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RESEARCH ARTICLES

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Global Medical & Health Communication (GMHC) is a journal that publishes medical and health scientific articles published every 4 (four) months. Articles are original research that needs to be disseminated and written in English.

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Table title is the typed center, font size 10 pt, bold, initial letter of each word written with capital letter, except conjunctions. The titles are numbered and written on top of the table. Example: Table 3 *Neisseria gonorrhoeae* Resistance to 8 Types of Antimicrobials in 20 Specimens. Table, no vertical dividing line, and there are only three horizontal borderlines. Created tables in sequence two spaces from the text. Table descriptions and abbreviations are placed in the table description, not on the table title.

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Pictures (graphs, diagrams, and photos) and tables besides written in its place, also created separately on other pages of texts with sufficient sharpness and blackness. A maximum number of tables and or images are six pieces. Photos are sent in black and white glossy, or colored format when required, minimum size 3R (9×13.5 cm). Images and photos can also be sent on CD.

Write correspondence as the footnote on the first page containing the full name of the author with degrees/academic degrees, institution, address, phone number, fax, mobile, and e-mail.

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The article contains results of original research in the field of basic medical or applied, and health. The article format consists of Title & Abstract (English) and *Judul* & *Abstrak* (Indonesian), Introduction, Methods, Results, Discussion, Conclusion(s), Conflict of Interest, Acknowledgments, and References.

Articles Title

Maximum article title consists of 12 words (choose words and terms that are dense meaning and able to characterize the entire contents of the script). Typed with bold fonts, size 12 pt, one space, the initial letter of each word is written in capital letters (except the conjunctive), and center. The ownership row consists of 2 elements, the author name and origin institution. Author's name written with the initial fonts are capital and bold, size 11 pt, one space, and center. Institution name written with the initial fonts are capital, size 10 pt, one space, and center.

Abstract

The abstract is typed using 12 pt font size and one spaces. The abstract is written in one paragraph, one space, maximum 250 words, and should describes the entire contents of the article. The abstract should be suitable for the format of introduction, methods (contain method, place, and time of study), results, and discussion. Abstract be equipped with keywords consisting of 3–5 words.

Introduction

The introduction is written succinctly to stimulate the reader's interest include all the necessary information. At the end of the introduction was written the purpose of the study.

Methods

Methods contains the material under study, and the way described briefly by the order of operation as well as the location and time of the study. Explain statistical methods in detail. Consideration of ethical issues is included. If the protocol has been approved then the ethical clearance/approval letter number and the health research ethics committee must be written.

Results

The result is the core of scientific writing. This section

presents data and information that will be used as the basis of the conclusion and even expected to get a new theory. In results, listed the tables and or images, graphics, photos to explain and abbreviate the description should be given; numbered according to their appearance in the text. Results of the study and discussion should be written separately.

Discussion
Discussion of the article reveals, explains, and discusses the results of the study with an analysis by the research design, interpretation, and explanation of its synthesis. Also, the results obtained are compared with the results of previous research of others.

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The conclusion is submitted by the results obtained by the researcher and written briefly and clearly in two or three sentences.

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All authors must make a formal statement at the time of submission indicating any potential conflict of interest that might constitute an embarrassment to any of the authors if it were not to be declared and were to emerge after publication. Such conflicts might include, but are not limited to, shareholding in or receipt of a grant or consultancy fee from a company whose product features in the submitted manuscript or which manufactures a competing product.

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Zhang B, Kunde D, Tristram S. Haemophilus haemolyticus is infrequently misidentified as Haemophilus influenzae in diagnostic specimens in Australia. Diagn Microbiol Infect Dis. 2014;80(4):272–3.

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Editor as Author
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Organization as Author
World Health Organization. Guideline: neonatal vitamin A supplementation. Geneva: WHO Press; 2011.

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Conference Proceeding
Nicholai T. Homeopathy. Proceedings of the Workshop Alternative Medicines; 2011 November 30; Brussels Belgium. Belgium: ENVI; 2011.

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King P. Haemophilus influenzae and the lung (Haemophilus and the lung). Clin Transl Med. 2012;1:10 [cited 2015 August 15]. Available from: https://clintransmed.springeropen.com/articles/10.1186/2001-1326-1-10.

Authors
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RESEARCH ARTICLE

The Differences in Maternal Compliance in Completing Basic Immunization between Two Groups

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Abstract

Immunization programs are implemented in Indonesia since 1956. Although the government has established a complete basic immunization program for infants aged 0–12 months, there are still more than 1.4 million child deaths in the world each year due to various infectious diseases. The diseases can be prevented by immunization. Low basic immunization coverage in infants is related to parental non-compliance in fulfilling primary immunization. The purpose of this study was to measure the differences in maternal compliance in completing basic immunization in two groups. Samples are a group of mothers provided with Maternal Child Health (MCH) book and special booklet, and another group provided with MCH book only. This study used a quasi-experiment design with quantitative methods with a sample of 76 respondents chosen by simple random sampling—this research conducted in August–October 2017 in Pir Batee Puteh Health Center, West Woyla district. The results indicate that there were differences in maternal compliance in completing basic immunization in mothers with MCH book and special booklet to mothers with only MCH book. Immunization health education interventions based on the MCH book and special booklet can improve the mother's compliance in completing the baby's basic immunization.

Keywords: Booklet, compliance, MCH book

Perbedaan Kepatuhan Ibu dalam Melengkapi Imunisasi Dasar antara Dua Kelompok

Abstrak

Program imunisasi mulai dilaksanakan di Indonesia sejak tahun 1956. Meskipun pemerintah telah menetapkan program imunisasi dasar lengkap pada bayi usia 0–12 bulan, masih terdapat lebih dari 1,4 juta kematian anak di dunia setiap tahun karena berbagai penyakit menular yang pada dasarnya dapat dicegah dengan imunisasi. Cakupan imunisasi dasar yang rendah pada bayi berkaitan dengan ketidakpatuhan orangtua dalam memenuhi kelengkapan imunisasi dasar. Tujuan penelitian ini adalah mengukur perbedaan kepatuhan ibu dalam memenuhi kelengkapan imunisasi dasar pada dua kelompok. Sampel adalah kelompok ibu yang diberikan buku Kesehatan Ibu dan Anak (KIA) dan *booklet*, serta kelompok ibu yang diberikan buku KIA saja. Penelitian ini menggunakan desain *quasy-experiment* dan metode kuantitatif dengan sampel 76 responden yang dipilih secara *simple random sampling*. Penelitian dilakukan pada Agustus–Oktober 2017 di wilayah kerja Puskesmas Pir Batee Puteh, Kecamatan Woyla Barat. Hasil penelitian menunjukkan bahwa terdapat perbedaan kepatuhan ibu dalam memenuhi kelengkapan imunisasi dasar pada ibu yang diberikan buku KIA dan *booklet* dengan ibu yang hanya diberikan buku KIA. Intervensi pendidikan kesehatan imunisasi berdasar atas buku KIA dan *booklet* dapat meningkatkan pengetahuan dan kesadaran ibu tentang pentingnya imunisasi pada bayi sehingga meningkatkan kepatuhan ibu dalam melengkapi imunisasi bayinya.

Kata kunci: *Booklet*, buku KIA, kepatuhan

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Introduction

The vaccine is one of the achievements of public health programs that must be improved to realize the degree of public health. The National Association of School Nurses (NASN) in Northern Indiana supports routine vaccination as recommended by the Advisory Committee on Immunization programs and supports local regulations on vaccination of students in schools.[1] In some states, including the United States, it is missing the goal of preventing disease with the use of vaccination. These barriers have been placed in three broad categories namely health care system barriers, healthcare provider barriers, and patient barriers.[2] Immunization programs began in Indonesia in 1956.[3] Although the government has established a complete basic immunization program for infants aged 0–12 months, there are still more than 1.4 million child deaths in the world each year caused by various infectious diseases that can be prevented by immunization.[4]

Children born with the assistance of a traditional birth attendant were much lower in rural areas. This reflects the distribution of rural-urban health personnel in Indonesia and most developing countries.[5] Although the first dose of the measles vaccine is not given to children aged 9 months, the availability of traditional birth attendants at birth appears to predict vaccination coverage. Thus, the availability of qualified health personnel is likely to continue immunization into early childhood. Besides, the availability of traditional birth attendants can also affect measles vaccination. For example, a study of inequality in maternal and child health in Asia-Pacific found that the overall geographic, and socio-economic context, contributed to 75% of the inequality of skilled midwives in Indonesia.[6] In particular, wealth contributed 27% and maternal education 12% to inequality. This determinant reflects the main determinant of identified inequality in measles vaccination. Also, other research results indicate that several other factors affect the completeness of the communication, namely individual, socio-cultural, and political factors.[7]

Based on the results of the Basic Health Research (*Riskesdas*) survey in Indonesia in 2013, DPT-HB-3 immunization coverage increased to 75.6%.[8] Despite the increase; the coverage was not evenly distributed across all regions in Indonesia. The coverage is not good enough which can be seen by diptheria incidence. The incidence of diphtheria in Indonesia in 2012 reached a high of 1,192 cases, decreased to 767 cases in 2013, then 394 cases in 2014, and increased by 502 cases in 2015.[9] Nationally; pneumonia cases increased by 63.45% in 2015.[4] While hepatitis B cases reached 21.8% in 2013.[3] Based on the survey, cases of diphtheria found in 37% of patients who had not received triple DPT dose immunization.[9]

Although Indonesia has succeeded in achieving polio-free certification with other South-East Asia Region (SEARO) countries in 2014, efforts to eradicate polio still have to be continued. The effort is important since if the coverage of polio immunization is low, it will enable the re-emergence of polio cases in infants.[9]

Pir Batee Puteh Health Center at West Woyla district is one of the health centers in West Aceh regency, which has a fairly low level of pentavalent and polio immunization coverage every year. The coverage of pentavalent and polio immunization coverage in 2016 were pentavalent-1, pentavalent-2 and pentavalent 3 were 30.6%, 33.1% and 28.8% respectively. The polio-1 immunization coverage, polio-2, polio-3 and polio-4, were 43.1%, 36.3%, 31.9% and 34.4% respectively.

This study aims to measure the differences in maternal compliance in completing basic immunization between two groups. The study will provide a group of mothers with Maternal Child Health (MCH) book and special booklet, and another group provided with an MCH book only.

Methods

This study used a quantitative quasi-experimental design with a sample of 76 mothers who had babies that not received pentavalent-1 and polio-2 immunization. The respondents were divided into two groups. One group as the intervention group provided with an MCH book and a special booklet, while the other group as the control, was only provided with the MCH book.

The development of the booklet used to improve maternal compliance in completing basic immunization for infants is as follows. Researchers developed a booklet based on a community needs analysis that aims to supplement the MCH book as a medium for immunization health education. The developed booklet content was assessed by a team from the Department of Child Health, Faculty of Medicine, Universitas Padjadjaran, Bandung. While a team

from Visual Communication Design, Institut Teknologi Bandung assessed the media design. The results of the content assessment were then analyzed using Rasch modeling to produce a booklet that was suitable for use. The data in this study using SPSS with chi-square statistical tests to measure differences in maternal compliance in completing infant immunization. This research was conducted in August–October 2017 in the working area of the Pir Batee Puteh Health Center, West Woyla district. This study used two groups (cases and controls). Prior to the study, the two groups were given treatment, namely, the case group was given health education about immunization based on information in the MCH and booklet, while the control group was given health education about immunization based on information in the MCH book.

This research ethics is from the Health Research Ethics Committee at the Faculty of Medicine, Padjadjaran University, with the ethical approval number: 108/UN6.C.10/PN/2017.

Results

Table 1 showed the characteristic of respondents. Based on Table 1 there were no significant differences in age, education, and work in both groups (p>0.05). Thus, it can be concluded that the two groups of respondents have homogeneous characteristics.

Table 2 showed a significant difference in the improvement of maternal compliance in completing basic immunization in infants between the two groups. Compliance in the intervention group was 27 of 38 respondents compared to 17 of 38 respondents.

Discussion

The development of the booklet in this study aims to supplement the MCH book as a medium for immunization health education in order to increase maternal compliance in fulfilling the basic immunization for infants. Booklet is developed based on an analysis of community needs that provide information about immunizations and their problems. The booklet aims to supplement the information that is not available in the MCH handbook.

The results of this study showed significant differences in improving maternal compliance with basic immunization in infants.

The provision of MCH books can help

Table 1 Characteristic of Respondents

Characteristics	Groups		p Value
	Intervention (n=38)	Control (n=38)	
Age			0.754*
Median (min–max)	24.50 (17–36)	23.50 (16–38)	
Average (SD)	25.32 (5.58)	24.89 (6.09)	
Education			0.956**
Elementary/equivalent	9	9	
Junior high school/equivalent	15	17	
Senior high school/equivalent	10	9	
University/academy	4	3	
Occupation			0.574**
Work	7	9	
Not work	31	29	

Note: *unpaired t test, **chi-square test

Table 2 Differences in Maternal Compliance in Completing Infant Immunization

Compliance	Groups		p Value*
	Intervention (n=38)	Control (n=38)	
Compliance	27	17	0.02
Non-compliance	11	21	

Note: *chi-square test

mothers improve their knowledge about the benefits and schedule of immunization. A complete recording will help mothers find out the type of immunization their babies received.[10] The distribution of MCH books, functioning as reminders of childhood immunization schedules. The book also acts as a simple health education media that is expected to increase knowledge and behavior about health, especially immunization.[11]

The research conducted by Osaki et al.[12] stated that the use of the MCH book increases the awareness of parents and families to complete their infant immunization. They are recorded according to a predetermined schedule so that it can significantly increase immunization coverage in infants. The use of the MCH book is beneficial in the delivery of preventive health services, such as complete immunization for children.

Other research results show that the utilization of the MCH books accompanied by health education is effective in increasing immunization compliance and reducing immunization drop out rates. The main reason for immunization dropouts is an understanding of the benefits and immunization schedules that are lacking.[13,14]

Some of the results of previous studies indicate that the use of booklets in health education provides a significant increase in changes in individual behavior. The results of Bastable's research in Moura et al.[15] showed that learning through reading, the average information obtained only reaches 10%, while seeing can reach 20%, and by listening, it can increase by 30%. However, through booklets which combined new writing and drawing, the information obtained will be able to be absorbed to an average of 70%. A booklet provided easier for message recipients to understand the health education material. The booklet showed that it would influence changes in individual behavior.

The results of the same study conducted by Owais et al.[16] in Pakistan showed that health education interventions using easy-to-understand picture cards and very simple language were able to convey messages that could change people's behavior. The health education intervention using visual media was successful in increasing DPT-3 immunization coverage by 39%.

In addition, there are several interventions designed to enhance changes in people's behavior toward immunization compliance. Based on the results of research conducted by Nelson et al.[17] Showed that the study group that was given intervention with home visits, home-based vaccine health education, immunization education using visual images, and redesigned immunization cards, the complete immunization coverage increased by 19–20%.

The results of the study by Uddin et al.,[18] home-based health education interventions coupled with on-site vaccines, health promotion, and enhanced immunization programs by helping patients to understand and utilize health services succeeded in increasing complete immunization coverage by 56% during the intervention period.

The results of a study conducted by Yu et al.[19] on heart failure patients showed a significant difference in treatment compliance between the two groups ($p<0.001$). Treatment compliance in the intervention group was better than the control group. The implementation of health education using booklets compiled according to patient information needs and effectively followed up by telephone can improve patient health and help patients maintain their physical, psychological, and social welfare to survive with heart failure. The use of booklets in health education is proven to improve patient adherence to treatment statistically.

The use of booklets, in addition to their low cost, is also easy to use as an educational medium that can integrate the latest evidence-based information in presenting standardized information. Henrotin et al.,[20] in their study, stated that a booklet was significantly effective in increasing patients' knowledge both in the long term and in the short term to increase patient adherence to exercise in reducing low back pain.

Claus et al.'s[21] research state that booklet increase patient confidence in avoiding fear in performing postoperative physical activity significantly. It stated that the highly effective booklet media is used as a tool to organize health promotions for professionals in providing health education to patients. The result is because the information presented in the booklet is very structured with a combination of exciting writing and drawing. The key message conveyed is very clear and objective, making it easier for the message recipients to understand the messages conveyed.

Conclusion

It can be concluded that there are differences in maternal compliance in completing basic immunization in infants in a group with the MCH book and booklet compare to a group with only

the MCH book.

Conflict of Interest

All authors stated that there no conflict of interest in this study.

Acknowledgments

The authors would like to thank the Pir Batee Puteh Health Center, West Woyla district, and respondents who participated in this study.

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RESEARCH ARTICLE

Lavender Flower/Mandarin Orange Peel Essential Oil-Soybean Oil to Repel *Culex* sp.

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Abstract

Diseases including Japanese encephalitis and filariasis can be transmitted to humans by *Culex* sp. Many methods could be applied to prevent their bites from reducing their population or preventing them from their bites. N, N-diethyl-meta-toluamide (DEET) has been widely used as an effective synthetic repellent, but DEET needs to be applied carefully, especially for children. Other repellents based on natural origin, i.e., *Lavandula angustifolia* D.C. (lavender) flower and *Citrus reticulate* L. (mandarin orange) peel essential oil and their combination with soybean oil, were studied in Parasitology Laboratory, Faculty of Medicine, Universitas Kristen Maranatha, Bandung on July–August 2018, for their repellent duration against female *Culex* sp. to find out the optimal formula. It is a simple randomized design with four replications and seven treatments, i.e., negative control, DEET, pure essential oil, pure soybean oil, three kinds of combination of essential oil and soybean oil in various ratios. The study was carried out using the arm in the cage method against four human arms, following Fradin and Day. The data were analyzed using ANOVA, continued with Tukey HSD with α=0.05. The result shows that DEET has the longest duration (p=0.000), the combination of each essential oil with soybean oil in 1:2 ratio had longer duration than the pure essential oil (p=0.000), soybean oil (p=0.000), and other combination ratios (p=0.000). It was concluded that a mixture of *L. angustifolia* D.C. flower/*C. reticulata* L. peel essential oil with soybean oil in a certain ratio was the ideal preparation to repel *Culex* sp.

Keywords: *Citrus reticulate* L. peel, *Culex* sp., essential oils, *Lavandula angustifolia* D.C. flower, repellent, soybean oil

Campuran Minyak Atsiri Bunga Lavender/Kulit Jeruk Mandarin-Minyak Kedelai untuk Menolak *Culex* sp.

Abstrak

Beberapa penyakit termasuk *Japanese encephalitis* dan filariasis dapat ditransmisikan ke manusia melalui gigitan nyamuk *Culex* sp. Banyak cara dapat dilakukan untuk mencegah gigitan nyamuk ini, baik dengan mengurangi populasinya atau mencegah gigitannya. *N, N-diethyl-meta-toluamide* (DEET) telah digunakan secara luas sebagai *repellent* sintetik yang efektif, tetapi pemakaian DEET harus dilakukan dengan hati-hati khususnya pada anak. *Repellent* lain yang berasal dari alam, yaitu minyak esensial bunga *Lavandula angustifolia* D.C. (lavender) dan kulit buah *Citrus reticulate* L., serta campurannya dengan minyak kedelai telah diuji durasi proteksi terhadap *Culex* sp. betina sehingga diperoleh formula *repellent* yang optimal. Penelitian dilaksanakan di Laboratorium Parasitologi, Fakultas Kedokteran, Universitas Kristen Maranatha, Bandung pada Juli–Agustus 2018 dan menggunakan desain *simple randomized* dengan empat replikasi dan tujuh perlakuan, yaitu kontrol negatif, DEET, minyak esensial murni, minyak kedelai murni, dan tiga macam rasio campuran minyak esensial dengan minyak kedelai. Pengujian menggunakan metode lengan dalam kandang menurut Fradin dan Day dengan empat lengan sebagai empat replikasi. Analisis data menggunakan ANOVA, dilanjutkan Tukey HSD dengan α=0,05. Hasil penelitian menunjukkan bahwa DEET memiliki durasi proteksi paling lama (p=0,000), durasi proteksi kombinasi minyak esensial dengan minyak kedelai rasio 1:2 lebih panjang dibanding dengan minyak esensial murni (p=0.000), minyak kedelai (p=0.000), dan rasio kombinasi lainnya (p=0.000). Simpulan, rasio tertentu campuran minyak esensial bunga *L. angustifolia* D.C./kulit buah *C. reticulata* L. dengan minyak kedelai merupakan sediaan ideal untuk menolak *Culex* sp.

Kata kunci: Bunga *Lavandula angustifolia* D.C., *Culex* sp., kulit buah *Citrus reticulate* L., minyak esensial, minyak kedelai, *repellent*

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Introduction

Mosquito bites can spread many diseases. That is why preventing these bites can reduce the disease's prevalence. Preventing the diseases is better and more important than curing them, while effective vaccines for viral and parasite mosquito-borne diseases are still not yet available. Some of these diseases are fatal or can reduce the productivity of the host. *Culex* sp. can spread Japanese encephalitis[1,2] and filariasis, specifically lymphatic filariasis, in an urban and semi-urban area.[3] Many methods can be taken to prevent the *Culex* sp. bites either reduce the mosquito population or prevent their bites against humans using mosquito repellent. N, N-diethyl-meta-toluamide (DEET) has been widely used as a synthetic repellent, and it is effective in preventing these bites.[4,5] However, DEET might have a toxicity threshold,[6] and its application, especially for children, must be carefully done.[5]

Alternatively, essential oils as volatile oils which contain secondary plant metabolites and have pungent odors have shown potential repellent activity against many arthropods. The metabolites found are monoterpene (alpha-pinene, cineole, limonene, eugenol, terpinolene, citronellol, citronellal, camphor thymol) and sesquisterpenes.[7] Essential oils as a natural product have another benefit because they are degraded rapidly, have low toxicity against mammalian.[8] An essential oil from the lavender flower (*Lavandula angustifolia* D.C.) contains similar compounds such as pinene, cineol, limonene, linalool, linalyl acetate, geraniol, borneol.[9] *Citrus reticulate* L. peel essential oil might act as a repellent because of its monoterpene hydrocarbons compound.[10] Although these essential oils might act as a repellent, and their volatility might harm the duration.

Several plant-based oils contain fatty acids and, as carriers of other repellents, could increase repellent activity duration.[11,12] This study aimed to explore the repellent activity of a mixture of lavender (*Lavandula angustifolia* D.C.) flower/ *Citrus reticulate* L. peel essential oil with soybean oil in a various ratio against *Culex* sp. compared to every single compound to find out the optimal ratio against the duration of repellent effect.

Methods

This method aims to reach effective disease prevention as a guideline of effective formulation and the timing of this repellent reapplication. The study was done in Parasitology Laboratory, Faculty of Medicine, Universitas Kristen Maranatha, Bandung in February–March 2018.

It was an experimental study, the arm in cage method with simple randomized design. It was carried out according to Fradin and Day[13] using 35×35×35 cm^3 cages at 24–32°C and 60–70% relative air humidity.

The 560-second generation copulated female *Culex* sp. mosquitoes aged 7–24 days, which had never sucked blood, were prepared. They reared in the School of Life Sciences and Technology, Institut Teknologi Bandung. Ten of these mosquitoes, which had been 24 h fasted, were put in each cage just before each experiment. Lavender (*Lavandula angustifolia* D.C.) flower and *Citrus reticulate* L. peel essential oils were products from Lansida, Yogyakarta, Indonesia. The volunteer research subjects aged 22–23 years should not be alcoholics and had to have good personal hygiene. The affected arms should be washed using non-perfumed soap before the examination. Before inserted into each cage, four clean lower arms of the research subjects chose in four replications. One group were treated each with 1 mL of water (treatment 1) on day 1, pure essential oil (treatment 2) on day 3, soybean oil (treatment 3) on day 5, a mixture of essential oil-soybean oil in 1:1 ratio (treatment 4) on day 7, a mixture of essential oil-soybean oil in 2:1 ratio (treatment 5) at day 9, a mixture of essential oil-soybean oil in 1:2 ratio (treatment 6) on day 11, and 15% DEET lotion (treatment 7) on day 13.

The duration in minutes between the first insertion until the first mosquito landing was recorded. These data were analyzed using ANOVA continued with Tukey HSD with α=0.05.

The study has been ethically approved by the Research Ethics Committee of Faculty of Medicine, Maranatha Christian University-Immanuel Hospital with the certificate number is 100b/KEP/III/2018.

Results

Duration of repellent activity of the combination of lavender (*Lavandula angustifolia* D.C.) flower essential oil and soybean oil was shown in Figure 1. According to Figure 1, DEET had the most prolonged duration of repellent effect among others (p=0.000), lavender-soybean oil 1:2 had

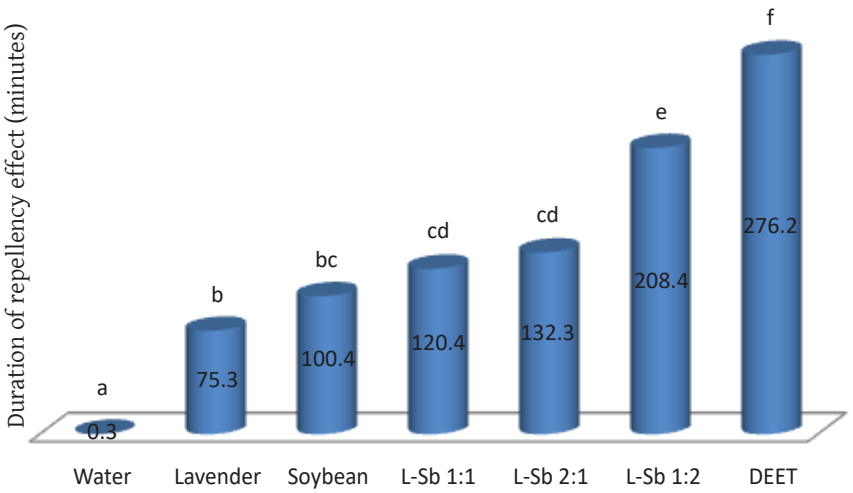

Figure 1 Duration of Repellent Activity of Mixture of Lavender (*Lavandula angustifolia* D.C.) Flower Essential Oil and Soybean Oil

L-Sb 1:1= mixture of lavender flower essential oil-soybean oil in 1:1 ratio, L-Sb 2:1= mixture of lavender flower essential oil-soybean oil in 2:1 ratio, L-Sb 1:2= mixture of lavender flower essential oil-soybean oil in 1:2 ratio. The same alphabet above the bar means no significant difference (p>0.05)

less duration than DEET (p=0.000) but was the longest one among the rest (p=0.000). The other preparation containing soybean oil had the same repellent duration as each other. The lavender flower essential oil had the same duration as soybean oil (p=0.302).

The duration of repellent activity of the mixture of *Citrus reticulata* L. peel essential oil and soybean oil was shown in Figure 2. According to Figure 2, DEET had the most prolonged duration of repellent effect among others (p=0.000), *Citrus reticulata* L. peels oil-soybean oil 1:2 had less duration than DEET (p=0.000), but was the longest one among the rest (p=0.000). There was a different duration of repellent effect each other in all these preparations except between *Citrus reticulata* L. peel oil-soybean oil 1:1 and 2:1.

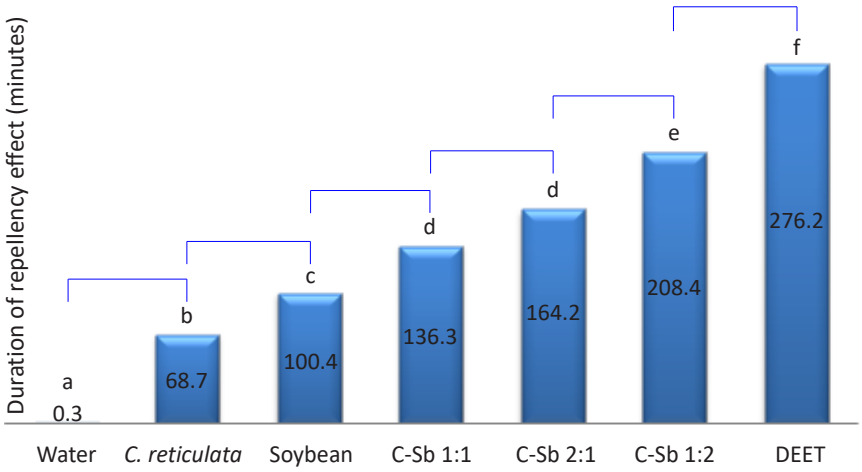

Figure 2 Duration of Repellent Activity of the Mixture of *Citrus reticulata* L. Peel Essential Oil and Soybean Oil

C-Sb 1:1= the mixture of *Citrus reticulata* L. peel essential oil-soybean oil in 1:1 ratio, C-Sb 2:1= the mixture of *Citrus reticulata* L. peel essential oil-soybean oil in 2:1 ratio, C-Sb 1:2= the mixture of *Citrus reticulata* L. peel essential oil-soybean oil in 1:2 ratio. The same alphabet above the bar means no significant difference (p>0.05)

Discussion

To prevent mosquito-borne diseases using mosquito repellent, we should know how human attracts mosquitoes because diseases prevention is better than diseases treatment. Mosquitoes have many receptors in their sophisticated olfactory system (olfactory receptor neuron, ORNs). The olfactory receptor is located at antennal hair and gustatory receptor (contact chemoreceptor) at gustatory receptor neurons (GRNs) located at its labella.[14,15] They are essential to detect an odor from humans such as lactic acid and CO_2 as a primary mosquito attractant. The CO_2 was more attractive for *Culex* sp. than for *Aedes* sp.[16] Other studies showed that the primary human odor attractant for *Culex* sp. was aldehyde compounds from human skin such as nonanal, octanal, and decanal in a certain ratio.[17] Repellent works by inhibiting the complex olfactory pathway so that they are not sensitive again to detect the attractant odor.[18] Inhibitory volatiles, such as the essential oils, could work as repellent.[18]

DEET also has repellent activity in several ways, smell through the odorant receptor, ingestion through the gustatory receptor, and contact through mosquito's tarsi.[19] DEET also stimulates an allosteric site of gustatory receptor neurons.[14,20]

The common compounds containing essential oils that have repellent activity are monoterpenes such as alpha-pinene, cineole, limonene, eugenol, and terpinolene citronellol, citronellal, camphor, and thymol.[7] Lavender flower essential oil may act as a repellent because it consists of pinene, cineol, limonene, linalool, linalyl acetate, geraniol, borneol, and tannins.[9] Monoterpene hydrocarbons as major compounds of *Citrus reticulata* L. peel essential oil may be responsible for its repellent effect.[10] A monoterpene such as citronellal demonstrates repellent activity through the gustatory receptor neuron[21] besides through interaction with TRPA1 channels and olfactory co-receptor Orco.[22]

DEET showed a longer duration of repellency. This longer duration might be caused by the more mechanism of DEET's action compared to the natural essential oils. DEET could act by three mechanisms: smell, ingestion, and also through contact via its tarsi.[19]

The mixture of the lavender flower essential oil, as well as *Citrus reticulata* L., peel essential oil with soybean oil, especially in 1:2 ratio, showed the most effective repellent among others except against DEET. Long-chain fatty acid content in soybean oil might be responsible for it because this fatty acid prevents evaporation of the essential oil[11,12] and could prolong a repellent activity. Further studies are needed to explore why for both essential oils, the mixture in 1:2 ratio with soybean oil had the longest duration. To achieve the longer duration of this repellent effect, studies are also needed to explore whether any other ratios are better than this ratio and their action mechanism.

In this study, soybean oil itself showed repellent activity. Its repellent activity might be caused by reducing evaporation. This action would reduce the water vapor as mosquito attractant.[23] Another study reported that coconut oil-derived fatty acid also showed even better repellent activity than DEET.[24] In contrast, another study reported that soybean oil itself had no repellent activity but only supported other repellent's effectivity.[11] This different result might be caused by the different composition of long-chain fatty acid in this oil originated from different geographic areas.

As shown in Figure 1 and in Figure 2: all of the examined substances had a repellent effect for more than 30 min duration, but DEET was still the longest duration repellent. A similar result was also reported by other study[4] as well as a repellent study using *Citrus grandis*.[25] As an alternative of DEET, a chemical substance, each of these essential oils could be used as a repellent, especially in combination with soybean oil in ratio 1:2, which showed the most prolonged repellency duration against *Culex* sp. The application of these combinations would protect against *Culex* sp. bite for enough long duration, i.e.: around 3 hours and prevent the diseases transmitted by the mosquito. It is essential because disease prevention is much better than disease treatment; there is still no vaccine available to prevent viral and parasite mosquito-borne diseases.

The possibility that human diet might influence the mosquito attractiveness need to be kept in mind. It was not easy to completely control the participants' diet because each treatment was carried out in different days.

Conclusion

A mixture of *Lavandula angustifolia* D.C. flower/*Citrus reticulata* L. peel essential oil with soybean oil in a 1:2 ratio might be considered to

repel *Culex* sp. bite optimally.

Conflict of Interest

We state that there is no conflict of interest.

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RESEARCH ARTICLE

The Risk Factors of Motorcycle Riders Traffic Accidents in Semarang City 2017

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Abstract

The incidence rate of motorcycle accidents in Semarang city increased every year in the period 2014–2016. The research related to the risk factor of traffic accident incidents on motorcycle riders in Semarang city is still scarce. This study aims to analyze the risk factors of traffic accidents on motorcycle riders in Semarang city. The type of research is an analytic observational study with a case-control design. The number of samples was 50 cases and 50 controls. The case is a motorcycle rider who had a traffic accident in Semarang city from July to November 2017. Control is a motorcycle rider who did not have a traffic accident. Data was analyzed bivariate and multivariate using logistic regression test backward LR method. Factors proven to be a risk factor for traffic accidents on motorcyclists are less alert (p=0.005, OR=4.255, 95% CI=1.540–11.759), non-distance habits (p=0.001, OR=5.209, 95% CI=1.997–13.584), and hasty behavior (p=0.029, OR=2.950, 95% CI=1.116–7.800). Conclusions, alertness, not keeping distance, and impulsive behavior are risk factors for traffic accident incidents on Semarang city motorcyclists.

Keywords: Motorcycle, risk factors, traffic accidents

Faktor Risiko Kecelakaan Lalu Lintas Pengendara Sepeda Motor di Kota Semarang Tahun 2017

Abstrak

Angka insidensi kecelakaan sepeda motor di Kota Semarang meningkat setiap tahun dalam kurun waktu 2014–2016. Penelitian terkait faktor risiko kejadian kecelakaan lalu lintas pada pengendara sepeda motor di Kota Semarang masih sangat jarang dilakukan. Penelitian ini bertujuan menganalisis faktor risiko kejadian kecelakaan lalu lintas pada pengendara sepeda motor di Kota Semarang. Jenis penelitian adalah studi observasional analitik dengan desain *case control*. Jumlah sampel 50 kasus dan 50 kontrol. Kasus adalah pengendara sepeda motor yang mengalami kecelakaan lalu lintas di Kota Semarang terhitung dari Juli hingga November 2017. Kontrol adalah pengendara sepeda motor yang tidak mengalami kecelakaan lalu lintas. Data dianalisis secara bivariat dan multivariat menggunakan uji *logistic regression* metode *backward LR*. Faktor yang terbukti sebagai faktor risiko kejadian kecelakaan lalu lintas pada pengendara sepeda motor adalah kurang waspada (p=0,005; OR=4,255; IK 95%=1,540–11,759), kebiasaan tidak menjaga jarak (p=0,001; OR=5,209; IK 95%=1,997–13,584), dan perilaku terburu-buru (p=0,029; OR=2,950; IK 95%=1,116–7,800). Simpulan, kurang waspada, kebiasaan tidak menjaga jarak, dan perilaku terburu-buru merupakan faktor risiko kejadian kecelakaan lalu lintas pada pengendara sepeda motor di Kota Semarang.

Kata kunci: Faktor risiko, kecelakaan lalu lintas, sepeda motor

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Introduction

The World Health Organization (WHO) report in 2013 predicts that around 1.24 million people die in traffic accidents each year. Traffic accidents resulted in 33,815 deaths in the South-East Asia Region (SEAR) in 2010, with an average of 18.5 deaths per 100,000 population.[1] In Indonesia, the number of traffic accidents in the year 2010 is 28 per 100,000 population.[2,3] In Central Java, the incidence of traffic accidents in 2013 has a pretrial rate of 57 per 100,000 population.[4,5] Incidence rate of motorcycle accidents in Semarang city based on the number of registered vehicles, i.e. 8.25 per 100,000 registered motorcycles in 2014, 8.69 years per 100,000 registered motorcycle vehicles in 2015, and 10.97 per 100,000 registered motor vehicles in 2016.[6,7]

Traffic risk factors for motorcycle riders include: no driver license[8], rider condition: tired condition,[9] sleepy condition,[9] drunk condition;[10] not alert;[10,11] not turning on the light;[12] driving at high speed;[8,10] use of lane;[13] violating the mark;[14] violating the traffic lights;[15] distance of vehicle too close;[10,16] hasty behavior.[17]

The preliminary study from 3,009 cases of motorcycle accidents in Semarang city 2014–2016 is as follows; less alertness (51.5%) followed by breaking lane (28.5%), breaking distance (9.2%), hasty behavior (8.6%), high speed (3.7%), violating the mark (2.3%), violating the traffic lights (1.5%), tired condition (0.5%), drowsiness (0.6%), drunk condition (0.5%), and improper headlight turning (0.3%).

The incidence of motorbike accident incidents has increased over the past three years. The magnitude of losses incurred by motorcycle riders as the largest contributor to the vehicle involved in accidents has led to the importance of special assessments and handling. Secondary data of causal factors and motorcycle traffic accidents in Semarang city has been done data processing in the initial research. However, some variables are considered essential and suspected as a risk factor for traffic accidents on motorcyclists.

The research related to traffic accidents' risk factors on motorcycle riders in Semarang city is still scarce. It is necessary to do this research to analyze the risk factors of traffic accident incidents on motorcycle riders in Semarang city.

Methods

The research is an analytic observational study with a case-control design. Consecutive sampling was used to choose 50 from 527 motorcyclists who had traffic accidents. The traffic accidents report was collected from the Resort Police of Semarang city from July to November 2017. The inclusion criteria are motorists who crashed or nudged, injured or not injured, suffered a traffic accident in the Semarang city. According to the identity card, they resided in Semarang city, recorded in the accident report Semarang city police traffic, and are willing to become respondents. In comparison, the exclusion criteria are death, defect, and no complete record of the identity.

Controls are motorcyclists without traffic accidents. Inclusion criteria are being able to ride a motorcycle, driving on the road where the accident occurred on the same day as the case, driving past the accident, residing in Semarang city according to the identity card, and being willing to be a respondent. For matching case and control groups: road and time variables.

Before data collection, we described the research's aim, and subjects signed informed consent if they agree to participate. We used questionnaires that have been tested for validity. The data includes sex, age, work type, motor type, rider speed, driver license ownership, violating traffic light habits, driving usage, rider alert, impulsive behavior, and violating the line mark habits. Data analysis used the chi-square test for bivariate analysis and multivariate analysis using logistic regression test of Backward LR method.

This study was approved by the Health Research Ethics Committee of Faculty of Public Health of Universitas Diponegoro Semarang with the letter number: 105/EC/FKM/2017.

Results

Table 1 shows the characteristic of respondents. Based on Table 1, the male proportion is almost the same in the case group 35 of 50 and the control group 41 of 50 (p=0.334). Subjects proportion aged <18 years was higher in the case group (9 of 50) than in the control group (0 of 50, p=0.004). Subjects proportion who never attended school, did not finish primary school, finished from elementary school, finished from junior high school, and finished high school/ vocational school are almost the same in both case and control groups with p=0.176. The proportion of non-working subjects was higher in the case group (4 of 50) than in the control group. The student proportion in the case group was 17

Table 1 Characteristic of Respondents

Characteristics	Groups		p Value
	Case (n=50)	Control (n=50)	
Sex			0.334
Male	37	41	
Female	13	9	
Age (years)			0.004
<18	9	0	
18–25	15	17	
26–59	20	31	
≥60	6	2	
Education			0.176
Never attended school	1	1	
Not finished primary school	0	3	
Finished elementary school	7	3	
Finished junior high school	11	5	
Finished high school	27	34	
Graduated from college	4	4	
Occupation			0.02
Unemployment	4	0	
Student	17	7	
Goverment employee	1	1	
Private employee	14	16	
Entrepreneur	12	25	
Farmers/Fishermen/laborers	2	1	

of 50 more than the control group (7 of 50) with p=0.02.

Results of the bivariate analysis showed that the variable that proved to be a traffic accidents risk factor on motorcycle riders was ≥50 km/hour speed (p=0.006, OR=4.49, 95% CI=1.61–12.54), no driver license (p=0.035, OR=3.16, 95% CI=1.17–8.51), use of a bad lane (p=0.001, OR=4.89, 95% CI=2.04–11.72), less alert (p=0.000, OR=6.29, 95% CI=2.52–15.69), hasty behavior (p=0.002, OR=3.93, 95% CI=1.68–9.15), habit not keeping the distance (p=0.000, OR=7.31, 95% CI=3.02–17.70) which can be seen in Table 2.

The independent variable used as the candidate for the logistic regression test is a bivariate analysis variable (chi-square) with a p value<0.25. There are eight variables included in the multivariate analysis of impulsive behavior, rider speed, driver license ownership, use of the lane, alertness of rider, keeping the distance, violating the mark, and motor type. Results of multivariate analysis showed that the factors that proved to be a traffic accident risk factor on motorcyclists were less alert (p=0.005, OR=4.255, 95% CI=1.540–11.759), non-distance habits (p=0.001, OR=5.209, 95% CI=1.997–13.584), and hasty behavior (p=0.029, OR=2.950, 95% CI=1.116–7.800) which can be seen in Table 3.

Backward results, it is known that rider alertness variable (b_1=1.448), keep distance (b_2=1.650), and hasty behavior (b_3=1,082).

So the regression equation:

$y=a+b_1X_1+b_2X_2+....+b_iX_i$

$y=-1.995+1.448.X_1+1.650.X_2+1.082.X_3$

$$p=\frac{1}{1+e^{-(a+b_1X_1+b_2X_2+....+b_iX_i)}}$$

The calculation results show that people who are less alert when riding a motorcycle and have a habit of not keeping a distance and behave in a hurry have a probability of a traffic accident by 90%.

Discussion

Precautions are the main factor that ensures the rider is always alert and aware of other road users. If the driver is always alert, he will act right in the face of other riders who can always be reckless.[18] Driving is not a job that only requires a person to have knowledge and experience about

Table 2 Risk Factors of Traffic Accidents Occurance on Motorcycle Riders in Semarang City 2017

Variables	Groups		OR	95% CI	p Value
	Case (n=50)	Control (n=50)			
Speed limit (km/hour)			4.49	1.61–12.54	0.006
≥50	19	6			
<50	31	44			
Driver license ownership			3.16	1.17–8.51	0.035
Not	17	7			
Yes	33	43			
Habit of violating the traffic light			1.00	0.06–16.44	1.000
Yes	1	1			
Not	49	49			
Use of lane			4.89	2.04–11.72	0.001
Bad	29	11			
Good	21	39			
Rider alertness			6.29	2.52–15.69	0.000
Late alert	29	9			
Alert	21	41			
Hasty behavior			3.93	1.68–9.15	0.002
Yes	37	21			
Not	13	29			
Habit of violating the mark			2.57	0.89–7.44	0.126
Yes	13	6			
Not	37	44			
Habit of keeping the distance			7.31	3.02–17.70	0.000
Not	37	14			
Yes	13	36			
Motorcycle type			0.52	0.23–1.159	0.160
Automatic	23	31			
Manual	27	19			

Table 3 Multivariate Analysis Result Risk Factors Traffic Accidents Occurance on Motorcycle Riders Year 2017

Factor	B	p Value	OR	95% CI
Less alert	1.448	0.005	4.255	1.540–11.759
Habit not keeping the distance	1.650	0.001	5.209	1.997–13.584
Impulsive behavior	1.082	0.029	2.950	1.116–7.800

how it should be driving, but rather the driver's awareness to always be vigilant in the face.[19] When the driver has a low level of alertness, the driver has difficulty controlling the vehicle, so the risk of traffic accidents will increase.[20] Check the rearview mirror is an essential thing of being alert, especially to slow the vehicle, stop abruptly, or move lane.[16] Based on multivariate analysis in this study, indicating that less alert was proven to be a risk factor for motorcycle traffic accidents with values (p=0.005, OR=4.255, 95% CI=1.540–11.759) means less alert when driving a chance for motorcycle traffic accidents by 4.2 times compared to bikers who are wary.

The result of this research is in line with the research of Arifuddin et al.[21] found that careless

riders/less vigilant at risk of traffic accidents increased accidents 3.1 times compared with the alert rider. This study also reinforced the results of Wicaksono et al.,[22] which stated that less-anticipated/less alert driver is the driver's behavior that most often leads to an accident with the percentage of 72.45%. In line with research by Pamungkas,[23] it contributed to 32.62% of accidents.

The best protection is the distance between riders and other road users. If a person makes a mistake, a safe distance allows time to react and see opportunities to avoid. Driving at an insecure distance poses the risk of being involved in a crash both from the front of or being hit by a vehicle behind.[16] Based on Haddon's matrix,[10] driving behavior is a determinant of traffic accidents' pre-event phase. Driving behavior that has the risk of an accident is the habit that does not keep the distance. It is also explained in Sugiyanto and Santi[24] determinants of traffic accidents. One of them is the safe distance between vehicles. This study also in line with the theory that the habit of not maintaining the distance proved as a risk factor of motorcycle traffic accidents with the value (p=0.001, OR=5.209, 95% CI=1.997–13.584). The habit of not keeping the distance when driving increased a motorcycle traffic accident by 5.2 times.

Research by Riskiansah and Zain[17] showed that most respondents stated that the accident was the respondent's fault and cause of the rush, that is 52%. Haddon's matrix driving behavior is a determinant in the pre-event phase of traffic accidents.[10] One of driving behavior is impulsive behavior while driving. Multivariate analysis indicated that impulsive behavior is proven to be a risk factor for motorcycle traffic accidents with values (p=0.029, OR=2.950, 95% CI=1.116–7.800). When driving, an impulsive behavior increased the chance for a motorcycle traffic accident by 2.9 times compared with riders who do not behave in a hurry.

Conclusion

Variables proven to be a risk factor for traffic accidents on motorcyclists are less alert, habits of not keeping distance, and impulsive behavior.

Conflict of Interest

The authors state that there is no conflict of interest.

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RESEARCH ARTICLE

Soil-Transmitted Helminths Contamination on the Yard's Soil of the Public Elementary Schools in Bandung City

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Abstract

Soil contamination by soil-transmitted helminths (STH) on the schoolyard can act as reservoir STH infection for students. The STH contamination on soil due to contamination of human and animal waste which was disposed of inappropriately. This study aimed to determine the presence of STH eggs in the yard's soil of public elementary schools in Bandung city. This research was an analytic observational study with a cross-sectional approach during September 2019. This study's samples were 97 surface soil of the public elementary schoolyard in Bandung city, selected randomly. Microscopic identification is made for identifying the STH contamination on soil samples. STH contaminates about 66% yard's soil of public elementary schools in Bandung city. We identified larva nematode, *Ascaris* eggs, *Trichuris* eggs, *Toxocara* eggs, and *Capillaria* eggs. The most common STH we had found was larvae nematode (53%). There is a correlation between flood and human STH contamination on soil (p=0.015). We concluded that STH contaminates the yard's soil of the public elementary schools in Bandung city. The source of STH contamination is from human and animal waste. Flood has a role in spreading human waste on the soil.

Keywords: Contamination, soil, soil-transmitted helminths

Kontaminasi *Soil-Transmitted Helminth* pada Tanah Pekarangan Sekolah Dasar Negeri Kota Bandung

Abstrak

Pencemaran tanah oleh *soil-transmitted helminth* (STH) di halaman sekolah dapat menjadi reservoir penularan STH bagi siswa. Pencemaran ini dapat terjadi akibat pengelolaan kotoran manusia dan hewan yang tidak tepat. Penelitian ini bertujuan mengetahui keberadaan telur STH di tanah pekarangan sekolah dasar negeri di Kota Bandung. Penelitian ini merupakan penelitian observasional analitik dengan pendekatan *cross-sectional* yang dilaksanakan pada bulan September 2019. Sampel penelitian berjumlah 97 tanah permukaan halaman sekolah dasar negeri di Kota Bandung yang dipilih secara acak. Identifikasi mikroskopis dilakukan untuk mengidentifikasi kontaminasi STH pada sampel tanah. Data banjir didapatkan dari wawancara dengan penduduk sekitar. Pencemaran STH terjadi pada 66% sampel. Kami mengidentifikasi larva nematoda, telur *Ascaris*, telur *Trichuris*, telur *Toxocara*, dan telur *Capillaria*. Jenis STH yang paling banyak ditemukan adalah larva nematoda (53%). Terdapat korelasi antara banjir dan pencemaran STH manusia di tanah (p=0,015). Kami menyimpulkan bahwa tanah pekarangan sekolah dasar negeri di Kota Bandung tercemar STH. Sumber pencemaran STH berasal dari kotoran manusia dan hewan. Banjir berperan dalam menyebarkan kotoran manusia di tanah.

Kata kunci: Kontaminasi, *soil-transmitted helminth*, tanah

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Introduction

Contaminated soil can be the source of diseases, one of which is a disease caused by soil-transmitted helminths (STH).[1,2] Soil contamination by human waste can occur if human waste management is inappropriate. Factors that contribute to it are the absence of a standard septic tank. The wastewater can overflow and spread to the environment during floods or the human waste disposal straight into rivers, polluting the soil during floods.[3] Then the soil-transmitted helminths eggs or larva in human waste contaminate soil and develop into infective stage.[1,2]

Ascaris lumbricoides, *Trichuris trichiura*, *Ancylostoma duodenale*, *Necator americanus*, and *Strongyloides stercoralis* are STH that infect humans. Soil-transmitted helminths infect about 24% of the world's population.[1,2,4] The incidence rate of STH infection in Indonesia is 2.5–76.67%. Infection by *Ascaris lumbricoides* and *Trichuris trichiura* mainly occurs in pre-school and elementary school children. The incidence rate of STH infection in primary school age in Indonesia is 60–80%.[5] Otherwise, the incidence of *Ancylostoma duodenale* and *Necator americanus* infections mainly occurs in young adults.[1,2,4]

Besides contamination by human waste, STH contamination on soil can also occur by animal waste contamination.[6] The incidence of STH in dogs and cats is relatively high.[7–16] About 37.8% of cat litter in Surabaya contains STH eggs, and about 34.21% of stray dogs in Bali are infected with STH.[15,16] *Ancylostoma* sp. and *Toxocara* sp. was the most common species that infect dogs and cats. Helminths that infect animals can also infect humans, and vice versa (helminthic zoonosis). This zoonotic disease is one of the neglected diseases, which is a world problem.[7–16] Research in Thailand states that *Strongyloides stercoralis* in cats can cause zoonotic diseases in humans.[17] *Ancylostoma ceylanicum*, a cat and dog hookworm, is the second most common human hookworm in Asia.[18] Seroprevalence *Toxocara* sp. in humans also reached 19% in Europe.[19]

The schoolyard is one of the places which is contaminated by animal waste. The schoolyard is also a place to play for children of primary school age, which allows for contact between children and the soil.[12,15]

This study aims to determine the presence of STH eggs in the yard's soil of public elementary Schools in Bandung city.

Methods

This research was an analytic observational study with a cross-sectional approach and was conducted in September 2019. This study's sample was the surface soil of the public elementary schoolyard in Bandung city, which was selected randomly. The formula obtains the minimum number of samples for the number of descriptive samples, and the minimum sample size was 97 samples. Flood status was carried out by asking questions to the people who lived around at the sampling site. The dried soil sample was sifted to remove solid objects. Then 3 g sample was put into a 15 mL centrifugation tube. Twelve milliliters of 5% sodium hydroxide (NaOH) was poured into the sample, shake, and then left for one h to separate eggs from the soil. The sample was then centrifuged for 2 minutes with 2.000 rotations per minute (rpm) to settle the eggs on the bottom. The supernatant was discarded, and the sediment was washed three times with distilled water. After washing, the sediment was resuspended in saturated sodium chloride (NaCl). We placed the tube into the stand add saturated NaCl in a pipette until the fluid was raised to the tube's brim. Left it for 15 minutes, then placed a coverslip on the fluid's surface for 5 minutes for sticking parasitic eggs to the glass. Placed the coverslip on the slide and observed the sample under the microscope at 100 and 400 magnification.

The study protocol had approved by the Health Research Ethics Committee of the Faculty of Medicine, Universitas Islam Bandung.

Results

The soil samples we got from 97 public elementary schoolyards in Bandung city were selected by random sampling. The public elementary school distribution in which the soil sample was taken describes in Figure 1.

The result of soil examination for STH contamination in Duplo examination is described in Table 1. Soil-transmitted helminths (STH) contaminate about 66% yard's soil of public elementary schools in Bandung city.

We identified the eggs and larva STH from soil samples. The larvae of the nematode showed the highest contamination. We found it in 53% yard's

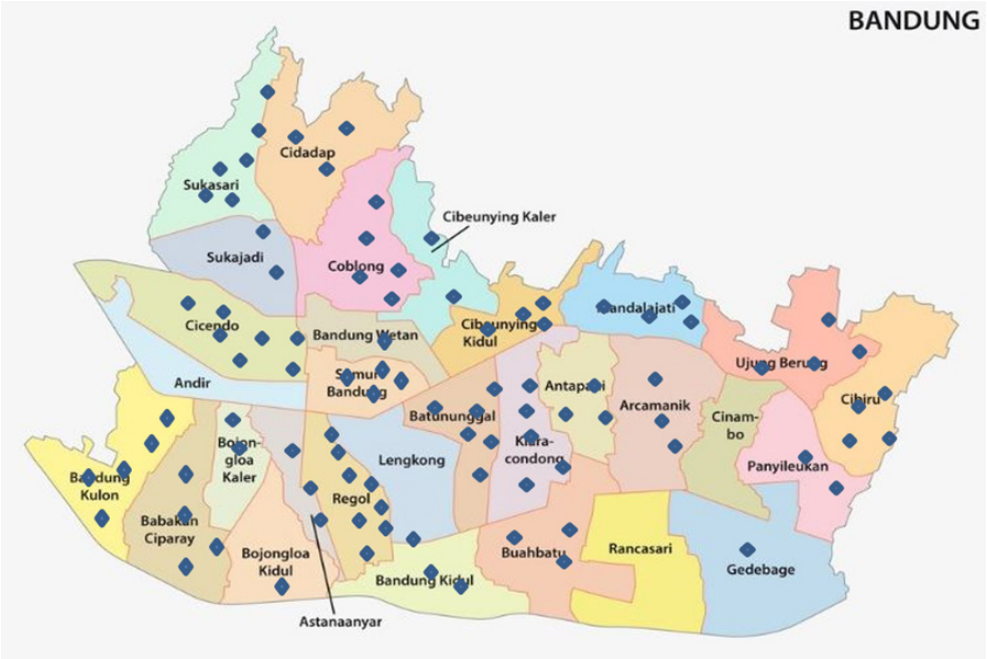

Figure 1 Area of Public Elementary Schools which Selected for Soil Examination

soil sample (Table 2). We could not differentiate the larva of hookworm or *Strongyloides*, so we grouped both of them as nematode larva (Figure 2a). We also found the *Trichuriasis* eggs (Figure 2b), which is similar to *Capillaria* (Figure 2c). Both eggs have a barrel shape with a polar plug, but the polar plug of *Capillaria* is asymmetry. *Ascaris's* eggs, which are spherical and thick walls, are identified (Figure 2d). We found the eggs of *Toxocara*, the morphology similar to *Ascaris's* eggs with a larger size (Figure 2e).

Ascaris and *Trichuris* are STH that infected humans. *Toxocara* and *Capillaria* are STH which infected animals. Nematode larva that we found

Table 1 STH Contamination on Soil of Public Elementary Schoolyard in Bandung City

STH Contamination	Number of Sample (n=97)	Percentage (%)
Positive	64	66
Negative	33	34

Table 2 Soil-Transmitted Helmints Identification

STH Eggs	Number of Sample (n=97)	Percentage (%)
Ascaris	7	7
Trichuris	11	11
Toxocara	5	5
Capillaria	2	2
Nematode larvae	51	53
Negative	21	22

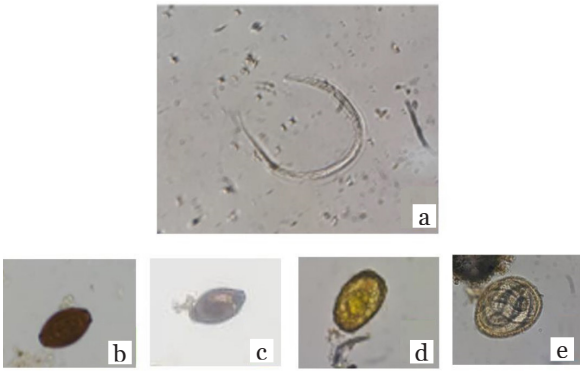

Figure 2 Nematode Larvae (a), *Trichuris's* Egg (b), *Capillaria's* Egg (c), *Ascaris's* Egg (d), and *Toxocara's* Egg (e) in 400 Magnification

Table 3 Correlation between Flood and Contamination of Human STH

Flood	Human STH		p Value
	Positive	Negative	
Yes	7	15	0.015
No	8	67	

Table 4 Correlation between Flood and Contamination of Nematode Larva

Flood	Nematode Larva		p Value
	Positive	Negative	
Yes	11	11	0.78
No	40	35	

could be *Strongyloides* larva with a free-living life cycle on soil or hookworm that infected animals or hookworms that infected humans.

The source of human STH contamination on soil can be from a flood that can spread the human waste which was not managed properly, such as dumped in the river. Because of it, we analyzed the correlation between flood and contamination of *Ascaris* and *Trichuris* eggs on the soil (Table 3).

There was a correlation between flood and contamination of human STH on soil (p=0.015) after analyzing data with chi-square. The source of contamination larva nematode found on soil samples could be from humans or animals or could be just a free-living nematode on the soil. We analyzed the correlation between flood and nematode larva contamination on the soil to predict the source of nematode larva contamination (Table 4).

There is no correlation between flood and contamination of nematode larva on soil (p=0.78).

Discussion

In this research, we identified contamination of STH, which infected humans on the soil. They are *Ascaris* and *Trichuris*. We found 7% *Ascaris* eggs and 11% *Trichuris* eggs from 97 soil samples. This result indicated human waste contamination on soil, which corresponding to the low endemicity of helminthiasis in Bandung city.[20] Although the prevalence of *Ascaris* and *Trichuriasis* was not too high. It could still be a potential source for *Ascariasis* and *Trichuriasis* to elementary students. *Ascaris* and *Trichuris* lives in the human intestine and causes diarrhea, anemia, and poor cognitive develompment.[1,21,22]

The statistical analysis showed a correlation between and contamination of human STH on soil (p=0.015). It indicated that flood has a role in spreading STH contamination on the soil. A flood can cause overflow and spread human wastewater on the ground when human waste had improper management, such as not dumped to the standard septic tank or dumped it to the river.[11]

In this study, nematode larvae were found in 53% of the soil sample. Because there was no correlation between flood and contamination of nematode larva on soil (p=0.78), we conclude that the source of nematode larva contamination was not from human waste. The source of animal STH contamination on soil can be from animals that dispose of their waste at the schoolyard due to the lack of animal supervision.[6,8,10,23–25] This soil contamination by animal waste can cause zoonotic diseases to public elementary school students in Bandung city.

We found the nematode larva could be *Strongyloides*, a free-living life cycle on soil, or larva animal hookworm. *Strongyloides* have a free-living life cycle nematode in soil, but *Strongyloides stercoralis* is also a parasite in humans, cats, and dogs. In this case, cats and dogs are reservoirs for humans. In human, *Strongyloides stercoralis* can cause diarrhea in human and even death in immunocompromised patients.[1,27]

The hookworm that infected dogs and cats are *Ancylostoma ceylanicum* and *Ancylostoma braziliensis*.[6–10,12–18] Both dog's and cat's hookworms can cause zoonotic diseases in humans. *Ancylostoma ceylanicum* can develop into an adult in the human intestine and lead to anemia, cognitive impairment, and enteritis in humans.[1,14,18] *Ancylostoma braziliensis* larvae that enter human skin can cause cutaneous larvae of migrants in humans. The *Ancylostoma braziliensis's* larvae can penetrate human skin but cannot penetrate the basal layer of the human's epidermis due to a lack of enzymes. Therefore, the larvae migrate and cause inflammation in the human epidermis resulting in itchy serpiginous

lesions.[1,26]

In this study, we also identified eggs of STH that belong to dogs and cats. They were *Toxocara* and *Capillaria*. *Toxocara* is a nematode that infects cats and dogs.[11,19,23,24] These nematodes live in the intestines of cats and dogs. *Toxocara* cannot develop into adults in the human body, but *Toxocara's* larvae can cause visceral larvae migrant if humans accidentally eat the eggs. The swallowed eggs will hatch in the human stomach. The larvae will penetrate the intestines and enter the bloodstream until they reach the organs and then cause inflammation.[9,23,24,28]

Capillaria eggs found in the schoolyard can also cause disease in humans who accidentally eat them. Although the disease is rare, *Capillaria hepatica* can cause hepatitis in humans. *Capillaria hepatica* is a helminth that lives in rat liver tissue. Its eggs can contaminate the soil through the waste of cats or dogs when cats or dogs eat rats suffering from capillariasis.[28,29]

Conclusions

Soil-transmitted helminths (STH) contaminates around 66% of public elementary schoolyards in Bandung city. The sources of STH contamination are from human and animal waste. Flood has a role in spreading human waste on the soil.

Conflict of Interest

The authors state that there is no conflict of interest.

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RESEARCH ARTICLE

Midwives Knowledge, Infrastructure Facilities, and Supervision-Monitoring of Immunization Management in West Bandung Regency

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Abstract

The midwife mostly carries out immunization activities in the health care unit. The midwife is an injection officer and responsible for planning, transportation, storage, and vaccine usage. This study aims to determine the effect of knowledge midwives on vaccine management, infrastructure availability, and immunization management supervision by midwives in the West Bandung regency. A total of 38 self-employed midwives who met the inclusion criteria were taken from the West Bandung regency from July 2017 to February 2018. This research was an observational analytical research with a cross-sectional design. Analysis of bivariate data using correlation regression. The multivariate correlation using multiple linear regression. The result showed that midwife knowledge about vaccine management influenced 33.3% (p=0.0001), infrastructure 54.2% (p=0.010), and the supervision 34.65% (p=0.010) to managing immunization. The linear regression test between the variables shows that the determinant factor in managing is the facilities' immunization availability (beta coefficient=0.615). In conclusion, midwife knowledge, infrastructure facilities, and supervision on immunization management in West Bandung regency affected the immunization processes.

Keywords: Immunization, infrastructure facilities, knowledge, supervision-monitoring

Pengetahuan Bidan, Sarana Prasarana, dan Supervisi-Pemantauan Manajemen Imunisasi di Kabupaten Bandung Barat

Abstrak

Kegiatan imunisasi sebagian besar dilakukan oleh bidan di unit pelayanan kesehatan. Bidan sebagai petugas injeksi bertanggung jawab atas perencanaan, pengangkutan, penyimpanan, dan penggunaan vaksin. Penelitian ini bertujuan mengetahui pengaruh pengetahuan bidan terhadap manajemen vaksin, ketersediaan sarana prasarana, dan supervisi manajemen imunisasi oleh bidan di Kabupaten Bandung Barat. Sebanyak 38 bidan wiraswasta yang memenuhi kriteria inklusi diambil dari Kabupaten Bandung Barat periode Juli 2017 hingga Februari 2018. Penelitian ini merupakan penelitian analitik observasional dengan desain *cross-sectional*. Analisis data bivariat menggunakan *correlation regression*. Korelasi multivariat menggunakan *multiple linear regression*. Hasil penelitian menunjukkan pengetahuan bidan tentang pengelolaan vaksin berpengaruh sebesar 33,3% (p=0,0001), sarana prasarana 54,2% (p=0,010), dan supervisi 34,65% (p=0,010) terhadap pengelolaan imunisasi. Uji *linear regression* antarvariabel menunjukkan bahwa faktor determinan dalam pengelolaan adalah ketersediaan sarana prasarana imunisasi (koefisien beta=0,615). Simpulan, pengetahuan bidan, fasilitas infrastruktur, dan supervisi tentang manajemen imunisasi di Kabupaten Bandung Barat berpengaruh terhadap proses imunisasi.

Kata kunci: Imunisasi, pengetahuan, sarana prasarana, supervisi-pemantauan

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Introduction

Immunization is preventive health care that becomes one of the Ministry of Health's priority activities to achieve Sustainable Development Goals (SDGs). The main objective of immunization is to reduce morbidity and mortality from preventable diseases by immunization.[1,2] The main problem with immunization is the storage of vaccines (temperature issues). If the temperature in storage does not conform to the recommended temperature, then the vaccine's potential decreases and even broken.[3,4]

According to the Ministry of Health New Zealand, there are two essential elements of immunization management, such as the regulating officers in storage and distribution on who work on health services. Both of the equipment used for storage, transportation, and monitoring of vaccines up to the patient.[5]

The providers should have good knowledge and understanding of vaccine management. Midwives must understand clearly about the transportation and storage of the vaccine until the vaccine is given.[6,7] The results of the study from Global Alliance for Vaccine Immunization (GAVI) and the Ministry of Health and the University of Padjajaran in 2011 in West Java was related to the availability of vaccine storage facilities of thermostats of 87.9%, while those with no monitoring sheets the temperature was 85.9%. Based on the data, it can be concluded that a community health center cannot control and supervise the temperature of the existing vaccine.[8]

The midwife mostly carries out the management of immunization in the health service. It explains that midwives are not only vaccine injectors but also managers of immunization programs, ranging from availability planning, storage transport to vaccine injections.[9,10] The findings in West Bandung regency that immunization management has not been appropriate even though coverage has been met. Moreover, there are still cases of diseases that can be prevented by immunization. It indicates that there are still many applications in the management of vaccines that are not appropriate, such as assuming that if the vaccines are stored in the refrigerator, they are safe. All vaccines will be damaged if they are exposed to heat or direct sunlight. Some vaccines are also not resistant to freezing. Even it can be permanently damaged in a shorter time compared to vaccines that are exposed to heat.[11,12,13]

This study was conducted to determine the effect of midwives' knowledge about vaccine management, availability of infrastructure facilities, and supervision-monitoring of immunization management in West Bandung regency.

Methods

This research is observational analytical research with a cross-sectional design. A total of 38 self-employed midwives who met the inclusion criteria were taken from the West Bandung regency area from July 2017 to February 2018. They are midwives who provide immunization services in their practice using vaccines taken from the community health care.

The sampling was conducted using a multistage sampling technique. The first step is determining the primary sampling unit (sub-districts), then the secondary sampling units, and the tertiary sampling units (independent midwifery practices in the community health center's work area that has been selected randomly).

Questionnaires and observations were used to collect the data. A questionnaire given to midwives contains questions about the midwife's knowledge about vaccine management tested for validity and reliability previously. This questionnaire also contains questions regarding the supervision and monitoring of the community health centers involved in immunization services. The process of collecting infrastructure data is conducted by observation using a checklist sheet. Likewise, immunization management is obtained from a checklist based on the Minister of Health Regulation Number 12 of 2017 concerning the Implementation of Immunizations. The observation is carried out three times in each midwife, starting from planning, transportation, storage, and use of vaccines.

Bivariate analysis in this research aims at determining the effect of midwife knowledge, availability of infrastructure, and supervision on the immunization management by midwives using regression correlation. If p value$<\alpha$ (0.05), the hypothesis is accepted, whereas the value is obtained from the coefficient of determination (R^2). Multivariate analysis to determine the most dominant factor in the management of immunization using multiple linear regression analysis can be seen from the most significant beta coefficient.

This research received ethical clearance from the Health Research Ethics Committee of Post Graduate Program of Midwifery Applied STIKes Dharma Husada Bandung Number 015/STIKes-DHB/SKet/PSKBS2/X/2017.

Results

Nearly half of the respondents were ≤30 years old. The majority of midwife education in this study is DIII Midwifery and most have never received any training.

Based on Table 3, most self-employed midwives already have facilities for injecting vaccines such as vaccines, syringes, body temperature thermometers, safety boxes, baby scales, baby length gauges, and Maternal and Child Health (MCH) handbook. It is just for cold chain infrastructure such as vaccine carrier, cold pack, cool pack, and thermometer more than half are not available in independent practice midwife (*bidan praktik mandiri*, BPM). As well as a temperature-monitoring card of 38 BPM only four self-employed midwives provide. Also, based on the univariate analysis of supervision-monitoring variables in independent midwives in West Bandung regency obtained 33 out of 38 self-employment, midwives stated that there were no supervisors related parties in their practice regarding immunization.

Based on the data processing results in Table 4 obtained the management of immunization in West Bandung regency in planning, transportation, and vaccine usages, more than half of the midwives already implement it according to the procedure. Only half the respondents did not perform according to the procedure, especially maintaining the vaccine cold chain.

Based on Table 5, there is a strong and positive relationship between midwives' knowledge and immunization management. Midwife knowledge influences immunization management by 33.3%, and other variables influence 66.7% immunization management. Likewise, the variable availability of immunization management infrastructure appears to have a strong positive relationship (r=0.736).

Determination coefficient value 0.542, meaning that the availability of infrastructure means to influence the management of immunization equal to 54.2% and the rest 45.8% immunization management influenced by other

Table 1 Characteristics of Midwives in West Bandung Regency

Parameter	n=38
Age (year)	
≤30	16
31–40	11
41–50	9
>50	2
Educational background	
DIII midwifery	36
DIV midwifery	2
Cold chain training	
Join	10
Never	28

Table 2 Analysis Descriptive of Knowledge Midwife about Vaccine Management Variable

Knowledge Midwife	Frequency (n=38)	Mean	Min Value	Max Value
Poor	19	10.11	4	19
Good	19			

Table 3 Analysis Descriptive of Infrastructure Facilities Variable

Availability of Facilities	Frequency (n)	
	Yes	No
Special refrigerator	17	21
Vaccine carrier (thermos/ cold box)	18	20
Cold pack	14	24
Cool pack	17	21
Thermometeric vaccine temperature	26	12
Temperature-monitoring card	34	4
Freeze watch or freezer tag	23	15
Vaccine	2	36
Solvent	2	36
Syringe 1 mL	1	37
Syringe 3 mL	1	37
Safety box	2	36
Thermometer	3	35
Stethoscope	2	36
Baby scales	3	35
Baby length gauge	2	36
MHC handbook	1	37

Table 4 Immunization Management

Parameter	Frequency (n=38)
Planning	
Corresponding	26
Not corresponding	12
Transportation	
Corresponding	22
Not corresponding	16
Storage	
Corresponding	19
Not corresponding	19
Vaccine used	
Corresponding	15
Not corresponding	23

variables. Supervision-monitoring has a value of determination coefficient of 0.120, meaning that supervision affects immunization management of 12.0. The linear regression test between the variables shows the result determinant factor in the management of immunization availability of facilities (beta coefficient=0.615).

Discussion

Midwives mostly carry out immunization management in health service units. From the results of research, most midwives have insufficient knowledge. Most midwives do not know the refrigerator's vaccine arrangement, the refrigerator temperature monitoring, the handling of the vaccine under special conditions, and the refrigerator maintenance. A research was conducted by Mboe et al.,[14] which states 55% of midwives in the Bandung city region had poor knowledge.

This study's results are in line with the research results conducted by de Timóteo Mavimbe and Bjune[15] in Mozambique against 44 vaccine management officers indicating that most officers have insufficient knowledge about vaccine storage. Another research study conducted in Vancouver[16] found good knowledge and followed up with acceptable vaccine management practices will decrease the number of damaged vaccines. In the study of 170 respondents, only 23% of officers with good knowledge and 49% of service units found damaged vaccines. Training programs can influence work behavior in two ways, and the most obvious is to directly improve the skills required by the officer to complete his or her job.[17,18]

The research conducted by Mallik et al.[19] revealed that based on 20 vaccine management officers in government and private health facilities, most of them had less knowledge about vaccine storage.

Knowledge is a fundamental domain in the formation of an action. From experience and research, the behavior based on knowledge will be better than the one with no knowledge because it is based on awareness, interest, consideration, and a positive attitude. On the other hand, the increased the amount of information or knowledge about a particular object of action, the greater the chance for the formation of behavior concerning the object.[14,20] Therefore, midwives need to improve their knowledge because they mostly carry out immunization management in the health service unit. In other words, in addition to injecting vaccines, midwives also have to manage immunization programs, starting from planning availability, transportation, and storage of vaccines.[7,10,21]

The test results obtained the influence between the availability of infrastructure and immunization management. Another study conducted by researchers by Kristini et al.[17] in Semarang city showed that the refrigerator's function is a factor influencing the way the midwife keeps the vaccine that undoubtedly affects the quality of vaccine management. The Ministry of Health Republic of Indonesia and WHO vaccine management guidance stated that the vaccine should always be at a temperature of 2–8°C without exception. It means that they have

Table 5 Analysis Bivariate and Multivariate Midwife Knowledge, Availability of Facilities, and Supervision-Monitoring with Immunization Management

Variables	r	R^2	p Value	Beta
Midwife knowledge	0.577	0.333	0.0001	0.242
Availability of facilities	0.736	0.542	0.0001	0.615
Supervision-monitoring	0.346	0.120	0.0100	0.214

to keep the vaccine temperature at a required temperature. It is necessary to support storage facilities, transportation, and vaccine. The guidelines describe what equipment is needed to store vaccines at optimum temperatures. Thus, good infrastructure will support improving the quality of immunization management.[2,10,22]

The cold chain needs to be maintained to achieve the effectiveness of vaccines. Therefore, it requires supporting infrastructure to keep the potency of vaccines. Only 12 out of 38 midwives have thermometers, which is considered the primary indicator of vaccines' cold chain. A depiction of the vaccines remains at the recommended temperature, both when delivering, storing, and injecting vaccines. All vaccines will be damaged if they are exposed to heat or direct sunlight. Some vaccines are also not resistant to freezing. Even it can be permanently damaged in a shorter time compared to vaccines that are exposed to heat.[11,12,23]

Maintenance and monitoring of vaccine temperature are essential in quickly determining whether vaccines are still suitable for use or not. The research on 379 clinics serving immunizations in Karachi, Pakistan, in 2014 states that only 38.5% of clinics routinely monitored the vaccine temperature twice a day.[22]

The problem of infrastructure is a classic problem in almost all fields because it is directly related to funding. The facilities and infrastructure in the management of immunization are a supporting factor for maintaining a cold chain in immunization management that is not negotiable. The vaccine has a fixed temperature that can not be reduced or so that the availability of facilities and facilities existence is necessary to manage immunization.[17,24,25]

Supervision-monitoring has a positive effect on immunization management. This study's results are in line with research conducted by Kristini et al.[17] that supervision with adequate frequency and quality can improve immunization services. Also, Robbins and Judge's[26] research state a correlation between the quality of supervision and performance improvement. A systematic form of supervision will be able to improve the service significantly.[5]

The contents of supervision include coverage, immunization targets by time, region, immunization preventable disease data by time and place, personnel, immunization equipment, vaccines, cold chain, recording, reporting, cross-program/sectoral cooperation results, and the problems found.[2,10] Similarly, Mboe et al.[14] suggest that the parties did not supervise many midwives. Some midwives who have never received supervision gain knowledge of vaccine storage from other midwives so that the truth of the substance of the knowledge can not be guaranteed and impact the management of immunization and public health.

To achieve the immunization program's ultimate goal is to reduce the mortality and mortality of immunization preventable diseases (*penyakit yang dapat dicegah dengan imunisasi*, PD3I) to see the high coverage and be accompanied by improvement of program quality by guidance and supervision. It is done among others West Bandung regency officials to supervise to the sub-district level, while the sub-district officers held guidance to the village/field by discussing it with puskesmas.[6,9]

Simultaneously, the knowledge variables, the availability of infrastructure facilities, and the supervision have a significant effect on immunization management. The influence given by the three independent variables is positive, means that the higher knowledge of midwife, supervision, and infrastructure means that the higher the management of immunization.

The most dominant variable is the availability of infrastructure.

In the implementation of the immunization program, facilities and infrastructure are very important. If there is no means, then immunization activities can not be implemented. Facilities include the availability of equipment, equipment, and space needed to support the immunization program's implementation. Suggestions and infrastructure required to consist of vaccines, vaccine storage equipment, vaccine use equipment, space comprised of space for immunization, counseling, counseling, vaccines, and medication activities. Facilities and infrastructure is one of the supporting activities and affecting individual performance.[10,12]

In conducting immunization services, activities can be implemented inside buildings, outside buildings, and private institutions. Vaccine storage at each administration level is different. At the central level, a vaccine storage facility is a cold room. This whole room is insulated to prevent heat from entering the room. The facility is equipped with a backup generator to cope with power outages. At the provincial level, the vaccine is stored in a cold room with a temperature of −20°C to −25°C, whereas at

the district level, vaccine storage facilities use refrigerators and freezers.[2,24,27]

In addition to infrastructure, compliance in the management of immunization is the supervision-monitoring, which is a series of activities undertaken.[14,20]

Conclusions

There is the influence of midwives' knowledge, infrastructure availability, and supervision on immunization management in the West Bandung regency. The infrastructure is determinant factor in the management of immunization.

Conflict of Interest

All researchers do not have a conflict of interest with the subjects of this study.

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RESEARCH ARTICLE

Cogongrass (*Imperata cylindrica* L.) Ethanol Extract on Sepsis Mice Model Body Weight and Sepsis Score

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Abstract

Sepsis causes damage for cells, behavioral phenotype regression, and will end in most patients' death. The ethanol extract of cogongrass (*Imperata cylindrica* L.) root (ECGR) acts as an antioxidant. This study aimed to observe the effect of giving ECGR to body weight (BW) and the sepsis score of the sepsis mice model by lipopolysaccharide (LPS) induction. This study was an in vivo study with a randomized post-test controlled group design at the Animal Laboratory of Universitas Padjadjaran, 2018. We used 4 (four) groups of male mice (*Mus musculus*) DDY strains. Group 1 as a control, group 2: LPS 10 µL/kgBW, group 3, and 4: LPS+ECGR (90 mg/kgBW, and a dose of 115 mg/kgBW, respectively). This treatment was performed for two weeks. Every three days, we measured their body weight. After two weeks, group 2, group 3, and 4 were injected with LPS for 8 hours to induce sepsis. Next, we measured body weight and sepsis score using murine sepsis score (MSS). Then statistical analysis was performed using ANOVA and the Kruskal-Wallis test. The results showed no differences in body weight were found in the treatment groups (3 and 4) compared with control, suggesting no effect of ECGR in decreasing mice body weight. The sepsis score was more than 21 in groups treated with LPS (2, 3, and 4), suggesting LPS can induce sepsis. There was a slight decrease in scores in-group 3 and 4 compared with group 2. This study concludes that the treatment of ECGR caused no harm to body weight and slightly decreased sepsis score in the sepsis mice model.

Keywords: Body weight, cogongrass, murine sepsis score, reactive oxygen species

Ekstrak Etanol Alang-alang (*Imperata cylindrica* L.) terhadap Bobot Badan dan Skor Sepsis Mencit Model Sepsis

Abstrak

Sepsis menyebabkan kerusakan sel, regresi fenotipe perilaku, dan akan berakhir kematian pada sebagian besar pasien. Ekstrak etanol akar alang-alang (*Imperata cylindrica* L.) (ECGR) berperan sebagai antioksidan. Penelitian ini bertujuan mengetahui pengaruh pemberian ECGR terhadap bobot badan (BB) dan skor sepsis pada mencit model sepsis yang diinduksi lipopolisakarida (LPS). Penelitian ini adalah penelitian *in vivo* dengan desain *randomized post-test controlled group* di Laboratoium Hewan Universitas Padjadjaran tahun 2018. Kami menggunakan 4 (empat) kelompok mencit jantan (*Mus musculus*) *strain* DDY. Kelompok 1 sebagai kontrol, kelompok 2 diinduksi LPS 10 µL/kgBB, kelompok 3 dan 4 diinduksi LPS+ECGR (dosis 90 mg/kgBB dan 115 mg/kgBB masing-masing). Perlakuan ini dilakukan selama 2 minggu. Setiap tiga hari dilakukan pengukuran bobot badan mencit. Setelah dua minggu, kelompok 2, kelompok 3, dan kelompok 4 diinjeksi LPS selama 8 jam untuk menginduksi sepsis. Selanjutnya, diukur bobot badan dan skor sepsis menggunakan *murine sepsis score* (MSS). Analisis statistik menggunakan ANOVA dan Uji Kruskal-Wallis. Hasil penelitian menunjukkan tidak terdapat perbedaan bobot badan pada kelompok perlakuan (3 dan 4) dibanding dengan kelompok kontrol yang menunjukkan ECGR tidak berpengaruh dalam menurunkan bobot badan mencit. Skor sepsis lebih dari 21 pada kelompok yang diinduksi LPS (2, 3, dan 4) menunjukkan LPS dapat menyebabkan sepsis. Terdapat sedikit penurunan skor pada kelompok 3 dan 4 dibanding dengan kelompok 2. Simpulan penelitian ini, pengobatan ECGR tidak membahayakan bobot badan dan mengakibatkan sedikit penurunan skor sepsis pada mencit model sepsis.

Kata kunci: Alang-alang, bobot badan, *murine sepsis score*, *reactive oxygen species*

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Introduction

Incidence of severe sepsis and septic shock has continued to increase over the past 30 years, and currently, more than 750,000 cases (about 3 out of 1,000 population).[1] There is life-threatening organ dysfunction in sepsis due to the host's response to the infection (inflammation).[2–4] The process of organ damage will continue to occur during sepsis due to an imbalance in the redox cycle, potentially lethal organ dysfunction, and it can affect any age.[1,5,6] Our previous study also found that sepsis induced by lipopolysaccharide (LPS) causes myocardial contractile dysfunction in mice.[7]

Cogongrass (CG) or *Imperata cylindrica* L. is a plant that is often considered as weeds. Nevertheless, several recent studies have shown that this plant contains phenol compounds such as flavonoids and isoeugenin. These bioactive compounds can act as a potential anti-inflammatory and antioxidant.[8–10]

Our previous study showed ethanol extract cogongrass (*Imperata cylindrica* L.) root (ECGR) depressed cholesterol level and triglycerides absorption in vivo studies.[11,12] In this current study, we pursued to explore the effect of ECGR in mice model sepsis, where we used LPS to induce sepsis. In this current study, we measured the body weight and the sepsis score in the sepsis mice model after treatment with ECGR.

Methods

Experimental laboratory research was conducted using a randomized post-test controlled group design. The Health Research Ethics Committee of Universitas Islam Bandung, Bandung, West Java, Indonesia, has approved the ethical clearance with number 153/Komite Etik.FKIII/2018. This study was conducted at the animal laboratory of Universitas Padjadjaran, 2018.

Cogongrass root was obtained from Solo, Central Java, Indonesia, and was tested to its authenticity by Institute Teknologi Bandung Institute, Indonesia. The roots of CG were separated and washed clean with water, dried for two weeks, then macerated, and filtered. The filtration in the extract's form was separated from the solvent by using a vacuum rotary evaporator. ECGR was diluted using carboxyl methylcellulose (CMC) 0.5% (Merck, U.S.A.) and divided in to 2 doses: 90 mg and 115 mg concentration/kgBW.[11]

The mice (*Mus musculus*) DDY strains with the same breed, age of 8–10 weeks with body weight (30–35 grams), were selected as objects of this study. Mice were provided by PT Bio Farma, Bandung, West Java, Indonesia. These mice were divided into four experimental groups consisting of 8 mice/group. Therefore the total of mice used in this experiment was 32 mice. Group 1 as the negative control, mice that only treated CMC 0.5% (the solvent ethanol extracts of *Imperata cylindrica* L. root); group 2 (CMC 0.5%+LPS); group 3 and group 4, mice that treated ECGR in dose 90 mg/kgBW and dose 115 mg/kgBW, respectively + LPS. LPS is well known used to induce sepsis conditions in many previous types of researches.[13–15]

The acclimatization of animal trials preceded the experiment for seven days in the laboratory. Thus they can adapt to their environment. Mice were placed within a cage at the Animal Laboratory of Universitas Padjadjaran with a controlled room temperature (setting of 12 hours of light and 12 hours of dark). Mice were given the standard food and drinking water ad libitum.

After acclimatization, groups 1 and 2 were treated 0.5% of CMC, groups 3 and 4 were treated ECGR+0.5% CMC each 90 mg/kgBW and 115 mg/kgBW for two weeks. The body weight of mice was measured every three days to find out whether there was an influence of the ECGR interfered with the bodyweight of mice or not. The ECGR was given once a day for two weeks, from 3 to 5 pm.[11] After two weeks of treatment, groups 2, 3, and 4 were injected LPS 10 mg/kgBW (Sigma-Aldrich, St. Louis, U.S.A.). LPS was diluted within 50 µL PBS and injected intraperitoneal based on previous research.[16] Next, we observed behavioral phenotype by using the murine sepsis score (MSS). There were seven variables assessed: appearance, level of consciousness, activity, response to the stimulus, posture, eyes, respiration rate, and respiration quality. The mice were in sepsis if the number of MSS in each mouse was more than 21 or had the respiratory quality or respiratory rate with a value of 3 or more.[17]

Statistical analyses were performed using GraphPad statistical package. Variables were summarized using the mean±SD for normal distribution data and median+interquartile range (IQR) for skewed data. Normality distribution was assessed with the Shapiro-Wilk test. The p value was calculated using the analysis of variance (ANOVA) for normal distribution (parametric) and the Kruskal-Wallis test for skewed data

(non-parametric). Two-tailed p values<0.05 were considered statistically significant, and p<0.01=very significant.

Results

First, we measured the mice's body weight before and after two weeks of treatment with ECGR. We showed no significant differences in mice's body weight after treatment between each group (36.7; 38; 39.5; 39.4) gram with p=0.35, p>0.05.

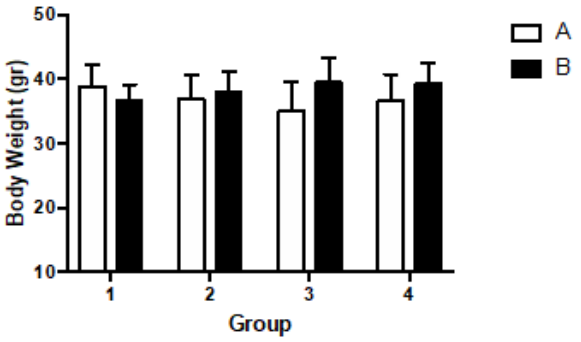

Figure 1 Bodyweight of Mice not Affected after Treatment with ECGR

A and B, the bodyweight of mice before and after two weeks treated with ECGR, respectively. Group 1, control; 2, LPS; group 3 and 4, treated ECGR 90 and 115 mg/kgBW, +LPS respectively. Data in the form of mean±STD, n=6–8/group. ANOVA with p<0.05

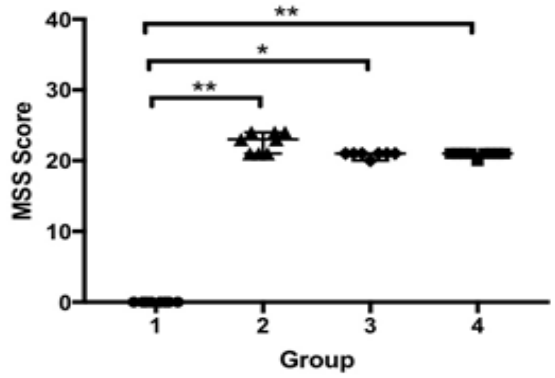

Figure 2 All Mice Treated with LPS were in Sepsis Condition

Group 1, control; 2, LPS; group 3 and 4, treated ECGR 90 and 115 mg/kgBW, +LPS respectively. Data in the form of median±IQR, n=6–8/group, Kruskal-Walis analysis with *p<0.05 (significant); **p<0.01 (very significant)

Next, we measure the sepsis score using the MSS. Our result showed all mice in-group 2, 3, and 4, which were treated with LPS, were in sepsis condition (23, 21, 21), while in-group 1 (control) showed no sepsis (MSS=0). Using the Kruskal-Wallis test, we showed very significant differences in groups 2 and 4 compared with group 1 (p=0.000; p=0.007, p<0.01, respectively) and significant differences in group 3 compared with group 1 (p=0.018, p<0.05).

Discussion

In this study, we revealed that the treatment of ECGR did not interfere with the bodyweight of the mice; moreover, ECGR also slightly reduces sepsis score in the sepsis mice model, which is induced by LPS.

We showed that ECGR did not affect mice's body weight, suggesting it does not interfere with the metabolism processes that can interfere with the bodyweight. Further study should be performed to measure body composition: fat mass, muscle mass, and body fat percentage.

MSS score is a method for assessing and comparing sepsis-associated outcomes, which consistently predicts sepsis mortality and progression in an animal model of sepsis.[17–19] Using this score, in the current study, LPS increased MSS score of more than 21, suggesting LPS can induce sepsis. This result supported several previous studies.[13–15,20,21]

Lipopolysaccharide (LPS) is an endotoxin located outside of the gram-negative bacteria membrane[22] and one of the infection stimuli that is well known to be used in experiments in causing many profound immunological responses of the host; one mechanism the toll-like receptor (TLR) 4 pathway.[1,15]

ECGR also slightly reduces sepsis score in the sepsis mice model, suggesting the possible role of ECGR maybe in some mechanisms in sepsis condition. The pathogenesis of sepsis involves the formation of reactive oxygen species (ROS). Endotoxins produced during sepsis, are capable of inducing ROS formation, such s superoxide, hydrogen peroxide, and hydroxyl.[23] This ROS production will cause significant structural changes in the cell and ultimately cause multiple organ dysfunctions.[24] Flavonoids in the ECGR play a role in the mechanism of ROS inhibition.[8] Flavonoids work as an anti-inflammatory by inhibiting interleukin eight formations so that

the recruitment process of polymorphonuclear (PMN) cells to inflamed tissues can be inhibited.[25] The flavonoids in the ECGR can also act as nitrite oxide (NO) scavenging, thereby reducing NO levels. Isoeugeunin found in *Imperata* roots can also inhibit inducible nitric oxide synthase (iNOS) so that the formation of NO free radicals can be suppressed.[9] Our next project is to explore some possible mechanisms of the potential role of ECGR in sepsis condition.

Also, we also observed the mice's behavioral phenotype by observing that mice in-group 1 had normal activities, such as eating, running, drinking, and other activities. On the contrary, the mice in group 2 showed suppressed activities, and most of the mice looked stationary. In-group 3 and 4 showed suppressing activities but more active than group 2, suggesting the potential effect of ECGR in improving the behavioral phenotype of mice induced by LPS.

Conclusion

The treatment of ECGR caused no effect on body weight and slightly decreased sepsis score in the sepsis mice model.

Conflict of Interest

The authors have read the manuscript and agreed to submit it in its current form for publication in the journal. There are no conflicts of interest to declare.

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RESEARCH ARTICLE

Pilot Study of Lung Function Improvement in Peak Expiratory Flow (PEF) Value Using Fish Oil Containing Omega-3 Therapy in Asthma

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Abstract

Fish oil contains omega-3 as an anti-inflammatory effect that can inhibit the production of arachidonic acid 5-lipoxygenase (ALOX5), an enzyme that aggravates the inflammation of the lungs that cause asthma. This study aims to determine the effect of omega-3 from fish oil on improving lung function with peak expiratory flow (PEF) value in patients with outpatient asthma in Surabaya. The research design used in this research is pre-post test design and lung function examination by using a peak flow meter. Then follow up every week for four weeks during the use of fish oil, and the results of his research were analyzed by t test. The study was conducted from April 2017 until January 2018 in Surabaya. The sample of the study was 27 adult asthma patients. The results showed that most of the study subjects had an increase in PEF value every week. Besides, there was a significant increase of PEF values gradually at T_0 (before intervention) to T_4 (intervention for four weeks), indicating an improved effect after the use of fish oil in a four-week study sample. In conclusion, fish oil containing omega-3 is effective in improving lung function in outpatient asthma patients.

Keywords: Asthma, fish oil, omega-3, peak expiratory flow

Pilot Studi Perbaikan Fungsi Paru Menurut Nilai *Peak Expiratory Flow* (PEF) Menggunakan Terapi Minyak Ikan Mengandung Omega-3 pada Asma

Abstrak

Minyak ikan mengandung omega-3 sebagai efek antiinflamasi yang dapat menghambat produksi asam arakidonat 5-lipoksigenase (ALOX5) merupakan enzim yang memperburuk peradangan paru yang menyebabkan asma. Penelitian ini bertujuan mengetahui pengaruh omega-3 dari minyak ikan terhadap perbaikan fungsi paru dengan nilai *peak expiratory flow* (PEF) pada pasien asma dewasa rawat jalan di Surabaya. Desain penelitian yang digunakan dalam penelitian ini adalah *pre-post test* dan pemeriksaan fungsi paru menggunakan *peak flow meter*. Kemudian dilakukan *follow up* setiap minggu selama empat minggu selama penggunaan minyak ikan dan hasilnya dianalisis dengan uji t. Penelitian dilakukan pada April 2017 hingga Januari 2018 di Surabaya. Sampel penelitian sebanyak 27 pasien asma dewasa. Hasil penelitian menunjukkan bahwa sebagian besar subjek penelitian mengalami peningkatan nilai PEF setiap minggunya. Selain itu, terdapat peningkatan signifikan nilai PEF secara bertahap pada T_0 (sebelum intervensi) sampai T_4 (intervensi selama empat minggu) yang menunjukkan efek membaik setelah penggunaan minyak ikan pada sampel penelitian selama empat minggu. Simpulan, minyak ikan yang mengandung omega-3 terbukti efektif dalam perbaikan fungsi paru pada pasien asma rawat jalan.

Kata kunci: Asma, minyak ikan, omega-3, *peak expiratory flow*

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Introduction

Asthma is defined as chronic inflammation of the airways, with respiratory symptoms such as wheezing, shortness of breath, chest tightness, and coughing that vary over time and intensity, together with variable limitations of expiratory airflow.[1] The Ministry of Health estimates that asthma is among the top 10 causes of illness and death in hospitals.[2] According to Global Burden data, asthma has increased and is now ranked 28th as a disease that affects one's adjusted-life year.[3] Adverse effects of asthma include decreased quality of life, decreased productivity, absence from school, increased health costs, increased risk of hospitalization, and even death.[4]

The treatment has now shifted from synthetic drugs to nutritional treatments. Therapy with synthetic drugs still often causes drug-related problems, both in drug selection, difficulties in using tools, the emergence of side effects, to the cost burden that is greater than it should be.[5–12] Lifestyle consumption of nutrients plays an essential role in developing several diseases, including inflammatory diseases as a cause of asthma.[5] Consumption of fish can prevent asthma in adult patients. Research shows that fish consumption at least once a month, can reduce the risk of asthma.[13] Populations with high intakes of fish also have low levels of asthma. This theory states that fish oil content can reduce inflammation that causes swelling in the lung channels leading to asthma attacks.[14] Fish oil is a very effective nutrient containing essential omega-3 fatty acids and can be absorbed easily. Fish oil contains docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA).[13] Omega-3 contained in fish oil is considered a potential therapy for asthma and other inflammatory diseases. Fish oil inhibits the production of arachidonic acid 5-lipoxygenase (ALOX5), an enzyme that exacerbates inflammation of the lungs that causes asthma.[15]

Indonesia, a maritime country, has excellent fish production potential, which can process fish oil, such as salmon, cod, etc. Meanwhile, several studies related to fish oil have also been carried out, which contain omega-3 as conducted by Aprizayanti,[16] and Santoso et al.[17] However, there are no studies related to the effect of omega-3 in fish oil on asthma improvement. Control of asthma symptoms is also related to the limitations of the expiratory airflow variable. The function of lung expiration varies from time to time and is more significant than in healthy populations.1 Many methods for assessing lung physiology have been widely accepted as a standard. It is spirometry and peak expiratory flow (PEF) examinations. PEF self-monitoring can be useful in asthma management, especially in those with low perceptions of their airways.[12] Peak expiratory flow has a unique role in the initial investigation of asthma work, where pulmonary testing functions are often needed.[18]

Hopefully, this research can improve knowledge related to the nutrition of asthma. Also, pharmacists' role supports the management of asthma and provides information, counseling, and education. So, they better understand the treatment regimen given so patients can play an active role in their treatment, improving their compliance with the drug. In the integrated team, the pharmacist's role is to provide recommendations in the selection of appropriate drugs based on the patient's condition obtained from the results of the interview and the results of the doctor's diagnosis.[4] This study aims to determine the effect of omega-3 from fish oil on lung function improvement with PEF values in outpatient adult asthma patients in Surabaya.

Methods

The research design was the pre-post test design, examining lung function using a peak flow meter. The study was conducted from April 2017 until January 2018, with ethical tests that have been conducted and get number 004/KE/I/2017 at the Institutional Ethical Committee of the University of Surabaya. The composition in fish oil given was 1000 mg omega-3, 180 mg EPA, 120 mg DHA. Fish oil was given to patients and then followed up every week for four weeks with a once-daily dose that was proven to consume fish oil at least once a month can reduce the risk of asthma, with a dose of 1 gram to 5.4 grams per day.[19] So, in this study, selected fish oil with a dose of 1.0 gram.

This study's variable was the value of PEF in outpatient asthma patients. The peak flow meter was a measure of PEF. Peak expiratory flow (PEF) can indicate the degree of limited airflow. For each type of peak flow meter, the PEF value obtained was also different. Respondents were asked to measure lung function's value using a peak flow meter three times and see the best value. Measurement using a peak flow meter

Figure Peak Flow Meter

was performed by patients with the researchers' assistance six times in 6 weeks after consuming fish oil for one week.

The study population was outpatient asthma patients. The research sample was with the following inclusion criteria were adults age 18–45 years, and patients were willing to participate in the study voluntarily after receiving informed consent. Exclusion criteria: (1) having a disease that can affect the data collection process requires a differential diagnosis. These diseases include bronchitis, chronic obstructive pulmonary disease (COPD), sinusitis, vocal cord dysfunction, bronchiectasis, heart disease, alpha1 deficiency-antitrypsin, pulmonary embolism, and kidney disorders. It also excludes patients, which is (2) smoking or stopping smoking <2 years, and (3) patients who used routine asthma medication (controller). The research subjects were obtained by purposive sampling method.

A paired t test was used to determine the presence or absence of an average difference between 2 groups of related samples. One sample underwent two different treatments. Test the difference between observations before and after therapy, using paired t test. This pooled t test was used to determine whether there was an average difference between the two unrelated sample groups. Test the difference between observing PEF values at week 0 and week 4 in patients receiving fish oil therapy.

Table 1 Distribution of Frequency of Characteristics of Respondents

Characteristics	n=27
Gender	
Male	7
Female	20
Age (year)	
Late teens (17–25)	25
Early adults (26–35)	1
Late adults (36–45)	1
Asthma medication used	
Short-acting oral beta-2 agonist	8
Short-acting inhalation beta-2 agonist	10
Not currently using any medicine	1
Agonist β-2 long work inhalation	2
Oral methylxanthine	4
Oxygen	1
Other	8
Not currently using any medicine	3

Results

In Table 1, explaining the number of samples (subjects) of male research was less than female respondents, with most ages ranging from 17–25

Table 2 Changes in Peak Expiratory Flow Value After Giving Fish Oil Therapy

Groups being Compared	Frequency of Subjects Changing PEF Value (L/sec)		
	Increased	Fixed	Decreased
T0 and T1	20	2	5
T0 and T2	21	1	5
T0 and T3	20	1	6
T0 and T4	24	1	2
T1 and T2	20	0	7
T2 and T3	16	2	9
T3 and T4	21	0	6

Note: PEF=peak expiratory flow; T0=week 0, the study sample has not received the intervention; T1=in the first week, the test group's research sample had received the intervention (fish oil) for one week; T2=in the 2nd week, the test group sample had received the intervention (fish oil) for two weeks; T3=in the 3rd week, the test group's research sample had received the intervention (fish oil) for three weeks; T4=in the 4th week, the test group's study sample had received the intervention (fish oil) for four weeks

Table 3 Average Peak Expiratory Flow Values

Average ($\bar{x}$) Changes in PEF Values from Before Therapy compared to when Given Fish Oil Therapy	Time of Data Collection for PEF	Average PEF Value (L/sec)	Average ($\bar{x}$) Changes in PEF values from Before Therapy compared to when Given Fish Oil Therapy
$\bar{X}_{T0-T4}$= 107.04 $\bar{X}_{T0-T3}$= 80.93 $\bar{X}_{T0-T2}$= 77.59 $\bar{X}_{T0-T1}$= 55.19	T0	217.96	$\bar{X}_{T1-T0}$= 55.19 $\bar{X}_{T2-T1}$= 22.41 $\bar{X}_{T3-T2}$= 3.33 $\bar{X}_{T4-T3}$= 26.11
	T1	273.15	
	T2	295.56	
	T3	298.89	
	T4	325.00	
Conclusion: all experienced an increase in PEF values after 4 weeks on average by 107.04			Conclusion: all have increased but the numbers are not significant every week

Note: PEF=peak expiratory flow; T0=week 0, the study sample has not received the intervention; T1=in the first week, the test group's research sample had received the intervention (fish oil) for one week; T2=in the 2nd week, the test group sample had received the intervention (fish oil) for two weeks; T3=in the 3rd week, the test group's research sample had received the intervention (fish oil) for three weeks; T4=in the 4th week, the test group's study sample had received the intervention (fish oil) for four weeks

years. Most subjects (10 of 27) used a short-acting beta-2 agonist by the inhalation route (salbutamol MDI) as asthma therapy was used only when asthma symptoms appeared.

Most research subjects experienced an increase every week after the use of fish oil (Table 2). In Table 3, it was known that there was an increase in PEF values at T0 to T4. It showed an improved effect after the use of fish oil in the study sample for four weeks. However, the increase did not occur similarly every week. T2–T1 had an average increase of 22.41 L/sec, T3–T2 had an average increase of 3.33 L/sec, and T4–T3 had an average increase of 26.11 L/sec.

Table 4 Normality Test for Peak Expiratory Flow Values

Groups	p Value*
T0	0.002
T1	0.131
T2	0.109
T3	0.209
T4	0.089

Note: *Shapiro-Wilk test; T0=week 0, the study sample has not received the intervention; T1=in the first week, the test group's research sample had received the intervention (fish oil) for one week; T2=in the 2nd week, the test group sample had received the intervention (fish oil) for two weeks; T3=in the 3rd week, the test group's research sample had received the intervention (fish oil) for three weeks; T4=in the 4th week, the test group's study sample had received the intervention (fish oil) for four weeks; p>0.05 means normal distribution and p<0.05 means that the distribution is not normal

The normality test used Shapiro-Wilk because of the number of samples <50 subjects. Normality tests regarding the research samples' PEF values at T0, T1, T2, T3, and T4 found that T1, T2, T3, and T4 groups were normally distributed (p>0.05). However, the t0 group was not normally distributed (non-parametric) (p<0.05, Table 4).

The normality test in Table 4 used a paired t test if it is normally distributed while a normally

Table 5 Statistical Tests of Peak Expiratory Flow Intervention Groups by Ratio Scale

Groups	p Value
T0 and T1	0.014*
T0 and T2	0.003*
T0 and T3	0.009*
T0 and T4	0.000*
T1 and T2	0.000**
T2 and T3	0.013**
T3 and T4	0.017**

Note: *Wilcoxon signed-rank test; **paired t test; T0=week 0, the study sample has not received the intervention; T1=in the first week, the test group's research sample had received the intervention (fish oil) for one week; T2=in the 2nd week, the test group sample had received the intervention (fish oil) for two weeks; T3=in the 3rd week, the test group's research sample had received the intervention (fish oil) for three weeks; T4=in the 4th week, the test group's study sample had received the intervention (fish oil) for four weeks; p>0.05: Ho is rejected, meaning there is no significant difference; p<0.05: Ho accepted means that there are significant differences

distributed Wilcoxon signed-rank test is used. Table 5 showed that there was a significant increase every week in the PEF values of study subjects. The most significant increase occurred in the first week (T1) of fish oil administration compared to before therapy (T0, Table 3).

Discussion

The PEF value estimated the peak expiratory rate. It is the fastest measure of airspeed exhaled by the lungs after inhaling a long breath expressed in units of liters per second (L/sec). Peak flow meters were used to assess the PEF. The peak flow in patients may show changes before the patient experiences an exacerbation.[20] Previous studies using PEF values as clinical outcomes for asthma therapy have been conducted by Burkhart et al.,[21] Harrison et al.,[22] and Ramsay et al.[23]

Table 2 showed an increase in PEF values at T0 to T4, indicating an improved effect after using fish oil in the study sample for four weeks. Table 5 showed a significant change every week, but the increase does not occur the same every week. It was due to several factors that can affect the PEF value, such as differences in activity and weather every week that cannot be controlled. The researcher cannot control the activity because the study sample is a student who has a dense activity. Besides that, the research is also carried out during the rainy season, which can increase the research sample's sensitivity so that it causes the emergence of asthma exacerbations.

It was also strengthened by the results of statistical analysis test results of PEF values between T0, T1, T2, T3, T4, and K1, which have $p=0.000$ ($p<0.005$) then Ho was accepted, meaning that the value of PEF after the use of fish oil was significantly different statistics. Researchers choose four weeks as the minimum time for fish oil intervention because a previous study stated that fish oil's effects appeared after a minimum consumption of 4 weeks. However, there was no further research if fish oil is consumed for more than four weeks. It was expected that further research would be on the effect of improving PEF values after fish oil use for more than four weeks.

Several factors affect the PEF value and can be controlled by researchers, such as food and drugs consumed by research subjects. Control of this factor is done by providing a logbook containing a list of foods and medicines consumed daily by the study sample for four weeks of research. Factors characteristic of the study sample that can affect the PEF value include gender, physical activity, nutrition/food intake, asthma treatment used, occupation, and lung function.

According to Zein and Erzurum,[24] in women, the influence of estrogen and progesterone hormones cause a high risk of asthma during and after puberty. Asthma is, therefore, more common in women after puberty compared to men.[1] The same thing was expressed by the Center for Disease Control and Prevention (CDC) in 2016, which said that women's prevalence was higher than men's.[25] Respondents in this study were teenagers aged 17–25 years at 96.15%, early adulthood 41–60 years at 3.85%, and late adulthood at 36–45 years at 0%.

Exercise-induced asthma is a symptom of asthma that arises in non-asthmatic patients due to excessive physical activity. When someone is doing strenuous physical activity, they will breathe more, faster through the mouth. It then causes the air that enters the lungs to be colder and drier than normal air. A bronchial membrane in the lungs can swell, which then appears asthma symptoms such as wheezing. Exercise-induced asthma generally occurs in winter.26 Entertaining physical activity classified as heavy can trigger an exacerbation in patients with asthma that is not controlled. Some also suffer from exacerbations only during physical activity.[1]

The appearance of asthma symptoms can be related to food chemicals that can cause individual reactions. It is related to a person's level of intolerance.[1]

Outpatient asthma treatment is divided into two, namely the controller and reliever. The controller is a treatment used daily in the long term to keep asthma under clinical control through its anti-inflammatory effects. Whereas reliever is a treatment used when necessary and quickly to reduce bronchoconstriction and reduce the acute symptoms that accompany it.[1] In this study, all respondents were in step 1, which means that none of the respondents used a type of asthma control controller to maintain asthma control daily. All respondents only used asthma reliever when experiencing worsening symptoms (reliever). This type of reliever's primary choice is short-acting beta-2 agonist (SABA), which is generally salbutamol by the route of inhalation administration. The inhalation route is preferred because it is topical, so side effects

tend to be smaller and can work directly to the bronchioles' target site.[1] However, from the respondents' treatment data, some respondents use corticosteroids (oral or inhalation) and methylxanthine group, which is an asthma therapy in the controller group.

In this study, 26 subjects were taken as respondents who have jobs as students (100%). Wijnhoven et al.,[27] in their study, stated that asthma patients with a higher level of education had a better quality of life than asthma patients with a lower level of education.Therefore, in this study, the work factor involves respondents who have status as students.

Measurement of lung function in this study assesses PEF with peak flow meters of the same type and brand. The condition of patients experiencing asthma exacerbations also affects the ability of research subjects when blowing peak flow meters. The amount of air will influence the device breathed (inspiration) and the amount of air exhaled (expiration). Whereas when patients have asthma exacerbations, the patient experiences impaired limitations in expiration.[1] Also, other factors can influence PEF measurements, such as body weight and socioeconomic status.

In this study, the best value prediction examination was not carried out because the patient first used the device and could not get the patient's height due to the condition or condition of the patient, which made it impossible to measure height in patients who had asthma exacerbations in the emergency room, so the predictive value in patients using the average height of Indonesians, namely for men at 162.5 cm and women 151.2 cm.[28]

There are still weaknesses and shortcomings in conducting research, although researchers have tried their best to make the research results perfect. Researchers realize that the study's limitations include: (1) respondents' inclusion criteria such as heart and kidney history data were not obtained accurately. Because when the respondent said that there was no history of heart and kidney, it was not supported by checking the doctor first by using an electrocardiogram (EKG); (2) the type of fish oil used in this study is fish oil from abroad. Researchers used this type of fish oil because the dose was by the desired fish oil dose of 1.0 gram. Therefore respondents felt uncomfortable consuming fish oil, which was considered quite large because some respondents commented on the large soft capsule; and (3) there are time variations that can affect PEF values. The PEF value variability depends on the diurnal cycle (morning and evening values are different), and the expected value of this variability <20%.[1,4]

Conclusion

Fish oil containing omega-3 effectively increases lung function every week in asthma patients, from the first week of therapy to the fourth week.

Conflict of Interest

There were no conflicts of interest related to this research.

Acknowledgments

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RESEARCH ARTICLE

Dengue Cases Prediction in Kupang

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Abstract

The pandemic of coronavirus (COVID-19) causes another infectious disease such as dengue is neglected in Indonesia. Since the majority of resources, both human and capital, are focusing more on COVID-19, it is still essential to also manage dengue as it is still becoming a threat to the community. This study aims to predict the number of cases of dengue in Kupang, East Nusa Tenggara, Indonesia. This study area is in Kupang city, East Nusa Tenggara province, Indonesia. Data regarding monthly dengue reported cases by months from January 2010–December 2019 in Kupang city was collected to describe the temporal patterns of dengue cases. The Box-Jenkins approach is used to fit the auto-regressive integrated moving average (ARIMA) models. This model will predict monthly dengue cases for the year 2020 (12 months). Data analyzed using the Minitab program version 18.0. This study shows that seasonality was an essential component for Kupang city, which performed an exploratory analysis of dengue incidence (ln data) for 2010–2019. The linear trend model shows the prediction of dengue cases in 2020 was Yt=36.9–0.131 × t. The forecast tells that dengue will remain high for the whole year. Maintaining a clean environment, reduction of breeding sites, and other protective measurements against dengue transmission are significant to perform.

Keywords: COVID-19, dengue, prediction

Prediksi Kasus Demam Berdarah Dengue di Kupang

Abstrak

Pandemi virus *corona* (COVID-19) mengakibatkan penyakit menular lain seperti dengue terbengkalai di Indonesia karena mayoritas sumber daya, baik manusia maupun permodalan, lebih berfokus pada COVID-19, sedangkan penanggulangan demam berdarah dengue (DBD) masih menjadi hal yang penting karena masih menjadi ancaman bagi masyarakat. Penelitian ini bertujuan memprediksi jumlah kasus DBD di Kupang, Nusa Tenggara Timur, Indonesia. Wilayah studi ini berada di Kota Kupang, Provinsi Nusa Tenggara Timur, Indonesia. Data bulanan kasus DBD yang dilaporkan per bulan dari Januari 2010–Desember 2019 di Kota Kupang dikumpulkan untuk menggambarkan pola temporal kasus DBD. Pendekatan Box-Jenkins digunakan untuk menyesuaikan model *auto-regressive integrated moving average* (ARIMA). Model ini akan memprediksi kasus DBD bulanan untuk tahun 2020 (12 bulan). Data dianalisis menggunakan program Minitab versi 18.0. Studi ini menunjukkan bahwa musim merupakan komponen penting bagi Kota Kupang yang melakukan analisis eksplorasi kejadian DBD (dalam data) untuk tahun 2010–2019. Model tren linier menunjukkan prediksi kasus DBD tahun 2020 adalah Yt=36.9–0.131 × t yang memperkirakan DBD akan tetap tinggi sepanjang tahun. Menjaga kebersihan lingkungan, mengurangi tempat berkembang biak, dan tindakan perlindungan lainnya terhadap penularan DBD penting dilakukan.

Kata kunci: COVID-19, DBD, prediksi

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Introduction

During the coronavirus (COVID-19) pandemic, almost all other diseases suffer from neglect from health officials and the community. In Indonesia, from the first confirmed cases of COVID-19 in early March until April 29, 2020, it already recorded 9,511 cases with 773 fatalities.[1] Government and hospitals continue to increase the allocation of personnel and medical devices for handling COVID-19, and as a result, the handling of other diseases such as dengue is neglected.[2] Simultaneously, the Ministry of Health Republic of Indonesia recorded that from January to the first week of July 2020, there were around 72 thousand cases of dengue nationally with 459 fatalities.[3]

East Nusa Tenggara was one of the provinces with the highest number of cases together with East Java. Until March 2020, there were 3,731 dengue cases in all of East Nusa Tenggara, with 43 fatalities.[4] Dengue is still a significant public health threat that needs attention.[5,6] Researchers concerned about dengue fever and COVID-19 are difficult to distinguish because they share clinical and laboratory features. Some cases of COVID-19 diagnosed as dengue are already reported in some hospitals. A new strain of this virus will probably contribute to a more complicated human-endemic transmission.[7,8]

Peri-domestic mosquitoes transmit dengue hemorrhagic fever through *Aedes aegypti* and *Aedes albopictus* as the vectors.[9] Especially in developing countries, the development-related activities, particularly concerning water storage, increase the mosquito habitats and the risk of disease.[10–13] Identifying the cause of a disease is a significant factor in its control. There are multifactor effects that are highly dynamic and change over time.[8,14–16] In several studies, the failure to achieve an intervention program objective is usually due to the program not being designed comprehensively and not taking a whole system perspective.[17–19] Studies found that the dengue prevention and control program was the most decisive disease prevention factor.[19,20] The program to eradicate dengue in Indonesia started at the beginning of the first cases. However, all efforts to suppress the spread of dengue for decades are now threatened by COVID-19.

East Nusa Tenggara Government already conducted some programs to control dengue following the Ministry of Health guidance.[21] Some activities were fogging to control the *Aedes aegypti* mosquito, distributing anti-mosquito lotions for free, and distributing abate powder to cut off the regeneration of infectious mosquitoes. However, studies stated that fogging is not sufficient to eradicate mosquitos.[8,22,23] The local government has also distributed anti-mosquito drugs to schools. Some regions open 24-hour posts for dengue infection detection services with rapid test kits such as the ELISA test. The government's challenge is that as the management of COVID-19 resorbs many sources, both human and capital, it is still important to manage dengue as it is still becoming a threat to the community. It is essential, especially for the government and community, to stay alert to dengue. This paper aims to predict the number of dengue cases in Kupang, East Nusa Tenggara, which can help the government plan for dengue program activities.

Methods

This observational study conducted in the study area in Kupang city, the capital city of East Nusa Tenggara province, Indonesia, located at 10°36'14"–10°39'58"S and 123°32'23"–123°37'01"E. It covers an area of 180.27 km^2. The average temperature in Kupang city ranges from 23.8°C to 31.6°C. The average air humidity ranges from 73% to 99%. Rainfall was 1,720.4 mm, and rainy days were 152 days. The highest rainfall occurred in January with 598.3 mm, while the highest rainy day occurred in December with 28 rainy days. Geographic and weather condition makes Kupang city ideal for dengue.[17]

Data regarding monthly dengue reported cases by months from January 2010–December 2019 in Kupang city, East Nusa Tenggara province, Indonesia, were collected from various relevant governmental departments. Data analysis is used for describing the temporal patterns of dengue cases in Kupang city by plotting monthly and yearly incidence for the study period. Data presented in table and graphic. This data analysis evaluated the data's overall features using the graphical approach: trends (increase, decrease), seasonality, and outliers. We estimate the parameter using the Box-Jenkins approach to fit the auto-regressive integrated moving average (ARIMA) models. This model will predict monthly dengue cases for the year 2020 (12 months). Data analyzed using the Minitab program version 18.0.

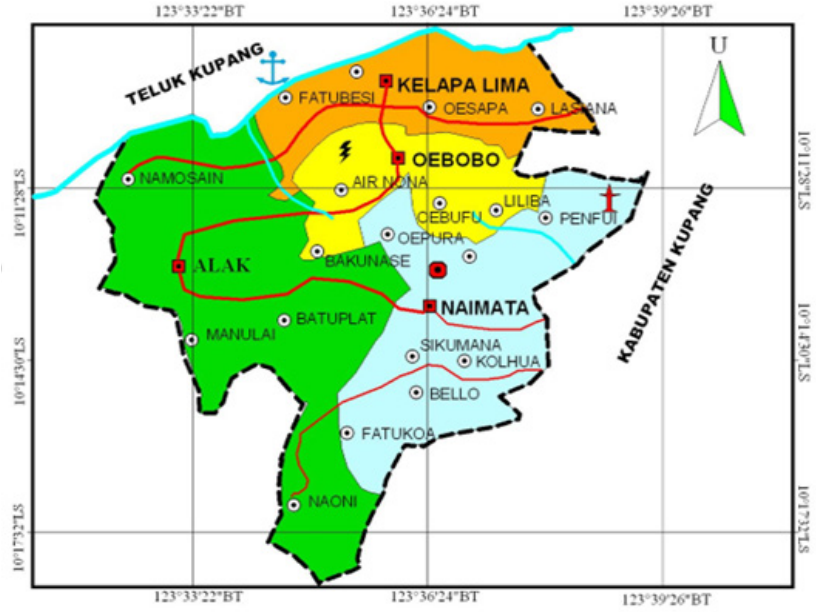

Figure 1 Map of Kupang City

Results

Figure 2 found in the Kupang city, the yearly incidence of dengue varied from 351 cases in 2010 to 609 cases in 2019, during the study period (2010–2019). The higher incidences were registered in the years: 2012 (n=890) and 2019 (n=609).

Figure 3 showed that seasonality was an essential component for the Kupang city, which performed an exploratory analysis of dengue incidence (ln data) for 2010–2019. The analysis showed that the highest incidence was registered from December to February with four outliers of 308 and 352 dengue cases registered in January and February 2012, 161 and 119 dengue cases in March 2012, and 2016 lowest incidence from May to November.

Figure 4 showed a linear trend model to predict dengue cases in 2020 was Yt=36.9–0.131

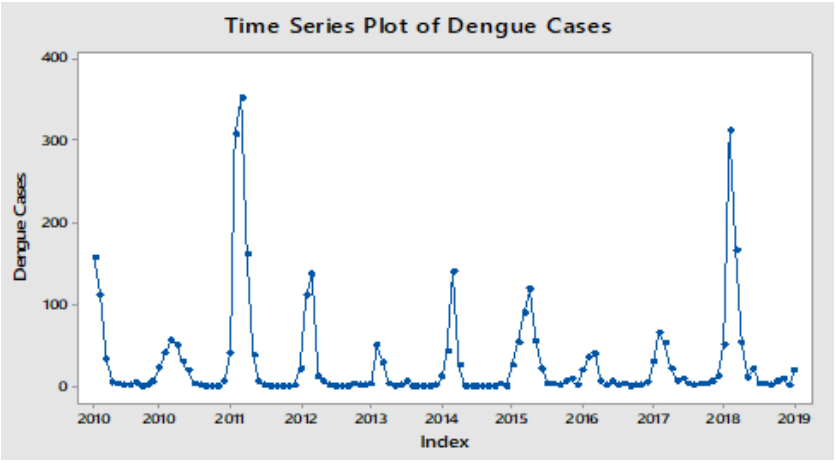

Figure 2 Reported Monthly Dengue Case Data in Kupang City, East Nusa Tenggara Province, Indonesia (2010–2019)

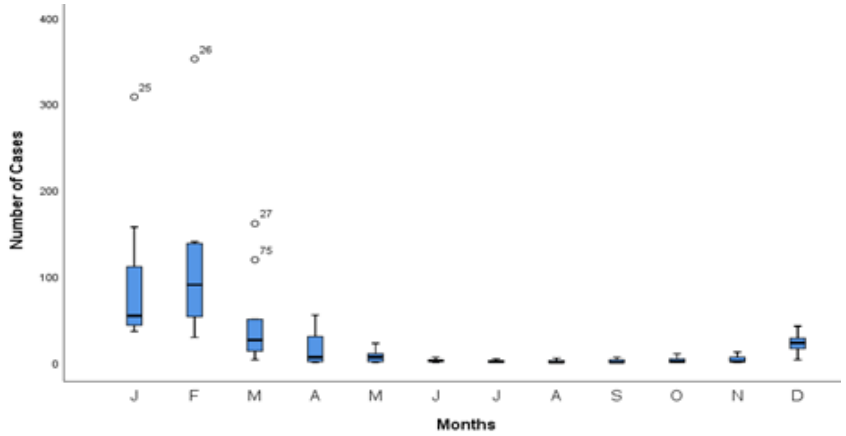

Figure 3 Seasonal Box-plot Distribution of Monthly Dengue Cases in Kupang City, East Nusa Tenggara Province, Indonesia (2010–2019)

× t. Table shows the monthly forecast of dengue cases according to the model in 2020 for Kupang city. The model predicted the total number of dengue cases for 2020 was 263 varying from 23 dengue cases in January and February, 22 dengue cases in March to September, and 21 cases dengue cases in October to December.

Discussion

Dengue, caused by infection with any of the four dengue virus serotypes (DENV-1, DENV-2, DENV-3, and DENV-4), is one of the most important mosquito-borne viral diseases as a major public health concern. Since its first report in 1968, Indonesia is still vulnerable to the dengue outbreak. In Indonesia, the outbreak pattern is roughly recorded every 6–8 years, since 1973, 1988, 1998, 2009, 2016, and now in 2019.[5,17] The country's vulnerability to dengue outbreak due to many factors such as sifting of dengue serotype, environment condition and people behavior, programmatic factors for prevention, control, and case management and government commitment.[12]

One study of the dengue outbreak in 1998 reveals that DENV-3, which is generally associated with the dengue outbreak in Indonesia, had a newly isolated genotype within DENV-3 that was never reported in Indonesia before 1998. This new isolated DENV-3 genotype is commonly circulated in Thailand. The finding indicated

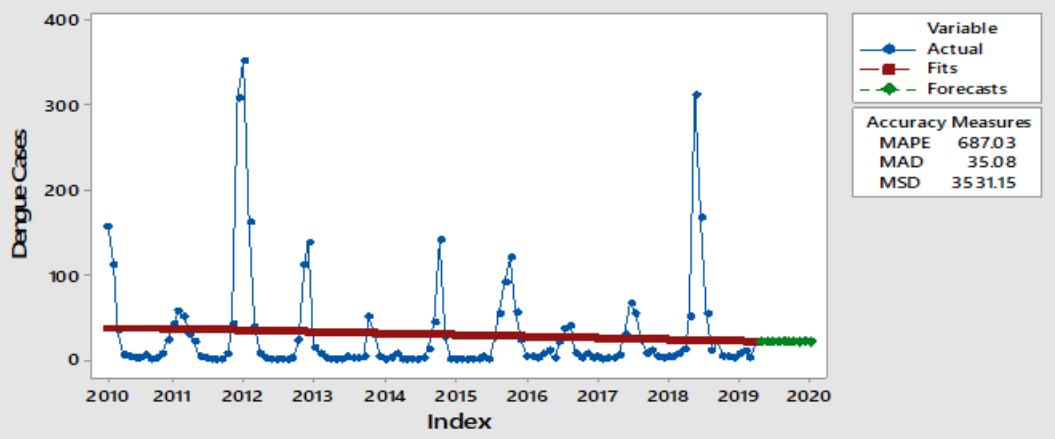

Figure 4 Trend Analysis Plot for Dengue Cases Based on Linear Trend Model
Note: Yt=36.9–0.131 × t

Table Forecasted Monthly Dengue Cases for Kupang City, East Nusa Tenggara, Indonesia in 2020

Period	Months (2020)	Predicted Cases
109	January	23
110	February	23
111	March	22
112	April	22
113	May	22
114	June	22
115	July	22
116	August	22
117	September	22
118	October	21
119	November	21
120	December	21
Total		263

that these new viruses have been imported into Indonesia and established its local transmission and associated with the increases of DHF cases.[17]

East Nusa Tenggara is the area with a dry spell in some months of the year, usually from June to September and heavy rains in the other months of December to March. People prepared for water scarcity during dry seasons by storing water in the containers, which usually are not properly closed. As dengue viruses are transmitted through the bite of infected *Aedes aegypti* and *Aedes albopictus* female mosquitoes, the available water for breeding places is essential for an outbreak. Our recent observation in West Java and Timor shows that some standing water, including puddles, water tanks, containers, and old tires, are still the main *Aedes* breeding sites.[5,14,18] A lack of community participation and government commitment to provide better and reliable sanitation and regular garbage collection also contribute to the spread of the mosquitoes.[15,17]

Our data shows that dengue incidences were peak in the rainy season, from December to April. The rainy season was more comfortable for the mosquito to breed in lots of newly created standing water. During this period, the number of possible new cases depends on how regions prevent the spread of the disease by controlling their surrounding environment, better sanitation measures, regular garbage collection, and the prevention of newly created standing water for mosquitoes to breed. The government developed several dengue prevention programs, such as larvae monitoring interpreter (*juru pemantau jentik*, Jumantik) and clean Friday (*Jumat bersih*, Jumsih), to suppress dengue incidence. Jumantik, whose task is to monitor mosquitoes' larvae and pupae's presence, is created to ensure that the community's water containers are free from larvae and pupae. Jumsih is the activity every Friday when all community members clean their environment together.

Although Indonesia Government has made efforts, both the incidence and case-fatality rates are still high during the dengue outbreak and not showing significant changes. In our observation from the programmatic review, a dengue surveillance system cannot provide a timely alert for anticipating the outbreak. Many outbreak events were realized by the authority when lots of cases and deaths were published on the news.[7,9] Community knowledge, awareness, and involvement against dengue play crucial roles in preventing dengue outbreaks.[15] During the recent dengue outbreak, government attention to anticipate the COVID-19 pandemic put the cost on more dengue cases and deaths in East Nusa Tenggara. This condition worsens by the unavailability of adequate laboratory capacity to detect and dengue diagnose.[19]

Central Government must send specialist and laboratory equipment to support East Nusa Tenggara during the dengue outbreak .[17] A similar condition is also reflected by the East Nusa Tenggara Government's limited capacity to perform adequate and timely COVID-19 sample testing. All samples of COVIDd-19 must send to referral laboratories for COVID-19, and it takes 7–14 days for the results to come. Not to mention the difficulties of sending the sample out from East Nusa Tenggara to Jakarta due to travel retractation during the regional lockdown and domestic travel ban [4,18].[4,18] The preliminary unreviewed version of this articles is published in preprints.org.[24]

Conclusions

As dengue claimed more life than COVID-19 in East Nusa Tenggara, the local government is more concerned about overcoming this outbreak. However, the global domino effects of the COVID-19 pandemic have put more burden on local government–which has limited resources to focus on both dengue and COVID-19 at the

same time. Community and government have to be informed that the stay at the home approach to preventing COVID-19 increases the chances of getting dengue virus if there is not enough effort to maintain a clean environment, reduce breeding sites, and other protective measures against dengue transmission.

Conflict of Interest

There is no conflict of interest at all authors.

Acknowledgments

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RESEARCH ARTICLE

Knowledge Level towards Cervical Cancer Among Students of Baabul Kamil Vocational High School

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Abstract

Cervical cancer is one of the most common causes of cancer-related death in women worldwide that is mostly preventable and treatable. Knowledge and awareness of cervical cancer screening programs allow the implementation of the prevention of cervical cancer. The community service program is aimed to increase the knowledge of adolescents about cervical cancer and its screening. It was a one-group pretest-posttest quasi-experimental study to measure the level of knowledge of 45 female students of Baabul Kamil Vocational High School, Jatinangor, Sumedang. The study was conducted in May–June 2018. The participants were asked 15 questions, which was an adaptation of previous questionnaires. The program was managed by a mini-lecture that focuses on cervical cancer risk factors and early detection. Furthermore, pretest and posttest were conducted to analyze the level of knowledge on the aforementioned aspects before and after the dissemination descriptively. The participants included in this study were mostly 16 years old (67%). The average recognition of cervical cancer and its early detection was not high. The knowledge of cervical cancer among students of Baabul Kamil Vocational High School was found to be moderate. There is a significant improvement in knowledge level after dissemination. The efficacy of dissemination among female students at Baabul Kamil Vocational High School was apparent in knowledge change. However, good cancer awareness, especially cervical cancer, needs to be established and integrated through effective cancer educational programs in the school curriculum. Key intervention strategies are required to raise cancer awareness in support of taking precautions and early detection measures.

Keywords: Cancer awareness, cancer education, dissemination, early detection, screening program

Tingkat Pengetahuan Siswi SMK Baabul Kamil tentang Kanker Serviks

Abstrak

Kanker serviks merupakan salah satu penyebab paling umum kematian terkait kanker pada wanita di seluruh dunia yang sebagian besar dapat dicegah dan diobati. Pengetahuan dan kesadaran tentang program deteksi dini kanker serviks merupakan upaya pencegahan kanker serviks. Program pengabdian pada masyakat ini bertujuan meningkatkan pengetahuan remaja tentang kanker serviks dan deteksi dininya. Penelitian ini merupakan penelitian *one-group pretest-posttest quasi-experimental* untuk mengukur tingkat pengetahuan 45 siswi SMK Baabul Kamil, Jatinangor, Sumedang. Penelitian ini dilaksanakan pada bulan Mei–Juni 2018. Responden diberikan 15 pertanyaan yang merupakan adaptasi dari kuesioner sebelumnya. Program ini dilakukan melalui penyuluhan tentang faktor risiko kanker serviks dan deteksi dininya. Selanjutnya, dilakukan *pretest* dan *posttest* untuk menganalisis tingkat pengetahuan aspek-aspek tersebut sebelum dan sesudah penyuluhan secara deskriptif. Responden yang terlibat dalam penelitian ini sebagian besar berusia 16 tahun (67%). Identifikasi pengetahuan tentang kanker serviks dan deteksi dininya rerata tidak tinggi. Pengetahuan tentang kanker serviks di kalangan siswa SMK Baabul Kamil tergolong sedang. Terdapat peningkatan yang bermakna tingkat pengetahuan responden setelah diberikan penyuluhan Efektivitas sosialisasi di kalangan siswa perempuan di SMK Baabul Kamil terlihat dari perubahan pengetahuan. Namun, kesadaran kanker yang baik, khususnya deteksi dini kanker serviks perlu diatur dan diintegrasikan melalui program pendidikan kanker yang efektif dalam kurikulum sekolah. Langkah strategis diperlukan untuk meningkatkan kesadaran tentang kanker demi mendukung tindakan pencegahan dan deteksi dini.

Kata kunci: Deteksi dini, kesadaran kanker, pendidikan kanker, penyuluhan, program skrining

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Introduction

Cancer is a global public health issue. The number of cases and deaths due to the disease increase every year.[1] WHO predicted that there would be around 60–81% increase in new cancer cases every year in the next two decades. Therefore, more severe cancer treatment measures are needed in low- and middle-income countries, which currently have the lowest survival rates.[2] According to global cancer statistics 2018, GLOBOCAN cervical cancer ranks second as cancer with the highest incidence in Indonesia.[3] The high prevalence of cancer and the late handling of cases in Indonesia require preventive actions and early detection efforts to ensure proper treatment and extend life expectancy.[4]

Universal human papillomavirus (HPV) vaccination remains out of reach for many countries. Therefore, an important strategy for integrating primary (HPV contact prevention and HPV vaccination) and secondary (screening) cervical cancer prevention must be taken as soon as possible. Cervical cancer burden has been dramatically reduced in countries that have implemented wide-scale screening program through cytological screening.[5–7]

According to WHO's national guideline, adolescents (aged 10–19 years old) are a key component of a multidisciplinary cervical cancer prevention and control program. The WHO national program consisted of community education, social mobility, immunization, reproductive health, adolescent health, and sexually-transmitted infections.[8] One of the problems that are caused by the lack of knowledge in reproductive health is cervical cancer. Every hour, an Indonesian woman passes away due to cervical cancer in the past three decades.[9]

Cervical cancer is a malignant tumor that grows at the boundary between the epithelium lining the ectocervix (portio) and the endocervical cervical canal called the squamocolumnar junction.[10] Sexual activity and HPV infection are the main causes of cervical cancer.[11] Infection occurs through direct contact from small lesions on the skin or mucosa during sexual intercourse or when a baby goes through the infected birth canal. Multiple sexual partners, family history of cervical cancer, and the immune system are the main risk factors of cancer development.[12] Mucosal HPV is divided into low-risk HPV, and high-risk HPV,[13] which low-risk HPVs are known for not causing cancer, namely HPV type 6, 11, 40, 42, 43, 44, 54, 61, 70, 72, and 81, and high-risk HPVs have a high tendency to cause cancer, namely HPV type 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68, 73, and 82.[13,14] A study in Bandung found that the most common genotypes in Dr. Hasan Sadikin Hospital are HPV type 16, 18, 45 dan 52.[15]

The Government of Indonesia has implemented visual inspections using acetic acid (VIA) screening in the public health center (*puskesmas*) since 2015 as it is affordable, available, and accessible.[15,16] Eighty percent of women aged 30–50 years were targeted for free VIA screening in *puskesmas*.[17,18] The program reached 575,503 people, with 25,805 women showed positive VIA results until 2012 and 666 women suspected of cervical cancer.[17] Previous reports on rural community perception regarding cervical cancer and screening uptake for VIA has not been achieved due to the lack of knowledge of women about cervical cancer and its early detection methods.[19,20] In parallel, people with better knowledge of reproductive health will be more likely to be in support of taking precautions and early detection measures. Through dissemination, access to information related to reproductive health is seen as influential in determining the risk levels of behaviors that might cause cervical cancer in women.[20]

At present, little is known about cervical cancer-related knowledge of cervical cancer, risk factors, symptoms, and prevention among adolescents. However, this group is at a vulnerable risk of acquiring HPV infection. Based on the problems that have been described, this study aimed to identify the level of knowledge on early detection of cervical cancer, especially among students of Baabul Kamil Vocational High School (SMK) in Jatinangor, Sumedang, West Java. This study seeks to increase students' knowledge about the early detection of cervical cancer through dissemination to adolescents. Expanding access and awareness of avoidable cervical cancer risk factors among adolescents are associated with certain preventive health-related behaviors, which can be a basis for healthy adulthood.[21]

Methods

This study used a quasi-experimental one-group pretest-posttest research design on all students of Baabul Kamil SMK, Jatinangor, Sumedang. A questionnaire survey was developed to achieve the aim of the study. The questionnaire's items were

adapted from a validated questionnaire from a similar study conducted previously by Liu et al.,[21] which divides knowledge into three domains: knowledge of symptoms, risk factors, and early detection of cervical cancer. The questionnaire was delivered in Bahasa and was revalidated in a similar population to the study sample. The final validated questionnaire was used in this study.

The method used in the study was dissemination regarding the early detection of cervical cancer by measuring the results of the questionnaires distributed before and after dissemination. The measurement of knowledge used the Guttman scale, in which the number of correct and wrong answers to the item was identified.[22] Each correct response of the study was scored one mark, and the wrong answer was scored with a zero. The total score obtained by each study subject was converted to a percentage. Interpretation of the level of knowledge is arbitrarily measured through the cumulative number of correct scores to the total score. A higher cumulative score signifies a higher level of knowledge, with the interpretation of the percentage scale of >75%, 50–75%, <50% as, respectively, good, sufficient, and bad.

The data was analyzed using SPSS version 20 (SPSS Inc., U.S.A.). The t test was used to distinguish the proportions of the pretest and posttest. The value of $p<0.05$ was considered significant. The research is conducted in Baabul Kamil SMK, Jatinangor, about 30 km from Bandung city center, in May–June 2018. There was no dissemination or research about the knowledge level on the early detection of cervical cancer in the research location.

This study has received ethics approval from the Health Research Ethics Committee of Universitas Padjadjaran Bandung number 567/UN6.KEP/EC/2018 and respondents had received informed consent regarding their participation in this study.

Results

Forty-six samples were obtained in this study. However, one sample was not included in the research data because the respondent was not present at the posttest, so the total sample used for data analysis was 45. Data on the respondents' characteristics were obtained through the information filled by respondents in the questionnaire. The data that was taken for this research include respondents' age, marital status, education, and previous information exposure, which can be seen in Table 1. The majority of the respondents were 16 years old (67%), single, and were vocational school students majoring in an administrative office.

Table 1 Respondent Characteristics

Characteristics	n=45	%
Age (years)		
14	1	2
15	7	16
16	30	67
17	7	16
Marital status		
Single	45	100
Married	0	0
Education		
Nursing students	14	31
Multimedia students	6	13
Administration office students	18	40
Female student - unknown	7	16

Data on respondents' previous information sources can be seen in Table 2. Almost all respondents were informed through television, while the rest of the respondents were informed by health workers, seminars, and more than one information source and were never exposed to information about cervical cancer before.

The knowledge about cervical cancer assessment and its early detection before and after the dissemination can be seen in Table 3.

Table 3 showed that meaningful changes were recorded regarding recognition of precancerous clinical symptoms, risk factors, and cervical cancer screening objectives, with respectively 0.025; 0.035; and 0.014. Meanwhile, a significant increase in knowledge was not recorded ($p>0.05$)

Table 2 Previous Information Source

Characteristics	n=45	%
No previous exposure	4	9
Radio	0	0
Television	29	64
Newspaper/magazine	3	7
Seminar	2	4
Health workers	2	4
More than one source	2	4
Other sources	0	0
Blank (no answer)	3	7

Table 3 Knowledge about Cervical Cancer and Its Early Detection

Questions about Cervical Cancer	Pretest Score (0–1)	Posttest Score (0–1)	p Value◇
Not a hereditary disease (genetic)	0.57	0.62	1.000
Has a long precancerous period	0.89	0.89	0.411
Cervical cancer can be treated if it was detected early	0.68	0.62	0.225
Cervical cancer patients who are receiving treatment can have a life expectancy rate of >10 years	0.55	0.51	0.405
Post-menopause women are still at risk of cervical cancer	0.26	0.15	0.223
HPV infection is the main cause of cervical cancer	0.83	0.96	0.096
Women with HPV (+) may not turn into cervical cancer	0.49	0.53	1.000
Hygiene of the sexual organ prevents cervical cancer	0.81	0.94	0.102
The precancerous lesion is asymptomatic in cervical cancer	0.34	0.57	0.025*
Post-intercourse bleeding is one of the symptoms of cervical cancer	0.47	0.66	0.102
Early sexual activity is one of the risk factors for cervical cancer	0.77	0.96	0.035*
A precancerous lesion can be detected earlier in cervical cancer	0.74	0.87	0.096
Women aged 21–65 years old must be tested for the detection of cervical cancer every three years	0.28	0.21	0.405
Pap smear is one of the main methods of detecting cervical cancer	0.81	0.94	0.096
The purpose of early identification of cervical cancer is to find a precancerous lesion	0.81	0.98	0.014*
Overall average (n=45)	0.65	0.69	

Note: ◇Wilcoxon test; *p<0.05

on questions about whether cervical cancer is a hereditary disease (genetics) or not. It also not recorded for the precancerous period, early detection of cervical cancer, life-expectancy rate after active treatment, relations between menopause and cervical cancer, HPV infection, diagnosis, hygiene of sexual organ and cervical cancer, clinical symptoms in stadiums (post-intercourse bleeding), screening, screening frequency, and screening method. The data shows the average recognition of cervical cancer and its early detection was not high (before and after dissemination, 65%, and 69% respectively).

The Shapiro-Wilk method was used to test the normality of data, and both had a normal distribution (p>0.05). Data on the level of knowledge of respondents before and after the dissemination is stated in Table 4.

Table 4 Analysis of the Knowledge Level Before and After Dissemination

Type of Test	n	Average+s.b	Average Difference+s.b	95% CI	p Value◇
Pretest score (before dissemination)	45	77.04±9.163	3.778±6.512	1.821–5.734	<0.0001
Posttest score (after dissemination)	45	80.82±7.389			

Note: ◇paired t test; CI=confidence interval

Table 4 indicates that female students of Baabul Kamil SMK had adequate knowledge about cervical cancer. T test results show that $p<0.0001$, hence it can be concluded that there was a significant increase in knowledge after cervical cancer dissemination.

Discussion

Cervical cancer can be prevented and treated if the changes in cervical cells or tissue are identified early.[4–7] One of the risk factors of cervical cancer is early sexual activity, and a history of promiscuity can increase exposure to sexually-transmitted infections, especially HPV as the cause of cervical cancer development.[11–14] Coverage level of HPV vaccination as the primary prevention of cervical cancer remains out of reach in a few low-income and middle-income countries.[6] Screening of cervical cancer (secondary prevention) by identifying precancerous lesions has dramatically reduced cervical cancer burden.[6,23] This study examined cervical cancer-related knowledge of risk factors, symptoms, and screening among female high school students in Jatinangor, Sumedang, Indonesia. A previous study had been conducted to examine knowledge of HPV vaccination and screening for cervical cancer among women in Yogyakarta province.[23] This study focused on the adolescent group, girls aged 14–17 years.

The level of knowledge on cancer signs and symptoms, early detection of cervical cancer positively correlates with a change in behavior on cervical cancer prevention.[20,24–27] Poor knowledge of cancer combined with negative beliefs and attitude has been considered the main reason for the late presentation and diagnosis of cancer, particularly if the symptoms are atypical.[29,30]

Our present study showed that most respondents identified a range of cervical cancer information, such as television, newspaper/ magazine, seminar, and health workers, while only 15.6% had not previously heard of cervical cancer.

This study identified that knowledge about cervical cancer and its early detection was not relatively high. Our finding regarding the knowledge level was consistent with the previous study in Indonesia.[23,24] The knowledge of some aspects was very low, such as postmenopause women still have the risk of getting cervical cancer; cervical cancer is asymptomatic in the precancerous lesion. Women should be screened for cervical cancer at least every three years. On the other hand, most of the respondents knew that cervical cancer has a long precancerous lesion period, and HPV infection is the main cause of cervical cancer. Maintaining sexual hygiene can prevent cervical cancer; cervical smear (pap smear) is a major cervical cancer screening method to discover precancerous lesions. Knowledge insufficiency regarding cervical cancer and its screening also occurred in other settings. For instance, inadequate knowledge was found among Tanzanian women at a low level,[25] and Nigerian women,[26] and female teachers in North-Western Nigeria.[27] Hence, it can be said that literacy regarding cervical cancer disease and prevention was globally low and different in which aspects they were lack. The observed difference here could be attributed to the composition of the study population. It may be related to their perception of the test. Although the impact on younger people is lesser than adults regarding avoidable cancer risk factors due to lower rates of exposure over time, awareness of these factors among teenager are associated with certain protective health-related behaviors.[28] A study by Due et al.[29] reported that adult health results from exposures and processes over the entire life course. Therefore, raising cancer awareness among teenagers should lead to health behaviors in adulthood.[29–31]

This research is significant as the dissemination of cervical cancer and its early detection to students in Baabul Kamil SMK in Jatinangor would increase their knowledge and intergenerational transmission on the issue and help them make the right decision in the future.

In this study, there are limitations related to post-dissemination follow-up due to the researchers' limited time and respondents' activities in school. We would have gained a clear picture of respondents' level of knowledge if we recollected the data three months after the dissemination. Future studies should enlarge the number of respondents and use a random sampling technique for better study results representing Indonesia's situation and to provide generalizable results.

Currently, access to information has become a public necessity. Information can be obtained from the internet, social media, print media, and outdoor media. The reproductive health dissemination program for adolescents around Jatinangor subdistrict needs to be improved so that adolescents' understanding of health

problems, especially prevention and early detection of cervical cancer, can also be improved. The incorporation of materials on adolescent reproductive health through social media, posters, billboards, and high school curricula could positively impact students' knowledge and change their behavior towards reproductive health. Hence, it will provide population-based health awareness education globally.

Conclusions

Having good knowledge and perception regarding cervical cancer among adolescent allow behavior change in cervical cancer prevention. Most of the vital adult health behaviors are initiated or significantly influenced by adolescence. It is necessary to promote school-based cancer education programs to support prevention and early detection measures.

Conflict of Interest

The authors declare that there was no conflict of interest.

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RESEARCH ARTICLE

The Development of Germicidal Air Purifier by Employing Ultraviolet System in Controlling Airborne Bacteria

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Abstract

The nosocomial infection could be acquired through airborne disease in the hospital. However, only a particular health center in Indonesia carried out a complete, cautious prevention procedure by utilizing air purifiers due to cost problems. Thus, to minimize the number of nosocomial infections related to bacterial air pollutants, excellent tools with low cost are required to address this problem. We developed an ultraviolet light system within the air purifier at a low cost and the best way to eradicate pathogenic microorganisms in the healthcare center. The study was conducted at the Faculty of Medicine, Universitas Padjadjaran, Bandung in 2009–2010. The room prototype was built from a transparent glass material with two holes at the upper corner as an inlet and outlet pipeline canal. In the middle of the pipeline circulation, a vacuum pump, ultraviolet system, and a cooler were installed so the air will initially flow through those devices before being re-circulated into the room through the pipeline's inlet hole. A fan was set on the room floor, and several ten-centimeter apart, Petri dishes containing microbial growth medium were placed. The microbial colonies from the room with and without the installed ultraviolet system in the air purifier were then compared for analysis. The result showed that an air purifier equipped with an ultraviolet system killed microorganisms 73% more effective than the air purifier without an ultraviolet system ($p<0.05$). In conclusion, employing an ultraviolet system within the air purifier might be effectively killed microorganisms and ultimately reduce nosocomial infection.

Keywords: Air purifier, nosocomial infection, ultraviolet system

Pengembangan *Air Purifier* Ruangan dengan Pemanfaatan Sinar Ultraviolet untuk Membunuh Mikrob Bawaan Udara

Abstrak

Infeksi nosokomial dapat ditularkan melalui penyakit yang ditularkan melalui udara di rumah sakit. Namun, hanya rumah sakit atau pelayanan kesehatan tertentu di Indonesia yang melakukan prosedur pencegahan infeksi nosokomial secara optimal dengan memanfaatkan *air purifier* karena kendala biaya. Oleh sebab itu, untuk meminimalkan jumlah infeksi nosokomial yang terkait dengan bakteri pencemar udara diperlukan pengembangan *air purifier* yang baik dengan biaya yang murah. Kami telah mengembangkan sistem pembersih udara yang terintegrasi sinar ultraviolet dengan biaya rendah untuk mengurangi mikroorganisme patogen di ruang pelayanan kesehatan. Penelitian dilaksanakan di Fakultas Kesehatan, Universitas Padjadjaran, Bandung pada tahun 2009–2010. Prototipe ruangan dibuat dari bahan kaca transparan dengan dua lubang di sudut atas sebagai ruang instalasi pipa saluran masuk dan keluar. Pada bagian tengah sirkulasi pipa dipasang pompa vakum, sistem ultraviolet, dan pendingin sehingga udara akan mengalir melewati alat-alat tersebut sebelum disirkulasikan kembali ke dalam ruangan melalui lubang masuk pipa. Sebuah kipas dipasang pada prototipe ruangan dan setiap jarak sepuluh sentimeter ditempatkan cawan Petri yang berisi media pertumbuhan mikrob. Koloni mikrob dari ruangan model dengan dan tanpa sistem ultraviolet yang terpasang di *air purifier*, kemudian dibandingkan untuk dianalisis. Hasil penelitian menunjukkan bahwa *air purifier* yang dilengkapi sistem ultraviolet membunuh mikroorganisme 73% lebih efektif daripada *air purifier* tanpa sistem ultraviolet ($p<0,05$). Simpulan, penggunaan sistem ultraviolet dalam *air purifier* efektif membunuh mikroorganisme dan pada akhirnya dapat mengurangi infeksi nosokomial.

Kata kunci: *Air purifier*, infeksi nosokomial, sistem ultraviolet

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Introduction

Nosocomial infection is acquired differently from common illnesses while undergoing hospital or healthcare treatment. It then developed in a patient for over 48 hours after admission. The hospital environment is capable of triggering nosocomial infection that worsened a patient's illness.[1,2] One of the pathways of nosocomial infection is an airborne transmission that can cause respiratory tract infections.[3] Airborne infections are transmitted through the pathogen or dust circulated from the hospital ventilation system.[4] The guidelines have recommended airborne precaution as one way of preventing hospital-acquired infections.[5,6] Environmental care management of health facilities has managed to support hospital hygiene, including cleaning and decontamination.[7–9]

Implementation of nosocomial infection prevention in Indonesia's healthcare facilities is still regarded as a huge burden due to cost issues.[6] Currently, a non-ultraviolet (non-UV) air purifier imported from foreign countries is used in Indonesian's hospital, such as a plasma air conditioner with a very expensive cost of 400 USD for one unit in a wardroom. This price is not affordable for middle and lower-level health care services such as primary health care or regional hospitals. As a consequence, cheap air purifiers that can be used automatically in multiple rooms are preferred.[3] Excellent and practical tools are necessary to fulfill this requirement. The use of UV rays might be the best way to kill microbes because UVs can kill microorganisms at a certain power.[9–12]

Our study proposed one way to reduce the number of microorganisms using a UV system installed in the ductal ventilation system in a prototype room. This air purifier design has low cost and provides good efficiency, effectiveness, automation, and easy to modify and implement elsewhere.[13–15]

Methods

This study was conducted at the Faculty of Medicine of Universitas Padjadjaran Bandung from 2009 to 2010. We created two types of prototype room. The first type was installed with a UV system air purifier, while the other was not. Subsequently, these distinct rooms were compared. All information, including the room's circulation framework and microorganism type that most likely causes nosocomial infection, were gathered from a previous study. The prototype room was made of an acrylic cube placed outside the laboratory with a temperature measured at 28°C. The observation was conducted at 7.00–8.30 AM (prototype room using UV system air purifier) and at 8.30–10.00 AM (prototype room not using UV system air purifier) for two days consecutively. The design of the prototype room is shown in Figure 1. The prototype room consisted of two holes at the upper corner as an inlet and outlet pipeline canal. At the middle of the pipeline circulation, a vacuum pump, UV system, and a cooler were installed so the air will initially flow through those devices prior to being re-circulated into the room through the pipeline's inlet hole. A fan was set on the floor of the room, and several ten-centimeter apart, Petri dishes containing microbial growth medium were placed.

The type of lamp used is a germicidal UVC lamp in the wavelength region of 200–280 nm. This UVC lamp has 1 inch (0.01274 m) diameter. The UVC lamp was placed inside the UV chamber built from PVC with 2 inches (0.0254 m) diameter, coated with aluminum foil, and equipped with an electric switch. The UV chamber's diameter size determined by the maximum air velocity allowed to pass the UV lamp (<2 m/sec). The estimated air velocity that passes through the UV lamp, generated by the vacuum pump is 0.31 m/sec air velocity, which complies with the requirement (<2 m/sec).

Both rooms were treated by healthy human coughing, sneezing, and chatting to ensure airborne microorganisms mixed in the prototype room. The growth of microorganisms observed by counting the number of colony-forming units (CFU) on the blood agar media placed in a different position. Colony identification was performed by Gram staining with crystal violet-iodine complex and safranin counterstain and a biochemical test before and after the operation of air purifier at minute 0 and 60, respectively.[16] The amount of microorganism estimated that the density of microorganism fell on the surface of an area per one place's cubic foot.[17]

The data showed in mean±SD. The number of colonies from each minute analyzed with a student t test.

Results

The difference between UV and non-UV system air purifiers, microbial aerosol generated from

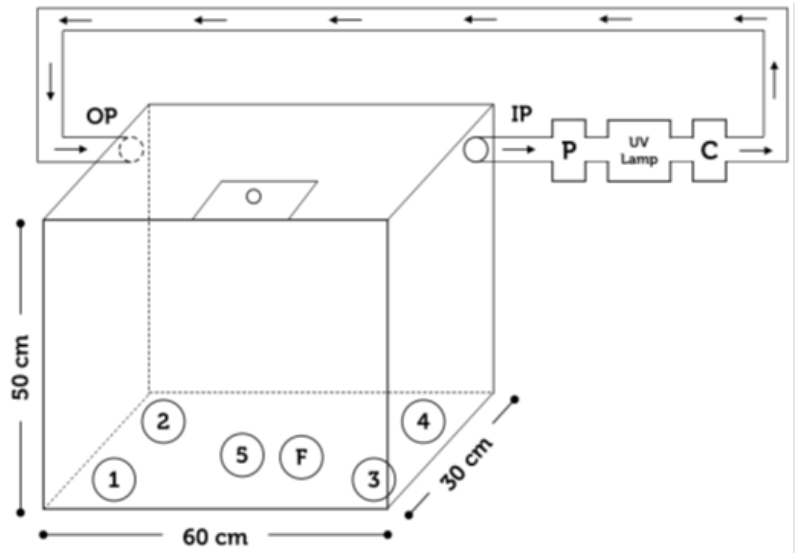

Figure 1 Trend Analysis Plot for Dengue Cases based on Linear Trend Model
The room was built with an acrylic cube with volume size of 0.09 m^3; 1–5: blood agar media placed in a different position, the corner and center of the room; F=fan; IP=inlet pipe; OP=outlet pipe; C=cooler; p=vacuum pump

healthy human coughing, sneezing, and chatting introduced and mixed with indoor air within each prototype room (Figure 1). The colony count on this step was noted in the minute 0 treatment result. After microbial aerosol mixed with the indoor air, the air purifier device operated for 60 minutes. By the end of this process, the colony count (CFU) was noted in the minute 60 treatment result. Statistical analysis was performed to find the significant difference between those treatments in each room. Our evaluation of the colony count demonstrated significantly fewer colonies after operating the air purifier in a prototype room with a UV system air purifier (Table 1).

The number of colony counts at minute 0, day 1 in the room installed with UV system air purifier was more significant than the other room. Statistical analysis showed a significant colony count decrease in the UV system air purifier room, with effectiveness value reaching 73% ($p<0.05$). In contrast, there was no significant difference between 0 and 60 minutes in a non-UV system ($p>0.05$, Figure 2). Table 2 compares the significant difference in the effectiveness between UV and non-UV system air purifiers. Total bacterial colony count in the prototype room with and without UV system air purifier at minute 0 and minute 60 after turning on the device presented in Figure 1. The colony count in

Table 1 Colony Count Comparison between UV and Non-UV System Air Purifier

Position	UV System		Non-UV System	
	mnt-0	mnt-60	mnt-0	mnt-60
1	46	21	7	7
2	26	8	12	5
3	78	6	14	29
4	47	15	13	3
5	30	4	9	34
Mean±SD	45.4±20.5	10.8±7.05	11±2.91	15.6±14.69
Student t test	0.007		0.511	

Note: the data is in CFU; mnt-0=minute 0; mnt-60=minute 60

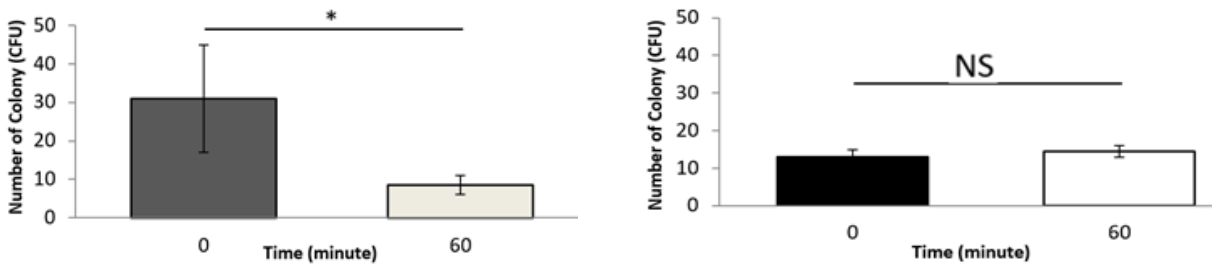

Figure 2 Total Bacterial Colony in Minute 0 and Minute 60
Prototype room using UV system air purifier (A). Prototype room without UV system air purifier (B). *p<0.05; NS=not significant

the prototype room with a UV system air purifier tended to decrease in contrast to the prototype room with a non-UV system air purifier, which increased slightly.

Furthermore, we performed the identification of colonies that were found. The result showed that there were around 25 different microorganism colonies in the indoor air of the prototype rooms, as summarized in Table 3. Circular colony form and bacilli cell form were found the most among other forms, while no rhizoid form was found. Besides, Gram-positive bacteria that appeared purple after Gram staining treatment were found dominant to Gram-negative bacteria, which decolorized and appeared in pink following such treatment.

Discussion

One way to reduce the number of nosocomial infections is by controlling airborne transmission. This study showed that the UV system air purifier's effectiveness was 73%, in contrast to the literature, which reached 99%.[18] This might occur due to the difference in the lamp's electrical power, which could be resolved by increasing the power accordingly. As for the non-UV installation, microorganism growth tends to be statically ascending because the substrate's presence grows, as in damp plumbing. The mechanism of UV radiation as a disinfectant can be explained through DNA activity.[11] UV radiations were absorbed between the wavelengths of 250 and

Table 2 Installation of UV System Air Purifier is More Effective in Controlling Airborne Bacteria than Non-UV System

UV System		Efectivity (%)	Non-UV System		Efectivity (%)
Mean mnt-0 (CFU)	Mean mnt-60 (CFU)		Mean mnt-0 (CFU)	Mean mnt-60 (CFU)	
31	8.4	73	13	14.5	11

Note: mnt-0=minute 0; mnt-60=minute 60; CFU=colony forming unit

Table 3 Characteristics of 25 Different Species of Microorganism Colonies Found in Medium

	Colony Form				Gram			Cellular Form		
	Cir	Irr	Fil	Rhiz	+	−	+/−	Bac	Coc	Cbac
Colony number	18	6	1	0	22	2	1	20	4	1

Note: Cir=circular; Irr=irregular; Fil: filamentous; Rhiz=rhizoid; Bac: bacilli; Coc=cocci; Cbac: coccobacilli

260 nm. This absorption led to the formation of bonds between the adjacent thymine within the DNA chain. The DNA replication was blocked by thymine during the process of cell division. Thus, the effectiveness rate of bacterial destruction is also affected by the time that is required for DNA destruction.[10,11]

The fundamental difference in these two prototype rooms was the presence of UV lamps. With low cost and easy machinery, the UV system has more advantages. For larger scales, such as in hospitals, more complex design criteria are required. The ductal ventilation system's benefit is that if there were an increase in the required space, it would only increase the installation cost. UV chamber and cooler can be used alternately, depending on the room's condition, such as the number of people in the room, microbial virulence level, and the need for sterilization. So, the device in one room is running at a specific time only. In other words, not all rooms were cleaned together.

The automaticity concept is expected by using a microcontroller. This tool can simplify the installation that is utilized in multiple rooms by detecting specific parameter changes, such as colony count or room temperature change. However, this study has used a timer that only ensures the tool runs within a preferred time, thus enhancing the study's accuracy in terms of time control.

There are some essential things to be considered regarding when to apply this UV system air purifier. Specifically, the number of visits and the number of people attended the room. Those factors will determine how many times the tool will run. The most visited hours in this setting were between 8.00–12.00 AM, so then the tool can run for 4 hours a day. There were cost consequences if the system is used in hospitals, particularly emerging waste products (used UV lamps, water from the cooler), and lifetime costs. These costs will depend on the endurance of the lamp and the quality of the maintenance. This problem can be solved by using wastewater for a cooler water source while recycling the UV lamp would be useful.

Eradication of mixed colonies this way would ensure the device's quality in reducing various types of bacteria, similarly to the condition in hospitals, where nosocomial infections commonly caused by opportunistic bacteria, that under normal conditions are not pathogenic. Still, because a person's immune condition is compromised, the bacteria can cause illness. Thus, device testing is not restricted to pathogenic bacteria but tends to varied bacteria in the air.[1,19]

The catalase and coagulase tests performed specifically for colonies to identify the staphylococci groups and distinguish them from the streptococci groups.[20] This is important, considering these groups of bacteria have had high resistance levels and can cause various diseases. In addition, fungi with smooth hyphae were found in the blood media.

Conclusion

Employing an ultraviolet system within the air purifier might be effectively killed microorganisms and ultimately reduce nosocomial infection.

Conflict of Interest

The authors declare no conflict of interests.

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RESEARCH ARTICLE

The Influence of Gestational Age and Birth Weight on Neonatal Mortality

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Abstract

Prematurity and low birth weight are some of the causes of neonatal death and significant health problem. This study aimed to determine the influence of gestational age and birth weight on neonatal mortality at the Al Islam Hospital Bandung in 2015–2019. It was a case-control retrospective observational analysis using medical records of the Al Islam Bandung Hospital from January 1, 2015, to December 31, 2019. The inclusion criteria for infants were born alive. Exclusion criteria had severe congenital abnormalities and gestational age <26 weeks. The chi-square test evaluated the univariate comparison test of risk factors between 2 groups. Multiple logistic regression to assess neonatal mortality's predictive factors and the percentage contribution of the influence was calculated (Nagelkerke's R^2 analysis). The number of infants enrolled in 2015–2019 was 6,791 neonates, and who died was 56 neonates (0.82%). In premature infants and low birth weight there was a very significant relationship with neonatal mortality, respectively p=0.000 (p<0.05) OR=30.397 (CI=16.506–55.976), and p=0.000 (p<0.05) OR=41.206 (CI=18.611–91.233). In the multiple logistic regression test, p=0.000 (p<0.05), with a Nagelkerke's R^2 value of 0.344 or 34.4%. This presence that gestational age and birth weight significantly affects neonatal mortality, either partially or simultaneously. The percentage contribution of the influence of gestational age and birth weight to neonatal mortality was 34.4%.

Keywords: Low birth weight, neonatal mortality, premature

Pengaruh Usia Gestasi dan Berat Badan Lahir terhadap Kematian Neonatus

Abstrak

Prematuritas dan berat badan lahir rendah merupakan beberapa penyebab kematian neonatus dan masalah kesehatan yang signifikan. Penelitian ini bertujuan mengetahui pengaruh usia gestasi dan berat badan lahir terhadap kematian neonatus di RS Al Islam Bandung tahun 2015–2019. Penelitian ini merupakan penelitian observasional retrospektif kasus kontrol menggunakan data rekam medis RS Al Islam Bandung periode 1 Januari 2015 hingga 31 Desember 2019. Kriteria inklusi bayi lahir hidup. Kriteria eksklusi bayi dengan kelainan kongenital berat dan usia gestasi <26 minggu. Uji *chi-square* mengevaluasi perbandingan univariat faktor risiko antara 2 grup. Regresi logistik multipel untuk mengevaluasi faktor prediktif kematian neonatus dan persentase kontribusi pengaruh dihitung (Analisis R^2 Nagelkerke). Jumlah bayi yang dirawat tahun 2015–2019 sebanyak 6.791 dan yang meninggal sebanyak 56 (0,82%). Pada bayi lahir prematur dan berat badan lahir rendah terdapat hubungan sangat bermakna terhadap kematian neonatus, berturut-turut p=0,000 (p<0,05) OR=30,397 (CI=16,506–55,976) dan p=0,000 (p<0,05) OR=41,206 (CI=18,611–91,233). Pada uji regresi logistik multipel, p=0,000 (p<0,05) dengan nilai R^2 Nagelkerke sebesar 0,344 atau 34,4%. Usia gestasi dan berat badan lahir berpengaruh bermakna terhadap kematian neonatus, baik secara parsial maupun simultan. Persentase sumbangan pengaruh usia gestasi dan berat badan lahir terhadap kematian neonatus sebesar 34,4%.

Kata kunci: Berat badan lahir rendah, kematian neonatus, prematur

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Introduction

Prematurity and low birth weight are some of the causes of neonatal death in the world and a major health problem.[1] Low birth weight (newborns weighing less than 2,500 grams at birth), due to premature and limited growth in the uterus, is also a significant contributor to neonatal and child mortality, as well as disabilities and non-communicable diseases globally.[2]

Of the fifteen million infants born each year prematurely, more than one million die from preterm birth complications.[2] The proportion of deaths according to WHO, neonatal prematurity was 14 percent in 2000, increased to 15 percent in 2001–2005 and 16 percent in 2006–2008, and continued to increase to 17 percent in 2009–2011.[1] Indonesia has a neonatal mortality rate of 14 per 1,000 live births based on data from 2015, which is the 10th highest mortality rate in the world. The neonatal mortality rate is even higher if only rural births are included, estimated at 24 deaths per 1,000 live births. A large portion of this mortality is related to the high prevalence of premature infants.[3]

More than 30% of global infant mortality rates are caused by low birth weight (LBW) infants.[1] In Indonesia, infant mortality due to LBW is estimated to reach as high as 29%. Alisyahbana et al.,[4] a population-based cohort study in Tanjungsari, a rural subdistrict of West Java, Indonesia, in the neonatal period the proportion of deaths in LBW infants (34.1%) and preterm (18%).

Nearly 85% of preterm infants are born between 32 and 37 weeks of gestation, and most of these infants do not receive intensive survival care. This intensive care is a solution to improve vulnerable premature and low birth weight infants' survival and health. More effort is needed to identify women at risk of preterm labor and support them to deliver in a health facility that can offer extra care when needed. To do this, families, communities, and health workers must value young infants to receive the rescue care they need.[2]

Until now, many studies have evaluated the relationship or influence of risk factors on prematurity, low birth weight on neonatal mortality. However, the influence of these risk factors on neonatal mortality, either partially or simultaneously, is not yet studied using the Nagelkerke's R^2 analysis.[5] Therefore, the study aims to determine the influence of gestational age and birth weight on neonatal mortality were treated at the Al Islam Bandung Hospital in 2015–2019. The results of this study are expected to be a source of information for the scientific community and specifically become benchmarks for planning better neonatal care at the Al Islam Bandung Hospital.

Methods

This study is a case-control retrospective observational analysis, using secondary data from the medical records of the Al Islam Bandung Hospital during 2015–2019. The inclusion criteria for infants born alive and treated in the neonatology unit of Al Islam Hospital Bandung from January 1, 2015, to December 31, 2019, exclusion criteria for severe congenital abnormalities, gestational age less than 26 weeks. The sample size was calculated using the total sampling technique for the case group and the control group.

For data analysis, subjects were divided into dead infants (case group) and live infants (control group)—the study's independent variables as risk factors for neonatal mortality, gestational age, and birth weight. A univariate comparison test of risk factors was carried out between the two groups, evaluated by the chi-square test, significance based on p value<0.05. Multiple logistic regression was used to assess neonatal mortality's predictive factors, and the percentage contribution of the effect was calculated (Nagelkerke's R^2 analysis). Model suitability was checked statistically by the Hosmers Lemeshow test. Statistical analysis using SPSS-25 software. Ethical clearance for this study was obtained from the Health Research Ethics Committee of Applied Al Islam Hospital Bandung with the issuance of the ethical clearance Number 0011/KEPK-RSAI/09/2020.

Results

The number of infants enrolled in the Al Islam Hospital Bandung's neonatology unit for 2015–2019 was 6,791 neonates. Total coverage based on gestational age, 647 (9.5%) infants were born preterm (<37 weeks), and 6,144 (90.5%) were born at maturity. Total coverage based on birth weight, 1,010 (14.9%) infants born with low birth weight (<2,500 grams), and 5,781 (85.1%) were born with normal birth weight (>2,500 grams; Table 1).

Table 1 Infant Coverage based on Gestational Age and Birth Weight

Categories	n=6,791	%
Gestational age (weeks)		
<37		
26 to 28	49	0.7
28 to 31+6	109	1.6
32 to 34+6	208	3.1
35 to 36+6	281	4.1
Subtotal	647	9.5
≥37	6,144	90.5
Birth weight (grams)		
<2,500		
<1,000	43	0.6
1,000 to 1,499	110	1.6
1,500 to 1,999	222	3.3
2,000 to 2,499	635	9.4
Subtotal	1,010	14.9
≥2,500	5,781	85.1

Of the 6,791 neonates enrolled during 2015–2019, 56 (0.8%) neonates experienced death. Characteristics of 56 neonates who died, 42 (75%) died at <37 weeks (premature) and 49 (87.5%) died with birth weight <2,500 grams (LBW, Table 2).

Based on gestational age, infants born prematurely had a very significant relationship with p=0.000 (p<0.05) on neonatal mortality with an OR of 30.397 (CI=16.506–55.976). Based on birth weight, LBW had a very significant relationship with p=0.000 (p<0.05) on neonatal mortality with OR=41.206 (CI=18.611–91.233; Table 2).

Multiple logistic regression tests determine the independent variables (gestational age, birth weight) on the dependent variable (neonatal mortality) simultaneously. Table 3 shows that the Sig regression p=0.000 (p<0.05), which means that gestational age, birth weight simultaneously had a significant effect on the occurrence of neonatal mortality. It was found that Nagelkerke's R^2 was 0.344 or 34.4%. This shows that the percentage contribution of the independent variables (gestational age, birth weight) to the dependent variable (neonatal mortality) was 34.4%, meaning that 65.6% of other risk factors affect neonatal mortality (Table 3).

Table 3 Logistic Regression Analysis, Summary Model

Step 1	Chi-square	df	Sig	Nagelkerke R^2
Step	216.478	2	0.000	0.344
Block	216.478	2	0.000	
Model	216.478	2	0.000	

Discussion

Premature infants are prone to severe illness or death during the neonatal period. Without adequate treatment, surviving infants are at increased risk of lifelong disabilities and low quality of life. Premature complications are the largest cause of newborn mortality and the second leading cause of death among children under five years. Global efforts to further reduce child mortality require urgent action to tackle preterm births.[6] Low birth weight is a significant health problem, resulting in 20 to 30 times higher morbidity and mortality rates than in infants with normal birth weight. More than 30% of global infant mortality rates are caused by LBW.[7] In Indonesia, infant mortality due to LBW is estimated to reach as high as 29%.[8] The high mortality rates are caused by LBW complications, such as hypothermia, hypoglycemia, asphyxia,

Table 2 Univariate Analysis of Gestational Age and Birth Weight on Neonatal Mortality (Chi-square Test)

Gestational Age and Birth Weight	Case n=56 (%)	Control n=6,735 (%)	Total n=6,791 (%)	p Value	OR	95% CI	
						Lower	Upper
Gestational age (weeks)				0.000	30.397	16.506	55.976
<37 weeks	42 (6.5)	605 (93.5)	647 (100)				
>37 weeks	14 (0.2)	6,130 (99.8)	6,144 (100)				
Birth weight (grams)				0.000	41.206	18.611	91.233
<2,500	49 (4.8)	978 (95.2)	1,034 (100)				
>2,500	7 (0.1)	5,757 (99.9)	5,757 (100)				

and respiratory distress syndrome (RDS). Other complications were apnea, chronic lung disease (CLD), cardiovascular problem, neurologic disorder, anemia, fluid and electrolyte imbalance, hyperbilirubinemia, malnutrition, sepsis.[8–10]

In this study, there were 42 preterm infant deaths (75%), and it is statistically proven that gestational age has a significant effect on neonatal mortality. In univariate analysis, preterm infants had a very significant relationship with p=0.000 (p<0.05) on neonatal mortality with an OR of 30.397 (CI=16.506–55.976). According to Sari and Syarif,[8] the relationship between prematurity and neonatal mortality showed that there was a statistically significant relationship (p<0.001) with the crude OR of 13.44 (95% CI=7.16–25.55). Meanwhile, Cupen et al.[11] showed that very low to extremely low birth weight (OR=15.41, CI=2.00–120.34, p=0.01) were identified as significant risk factors for preterm neonatal mortality.

In this study, the percentage of LBW was 49 infants (87.5%), and statistically, it was proven that birth weight had a significant effect on neonatal mortality. Pepler et al.[12] based on their study, birth weight significantly influence the odds of neonatal death. This result is supported by research by Suparmi et al.,[13] which states that infants with LBW have a 9.89 times risk of dying than neonatal infants born with average weight. Other results suggest that LBW is a strong predictor of neonatal mortality, with LBW infants 5.5 times more likely to experience death. In Indonesia, LBW prevalence has decreased from 9–30% in 2002 to 7.2–16.8% in 2013, depending on regional socioeconomic status.[14] In South Borneo, LBW prevalence is relatively high at 16.6% of total live births.[15]

In this study, gestational age and birth weight simultaneously had a significant effect on neonatal mortality. The impact of gestational age and birth weight on neonatal mortality was 34.4%, meaning that 65.6% of other risk factors contributed to neonatal mortality, such as; maternal factors, health personnel handling aspects, and care facilities. Meanwhile, in research conducted by Hidayah and Hafidh[16] at the Moewardi Hospital in Surakarta, the risk factors significantly correlated with neonatal mortality in the univariate analysis included preterm, low birth weight, sepsis, maternal age >35, and non-spontaneous delivery. When these factors were evaluated using regression analysis, only preterm, low birth weight, and sepsis were significantly associated with neonatal mortality. In general, maternal factors play a significant role in the fetus's survival and the baby itself. However, in the multivariate analysis, the significant relationship to infant mortality was only childbirth factors (OR=2.6, 95% CI=1.2–5.5) and maternal contact with health workers (OR=2.1, 95% CI=1.4–3,4).[17] Meanwhile, Cupen et al.[11] in the multivariate binary logistic regression for the maternal variables. Obstetric complications (≥1, OR=8.73, 95% CI=1.07–71.09, p=0.04) were the only significant risk factor for preterm neonatal mortality.

It indicates that the prematurity in the above model shows a role in neonatal mortality. To reduce infant mortality, increasing attention to services during the neonatal period is important. The resulting model also indicates the need for attention from various parties to premature birth cases at the service level.[3] Neonatal health will need to be addressed more effectively for progress on overall child mortality to continue rapidly. Further reductions in neonatal deaths, in particular, depend on building more robust health services, ensuring that every birth is attended by skilled personnel, and making hospital care available in an emergency. Every newborn action plan endorsed by governments, the private sector, and civil society calls for reducing neonatal mortality rates in all countries to fewer than 10 deaths per 1,000 live births by 2035.[3] Many of the conditions leading to early neonatal death in low-income countries are preventable with relatively easy and cost-effective interventions. It requires educated and equipped health care workers, especially those with midwifery skills, training in resuscitation practices, simplified algorithms. Early detection of perinatal infections, early initiation of breastfeeding and skin-to-skin care (kangaroo mother care), contraception, vaccination of pregnant women, and hygienic delivery at a hospital were some programs to decrease mortality. The provision of essential commodities such as antenatal corticosteroids, resuscitation devices, injectable antibiotics, and chlorhexidine for clean cord care was also important.[7,19,20] The same requirements are needed for the management of serious illness later in the neonatal period that might be detected by community health workers and referred for treatment.[21]

Preterm birth requires adequate newborn care, while premature infants need intensive care with complete hospital equipment.[18]

Premature cases require financial guarantees

so that special service needs for newborns can be met. Service providers and people who experience premature birth conditions are not burdened with financing problems.[21] Preterm birth is increasingly common with substantial medical, economic, and social impact as it is invariably associated with acute and chronic complications. The median cost per infant increased with the level of care and degree of prematurity. The cost was dominated by overhead (fixed) costs for general (hospital), intermediate (clinical support services), and final (NICU) cost centers, where it constituted at least three-quarters of admission cost per infant. At the same time, the remainder was consumables (variable) cost. Breakdown of overhead cost showed NICU specific overhead contributing at least two-thirds of admission cost per infant. Personnel salary made up three-quarters of NICU specific overhead.[22] Many studies have reported that NICU costs are closely related to gestational age, the severity of illness, and the need for mechanical ventilation. The mean length of hospital stay was 13.6±13.4 days. Hundred and four (49.5%) patients were found to be ventilated. The median ventilation day was three days. We found a statistically significant relationship between hospital stay length, ventilation duration, presence of intervention, respiratory distress syndrome (RDS), sepsis, and hospital costs. The mean total hospitalization cost and the preterm's daily costs were 4,187 USD and 303 USD, respectively.[23]

Efforts to treat prematurity to prevent neonatal mortality are a significant investment for the nation and state because they have an impact on indicators of neonatal mortality and infant mortality rates. The reduction in the child mortality indicator will increase the life expectancy at birth to increase the public health status.[21] The Regulation of the Minister of Health (*Permenkes*) Number 25 of 2014 concerning health efforts states that low or premature newborns require standard treatment.[18] Every preterm newborn who gets adequate treatment can prevent neonatal deaths to reduce infant mortality automatically.[3] If the Indonesian government wants to reduce child mortality, infant mortality, and neonatal mortality, it needs special attention to premature and LBW infants. For that, a program to save premature infants and LBW is required. Every effort to keep premature infants/LBW is a long-term investment because every baby that is rescued contributes to improving the community's welfare and contributes to global health efforts.[24]

Conclusions

This study concludes that in the 2015–2019 Al Islam Hospital Bandung, the highest cause of death was prematurity. Gestational age and birth weight partially have a significant impact on neonatal mortality, and gestational age and birth weight simultaneously impact neonatal mortality. The percentage contribution of the influence of gestational age and birth weight to neonatal mortality was 34.4%. Further research is needed to determine maternal risk factors for neonatal mortality.

Conflict of Interest

All authors stated that there no conflict of interest in this study.

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RESEARCH ARTICLE

Cogongrass (*Imperata cylindrical* L.) Roots Ethanol Extract to Improve Hematological Profile in Carbon Tetrachloride-Injection Mice Model

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Abstract

Carbon tetrachloride (CCL_4) is widely used in industry, toxic to the environment and humans, and most often used as a model of acute liver damage and liver fibrosis in experimental animals. Liver damage can deteriorate the hematological profile. The roots of cogongrass (*Imperata cylindrica* L.) have been used as traditional medicine due to its antioxidant activity. This study was conducted at the Faculty of Medicine, Universitas Padjadjaran, from January to March 2019. The study aimed to investigate whether the cogongrass roots ethanol extract (CGRE) can ameliorate the disturbance in the hematological profile in acute CCl_4-injected mice. CGRE in dose 150 and 200 mg/kgBW was given orally to mice for four weeks before intraperitoneal injection of CCl_4 1 mL/kgBW in olive oil (1:1 v/v). After 48 hours, mice were sacrificed, and the whole blood was drawn for hematological analysis. As a result, mean corpuscular volume (MCV) was reduced in CCl_4-induction mice treated with CGRE in dose 150 mg/kgBW (49.25±3.06 vs 43.38±2.13 fl, $p<0.05$). This condition was followed by the improved hematocrit (Hct) and mean corpuscular hemoglobin concentration (MCHC). Platelet and platelet crit (Pct) levels were tended to decrease in CCl_4-induction mice treated with CGRE in dose 150 mg/kgBW. In conclusion, CGRE dose 150 mg/kg BW can improve MCV, Hct, MCHC, platelet, and Pct in CCl_4-injection mice. The antioxidant level in CGRE might facilitate it.

Keywords: Antioxidant, carbon tetrachloride, cogongrass roots, hematological profile, liver damage

Ekstrak Etanol Akar Alang-alang (*Imperata cylindrical* L.) Memperbaiki Profil Hematologi pada Mencit yang Diinjeksi *Carbon Tetrachloride*

Abstrak

Carbon tetrachloride (CCL_4) banyak digunakan pada industri, bersifat toksik bagi lingkungan dan manusia, serta sering digunakan pada hewan coba untuk kerusakan liver akut dan fibrosis. Kerusakan liver dapat menyebabkan gangguan profil hematologi. Akar alang-alang (*Imperata cylindrica* L.) telah digunakan sebagai obat tradisional karena memiliki aktivitas antioksidan. Penelitian ini dilakukan di Fakultas Kedokteran Universitas Padjadjaran pada bulan Januari hingga Maret 2019. Tujuan penelitian ini adalah meneliti apakah ekstrak etanol akar alang-alang dapat memperbaiki gangguan profil hematologi pada mencit yang diinjeksi CCL_4 secara akut. Ekstrak etanol akar alang-alang (EEAA) dosis 150 dan 200 mm/kgBB diberikan per oral kepada mencit selama empat minggu sebelum injeksi intraperitoneal CCl_4 1 mL/kgBB yang dilarutkan dalam minyak zaitun (1:1 v/v). Setelah 48 jam, mencit dikorbankan dan diambil darahnya untuk pemeriksaan hematologi. Sebagai hasil, *mean corpuscular volume* (MCV) menurun pada mencit yang diinduksi CCl_4 dengan perlakuan EEAA 150 mg/kgBB (49,25±3,06 vs 43,38±2,13 fl, $p<0,05$). Keadaan ini diikuti dengan perbaikan hematokrit (Hct) dan *mean corpuscular hemoglobin concentration* (MCHC). Kadar platelet dan *platelet crit* (Pct) cenderung menurun pada mencit yang diinduksi CCl_4 dengan perlakuan EEAA 150 mg/kgBB. Sebagai simpulan, EEAA dosis 150 mg/kgBB dapat memperbaiki MCV, Hct, MCHC, platelet dan Pct pada mencit yang diinjeksi CCL4. Kemungkinan difasilitasi oleh antioksidan pada EEAA.

Kata kunci: Akar alang-alang, antioksidan, *carbon tetrachloride*, kerusakan liver, profil hematologi

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Introduction

Tissue damage can be caused by an increase in oxidative stress, where the production of reactive oxygen species (ROS) is higher than antioxidants in the body.[1] ROS originates from the body's biological process, such as by-products of the electron transport chain and oxidase and peroxidase enzymatic activity. ROS production can also come from external exposure, such as organic solvent chemicals and pollution.[2,3] Carbon tetrachloride (CCL_4) is chlorinated hydrocarbon solvents widely used in industry and can be toxic to the environment and humans.[4] CCL_4 is a chemical that can cause liver damage and is most often used as a model of acute liver damage and liver fibrosis in experimental animals.[5–7] The CCl_4 from circulation that goes to the liver is converted by cytochrome P-450 (CYP2E1), forming trichloromethyl free radicals (CCl_3) and further converted to trichloromethyloxy radical (CCl_3O_2) which has more radical properties.[8,9] These radicals then attack cellular macromolecules and cause peroxidation of lipid, protein degradation, and DNA damage. This process is followed by the release of liver inflammatory cytokines such as interleukin-1β (IL-1β) and tumor necrosis factor-α (TNF-α), which ultimately leads to liver cell damage.[6]

The liver is an organ that plays a role in hematopoiesis. Damage to the liver cells causes the liver not to function normally so that the hematopoiesis system is disrupted. Anemia and thrombocytopenia are common findings in a patient with liver damage.[10,11] The anemia is caused by bleeding due to thrombocytopenia-induced coagulopathy, the shortening of erythrocytes' life span, and reduction of red blood cell production in the bone marrow. These phenotypes also occur in liver damage animal models. For example, chronic intraperitoneal injection of CCl_4-induced hepatic damages can disrupt hematological profile in rats showed by anemia, thrombocytopenia, and leucocytosis.[12,13]

Studies showed that plant extracts benefit from protecting the liver from damage and further complication of liver damage. For example, basil extract (*Ocimum basilicum*) ameliorates liver damage in the CCl_4-injection rats model showed decreased fibrosis signs and liver enzyme marker reduction and peroxidation activity.[14] Other extract plants, *Cnidoscolus aconitifolius*, leaves extract, *Teucrium polium* aqueous extract, and *Mangifera indica* leaves extract has been identified to protect rats from hematology deterioration caused by CCl_4-injection rat.[12,13,15] These extract plants contain high flavonoids derivate that have the ability as an antioxidant to protect cells from free radical.[16]

Cogongrass (*Imperata cylindrica* L.) or *alang-alang* (Indonesian language) is a weed species invasively cultivated in tropical areas. Cogongrass roots have been used as a traditional medicine to treat fever and as a tonic due to their antioxidant activity.[16–18] The extract ethanol of cogongrass roots (CGRE) has bioactive compounds, including flavonoid, isoflavone, and flavonol that play an antioxidant role.[16] We suggested CGRE can ameliorate disturbance in hematological profile due to liver damage. Thus, the study aimed to investigate whether CGRE can ameliorate disturbance in hematological profile in acute CCl_4-induced liver damage animal model.

Methods

Cogongrass roots were obtained from Garut, West Java, and were identified by the School of Life Sciences, Institut Teknologi Bandung. Cogongrass roots were made powder and extracted using 96% ethanol (Merck, Japan) through a 72-hour maceration process. Maceration results were filtered and concentrated with the freeze-drying technique. The yield of CGRE products was diluted using 0.5% carboxymethyl cellulose (CMC, Merck, Japan).

Eight-week-old male mice were obtained from the Animal Laboratory, PT Bio Farma, Bandung, Indonesia. The study was conducted at the Faculty of Medicine, Universitas Padjadjaran, from January to March 2019 after obtaining approval from the Research Ethics Committee Universitas Padjadjaran (Number 1353/UN6.KEP/EC/2018). Mice were placed in a temperature-controlled room, 12-hour light, and 12-hour dark cycle and had unlimited access to water and food. Mice were divided into four groups; group I (as normal control) and II (as a negative control) were given 200 µL 0.5% CMC orally. Group III was given CGRE at a dose of 150 mg/kg Body Weight (BW) in 200 µL CMC 0.5%, and group IV were given CGRE at a dose of 200 mg/kgBW in 200 µL CMC 0.5%. The treatment was carried out for 28 days. Considering the high damage caused by CCl_4, the dose was doubled from the previous study to gain more flavonoid compounds.[19] After four

weeks of treatment, groups II, III, and IV were given an injection of CCL_4 1 mL/kgBW in olive oil (1:1 v/v).[7] After 48 hours of induction; mice were terminated for blood collection by injection of ketamine-xylazine. Blood was drawn out through the abdominal portal vein as much as 100 µL and transferred into the EDTA microtube (BD, U.S.A.). The examination of 14 parameters of the hematology profile was conducted using the hematology analyzer machine (Samsung Labgeo HC-10).

Statistical analysis was performed by using GraphPad Prism 8. Data normality analysis was performed using the Shapiro-Wilk test of the normality test method. Analysis of variance (ANOVA) was used to analyze data among groups, followed by the Bonferroni post hoc test. Values are expressed as mean±standard deviation with significant level $p<0.05$.

Results

The results of hematological examination related to the profile of red blood cells are shown in Table 1. The total red blood cell examination (RBC) and hemoglobin did not show significant differences between groups after CCL_4 induction. There was a significant increase in hematocrit in CCl_4 compared to group I ($p<0.05$), but no change in the group given CGRE (groups III and IV). There was a significant increase in MCV values and decreased MCHC in group II compared to group I. However, the administration of CGRE significantly improved MCV and MCHC to the normal value in group I. There were no significant differences between groups in the mean corpuscular hemoglobin (MCH) value.

The results of hematological parameters related to white blood cells showed no increase in white blood cells' components 48 hours after CCL4 induction (Table 2). CGRE administration did not change the value of total white blood cells (WBC), lymphocytes, monocytes, and granulocytes. Consistent with these results, the percentage value of white blood cell groups, i.e., % lymphocytes, % monocytes, and % granulocytes, did not differ significantly after CGRE administration.

The profile of hematological examination related to platelet parameters is shown in Table 3. The induction of CCl_4 significantly increased the platelet and platelet crit (Pct) values by almost three times ($p<0.05$). However, the mean platelet volume (MPV) and platelet distribution width

Table 1 Red Blood Cells Parameters

Groups	RBC (10^6/µL)	Hb (g/dL)	Hct (%)	MCV (fl)	MCH (pg)	MCHC (g/dL)
Group I	8.60±1.85	13.69±2.03	37.37±7.48[a]	43.71±2.56[a]	16.24±1.71	37.14±2.82[a]
Group II	9.44±0.36	15.09±1.17	46.61±4.24[a]	49.25±3.06[a,b]	15.96±0.93	32.17±1.11[a,b]
Group III	9.72±1.00	14.86±1.38	41.97±3.09	43.38±2.13[b]	15.34±0.87	35.36±1.01[b]
Group IV	9.24±1.06	14.10±1.99	40.99±7.05	44.29±3.86	15.21±0.68	34.64±2.55

Note: the same letter in superscript at the same column indicates statistically significant ($p<0.05$). RBC=red blood cells; Hb=hemoglobin; Hct=hematocrit; MCV=mean corpuscular volume; MCH=mean corpuscular hemoglobin; MCHC=mean corpuscular hemoglobin concentration

Table 2 White Blood Cells Parameters

Groups	WBC (10^3/µL)	Lymphocyte (%)	Monocyte (%)	Granulocyte (%)
Group I	4.32±2.00	77.40±5.63	12.01±1.98	10.56±4.46
Group II	5.15±0.08	77.13±8.74	10.98±4.67	11.90±4.79
Group III	6.95±2.02	77.18±7.61	10.80±3.79	12.03±7.56
Group IV	5.80±2.26	79.63±6.94	9.78±4.12	10.60±3.76

Note: WBC=white blood cells

Table 3 Platelets Parameters

Groups	Thrombocyte ($10^3/\mu L$)	Pct (%)	MPV (fl)	PDWc (%)
Group I	494.29±178.58[a]	0.15±0.05[a]	3.10±0.39	35.17±1.86
Group II	709.25±96.09[a]	0.28±0.12[a]	3.93±1.29	35.13±1.89
Group III	583.75±91.55	0.18±0.03	3.16±0.33	34.91±1.81
Group IV	604.43±164.66	0.18±0.10	2.87±0.89	34.06±1.58

Note: the same letter in superscript at the same column indicates statitically significant ($p<0.05$). PCT=platelet crit; MPV=mean platelet volume; PDW=platelet distribution width

(PDW) values did not differ significantly. CGRE administration reduced the value of Pct, although the statistical calculation was not significant.

Discussion

CCl_4 is widely used in industry and has a toxic effect on humans.[3,20] The induction of CCl_4 in animal models is used to investigate the impact of organ damage in the brain and liver.[1,20] The increase of reactive oxygen mostly facilitates liver damage by CCl_4 and further can cause hepatocyte apoptosis. A disruption in lipid metabolism also causes liver damage that leads to the increase of lipid peroxidation.[20] In the long term, liver necrosis signs appear, and the liver enters the cirrhosis state. Natural products can be used to improve liver conditions and prevent further liver damage. For example, oral soybean consumption reduced hepatocyte apoptosis signs in CCl_4-induction mice.[21]

Liver damage can influence the hematological profile signed by anemia, leucocytosis, and thrombocytopenia.[10,11] Our study focused on the role of CGRE to improve hematological profile in CCl_4-induced liver damage mice model in an acute state. According to the previous study, the assessment of hematological profile was performed after 48 hours of the induction after 4 weeks of oral CGREE treatment.[7] After two days of CCl_4 induction, the circulation liver enzyme, aspartate transaminase (AST), and alanine aminotransferase (ALT) were dramatically increased, and necrosis signs appeared in the liver histopathologically.[7]

The number of RBC, WBC, and thrombocyte did not change after two days of CCl_4 injection. These results indicated that hematological profile deterioration, such as anemia, leucocytosis, and thrombocytopenia, resulted from chronic liver damage. This suggestion is supported by previous studies that showed chronic CCl_4 injection disrupts the number of RBC. WBC and thrombocyte and the giving of natural products such as *Cnidoscolus aconitifolius* leave extract, *Teucrium polium* aqueous extract, and *Mangifera indica* leave extract can ameliorate the hematological profile.[12,13,15] Adebayo et al.'s[22] study conducted acute liver damage by administering a solution of CCl_4: olive oil (1:1) with a dose of 2 mL/kgBW for four times in consecutive days before treatment. They showed that hemoglobin. RBC and platelet were reduced. However, no studies describe the hematological profile in a single dose of CCl_4 injection for an animal model of acute liver damage. Despite our findings, several red blood cell and platelet cell parameters had been disrupted in CCl_4-injection mice.

Hct and MCV were increased in CCl_4-induction mice and decreased after CGRE treatment with a dose of 150 mg/kgBW. The increase of Hct reflecting the increase of the ratio of red blood cells to the blood total volume and correlates with the increase of MCV, that calculated by multiplying Hct by ten and divided by RBC count.[23] The increase of MCV, suggesting macrocytic anemia. The condition is found in vitamin B12 deficiency or liver disease.[23] Injection of CCl_4 causes disruption in lipid metabolism and further compromise in a lipid bilayer in RBC. CGRE treated mice showed the reduction of MCV and Hct, suggesting antioxidant compounds in CGRE rescued lipid metabolism. MCHC level reflecting the level of hemoglobin in RBC. Hemoglobin is a protein carrier for nutrients and oxygen derived from iron (Fe) metabolism. Considering the normal hemoglobin level and increase the MCV level, the low level of MCHC is secondary to the increase of RBC volume and less

likely due to iron deficiency. Improvement of Hct and MCV facilitated by CGRE dose of 150 mg/kgBW might increase the level of MCHC. Further analysis of the iron level and iron-related protein could confirm this hypothesis.

Thrombocytopenia is commonly found in chronic liver damage conditions both in human and animal models.[15,22,24] However, the results of the platelet count is not stable. The platelet count was increased in CCl_4-induction mice and agreed with the study conducted by Saleh Gazwi and Mahmoud.[12] However, the increase of platelet count and Pct might cause thrombocytosis leads to organ disruption. A recent study showed that Pct could be used as a predictor of liver fibrosis.[25] Administration of CGRE before CCl_4-induction can protect the liver from further liver damage due to its antioxidant effect indicating Pct's reduction. Liver histopathology and inflammation marker examination are necessary to confirm this hypothesis.

Conclusions

A CGRE dose of 150 mg/kgBW can improve MCV, Hct, MCHC platelet, and Pct in CCl_4-injection mice. A high antioxidant level in CGRE might facilitate it.

Conflict of Interest

All authors state there is no conflict of interest in this article.

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RESEARCH ARTICLE

The Availability of Health Resources on the Performance of Maternal and Child Health Policy Implementation in East Nusa Tenggara

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Abstract

Maternal and child health problems continue to be priority health issues in Indonesia, especially in East Nusa Tenggara (NTT). The maternal mortality rate in NTT has reached 159/100,000 live births, while infant and under-five mortality rates have reached 32/1000 live births and 40/1,000 live births, respectively above the national value of 23/1000 live births and 32/1,000 live births. It indicates that the health and maternal and child health policies in NTT have not been maximally implemented. One of the causes is the lack of available health worker resources that provide health services. The research objective is to identify the effect of health resources' availability on the performance of maternal and child health policy implementation in NTT. A quantitative research method for data collection was carried out in 11 districts in NTT and 104 public health centers (*pusat kesehatan masyarakat*, *puskesmas*) towards 235 health workers from August to December 2019. The results show that the health workers were categorized as insufficient/not available (mean value of 2.64), and puskemas did not have doctors, midwives, and nurses conforming to standards. There was also inadequacy in some aspects such as budget (average value of 2.45), medical devices (average value of 2.75), medicines and medical supplies, buildings, and transport. A correlation was found between resources and the performance of maternal and child health policies (p=0.00) with a coefficient correlation of 0.546. It indicates a strong and positive correlation, which means that if there is an increase in resources, maternal and child health policy implementation will also. Partial linear regression tests showed t arithmetic=13.304 >t table 1.97, which means that H0 was rejected. It suggests a significant effect between resources and the performance of maternal and child health policy implementation in NTT. In conclusion, resources had a positively impact on the performance of maternal and child health policy in NTT.

Keywords: Implementation, maternal and child health, performance, policies, resources

Pengaruh Ketersediaan Sumber Daya Kesehatan terhadap Kinerja Implementasi Kebijakan Kesehatan Ibu dan Anak di Nusa Tenggara Timur

Abstrak

Permasalahan kesehatan ibu dan anak (KIA) terus menjadi prioritas masalah kesehatan di Indonesia khususnya di Nusa Tenggara Timur (NTT). Angka kematian ibu di NTT mencapai 159/100.000 kelahiran hidup (KH), sedangkan angka kematian bayi dan balita mencapai 32/1.000 KH dan 40/1.000 KH yang masing-masing di atas nilai nasional, yaitu 23/1.000 KH dan 32/1.000 KH. Kondisi tersebut mengindikasikan bahwa penerapan kebijakan KIA di NTT belum dilaksanakan secara maksimal. Salah satu penyebabnya adalah sumber daya manusia kesehatan yang memberikan pelayanan kesehatan kurang tersedia. Tujuan penelitian adalah mengidentifikasi pengaruh ketersediaan sumber daya manusia kesehatan terhadap kinerja penerapan kebijakan KIA di NTT. Metode penelitian adalah kuantitatif. Pengumpulan data dilakukan di 11 kabupaten dan 104 pusat kesehatan masyarakat (puskesmas) pada 235 tenaga kesehatan dari bulan Agustus hingga Desember 2019. Hasil penelitian menunjukkan bahwa tenaga kesehatan dikategorikan tidak cukup/tidak tersedia (nilai rerata 2,64) dan puskesmas tidak memiliki dokter, bidan, dan perawat sesuai standar. Selain itu, terdapat juga kekurangan di beberapa aspek seperti anggaran biaya (nilai rerata 2,45), alat kesehatan (nilai rerata 2,75), obat dan perbekalan kesehatan, alat medis, bangunan, serta alat transportasi. Korelasi ditemukan antara sumber daya dan kinerja penerapan kebijakan KIA (p=0,00) dengan koefisien korelasi 0,546. Hal ini berarti korelasi cukup kuat dan positif, artinya jika sumber daya ditingkatkan maka kinerja implementasi kebijakan KIA juga meningkat. Uji regresi linier parsial menunjukkan t hitung=13,304 >t tabel 1,97 yang bermakna H0 ditolak. Hal ini menunjukkan pengaruh yang signifikan antara sumber daya dan kinerja penerapan kebijakan KIA di Provinsi NTT. Simpulan, sumber daya berpengaruh positif terhadap kinerja penerapan kebijakan KIA di NTT.

Kata kunci: Implementasi, kebijakan, kesehatan ibu dan anak, kinerja, sumber daya

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Introduction

Maternal and child health (MCH) is still a significant health problem in Indonesia, particularly in East Nusa Tenggara (NTT). Based on data, deliveries at health facilities were up to 86.9%, and those assisted by health workers were 86.63%. The maternal mortality rate (MMR) was 179/100,000 live births in 2013, 159/100,000 live births in 2014, and 102/100,000 live births in 2015.[1–3] The national target in Indonesia is 153/100,000 live births. Meanwhile, the infant and under-five mortality rates were 32/1,000 live births in 2013 and 40/1,000 live births in 2014, with the national target of 23/1,000 live births and 32/1,000 live births, respectively. It shows the failure to implement maternal and child health policies in NTT that directly impacted the human development index in NTT. NTT ranked the 32nd out of 34 provinces, ranging from 68.77.[1,2,4]

In 2012, the local government targeted 80% of deliveries to be carried out in health facilities, but surprisingly the figures slightly exceeded 81%. On the contrary, in 2013, only 86% of deliveries were successfully met out of 90% of the target. The targeted number of deliveries assisted by health workers in 2012 was 94%, but only 81% were reached. While in 2013, only 86% were reached out of 96% of the target. The achievement indicators of maternal and child health as opposed to national targets refers to the percentage of fourth antenatal care visit (K4) coverage (61.78% vs 85.63%), obstetric complication management (46.5% vs 73.3%), low birth weight babies (15.5% vs 10.01%), neonatal treatment outcomes (15.34% vs 41.47%), first neonatal visit outcomes (75.51% vs 92.33%), infants service coverage (69.38% vs 87.77%), complete basic immunisation coverage in infants (69.9% vs 89.86%), and prevalence of undernutrition children (33% vs 19.6%).[4–6]

The failure in implementing the maternal and child health policies in NTT is allegedly due to the limited health resources available.[5–7] They also point out six obstacles and stimulants of the program implementation from Van Metter and Van Horn: policy measurement and objectives,[8,9] resources, characters of the implementing agency, attitudes/tendency of implementers,[9,10] communication between organizations and implementation activities, and economic, social, and political environment.[11,12]

Ngambut and Sila[13] reported that in Renda village, Satar Mesa district, Manggarai regency, NTT, many women have their deliveries attended by a traditional birth attendant (*dukun*) and delivering at home. Health workers and the community have not appropriately utilized the village maternity hut (*polindes*). Gae Dopo[14] concludes that there has been a significant increase in numbers since the mother and child health revolution program. However, this number has not been sufficient for fulfilling the needs of health workers in Soa subdistrict, Ngada regency, NTT.

This study aims to determinant the effect of the availability of resources on the performance of maternal and child health policy implementation in NTT. This study's results are expected to provide recommendations to the government in improving maternal and child health policy programs to decrease the mortality rate of mothers and children in the future.

Methods

This research used quantitative methods, and it needed six months to collect the data from August to December 2019. The research was carried out in 12 regencies, specifically in 104 public health centers (*puskesmas*) throughout NTT. This study's target population was all actors implementing maternal and child health policies at the *puskesmas* level. The total number of the target population was 3,372 people, and the population reached (i.e., implementing maternal and child health services) was 2,233 people.

The sampling technique used was the multistage random sampling technique, and the number of samples obtained was 235 people. The dependent variable is maternal and child health policy implementation in NTT and the independent variable is health resources. Health resources are the availability of power resources to implement policies that cover human and non-human resources, including financial resources. Performance of policy implementation is the on-target result or impact of policies. Data collection was carried out using a questionnaire that employed the first validity, and the reliability test was performed on 20 respondents. The test results show that the instrument was valid and reliable because most items had an average calculation value of r table=0.43166, which was smaller than r arithmetic.

Regarding measurement, this study used

a Likert scale and ordinal scale. Moreover, a univariate analysis was carried out to determine the distribution of data descriptively, followed by a bivariate analysis to see the relationship between the independent variable and the dependent variable using a simple linear regression tool. The study has obtained research ethics permit from the Health Research Ethics Committee of the Politeknik Kesehatan Kemenkes Kupang with the registration number LB.02.03/1/0070/2019. All respondents were asked for their consent before data collection.

Results

The research was conducted in 12 regencies in NTT province. The results of the study were analyzed in a number of stages starting from univariate, bivariate, and multivariate analyses towards all variables. The characteristics of the samples are depicted in Table 1, with the largest number of samples coming from Kupang regency and North Central Timor.

The health variables include the availability of human resources, budget, and health service tools/facilities. The availability of personnel in quantity, quality, and distribution is focused on doctors, midwives, and nurses. In contrast, budget resources' availability is concentrated on maternal and child health services at the *puskesmas* level. This budget comprises adequacy funds from the provincial budget, regional budget, national budget, public funds, referral costs, and procurement budget for facilities, infrastructure, and medicines. In comparison, the availability of equipment/facility resources includes decent infrastructure, medical devices, medicines, transportation, maternity waiting homes, and equipment following maternal and child health service standards. The results of the average assessment of resource indicators in implementing the maternal and child health policy in 2017 in NTT are shown in Table 2.

Table 2 shows that the availability of human resources in implementing maternal and child health policy in NTT is in the category of insufficient/not available (average value of 2.64). The budget availability is also seen as inadequate for policy implementation (average 2.45), which means that the government's budget has not been sufficient for policy implementation. The availability of health equipment is also categorized as inadequate with an average value of 2.75. Overall, the resource variable is in the category of inadequate standing at an average value of 2.61.

The performance of maternal and child health policy implementation is the extent to which policy targets' achievement is following the policy standards. This study uses a statement that shows the implementation of activities that describe the specified achievement. The calculation of the average value of performance achievement indicators in implementing MCH policy in NTT province in 2019 is shown in Table 3.

Table 3 elaborates the average value of maternal and child health policy implementation in NTT with 3.36. It means that maternal and child health service targets have been created but not maximally implemented yet. Overall, the score for all question items is less than 4.0, and the lowest score is in questions related to the patient referral fees charged to the local government and blood donor fees. The highest value on maternal and child health services was antenatal check-up services at least four times during pregnancy.

According to the method of Van Meter and Van Horn, the availability of resources precedes attitudes.[9,10] It refers to the availability of human resources that will influence the implementers' attitudes and subsequently affect the performance of the policy implementation. The resource shown in Table 4 is based on the performance of the MCH policy in NTT.

Table 4 shows the conformity between resources and the performance of policy implementation. It also suggests that the category of available human resources is not sufficient to

Table 1 Characteristics of Samples

No.	Regency	n=235	%
1	Manggarai	22	9.36
2	East Manggarai	24	10.21
3	Sikka	25	10.64
4	East Flores	21	8.94
5	Lembata	10	4.26
6	Alor	26	11.06
7	North Central Timor	27	11.49
8	Kupang regency	27	11.49
9	Rote Ndao	13	5.53
10	Sabu Raijua	6	2.55
11	West Sumba	10	4.26
12	East Sumba	24	10.21

Table 2 Average Indicator Value of Resources in Maternal and Child Health Policy Implementation in NTT in 2017

Availability of Resources in Maternal and Child Health Policy Implementation in NTT	Average Value
Availability of human resources	**2.64**
Health workers (doctors, midwives, nurses).	2.83
Supporting health workers.	2.83
Administration staff.	2.25
Doctors, midwives, and nurses who have been trained according to maternal and child health needs.	2.69
Human resources residing in maternal and child health policy.	2.62
Availability of budget	**2.45**
Adequate costs and budget.	2.7
Incentives for the policy implementers.	2.4
Community funds.	1.8
Costs and budget from the district government (APBD II).	2.6
Costs and budget from the provincial government (APBD I).	2.3
Referral costs.	2.7
Funds for facility, infrastructure and medical devices.	2.7
Availability of tools	**2.75**
Medical devices according to the policy standards.	2.8
Buildings and rooms according to the policy standards.	2.7
Facilities (buildings, delivery rooms, treatment rooms) according to the policy standards.	2.7
Medicines and supplies according to the standards	2.8
Transport for the policy implementation.	2.8
Maternity waiting homes for pregnant women and their families.	2.6
Office stationery and formats.	3.0
Variable average value	**2.61**

indicate implementation performance. On the contrary, the category of sufficiently available human resources shows good performance of the implementation. It means that the policy's good performance is following human resources availability, whereas poor policy performance corresponds with the insufficiency of human resources.

For a further review, a statistical analysis of the relationship between human resources availability and the performance of maternal and child policy implementation can be seen in Table 5.

Table 5 shows the correlation between health resource variables and the performance of maternal and child health policy implementation (p=0.00). The correlation is quite strong, with the correlation coefficient standing at 0.546. This means that if the resources increase or are added, the policy implementation's performance will improve too. A partial linear regression test (t test) was performed to assess resource variables' effect on policy performance. It is then found that t count=13.304 >t table 1.97, which means that Ho was rejected. It can also refer to a significant effect of resources on maternal and child policy implementation in NTT.

Discussion

Data analysis results show that the availability of human resources in implementing maternal and child health policies in NTT province is not sufficient/not available (value 2.64). The available doctors, midwives, and nurses are not according to public health service centers' standards. Costs and budget are also insufficient (value 2.45), and medical tools such as medicines, medical devices, buildings, and health facilities are categorized inadequate (value 2.75). Resources, including

Table 3 Performance Scores for Implementing Maternal and Child Health Service Policies

Indicators	Average Value
Health services for pregnant women, childbirth, postpartum, and infants aged 0–28 days born normal or with complications.	3.8
Puskesmas provide antenatal services at least 4 times.	4.0
Antenatal care is attended by trained obstetric and neonatal emergency staff.	3.7
Maternity assistance is attended by midwives, general practitioners, obstetricians.	3.8
Puskesmas prioritise infection prevention, delivery assistance according to standards, giving referrals, encouraging early initiation of breastfeeding, preventing complications.	3.8
Postpartum care at least 3 times: (KF-1) 6 hours after delivery up to 3 days; (KF-2) day 8 to day 14 after delivery; (KF-3) day 36 to day 42 after delivery.	3.8
Neonatal services at least 3 times (KN-1), (KN-2), (KN-3).	3.8
Obstetric and complication services for pregnant women, delivery rooms and childbirth.	3.8
Availability of tools and medicines, manuals and managerial guidance, delivery rooms, at least 2 beds, clean water, bathroom/toilet.	3.3
Sources of funds for delivery assistance services and handling complications, and referrals from the government.	3.5
All labour costs are borne by the government or local government.	3.4
Availability of maternity waiting homes for pregnant women with complications of pregnancy and childbirth.	3.0
The transport cost of blood donors is borne by the government.	2.9
All referral costs for pregnant women and childbirth are borne by the government.	3.3
Pregnant women with complications stay at maternity waiting homes for 2 weeks before giving birth and 1 week postpartum.	3.0
Average value	**3.36**

human resources, financial resources, and equipment resources, play an essential role in policy implementation.[15] Human resources are a variable that determines the success or failure of policy implementation.[16]

Human resources, including doctors, midwives, and nurses, are the primary providers of health services.[17] Data collection results show that most of the public health centers for health workers did not meet the standards. According to standards, the availability of health workers was found in 371 health centers throughout NTT with 40.70% of doctors according to national standards, 54.72% of midwives, and 58.76% of

Table 4 Resources based on Performance of Policy Implementation

Health Resources	Performance of Policy Implementation				Total
	Poor	Fair	Good	Very Good	
Not available	4	1	2	0	7
Fair	15	61	22	0	98
Sufficiently available	3	30	61	6	100
Available as needed	0	3	20	7	30
Total	22	95	105	13	235

Table 5 Relationship between Resources and Performance of Policy Implementation

			Performance of Policy Implementation	Health Resources
Spearman rho	Performance of Policy Implementation	Correlation coefficient	1.000	0.546**
		Sig (2-tailed)		0.000
		n	235	235
	Health Resources	Correlation coefficient	0.546**	1.000
		Sig (2-tailed)	0.000	
		n	235	235

Note: **significant correlation at level 0.01 (2-tailed)

nurses. According to *puskesmas* data in 2016, 41.78% of *puskesmas* did not have doctors, 18.33% did not have nurses according to standards, and 25.07% did not have midwives according to standards. As much as 72.51% of *puskesmas* did not have five supporting health workers such as pharmacy, public health, sanitation, nutrition, and medical analysts.

Pujowati[8] concludes that actors involved in the implementation of cross-sectoral health services perform their roles in different ways. Some efforts to raise public awareness to create healthy life behaviors are challenging because socioeconomic factors do not adequately support them. Indeed, the contributing factor to the implementation of this policy is the imposing of regulations as legal protection.

Paruntu et al.,[18] point out that human health resources in the health department and *puskesmas* are not based on the same perception of methods or measuring instruments. The problems seem to lack communication and coordination. Apart from the fact that there is no scheduled planning for human health resources, monthly or yearly health worker maintenance, and career development for health workers.

Health human resources are currently inadequate due to the low ratio of health workers compared to the population. Some efforts have been attempted to meet the health needs of human resources by placing health workers throughout Indonesia. However, it is still seen insufficient in terms of types and quality of health workers able to achieve the highest health status following the legal mandate. The low level of human resources is one of the weaknesses in the implementation of maternal and child health policies. Permatasari et al,[19] point out that despite the fulfillment of decent facilities and the regulation of fund resources in budget planning and budgeting, human resources are still seen as inadequate. Meanwhile, the inhibiting factor in the implementation of PONEK is the lack of human resources, and some PONEK team members have not performed their duties based on their primary tasks and functions.

The insufficiency of cost and budget resources (value 2.45) illustrates that the government has not prepared the budget optimally, even though Indonesia's health financing comes from the government and the community. According to Adisasmito,[20] budget allocations and expenditures originating from the Indonesian government always receive a meager portion, with the national average not reaching 5% of the total government budget. It shows that the health sector is not fundamentally prioritized. Substantively, health development is an investment in improving human resources quality that plays an essential role in increasing economic growth and reducing poverty and unemployment.

Human resources' quality is closely related to skills, dedication, professionalism, and competence in the fields. At the same time, the quantity is associated with the number of human resources, despite not having reached all the targeted groups in implementing policies. Indeed, budgetary resources are needed to ensure that the implementation of public policies can be run effectively in achieving standards and objectives. Also, the availability of decent facilities and infrastructures like buildings, land, office equipment, and other supporting facilities affect the program's success.

This study's findings indicate that the performance of the maternal and child health

policy implementation in NTT was in category 3.36, which implies that although there are still many targets that have not been achieved, the current results of the implementation are rated good.

The performance of public policy implementation evaluates policy efficiency by comparing the inputs and outputs. At the same time, the effectiveness of policies can be seen from the outputs and impacted outcomes. According to Anderson,[21] the dimensions of impact in the state policy are: (1) the expected and unexpected impacts of policies on society; (2) waste of policy for situations or people who are not the main target of the policy; (3) the impact of the policy can occur in the present or future conditions; (4) the impact of the policy affects the direct and indirect costs experienced by community members.

Most of all, health service output indicators have increased, but unfortunately, they are still below the national target. In comparison to national figures, the achievement of health service output indicators is still meager. Therefore, it is necessary to optimize the role of various society components and intensify cooperation among related sectors.[22]

The policy implementation's success depends on using available resources, particularly human resources, as the most critical asset. Each stage of implementation requires a higher quality of human resources.[23,24] Even though the policy is delivered accurately, clearly, and consistently, the implementation will not be effective if the implementer lacks resources.[25]

The ability and competence of the implementers are immensely needed to ensure public policy implementation improvement.[17,26] Management of human resources is seen as one primary strategy that aims to increase the workers' productivity and contribution to organizational goals.[27] Since human resources are the aspect of determining policy implementation's effectiveness, they must possess the skills and capability needed to carry out their duties and functions.[23,28]

Anggraeni and Muazaroh in Kusbandiyah,[27] in line with Van Meter and Van Horn theory, stated a relationship between resources and policy implementation. The availability of sustainable resources such as human resources, funds, facilities, and infrastructure will generate positive results and successful policies. Adequate resources that are not accompanied by a positive attitude from the organizers will result in suboptimal implementation.[27,29] For example, providing maternal and child health services requires qualified human health resources.[22,30] In fact, to date, the number of health workers has not been sufficient because the ratio of health workers to the total population is still low.[24,31]

Conclusions

The availability of health resources (human resources, financial resources, and health equipment/medical devices) in implementing maternal and child health policies in NTT is categorized as inadequate. Performance of maternal and child health policy implementation is satisfying, although some service targets have not been implemented maximally. Human resources have a significant and positive effect on maternal and child health policy implementation in NTT.

Conflict of Interest

There was no conflict of interest or, in other words, this research was conducted without commercial or financial relations, which could be interpreted as a potential conflict of interest.

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