettsiosis can occur in all areas including Banjarnegara District. There has been no report about the occurrence of murine typhus in there. Banjarnegara is a regency in the southwestern part of Central Java province in Indonesia, in which climatic and ecologic conditions are favorable for maintaining reservoirs and vectors of murine typhus.

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The high rat population density in Banjarnegara also contributed to murine typhus transmission. The trap success of rodent trapping indoor that have been reported in Argasoka was 10.5% and Kutabanjarnegara was 6%.<sup>13</sup> Another study showed that from a total of 147 trapped rats, 22.4% were caught indoor; 8.2% in garden; 7.5% in wetland; and 61.9% in traditional market.<sup>14</sup> The trap success index in indoors more than 7% and outdoors over 2% indicates that the relative density of rats is high.<sup>15</sup> *Rickettsia* infection in rodent flea has not been reported. Therefore, a study was conducted to investigate the role of fleas as possible vector of murine typhus.

## MATERIALS AND METHOD

**Sample collection and flea identification.** A total of 374 fleas were collected from rat trapping in several areas of Banjarnegara in September to November 2017. Study sites were located in Kutabanjarnegara (at 308-318 m, domestic and peridomestic areas), Kepakisan (at 1797-1831 m, domestic peridomestic and semi-silvatic area), Petambakan (at 305-329 m, peridomestic areas), Kendaga (at 654-730 m, semi-silvatic area).

Five percent of collected fleas (19 specimens) preserved in 70% ethanol were eventually prepared onto slides<sup>16</sup> and identified according to previously described identification keys (Traub<sup>17</sup>, CDC<sup>18</sup>, Hopkins and Rothschild<sup>19</sup>). For molecular testing, fleas were pooled per flea species, host species and host habitat (maximum

10 specimens per vial) and preserved in sodium chloride, store at -20°C before DNA extraction. Fleas were grouped into 99 pools (88 pools for *X. cheopis* and 11 pools for *S. cognatus*).

**Detection of *Rickettsia* in flea pools.** Extracted DNA of flea pools was screened with a *Rickettsia* genus by PCR assay. Amplification was conducted using a pair of primer forward (*RpCS877p*) and reverse (*RpCS1258n*) with targeted DNA band at 381-bp.<sup>20</sup> DNA amplification was done in thermal cycler with the following cycling conditions as described previously.<sup>2</sup>

To confirm *R. typhi* positive PCR results, a second PCR assay was conducted with the primer pair forward (Primer 1) and reverse (Primer 2) with targeted DNA band at 434-bp.<sup>21</sup> PCR was performed in thermal cycler with the following cycling conditions as described previously.<sup>12</sup>

**Data analysis.** The infection rate of *R. typhi* in rat fleas was calculated using the formula of minimum infection rate [(number of positive tools/total specimens tested)x1000].<sup>22</sup>

## RESULTS

Oriental rat flea, *X. cheopis*, was identified on the *R. tanezumi* and *R. norvegicus*. This species was found in domestic and peridomestic area. *Stivalius cognatus* only infest on the semi-silvatic rats (Table 1).

**Table 1. Flea species collected from rats in various habitat in Banjarnegara**

Flea species	No. flea specimens identified	Sex	Host	Host habitat
<i>X. cheopis</i>	6	female	<i>R. tanezumi</i>	domestic
	9	male	<i>R. tanezumi</i> , <i>R. norvegicus</i>	
	1	female	<i>R. tanezumi</i>	peridomestic
	1	male	<i>R. tanezumi</i>	
<i>S. cognatus</i>	1	female	<i>R. tiomanicus</i>	semi-silvatic
	1	female	<i>R. exulans</i>	semi-silvatic

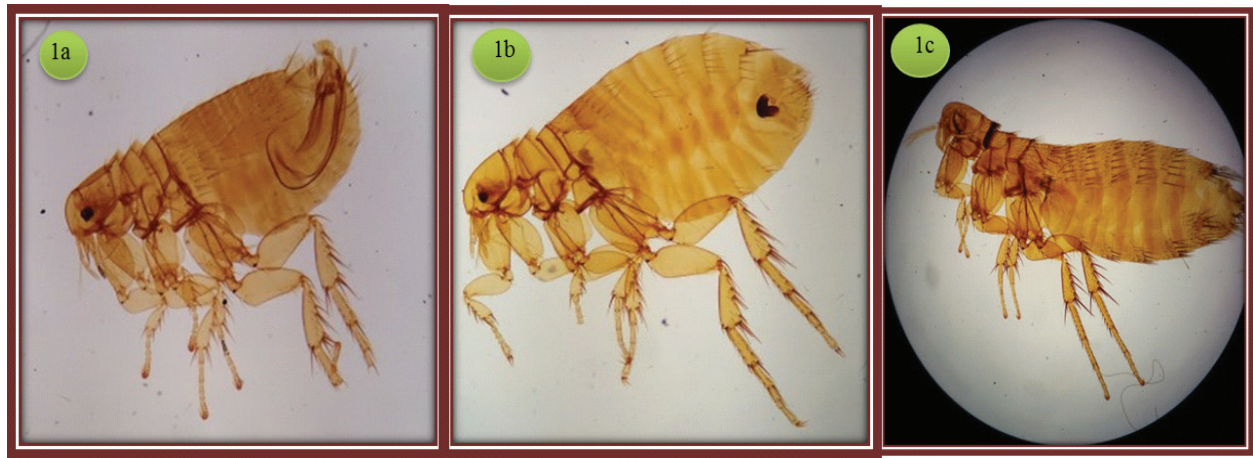


Figure 1. Male *X. cheopis* (a); female *X. cheopis* (b); female *S. cognatus* (c)<sup>23</sup>

Proportion of *Rickettsia* spp. were higher in *X. cheopis* infesting *R. tanezumi* in Kutabanjarnegara Village (39/65). *Rickettsia* spp. was also detected in *S. cognatus* (Table 2). Strong positive PCR amplifications were obtained in 48 flea pools with DNA band specific for *Rickettsia* spp. at 381 bp .

Table 2. Proportion of *Rickettsia* spp. in rat fleas from three habitat types in Banjarnegara

Location	Flea species	Host	Host habitat	No. tested (pool*)	No. positive (pool)	Proportion
Kutabanjarnegara	<i>X. cheopis</i>	<i>R. tanezumi</i>	domestic	65	38	38/65
		<i>R. tanezumi</i>	peridomestic	5	3	3/5
		<i>B. indica</i>	peridomestic	1	1	1/1
		<i>R. tiomanicus</i>	peridomestic	4	1	1/4
		<i>R. norvegicus</i>	peridomestic	2	1	1/2
Kepakisan	<i>X. cheopis</i>	<i>R. tanezumi</i>	domestic	10	1	1/10
		<i>R. tanezumi</i>	peridomestic	1	0	0
	<i>N. fasciatus</i>	<i>R. exulans</i>	semi-silvatic	9	2	2/9
Kendaga	<i>N. fasciatus</i>	<i>R. tiomanicus</i>	semi-silvatic	2	1	1/2

The highest minimum infection rate of *R. typhi* was seen in *X. cheopis* infesting *R. tanezumi* in Kutabanjarnegara Village (Table 3). Strong positive PCR amplifications were obtained in 29 *X. cheopis* pools. DNA band specific for *R. typhi*.

Table 3. Minimum Infection Rates of *R. typhi* in flea pools in Banjarnegara

Location	Rat flea	Host species	Host habitat	No. of flea pools	Total no. of flea	No. positive pools	MIR/1000
Kutabanjarnegara	<i>X. cheopis</i>	<i>R. tanezumi</i>	domestic	65	260	27	103.8
		<i>R. tanezumi</i>	peridomestic	5	26	1	38.5
		<i>B. indica</i>	peridomestic	1	1	0	0
		<i>R. tiomanicus</i>	peridomestic	4	6	0	0
		<i>R. norvegicus</i>	peridomestic	2	4	0	0
Kepakisan	<i>X. cheopis</i>	<i>R. tanezumi</i>	domestic	10	32	1	31.3
		<i>R. tanezumi</i>	peridomestic	1	7	0	0
	<i>N. fasciatus</i>	<i>R. exulans</i>	semi-silvatic	9	16	0	0
Kendaga	<i>N. fasciatus</i>	<i>R. tiomanicus</i>	semi-silvatic	2	3	0	0

## DISCUSSION

*Xenopsylla cheopis* and *S. cognatus* were identified in this study. *Xenopsylla cheopis* is the most common ectoparasite infesting rats in tropical regions. This flea was found on *R. tanezumi* and *R. norvegicus* in this study. This is in accordance with other studies that showed similar results in Java, Sumatra, and Sukhotai Province, Thailand that *R. tanezumi*, *R. norvegicus*, *R. exulans*, and *Bandicota indica* were the host of this flea.<sup>16,24</sup>

*Stivalius cognatus* was collected from semi-silvatic rats (*R. exulans* and *R. tiomanicus*) in areas with elevation 654-730 m and 1797-1831 m. Williams *et al.* had found *S. cognatus* on *R. tanezumi*, *R. exulans*, *R. tiomanicus* and *R. niviventer* in Boyolali, Central Java, Indonesia.<sup>25</sup> *Stivalius cognatus* were often founded from peridomestic and silvatic rats in areas over 800 m.<sup>26</sup> *Stivalius cognatus* had a high density among the peridomestic and campestral rats.<sup>27</sup>

*Xenopsylla cheopis* is the main vector of murine typhus.<sup>28</sup> *Rickettsia typhi* in this study was detected in *X. cheopis* with the highest minimum infection rate was seen in *X. cheopis* infesting *R. tanezumi*. Accordingly, murine typhus more prevalent in urban area because the presence of rats and their fleas within indoor urban environments.<sup>29</sup> Similar result also reported that *X. cheopis* infected by *R. typhi* in Thailand with prevalence 2,6%,<sup>30</sup> 4% in Cyprus, Middle East,<sup>1</sup> 1% in Benin,<sup>31</sup> 72% (pool) in Kisangani, Kongo,<sup>32</sup> 1,9% in Hawaii,<sup>5</sup> and among the trapped rats and mice in Semarang Port, Kupang Port dan Maumere Port.<sup>2</sup>

*Rickettsia typhi* is an obligate intracellular gram-negative organisms which can infects the midgut epithelium of the flea and is shed in the feces, where it is transmitted to humans by the inoculation of *R. typhi*-infected flea feces or mucous membranes.<sup>33</sup> The fleas acquire the infection from rats with rickettsemia during haematophagus activity.<sup>4</sup> The fleas can become infectious approximately 10 days after acquiring infection. *R. typhi* seems to cause little damage to its flea vector, as indicated by the fact that fleas become infected for life and yet do not appear to suffer significant decreases in longevity or reproductive output.<sup>34</sup> Other transmission way includes inhalation of flea infected feces when the hygienic conditions are inapropiated.<sup>4,33</sup> *Rickettsia typhi* can remain infectious in dried flea feces for  $\geq 100$  days.<sup>6,37</sup>

Contact between humans and rats did not play significant role in *R. typhi* transmission because *X. cheopis* can survive in the environment when they did not find a host. Moreover *X. cheopis* have strongly developed hind legs that permit them to jump up to 150 times their own body legth. This behaviour would assist them in host seeking for haematophagus activity.<sup>35</sup> Humans should also be aware that flea may be transmit *R. typhi* transovarially to their progeny. This has been studied by Farhang-Azad on a laboratory scale.<sup>36</sup> This is possible under limited environmental conditions, *Rickettsia* can still live despite its low survival. Moreover, the rapid spread of flea-borne pathogens to human populations is caused by the frequent feeding behavior and extraordinary mobility of fleas, and the abundance of cosmopolitan rat species, that once were infected by *R. typhi*.<sup>37</sup>

The presence of *R. typhi* in *X. cheopis*, in Banjarnegara district is a warning to people to be more vigilant against the transmission of murine typhus. Data about this disease has not been reported. Therefore, screening of undifferentiated acute fever patients (AUF) needs to be done. A study conducted at Dr. Kariadi Hospital in Semarang reported that 9 patients (7%) of 137 examined AUF patients, were infected with *R. typhi*. Another study found 70% of AUF patients at temporary shelters on the Thai-Cambodia border were diagnosed with murine typhus.<sup>28</sup>

## CONCLUSION

The presence of *R. typhi* in *X. cheopis* in residential area of Banjarnegara needs serious attention, as a form of awareness of disease transmission, especially murine typhus. Additional studies are needed to investigate murine typhus among the patient with acute undifferentiated fever at level of primary health care and hospital.

**Ethics approval:** The study protocol was approved by Medical and Health Research Ethics Committee of Faculty of Medicine Gadjah Mada University.

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## REFERENCES

- Christou, C., Psaroulaki, A., Antoniou, M., Toumazos, P., Ioannou, I. Rickettsia typhi and Rickettsia felis in Xenopsylla cheopis and Leptopsylla segnis parasitizing rats in Cyprus. *Am J Trop Med Hyg.* 2010;83(6):1301-1304.
- Joharina, A.S., Mulyono, A., Sari, T.F., Rahardianingtyas, E., Bagus, D., Putro, W., Pracoyo, N.E. Rickettsia pada pinjal tikus (Xenopsylla cheopis) di daerah Pelabuhan Semarang, Kupang dan Maumere. *Bul Penelit Kesehat.* 2016;44(4):237-244.
- Barbara, K.A., Farzeli, A., Ibrahim, I.N., Antonjaya, U., Yunianto, A., Winoto, I., et al. Rickettsial infections of fleas collected from small mammals on four islands in Indonesia. *J Med Entomol.* 2010;47(6):1173-1178.
- Peniche Lara G., Dzul-Rosado K.R., Zavala Velázquez J.E., Zavala-Castro J. Murine typhus: clinical and epidemiological aspects. *Colomb Med.* 2012;43(2):175-180.
- Eremeeva, M.E., Warashina, W.R., Sturgeon, M.M., Buchholz, A.E., Olmsted, G.K., Park, S.Y., et al. Rickettsia typhi and R. felis in rat fleas (Xenopsylla cheopis), Oahu, Hawaii. *Emerg Infect Dis.* 2008;14(10):1613-1616. doi:10.3201/eid1410.080571.
- Aung, A.K., Spelman, D.W., Murray, R.J., Graves, S. Rickettsial infections in Southeast Asia: implications for local populace and febrile returned travelers. *Am J Trop Med Hyg.* 2014;91(3):451-460.
- Richards, A.L., Rahardjo, E., Soeatmadji, D.W. Rickettsial disease: risk for Indonesia. *Bul Penelit Kesehat.* 1995;23(3):78-89.
- Dennis, D., Hadi, T., Brown, R., Sukaeri, S., Leksana, B., Cholid, R. A survey of scrub and murine typhus in the Ancol section of Jakarta, Indonesia. *Southeast Asian J Trop Med Public Heal.* 1981;12(4):574-580.
- Hadi, T.R., Supalin, Annie, C. A survey of murine typhus in Mulyorejo Village, Way Abung III transmigrasi scheme, Lampung Utara, Sumatera, Indonesia. *Bul Penelit Kesehat.* 1986;14(3):1-3.
- Richards, A., Soeatmadji, D., Widodo, M., Sardjono, T., Yanuwadi, B., Hernowati, T., et al. Seroepidemiologic evidence for murine and scrub typhus in Malang, Indonesia. *Am J Trop Med Hyg.* 1997;57(1):91-95.
- Richards, A.L., Ratiwayanto, S., Rahardjo, E.K.O., Kelly, D.J., Dasch, G.A., Fryauff, D.J., Bangs, M.J. Serologic evidence of infection with ehrlichiae and spotted fever group rickettsiae among residents of Gag Island, Indonesia. *Am J Trop Med Hyg.* 2003;68(4):480-484.
- Widiastuti, D., Sunaryo, Djati, A.P., Kesuma, A.P. Faktor Risiko Infeksi Murine Typhus Di Kota Semarang. Laporan Penelitian. Balai Litbang P2B2 Banjarnegara, Banjarnegara, 2017.
- Widayan, H.A., Susilowati, S. Identifikasi tikus dan cecurut di Kelurahan Argasoka dan Kutabanjarnegara Kecamatan Banjarnegara Kabupaten Banjarnegara tahun 2014. *BALABA.* 2014;10(1):27-30.
- Priyanto, D., Ningsih, D.P. Identification of endoparasites in rats of various habitats. *Health Science Indones.* 2014;5(1):49-53.
- Hadi, T., Ima, N., Ristiyanto, Nina, N. Jenis-jenis ektoparasit pada tikus di Pelabuhan Tanjung Mas Semarang. *Proceeding Seminar Biologi VII. Pandaan Jawa Timur;* 1991.
- Ristiyanto, Handayani, F.D., Boewono, D.T., Heriyanto, B. *Penyakit Tular Rodensia.* Gadjah Mada University Press, Yogyakarta, 2014.
- Traub, R., 1972. The Gunong Benom expedition, 1967, II: notes on zoogeography, convergent evolution, and taxonomy of fleas (Siphonaptera), based on collections from Gunong Benom and elsewhere in South-East Asia, I: new Taxa (Pygiopsyllidae: Pygiopsyllinae). *Bulletin of the British Museum (Natural History), Zoology.* 1972;23(9):201-305.
- CDC. *Pictorial Keys to Anthropods, Reptiles, Birds, and Mammals of Public Health Significance.* Atlanta, Georgia, 1946.
- Hopkins G, Rothschild M. *An Illustrated Catalogue of the Rothschild Collection of Fleas (Siphonaptera) in the British Museum, Volume I Tungidae and Pulicidae.* The Trustees of the British Museum, London, 1953.

20. Regnery, R.L., Spruill, C.L., Plikaytis, B.D. Genotypic identification of *Rickettsiae* and estimation of intraspecies sequence divergence for portions of two *Rickettsial* genes. *J Bacteriol.* 1991;173(5):1576-1589.
21. Webb, L., Carl, M., Malloy, D.C., Dasch, G.A., Azad, A.F. Detection of murine typhus infection in fleas using polymerase chain reaction. *J Clin Microbiol.* 1990;28(3):530-534.
22. Moncayo, A.C., Cohen, S.B., Fritzen, C.M., Huang, E., Yabsley, M. J., Freye, J.D., et al. Absence of *Rickettsia rickettsii* and occurrence of other Spotted Fever Group *Rickettsiae* in ticks from Tennessee. *Am J Trop Med Hyg.* 2010;83(3):653-657. doi:10.4269/ajtmh.2010.09-0197.
23. Pramestuti N. Deteksi *Rickettsia* pada bahan tersimpan ektoparasit tikus sebagai kewaspadaan dini potensi penularan rickettsiosis di Kabupaten Banjarnegara. Tesis. Program Pascasarjana, Fakultas Kedokteran, Kesehatan Masyarakat dan Keperawatan, Universitas Gadjah Mada, 2018.
24. Changbunjong, T., Weluwanarak, T., Chamsai, T., Sedwisai, P., Ngamloephochit, S., Suwanpakdee, S., et al. Occurrence of ectoparasites on rodents in Sukhothai province, Northern Thailand. *Southeast Asian J Trop Med Public Health.* 2010;41(6):1324-1330.
25. Williams J.E., Hudson B.W., Turner R.W., Saroso J.S., Cavanaugh D.C. Plague in Central Java, Indonesia. *Bull World Health Organ.* 1980;58(3):459-468.
26. Turner R.W., Padmowirjono S., Martoprawiro S. Dynamics of the plague transmission cycle in Central Java (ecology of mammalian hosts with special reference to *Rattus exulans*). *Bull Penelit Kesehat.* 1975;3:41-71.
27. Liat L, Sustriayu N, Hadi T, Bang Y. A study of small mammals in the Ciloto field station area, West Java, Indonesia, with special reference to vectors of plague and scrub typhus. *Southeast Asian J Trop Med Public Heal.* 1980;11(1):71-80.
28. Mahajan S.K. *Rickettsial diseases.* JAPY. 2012;60:37-60.
29. Merhej V., Angelakis E., Socolovschi C., Raoult D. Infection, genetics and evolution genotyping, evolution and epidemiological findings of *Rickettsia* species. *Infect Genet Evol.* 2014;25:122-137.
30. Chareonviriyaphap, T., Leepitakrat, W., Lerdthusnee, K., Chao, C.C., Ching, W.M. Dual exposure of *Rickettsia typhi* and *Orientia tsutsugamushi* in the field-collected *Rattus* rodents from Thailand. *J Vector Ecol.* 2014;39(1):182-189.
31. Leulmi, H., Socolovschi, C., Laudisoit, A., Houemenou, G., Davoust, B., Bitam, I., et al. Detection of *Rickettsia felis*, *Rickettsia typhi*, *Bartonella* Species and *Yersinia pestis* in fleas (Siphonaptera) from Africa. *PLoS Negl Trop Dis.* 2014;8(10):e3152.
32. Laudisoit, A., Falay, D., Amundala, N., Akaibe, D., de Bellocq, J.G., Houtte, N.V., et al. High prevalence of *Rickettsia typhi* and *Bartonella* Species in rats and fleas, Kisangani, Democratic Republic of the Congo. *Am J Trop Med Hyg.* 2014;90(3):463-468. doi:10.4269/ajtmh.13-0216.
33. Blanton, L.S., Walker, D.H. Flea-borne rickettsioses and *Rickettsiae*. *Am J Trop Med Hyg.* 2017;96(1):53-56. doi:10.4269/ajtmh.16-0537.
34. Eisen, R.J., Gage, K.L. Transmission of flea-borne zoonotic agents. *Annu Rev Entomol.* 2012;57(1):61-82.
35. Bitam, I., Dittmar, K., Parola, P., Whiting, M.F., Raoult, D. Fleas and flea-borne diseases. *Int J Infect Dis.* 2010;14(8):e667-e676.
36. Farhang-Azad, A., Traub, R., Baqar, S. Transovarial transmission of murine typhus *Rickettsiae*. *Science.* 1985;227(4686):543-545.
37. Azad A. Epidemiology of murine typhus. *Annu Rev Entomol.* 1990;35:553-569.
38. Birawida, A.B., Selomo, M., Mallongi, A, 2018. Potential hazards from hygiene, sanitation and bacterium of refill drinking water at Barrang Lompo island (water and food safety perspective), IOP Conference Series: Earth and Environmental Science.

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