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(National Public Health Journal)

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TABLE OF CONTENT

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Dear Editorial Team, Authors, Viewers, Subscribers, and Readers

In these hard times because of the COVID-19 pandemic, I would like to thank to everyone participating in the making of Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal) Volume 15 Issue 4. I got so many insights from the published articles, especially the invited article entitled "When will the COVID-19 Pandemic in Indonesia End?". We all know that in this pandemic era, we deeply want this pandemic will end very soon. However, we have to be more understanding that in Indonesia, there are a lot of elements (not only the government and the vaccine) that will be the supporting factors for the pandemic to come to an end. I do hope that we can survive this pandemic and do what we have to do maximally. **(Mandira, Jakarta)**

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Hafizurrachman *et al. Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)*. 2021; 16 (1): 1-8
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Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)

Junk Food Consumption and Symptoms of Mental Health Problems: A Meta-Analysis for Public Health Awareness

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Abstract

Junk food consumption increases the risk of having symptoms of mental health problems. This study aimed to conduct a meta-analysis to assess the association between junk food and symptoms of mental health problems. The study was conducted by a systematic literature review from October to December 2020. The data sources were selected from PubMed and ScienceDirect articles published from 2010 to 2020. Those websites were check-marked for text availability for original articles, using keywords for junk foods and mental health. This study had inclusion criteria for selecting articles and organizing articles using the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guideline. The full-text articles were selected for conducting a meta-analysis using R Studio Software. The 5,079 article titles were obtained, seven of which met the relevant requirements for meta-analysis. The range of respondents who experienced symptoms of mental illness was 1.38%–79.8%. There was no heterogeneity based on the tau-squared test. The correlation coefficient was 0.11 (95% CI = 0.09–0.14), with no publication bias based on Egger's regression test (0.602 or p-value > 0.05). The frequent consumption of junk food can contribute to mental illness symptoms, even within minimal effects.

Keywords: children, junk food, mental health problems, meta-analysis

Introduction

Mental illness symptoms, such as stress, depression, and anxiety, causes long-term nervousness and psychological problems,[1] weight loss,[2] drug abuse,[3] self-torture,[4] suicide,[5] murder,[6] and premature mortality.[7] In Indonesia, people with mental disorders were isolated using tied ropes or "*dipasung*," to prevent them from endangering the lives of others.[8] People in any age group can have a mental illness, including children.[9] In fact, children might have prolonged mental illness up to their adulthood.[10]

A study showed that the risk factors for mental illness are social environment, family issues, and violence.[5] Several studies also revealed that a healthy diet contributes to reducing the risk of mental illness.[11] Consumption of fruits and vegetables is believed to improve mental health because micronutrients such as vitamins, antioxidants, and minerals protect against mental illness.[12] Unfortunately, the habit of fruit consumption has been pushed aside by the increasing trend of high salt/sugar-laden diets.

The habit of junk food consumption has increased around the world.[13] Foods with high sugar and salt content are widely recognized as causes of non-communicable diseases such as diabetes, heart disease, and stroke.[14] Recent evidence demonstrates an association between junk food consumption and an increased risk of mental disorders.[15] Previous studies only applied meta-analysis techniques between nutritious foods and mental problems. The results did not include junk foods to quantify the findings.[16]

Method

The systematic literature review (SLR) was conducted by six authors, consisted of two primary authors and four authors assistants, organized from October to early December 2020. The SLR refers to the guidelines for systematic review and meta-analysis, called the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guideline.[17] This study has been registered to the International Prospective Register of Systematic Reviews, known as PROSPERO, with ID CRD42020218992 and accepted as a type of systematic review and meta-analysis. PROSPERO is an international database of prospectively registered systematic reviews, rapid reviews, and umbrella reviews in health and social

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care also does not accept scoping reviews or literature scans. Key features from the review protocol are recorded and maintained as a permanent record in PROSPERO. The Ethics Committee has approved the study at Sekolah Tinggi Ilmu Kesehatan Indonesia Maju, reference number: 2417/Sket/Ka-Dept/RE/STIKIM/IX/2020.

The source of this study used was from PubMed and ScienceDirect website. The reason for choosing these two databases was because they are well-known health databases and their bibliometrics offer free and easy access to verify work conducted by others. The first step is to go to the address https://pubmed.ncbi.nlm.nih.gov/. Then enter keywords into the website search engine, representing study material to find relevant articles. On the PubMed website, "check-mark" the text availability article (full text and free full text), article type (book and documents, clinical trial, and Randomized Control Trial), with the publication of the last ten years (2010–2020). For ScienceDirect: go to the address https://sciencedirect.com. Do the same as with the PubMed website, by specifying the article type or research article, "checkmark" all categories for the publication title, and all subject areas.

The next step was following the PRISMA guideline.[17] The guideline was: 1) Identifying: It was to identify the titles of relevant journal articles in the search column on the two website addresses for this study, the authors used keywords for study themes by using quotation marks or apostrophes. For two or more keywords, the authors used the boolean symbol "AND" between keywords. The keywords used to find articles related to junk food consumption (as an exposure) and mental illness (as an outcome) are: "junk food" and "mental health," "Junk food" and "mental disorders," "Junk food" and "depression," "junk food" and "stress," "junk food" and "sadness," "junk food" and "insomnia," "junk food" and "anxiety;" "mental health" and "snacks," "mental health" and "bread," "mental health" and "ice cream," "mental health" and "chocolate," "mental health" and "sweetened food," "mental disorder" and "snacks," "mental disorder" and "bread," "mental disorder" and "ice cream," "mental disorder" and "chocolate," and finally, "mental disorder" and "sweetened food." Additionally, junk food components were defined as "canned food," "chocolate," "instant noodles," and "bread," paired with "processed cheese," "frozen cake," "ice cream," "candy," "baked food," and "dried sweet food".[18–20] Duplicate articles that appeared several times during keyword searches were not reused; 2) Screening: to screen journal articles' titles, select the article title that matches the research theme. All abstract identifications were read and reviewed based on the inclusion criteria. The inclusion criteria are that they are original articles discussing junk food and mental health. Study interviews were conducted in person and written in English, and the study's method was quantitative. Mental health inclusion criteria were "depression," "stress," "sadness," "insomnia," and "anxiety" because these five disorders have a high prevalence worldwide.[18,19] Abstract articles that did not meet the criteria were eliminated; 3) Eligibility: Selected journals that meet the inclusion criteria should be downloaded with full text. The criteria prevail to both open- and closed-access journals. All journals are reviewed and selected to find the association between junk food consumption and symptoms of mental health problems. Articles where no associations were found will not be used; 4) Included: All journals articles at this phase that meet all the inclusion criteria are arranged by author year, country study, study design, study period, sample size, number, respondents, average age, type of junk food, consumption frequency, cases of mental problems, sample case(s) of mental problems, percentages, covariates, and OR values. This data is required to compute a meta-analysis using R Studio Software, an open-source software named "The Metaphor Package" (can be downloaded from https://cran.r-project.org/package=metafor). The OR values of journals that were not found were excluded.

The final step calculates the meta-analysis by showing the three components: 1) heterogeneity figure (Q-statistic, I-squared, tau-squared). It seeks to obtain whether the data results on the selected journals are homogenous or heterogeneous; 2) Looking at the publication bias figure (Funnel Plot, Egger's regression test) with the target result that there is no publication bias; and 3) Visual Effect size figure shows a significant target yield and no bias. If the article found does not provide a 2x2 table information, then to calculate the meta-analysis it is necessary to transform the OR value into the Pearson Product Moment Value through Cohen's d Calculation.[21]

Results

Figure 1 shows the process of identification of eligible articles for a meta-analysis of the association between junk food consumption and symptoms of mental health problems. A review of the database online journals found 1,889 articles that were necessarily removed due to duplication. On the other hand, 2,209 articles were excluded because 611 articles did not discuss junk food, 94 articles did not use humans subjects, 141 and 987 articles were comment and review articles, respectively, and 376 articles used a qualitative design. During the full-text article review, 82 articles were excluded for not reporting the association test. Upon completion, seven eligible articles relevant to the study remained.

Table 1 shows the resulting characteristics of the eligible article for the systematic review. Most of the studies were carried out in developed countries such as the

United Kingdom,[19,22] and Norway,[23] from continental Europe, Korea,[24] and China,[25] from Asia. All studies used a cross-sectional design. One article from the publication year fell within the inclusion time frame of this study. The study used data from 2006 and 2009.[22] All articles used large sample sizes. The least was 334 respondents,[26] and the most were 105,061 respondents.[27] The age groups of respondents varied from children to 15–19 year-old,[15] adolescents,[24] and all age ranges. The lowest age group was 12 years.[22,23] The oldest was 58 years.[26]

Table 2 shows, in the eligible articles, that the various types of junk food were salty and unhealthy snacks,[15,19] cakes, biscuits, sugary products, sweetened food, and pizza.[27] All studies mentioned that daily junk food consumption is associated with developing symptoms of mental health problems. The other frequent categories were "high frequency",[24] and "always consuming" junk food.[22] In general, mental health problems were comprised of poor mental health,[22] and mental health illness.[15,22–25,27] They also included psychiatric disorders,[15,23] sleep dissatisfaction,[24] stress,[25] and suicide attempts.[27]

The proportions of respondents suffering from mental health problems ranged from 1.38%,[24] to 79.8%.[27] Covariates of the study were sociodemographic conditions (age, gender, level of education, hostile behaviors such as smoking,[15,18,19,22] alcohol use,[19,24] and body mass index (BMI).[15,18,22] The control variables to reduce the adverse mental health effects were routine fruit and vegetable,[27] consumption and physical activity.[22,27]

All of the articles produced OR ranged from 1.31 to 1.9.[25,27] Nor did all of the articles present the total cases of respondents with mental health problems,[19,26] as presented in Table 2. Because there is no 2x2 table information in Table 2, the OR value of the seven selected articles must be transformed into a Pearson Product moment value that shown in Figure 2.

The meta-analysis based on R Studio Software, the random effect model's heterogeneity analysis results show that the estimated amount of total heterogeneity using the tau-squared test was equal to 0.0008 and Q-statistic with a p-value equal to 0.0001. Furthermore, the calculation of the I-squared result was 93.91%. The three

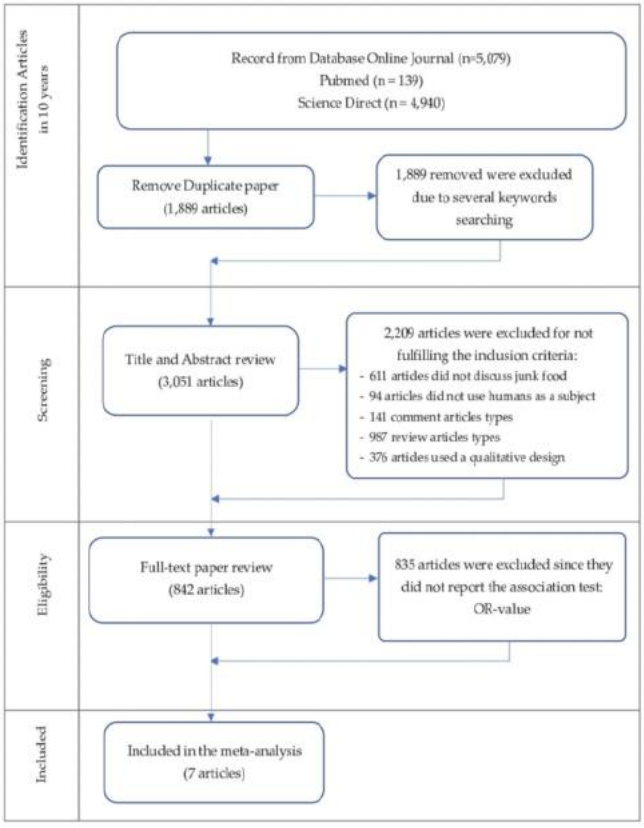

Figure 1. Flowchart of PRISMA Guideline

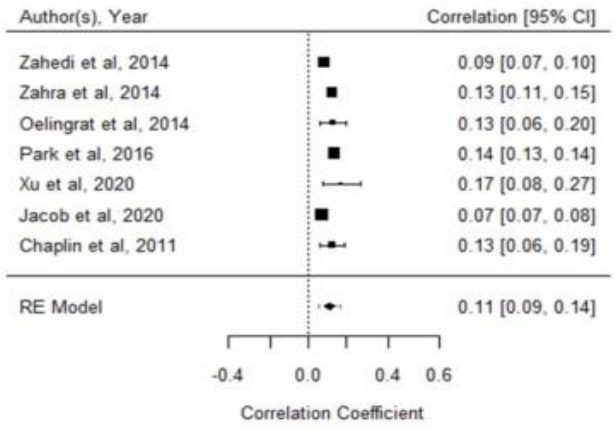

Figure 2. Forest Plot between Junk Food Consumption and the Symptoms of Mental Health Problems

Table 1. Eligible Articles Characteristic

Author	Year	Country Study	Study Design	Study Period	Sample Size	Respondents	Age (Mean in Years)
Zahedi, *et al.,*[15]	2014	Iran	Cross-sectional	2011–2012	13,486	Children	15–19
Zahra, *et al.,*[22]	2014	United Kingdom	Cross-sectional	2006 and 2009	10,645	Participants	12–14
Oelingrath, *et al.,*[23]	2014	Norway	Cross-sectional	2010	789	Participants	12–13
Park, *et al.,*[24]	2016	Korea	Cross-sectional	2015	68,043	Adolescents	15.07
Xu H, *et al.,*[25]	2020	Chinese	Cross-sectional	2017– 2018	14,500	Middle schools	14.9
Jacob, *et al.,*[27]	2020	32 Countries	Cross-sectional	2009–2015	105,061	Adolescents	13–15
Chaplin, *et al.,*[19]	2011	United Kingdom	Cross-sectional	2011	870	Participants	45

Table 2. Type of Junk Food and Mental Health Problems in the Eligible Article

Author	Type of Junk Food	Consumption Frequency	Case of Mental Problem	n	%	Covariate	OR
Zahedi, *et al.*,[15]	Salty Snacks, Sweets, Sweetened Beverage, Fast Food	Daily	Psychiatric distress (worry, depression, confusion, insomnia, anxiety, aggression, and feelings of worthlessness) and violent behaviors (physical fighting, victimizing, and bullying)	5,352	39.86	Family size, father's occupation, mother's occupation, father's education, mother's education, sedentary lifestyle, screen time, physical activity, socio-economic status, family history, body mass index (BMI), body image, passive smoking, current smoking.	1.37
Zahra, *et al.*,[22]	Hamburger, chips, crisps, fizzy drinks, sweets	Always	Poor mental health	1,836	17.24	Eat at irregular times, eat junk food daily, gender, age, ethnicity, overcrowded, free school meal, special educational needs, smoking, parenting style, poor physical health.	1.59
Oelingrath, *et al.*,[23]	Junk foods	Daily	Psychiatric disoders	72	9.1	Child's BMI category, maternal education, family income, family structure, child's gender, child's gender, child's physical activity, inactivity of child.	1.6
Park, *et al.*,[24]	Energy drinks and junk food	High frequency	Sleep dissactifaction, perceived stress, persistent depressive mood, suicidal ideation, suicide plan, suicide attempt(s)	945	1.38	Males, high school, rural residence, non-residence with family, high academic achievement, lifetime alcohol use, physically active, age.	1.65
Xu H, *et al.*,[25]	Western junk food, Chinese junk food, takeaway junk food, hot food packed in disposable fastfood box	During last week, 1-2 times	Severe stress, depressive mood, suicidal ideation, suicide plans, suicide attempts, and sleep dissatisfaction	432	3.1	Age, gender, residence, boarding school, being the only child in the family, father's education level, mother's education level, the number of close friends, sports, and self-perceived socio-economic status.	1.9
Jacob, *et al.*,[27]	Adherence to Western dietary patterns (snacks, pizza, sweets, and desserts)	Daily	Suicide attempts	NA	26.7-79.8	Sex, age, food insecurity (a proxy of socioeconomic status), alcohol consumption, smoking, physical activity, obesity, carbonated soft drink consumption, fruit, and vegetable consumption.	1.31
Chaplin, *et al.*,[19]	Unhealthy snacks	More than three times a week	Life stress	NA (Only showed the association)	NA	Alcohol consumption, smoking, difficulty sleeping, gender, age, neuroticism, total negative job score.	1.59

Note: OR = Odds Ratio; NA = Not Available

tests above resulted in different statuses of heterogeneity. Two tests said the study had heterogeneity (Q-statistic and I-squared), one study said no heterogeneity (tau-squared). It was caused by a range of sample sizes among the selected articles.

Figure 2 shows the magnitude of association measured by the correlation coefficient showed a small association between junk food consumption and the symptoms of mental health problems (0.11 with 95% CI = 0.09–0.14).

In Figure 3, the results of publication bias analysis using a Funnel Plot showed asymmetric results since the distribution of dots has no balance. There is another test, Egger's regression test, which aims to compare the Funnel Plot result. The results of Egger's regression test analysis showed a value of 0.602 or a p-value of more than 0.05, which indicates that there is no publication bias.

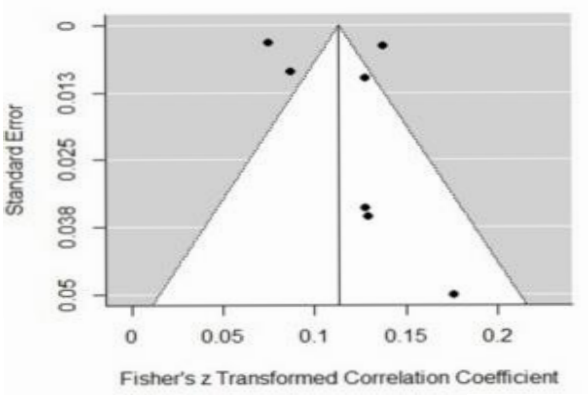

Figure 3. Funnel Plot of Junk Food Consumption and the Symptoms of Mental Health Problems

Discussion

The results of the meta-analysis of this study indicate a significant positive association between the frequency of junk food consumption and symptoms of mental health problems (0.11 with 95% CI = 0.09–0.14). Several previous systematic review articles between nutrient food and mental illness suggest that it is better to reduce the consumption of high fat and high sugar foods to prevent mental illness symptoms.[16] Polat, *et al.*,[28] revealed that frequent junk food consumption leads to an increase in testosterone and estrogen production, which might cause specific problems, including stress triggers. Palacios, *et al.*,[29] added that junk food substances from nuts trigger phytoestrogens' development, which can

cause stress. This condition will increase with high caloric content, high salt, high saturated fat, high sugar, and low fiber in junk food.[30] Perfluoroalkyl substances (PFASs) found in foods such as hamburgers, sausages, and pizza can interfere with the function of testosterone and other steroid hormones.[31] This condition is worrying because the quick reaction to these substances can cause increased risks of anemia, anxiety, and insomnia as triggers for mental health problems.[32] These quick reaction symptoms were clearly shown in the selected articles, which use the cross-sectional design in this study. It is differs from the effects of non-communicable diseases such as heart disease, diabetes, stroke, and cancer, which take a long time to manifest after junk food consumption.[33,34] The reaction will stimulate a higher impact if junk food is consumed in large quantities, exceeding the standard daily dose of health, and consumed frequently.

Although it proved a significant positive association, the results of this study's meta-analysis showed that differences are resulting in the heterogeneity of the association between junk food consumption and the symptoms of mental health problems. Heterogeneity might occur due to the various outcomes and sample sizes of mental health problems, including mental disorders, psychiatric disorders, sleep dissatisfaction, stress, autistic fantasy, and suicide attempts.[15,20,22–27] However, based on the tau-squared test, the heterogeneity has no occurred that one of the requirements for further analysis in this study. A meta-analysis study meets high qualifications if the calculation results do not have heterogeneity of measurement values.

Another prerequisite for better meta-analysis is that there be no publication bias in any of the measurement tests. In this study, publication bias was calculated by two measurements–the Funnel Plot and the Egger's regression test. Both measurements yielded different results. The Funnel Plot showed a publication bias, while the Egger's regression test showed none. Since this study included only seven articles, the Egger's regression test proved more robust or suitable.[35] It can be said that there was no publication bias for this study.

Under real conditions, various types of mental disorders might cause heterogeneity of the result.[36] These results provide strong evidence for a connection between junk food consumption and the occurrence of problematic mental health issues.

The systematic review showed that children are susceptible to symptoms of mental health problems,[23,25] such as depression, anxiety, and low self-esteem due to anatomical and physiological conditions.[37,38] Moreover, junk food such as chips and fries, chocolate, cookies, pizza, and burgers are more consumed by children than adults.[39] Junk food, especially the type that contains excessive sweet or salty taste, can inhibit information processing in the brain. Therefore, children and adolescent who consumes a lot of junk food usually have concentration difficulties at school.[40] Junk food also exacerbates existing mental disorders. In Indonesia, schools provide *Unit Kesehatan Sekolah* or School Health Unit to prevent mental illness in children. However, it is still a pilot project, and controlling junk food has not been determined as the program's aim.[41] In India, there is a High in Fat, Sugar, and Salt (HFSS) guideline, regulating children's excessive consumption of junk food because of its association with higher body mass index. However, these guidelines do not address the risks of developing mental illness.[42]

Based on the discussion above, the association between junk food and mental health problems is sufficiently acute. Even minimal but frequent consumption of junk food could contribute to aggravated mental health symptoms. A regular public education awareness campaign to prevent mental illness through improvements to diet and lifestyle is warranted. The community must be aware of policy makers' issues through guidelines, rules, and publicity campaigns. The community needs to ramp up awareness of junk food consumption risks, mainly to prevent long-lasting mental health problems for children.

The findings from several eligible articles showed that negative behaviors, such as smoking, and drinking were significant determinants of poor mental health conditions.[19,26,27] These findings were consistent with the other studies.[43] Both sugar and fat nutrients and nicotine exposure may activate stressors in the body.[44] Further study is required to support this finding.

Body mass index is also considered a covariate in several eligible studies.[15,18,23] Obesity affects stress because it strains emotional function, causes depression, and delays the development of teeth, bones, and muscles.[45] Therefore, maintaining an ideal BMI, smoking, and alcohol cessation are also necessary to prevent the aggravation of mental illness symptoms.

Food is not the only risk factor for poor mental conditions. It can be seen from the covariate variations that affect the associations between junk food consumption and the incidence of mental illness in all eligible studies for meta-analysis in this study. However, the potential for mental illness from junk food consumption has not received much awareness from public health personnel and medical personnel.[46] The efforts of mental illness prevention implemented by health personnel have included junk food consumption control.[47] Some nutritionists have implemented campaigns against junk food consumption in patients because of the risk of mental illness, but it has not been implemented by other health personnel.[48] For example, nurses in primary health care have not actively advertised the importance of controlling junk food consumption to prevent stress symptoms in their

patients.[49] Treatment of mental illness in health services should include encouraging the consumption of vegetables and fruit instead of junk food. Public health personnel as the front liners in preventing mental illness should campaign on junk food consumption restriction.

The existing health policy has linked the consumption of junk food with malnutrition. However, it has not emphasized the potential risks of developing mental illness.[50–52] Developing and developed countries such as the United States, France, Mexico, Chile, Brazil, and South Africa have imposed taxes on food and sweetened drinks to limit the consumption of foods that pose a health risk.[53–55] Other countries might need to implement a similar policy.

Regular consumption of fruits and vegetables, instead of junk food, can prevent mental illness. Fruits and vegetables provide a wide variety of vitamins, minerals, fiber, and phytochemicals that the body needs to keep healthy, while junk food provides abundant calories that harm health.[56,57] Promoting regular consumption of fruit and vegetable have been routinely encouraged by health personnel to patients and the community. However, policy needs to be developed especially for children, to regularly eat fruits and vegetables to avoid various mental health problems.[58–60]

This study's novelty is that it is the first meta-analysis conducted to determine the positive relation between junk food consumption and the symptoms of mental health problems by using two well-known health databases. The existing meta-analysis research method approaches the subject from a less comprehensive point of view. This approach is to the importance of healthy food intake to improve the symptoms of mental health problems.[16] Simply the result of this first meta-analysis will allow future researchers around the world to examine the different effects of junk food consumption and the symptoms of mental problems by using observatory data from their own countries. Using combination of two databases that are sufficiently strong for SLR study such as journal searches becomes less time-consuming and efficient. It obtains high index articles without having to identify other well-known databases. These two databases have advanced the search, facilitating the specific journal search process.

Limitations of this study only used five categories of mental health problems and did not include other symptoms such as schizophrenia. Meanwhile, junk food categories did not measure fried foods (*gorengan*) that contain unhealthy carbohydrates and fats and are widely consumed by society. The source of the meta-analysis comes from just two databases. It might still be possible to find a stronger association between exposure and outcome. Therefore, other researchers could investigate more varied types of junk food and mental health problems for the next SLR research and use more databases and website resources.

Conclusion

This systematic review and meta-analysis study demonstrated a significant positive association between frequent junk food consumption and the potential for symptoms of mental health problems. These problems can be suffered by all age categories, including children and adolescence. On the other hand, routine junk food consumption coupled with negative behaviors such as smoking and drinking alcohol, and being overweight or obese, contribute to the growth of mental health problems. Therefore, society and policymakers together must be made aware of the outcomes of this study and the need to develop junk food consumption controls, especially for children, to raise public health awareness toward the negative outcome of mental health problems.

Abbreviations

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analysis; SLR: Systematic Literature Review; PROSPERO: International Prospective Register of Systematic Reviews; BMI: Body Mass Index; CI: Confident Interval; NA: Not Available; OR: Odds Ratio; PFASs: Perfluoroalkyl Subtances; HFSS: High in Fat, Sugar, and Salt.

Ethics Approval and Consent to Participate

The analysis used an online database journal from PubMed and ScienceDirect. Ethics approval was obtained by the Ethics Committee of Sekolah Tinggi Ilmu Kesehatan Indonesia Maju, reference number: 2417/Sket/Ka-Dept/RE/STIKIM/IX/2020.

Competing Interest

The author declares that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

The data is publicly available from Pubmed and Science Direct from October 2010 to October 2020. The data of this study can be obtained from seven eligible articles that have been included in references. Also, the reader may contact the corresponding author for further information.

Authors' Contribution

MH contributed to the conception, data screening, supervising, and writing of the manuscript. RKH participated in the conception and writing of the manuscript.

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Evaluation of Added Sugar and Sugar-Sweetened Beverage Consumption by University Students

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Abstract

Today, increased intake of sugar and sugar-sweetened beverages is seen as an important factor in the growing prevalence of chronic diseases, such as obesity, obesity-related diabetes, and coronary heart diseases. This study involved 214 Ankara University students from the Department of Nutrition and Dietetics, which was intended to evaluate the consumption of sugar and sugar-sweetened beverages. The frequency of student consumption of beverages and the quantities and amounts of sugar taken with beverages were questioned. The average total amount of sugar added to drinks by the students was 4.69 ± 6.35 gram, while the average total amount of sugar taken with sugar-sweetened beverages was 11.34 ± 15.32 gram. Female students relative to male students, students in grade 4 compared to grades 2 and 3, and students who had daily breakfast compared to those who did not had lower average sugar consumption (p-value < 0.05). As class grades increase, the amount of sugar added to beverages and fruit juice and sweetened soft drinks and carbonated beverages decreased (p-value < 0.05). The consumption of herbal teas and dietary beverages increased and the eating habits of students generally changed positively (p-value > 0.05). It is important to educate university students about the reduction in sugar intake and sugar-containing food in order to avoid many chronic diseases that may be seen in older ages.

Keywords: sugar, sugar-sweetened beverages, university students

Introduction

Obesity is a significant health concern in both developed and developing countries today. There have been several factors in the etiology of obesity, but the association between increased obesity prevalence and high sugar consumption has gained attention recently.[1] Moreover, the relationship between high sugar consumption and health problems such as obesity, diabetes, cardiovascular diseases, dental caries, and hyperactivity is discussed.[2-5]

Experimental and observational studies have shown that the amount of sugar added to beverages or taken by sweetened beverages induces weight gain in children and adults. It is also strongly emphasized that this situation is closely linked to diseases such as oral and dental health, cardiovascular diseases, diabetes, and metabolic syndrome.[6-9] Studies in Turkey indicate that 68.8% of young people consumed sugar added tea and coffee, 33.2% consumed cola drinks, 46.4% consumed fruit juice, and 49.2% consumed foods such as sugar and chocolate;[10] 30% preferred milk and fruit juice as a drink at breakfast;[11] 10.6% of students consumed cola, and 19.9% consumed fruit juice.[12] Other studies stated that most young people prefer cola drinks between meals.[11,13] Another study conducted in Turkey found that 11.5% of young people consumed sweetened carbonated beverages or cola drinks every day.[14]

Nowadays, sugar added or sugar-sweetened fruit juices, soft drinks, and carbonated beverages take place in nutritious drinks such as milk and ayran.[15] Little is known about factors that determine the preferences of beverages as well as the influence of university students on the consumption of sweetened beverages by many factors. In order to better understand these factors, there is a need for the planning and implementation of dietary habits, particularly for the consumption of sweetened beverages by young people. It is considered that this aspect should be taken into account when evaluating the risk of chronic diseases associated with nutrition and health-promoting and protective practices.

For that reason, this study was organized and conducted to determine the amount of sugar added to bever-

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ages or taken by sweetened beverages and the number of beverages consumed by 2nd-, 3rd-, and 4th-year students studying at the Faculty of Health Sciences, Department of Nutrition and Dietetics of Ankara University, Turkey.

Method

This study was conducted between November and December 2016 in a total of 214 students in the 2nd, 3rd, and 4th years of the Faculty of Health Sciences, Department of Nutrition and Dietetics of Ankara University, Turkey. This study involved all students (214 students) studying at the Department of Nutrition and Dietetics (the second, third, and fourth years).

Data from the survey were obtained by applying a face-to-face questionnaire, which consists of two parts. The first part contains some demographic information on students and some nutritional habits, such as having breakfast daily and eating outside the house. The second part includes information on students' beverage consumption (daily water consumption; frequency of tea, herbal teas, Nescafe, milk, etc.; addition of sugar to some beverages; preference of sweetened beverages; etc.).

Beverage consumption by university students was determined by frequency and quantity. Moreover, it was questioned how much and how often students consumed drinks such as milk, ayran, fruit juice, cola or diet drinks, Nescafe, Turkish coffee, energy drinks, and alcohol (e.g., one cup a day, one cup of water at a time). University students were asked to complete the surveys, taking into account the frequency of beverage consumption in the last three months. Beverage frequency consumption of each item was evaluated using seven categories: never, once a week, two to three times per week, four to six times per week, once a day, two to three times per day, and four to eight times per day. Later, beverage consumption coefficients were multiplied by the number of drinks consumed at one time. The amount of beverage consumed by university students per day was calculated in mL.

Daily beverage intake was determined using the following formula: frequency of intake (the conversion factor) × serving size × total number of servings × mL of beverage in one serving.[16] Water consumption of university students questioned in the form of water glass. Students who added sugar to beverages were asked to write down the amount of sugar they added as a teaspoon, depending on the amount they consumed (one teaspoon, one cup, etc.), and the amount of sugar added to beverages is calculated in grams, taking into account the amount of beverage consumed. In this study, one teaspoon of sugar was accepted as 5 grams.[17] In addition, sugar fractions used in sweetened beverages are taken from the official websites of the related beverage companies and the amount of sugar taken from sweetened beverages, and finally, the total amount of sugar is calculated.[18-21]

Statistical evaluation was assessed using the Statistical Package for the Social Sciences (SPSS) version 24 (IBM SPSS Advanced Statistics 24.0, Program Number: 5725-A54). Charts showing mean and percent values were prepared when the frequency of beverages was evaluated. One-way ANOVA was used to assess sugar consumed in sweetened beverages and the amount of daily consumption of some beverages and drinks. Further, independent samples of t-tests were used to assess sugar consumption among groups where demographic information and nutrition habits are considered. Additionally, the significance level was accepted as p-value < 0.05 in all statistical analyses. The study was approved by the Ethics Committee of Ankara University (Approval ID: 06-258-16).

Results

A total of 214 university students (21 males, 193 females) participated in the study, with a mean age of 20.57 ± 1.10 years and a mean number of siblings of 3.04 ± 1.52. According to Table 1, 18.7% of university students say they drink milk once a day, 39.3% drink ayran two to three times a week, 38.9% drink tea two to three times a day, and 35.0% drink Turkish coffee once a week. In addition, 98.6% of students did not consume energy drinks, 93.9% turnip, 89.7% alcoholic beverages, 82.7% diet drinks, 65.4% mineral water, 64.5% of pure fruit juices, and 56.5% carbonated drinks.

University students' consumption of carbonated beverages, fruit juice, sweetened tea, and sweetened soft drinks (mL/day) were lower as the class level increased, whereas consumption of herbal tea and diet beverages increased (Table 2). The average daily water consumption of university students was 1228.04 ± 533.5 mL/day.

Table 3 indicates the amount of sugar (gram) added to beverages by university students and the amount of sugar taken with sweetened beverages by grade level (2, 3, 4). Accordingly, as the grade level increases, the amount of sugar added to beverages and the amount of sugar taken with sweetened beverages are reduced. The average amounts of sugar added to all beverages are 7.21 ± 7.43 g, 3.64 ± 5.39 g, and 2.15 ± 3.95 g in grades 2, 3, and 4, respectively. The total amounts of sugar taken with sweetened beverages for 2nd, 3rd, and 4th grades, respectively, are 17.09 ± 21.62 g, 8.56 ± 14.53 g, and 7.08 ± 8.57 g.

When the amount of sugar consumed by students is considered in line with some nutritional habits; students who have obese individuals in their families, who have daily breakfast regularly, and who have not consumed anything before sleeping had significantly lower sugar consumption. However, students who added salt without

Table 1. Frequency of Some Beverages Consumption by University Students in Ankara City, Turkey (N = 214)

Beverage	Per Day						Per Week						Never	
	Four to Eight Times		Two to Three Times		One Time		Four to Six Times		Two to Three Times		One Time			
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Milk	-	-	11	5.1	40	18.7	33	15.4	67	31.3	49	22.9	14	6.5
Ayran	-	-	2	0.9	9	4.2	26	12.1	84	39.3	77	36.0	16	7.5
Pure fruit juice	-	-	-	-	-	-	2	0.9	16	7.5	58	27.1	138	64.5
Fruit juice	-	-	-	-	3	1.4	9	4.2	35	16.4	57	26.6	110	51.4
Carbonated drinks	-	-	-	-	-	-	5	2.3	24	11.2	64	29.9	121	56.5
Diet drinks (zero, light, etc.)	-	-	-	-	-	-	1	0.5	10	4.7	26	12.1	177	82.7
Black tea	20	9.3	83	38.9	55	25.7	17	7.9	22	10.3	9	4.2	8	3.7
Sweetened tea (ice tea, etc.)	-	-	1	0.5	3	1.4	8	3.7	13	6.1	52	24.3	137	64.0
Herbal teas	1	0.5	5	2.3	12	5.6	15	7.0	46	21.5	59	27.6	76	35.5
Nescafe	3	1.4	16	7.5	25	11.7	24	11.2	54	25.2	51	23.8	41	19.2
Turkish coffee	-	-	3	1.4	11	5.1	13	6.1	33	15.4	75	35.0	79	36.9
Mineral water	-	-	-	-	3	1.4	7	3.3	15	7.0	49	22.9	140	65.4
Sweetened soft drinks	-	-	-	-	-	-	2	0.9	12	5.6	63	29.4	137	64.0
Oralet	-	-	-	-	-	-	1	0.5	2	0.9	10	4.7	201	93.9
Turnip	-	-	-	-	-	-	1	0.5	2	0.9	10	4.7	201	93.9
Energy drinks	-	-	-	-	-	-	-	-	-	-	3	1.4	211	98.6
Alcoholic beverages	-	-	-	-	-	-	-	-	5	2.3	17	7.9	192	89.7

Table 2. Consumption Amounts of Some Beverages Consumed by University Students (N = 214) (mL/day)

Beverage	Amount of Consumed Beverage (mL/day)					
	2nd Grade (N = 84)	3rd Grade (N = 79)	4th Grade (N = 51)	Total (N = 214)		
	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD	F	p-value
Milk	195.23 ± 77.46	193.03 ± 55.31	184.31 ± 67.44	191.82 ± 67.42	0.435	0.64
Ayran	210.71 ± 83.61	205.82 ± 73.91	186.27 ± 80.04	203.08 ± 79.51	1.582	0.20
Pure fruit juice	106.07 ± 106.14	62.40 ± 96.15	35.29 ± 77.00	73.08 ± 99.90	9.359	0.00[a] 0.01[b]
Fruit juice	175.00 ± 176.59	110.12 ± 145.48	69.21 ± 108.12	125.84 ± 156.39	8.442	0.00[a] 0.01[b]
Carbonated drinks	136.30 ± 140.68	98.35 ± 143.93	90.98 ± 121.41	111.49 ± 138.44	2.293	0.10
Diet drinks	25.35 ± 70.70	43.67 ± 98.30	59.21 ± 108.32	40.18 ± 91.75	2.278	0.10
Black tea	192.85 ± 131.52	185.44 ± 159.35	205.00 ± 151.27	193.01 ± 146.51	0.274	0.76
Sweetened tea	102.26 ± 132.04	97.97 ± 151.81	90.98 ± 159.81	97.99 ± 145.77	0.094	0.91
Herbal teas	98.80 ± 91.16	115.08 ± 92.64	117.68 ± 96.17	109.57 ± 92.88	0.932	0.39
Nescafe	144.04 ± 79.68	134.17 ± 90.42	174.50 ± 121.80	147.66 ± 95.89	2.890	0.58
Turkish coffee	76.19 ± 63.28	70.88 ± 55.81	67.64 ± 70.58	72.19 ± 62.31	0.324	0.72
Mineral water	91.66 ± 124.38	52.27 ± 91.49	63.72 ± 92.23	70.46 ± 106.78	2.956	0.054
Sweetened soft drinks	102.73 ± 102.51	56.32 ± 91.41	46.07 ± 84.16	72.10 ± 97.17	7.472	0.02[a] 0.00[b]

Notes: p-value < 0.05[a] = the level of significance between the 2nd and 4th grades; p-value < 0.05[b] = the level of significance between the 2nd and 3rd grades; SD = Standar Deviation

tasting their meals were found to have significantly higher average sugar consumption than those who did not (p-value < 0.05) (Table 4).

Discussion

The mean age of 214 university students involved in the study was 20.57 ± 1.10 years. Furthermore, 38.9% of university students consumed tea two to three times a day, and 35.0% consumed Turkish coffee once a week. In addition, 51.4% of students did not consume fruit juice, 56.5% carbonated drinks, 35.5% herbal tea, 65.4% mineral water, and 89.7% alcoholic beverages.

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Table 3. Evaluation of the Amount of Sugar Added to 100 mL of Some Beverages According to Grades of University Students (g)

	Amount of Sugar Added (g)					
	2nd Grade (N = 84)	3rd Grade (N = 79)	4th Grade (N = 51)	Total (N = 214)		
	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD	F	p-value
Sugar added to tea	2.26 ± 2.33	1.11 ± 1.65	0.82 ± 1.60	1.49 ± 2.03	11.09	0.001[a] 0.000[b]
Sugar added to herbal tea	1.85 ± 2.33	0.86 ± 1.93	0.35 ± 0.95	1.13 ± 2.02	10.76	0.003[a] 0.000[b]
Sugar added to Nescafe	2.00 ± 2.59	1.24 ± 1.90	0.82 ± 1.55	1.43 ± 2.18	5.34	0.006[b]
Sugar added to milk	1.09 ± 2.11	0.43 ± 1.34	0.15 ± 0.67	0.62 ± 1.63	6.45	0.023[a] 0.003[b]
Total sugar added to beverages	7.21 ± 7.43	3.64 ± 5.39	2.15 ± 3.95	4.69 ± 6.35	13.09	0.001[a] 0.000[b]
Sugar taken with fruit juice	8.26 ± 14.50	3.18 ± 5.32	2.44 ± 4.90	5.00 ± 10.24	7.52	0.004[a] 0.003[b]
Sugar taken with carbonated drinks	3.98 ± 6.95	2.71 ± 6.24	1.95 ± 2.96	3.03 ± 5.95	2.03	0.13
Sugar taken with sweetened tea	2.97 ± 8.89	1.76 ± 4.34	1.94 ± 4.10	2.28 ± 6.48	0.80	0.44
Sugar taken with sweetened soft drinks	1.85 ± 2.38	0.90 ± 1.88	0.74 ± 1.53	1.23 ± 2.07	6.50	0.008[a] 0.006[b]
Total sugar taken with sweetened beverages	17.09 ± 21.62	8.56 ± 14.53	7.08 ± 8.57	11.34 ± 15.32	7.68	0.004[a] 0.003[b]
Total	24.30 ± 2.58	12.21 ± 2.03	9.24 ± 1.47	16.25 ± 20.19	12.56	0.000[a] 0.000[b]

Notes: p-value < 0.05[a] = the level of significance between the 2nd and 4th grades; p-value < 0.05[b] = the level of significance between the 2nd and 3rd grades; SD = Standard Deviation

Table 4. Examination of the Total Amount of Sugar Consumed by University Students per Day (Total Sugar From Sweetened Beverages and Total Sugar Added to Beverages) According to Some Variables (N = 214)

Variable	Category	Total Sugar Consumption (g)		
		n (%)	$\bar{x}$ ± SD	p-value
Gender	Male	21 (9.8)	32.06 ± 32.52	0.024*
	Female	193 (90.2)	14.53 ± 17.65	
Obese individuals in the family	Yes	119 (55.6)	12.61 ± 13.04	0.006*
	No	95 (44.4)	20.80 ± 25.93	
Regular breakfast	Yes	142 (66.4)	13.82 ± 14.88	0.039*
	No	72 (33.6)	21.04 ± 27.35	
Eating before sleeping	Yes	127 (59.3)	19.28 ± 23.33	0.003*
	No	87 (40.7)	11.82 ± 13.36	
Eating outside	Yes	131 (61.2)	16.74 ± 21.94	0.652
	No	83 (38.8)	15.46 ± 17.16	
Adding salt to meals	Yes	34 (15.9)	24.99 ± 27.60	0.041*
	No	180 (84.1)	14.60 ± 18.09	
Adequate and balanced nutrition according to students	Yes	87 (40.7)	12.69 ± 14.54	0.021*
	No	127 (59.3)	18.68 ± 23.02	

Note: SD = Standard Deviation

20-year-olds and over in the last 1-month beverage is evaluated, blacktea was the most commonly consumed in both gender; it is drunk every day, 92.3% in urban and 94.5% in rural areas.

The effects of caffeine in tea on health should not be overlooked. Coffee, tea, cola drinks, cocoa, and chocolate contain caffeine. About 100–120 mg of caffeine is in a cup of brine (200–250 mL), 40–50 mg infused in a cup of tea for 5 minutes, and 35–36 mg is in 100 mL of cola. If taken more than 5 grams per day, congestion, coma, respiration, and heart failure can occur.[23-25]

According to data from TBSA,[22] the consumption frequency of herbal teas was generally low, with a total unconsumed rate of 71.2%. The university students included in this study had a higher consumption frequency of herbal teas than the TBSA data. It is thought that university students are preferred because of the easy consumption of packaged herbal teas, and this situation contributes to an increase in the consumption of herbal tea.

Additionally, according to TBSA data,[22] while 21.3% of people drink coffee or Nescafe every day. In this study, 20.6% of students declared that Nescafe was drunk at

least once a day; similar results were obtained in both studies. In the same study, the rate of fruit juice consumption one to two times a week was 22.0%, and the rate of consumption three to four times a week was 11.2%. In this study, both rates were found to be 26.6% and 16.4%, respectively. According to TBSA data,[22] the rate of people consuming carbonated drinks daily was 11.7%. At the same time, all of the students who participated in the study reported that they did not consume carbonated drinks every day. This outcome is incredibly rewarding because students in the Department of Nutrition and Dietetics have turned vocational education into a lifestyle. In the same study, the rate of people who did not consume alcoholic beverages was 84.9%, compared to 89.7% in this study. Due to the drunkenness of alcohol in the Islamic world, it is thought that alcohol consumption is not considered legitimate.

Water is the essential component of nutrition. Every body function is supplied with fluid, and losing 10% of water causes serious problems in the body. Water and other beverages are important for the preservation of body fluid balance. An average of 2–2.5 liters (8–10 cups) of water per day is recommended to dispose of toxic substances through food consumption in the body and for the body's heat balance.[26,27] The average amount of water consumed by university students is 1228.04 ± 533.5 mL/day (6.15 ± 3.41 cups) in this study, lower than recommended.

This study determined that university students' consumption of carbonated drinks, fruit juice, and sweetened soft drinks (mL/day) by university students decreased as the grade level increased (Table 2). In this result, vocational consciousness, abilities transforming knowledge to behavior and active course contents in students of the Department of Nutrition and Dietetics are considered to play an important role. The total amount of sugar added to drinks and the total amount of sugar taken in sweetened beverages were 4.69 ± 6.35 g/day and 11.34 ± 15.32 g/day, respectively, for students of the Department of Nutrition and Dietetics (Table 3). The total sugar added and sugar of sweetened beverages is approximately 44 kcal, equivalent to around 2.75% of the 2,000 kcal diet. The energy given by the amount of sugar added to beverages or taken by sweetened beverages constitutes between 13% and 16% of the daily energy intake of adults and adolescents in the United States (US).[28]

In a study of 253 university students, West, *et al.*,[29] found that male and female students had 620 ± 671 kcal/day (~155–168 g) and 505 ± 670 kcal/day (~126–168 g), respectively, (~135 g) of energy when both groups were included, but this difference was not statistically significant. Murad,[30] found that students studying at a university in the US, between 18 and 24 years of age, with 203 university students, had lower consumption of sugar added to beverages or taken by sweetened beverages as grade increases. According to Huffman and West,[31] 201 college students in the college preparatory period had a significantly higher rate of sugar consumption (p-value < 0.01) than those who continue to study at university (p-value < 0.01). Additionally, the average daily amounts of consumed sweetened beverages were 12.6 ± 4.8 and 7.6 ± 5.0, respectively. The findings of this study were similar to those of Murad,[30] and Huffman and West,[31]; the students' daily sugar consumption was found to be lower than the study conducted by West, *et al.*[29] The main difference is thought to be that the students of the Department of Nutrition and Dietetics have turned the course content and nutritional education gained in this direction into a lifestyle.

In this study, students who have daily breakfasts compared to those who do not have, and students who think they are well fed and balanced compared those who do not had significantly lower (p-value < 0.05) total sugar consumption (Table 4). Welsh, *et al.*,[32], Collison, *et al.*,[33] and Gao, *et al.*,[34] found that the amount of sugar from sweetened beverages was significantly higher in men than in women (p-value < 0.005); Huffman and West,[31] found no relationship between consumption of sweetened beverages and gender.

The Institute of Medicine,[35] recommends that energy received by added or free sugar consumption should be less than 25% of daily energy. Further, the World Health Organization (WHO),[36] also recommends less than 10% of the energy consumed. The American Heart Association,[37] reports that energy taken from free sugars should be less than 150 kcal (37.5 g) and 100 kcal (25 g) for men and women, respectively. The United States Department of Agriculture,[38] recommends that energy obtained with solid fats and sugar should account for 5–15% of daily energy. The WHO,[39] on the other hand, points out that sugar energy is less than 5% of the daily energy requirement. Although international sugar consumption recommendations vary from country to country, it is suggested for our country that a maximum of 9–10% of energy (40 g/day for men, 30 g/day for women) should be consumed from sugar.[39,40] Even though a maximum of 15% of the 2,000 kcal diet (average 75 g) was considered to be met by sugar, the results of this study indicate that university students have low sugar consumption. In this study, the amount of sugar taken from foods such as sweets and chocolate (one serving containing about 40–50 g of sugar) was not calculated. The only amount of sugar added to beverages or taken from sweetened beverages was determined.

In adolescence or adulthood, skipping breakfast is a serious problem, and this rate is close to 30% for young people in the US and European countries. Studies in the literature indicate that individuals who have a habit of

having regular breakfast typically eat sufficiently and balanced.[41-43] Although some studies,[44,45] show that individuals who have regular breakfast have lower daily sugar consumption than those who do not, studies claiming the opposite of this situation,[46-48] are available.

Conclusion

As the grades of Nutrition and Dietetics students increase, their sugary beverage consumption decreases. The eating habits of students usually shift positively. It should be evaluated to reduce the consumption of sugar and sugary foods and beverages in young people and develop recommendations for this, particularly regarding the prevention of chronic diseases in adults. In order to better understand these factors, it is important to plan and practice dietary habits, particularly in children and young adults, with regard to the consumption of soft drinks. Nutritional education, which is widely and efficiently provided, is essential to public health.

Abbreviations

SPSS: Statistical Package for the Social Sciences; TBSA: Türkiye Beslenme ve Sağlık Araştırması/Turkey Nutrition and Health Research US: United States; WHO: World Health Organization.

Ethics Approval and Consent to Participate

The study was approved by the Ethics Committee of Ankara University (Approval ID: 06-258-16).

Competing Interest

The author declares that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

The data are not publicly available as it contains information that could compromise the privacy of research participants.

Authors' Contribution

ÇSM, NYA, and HÖY were involved in the design and conceptualization of the study, ÇSM and HÖY in data collection, ÇSM, NYA, and HÖY in data analysis, discussing the final results and contributing to the final manuscript.

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Assessment of Characteristics and Conditions before the End of Lockdown

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Abstract

After months of blockades and restriction, the decision of the best time to end the lockdown after the first wave of the COVID-19 pandemic is the big question for health rectors. This study aimed to evaluate the characteristics and conditions for ending the blockade after the first wave of COVID-19. Data on the variables of interest were subjected to linear and non-linear regression studies to determine the curve that best explains the data. The coefficient of determination, the standard deviation of y in x, and the observed curve of the confidence interval were estimated. Regression which was estimated, subsequently revealed the trend curve. The study found that all dependent variables tend to decrease over time in a quadratic fashion, except for the variable for new cases. In general, the R^2 and mean absolute percentage error (MAPE) estimated were satisfactory: gradual and cautious steps should be taken before ending the lockdown. The results suggested that surveillance of crucial indicators (e.g., incidence, prevalence, and PCR test positivity) should be maintained before lockdown is terminated. Moreover, the findings indicated that long-term preparations should be made to contain future waves of new cases.

Keywords: COVID-19, forecasting, lockdown, SARS-CoV-2

Introduction

The global population is possibly experiencing the most critical juncture of this millennium due to the emergence of the Corona Virus Disease 2019 (COVID-19) (e.g., the disease caused by the coronavirus SARS-CoV-2) pandemic. In the absence of definitive treatment modalities and lack of development of a vaccine, the only effective strategy currently appears to be preventive in nature. Containment and restrictive measures result in considerably low rates of transmission of the virus. Therefore, a significant part of the world's population is at home as a strategy for containing the pandemic.[1]

Following many Asian and European countries, cities are closed to fight the virus. The most stringent social isolation measure taken to date is total closure. This scheme is projected to be the most effective in preventing the spread of the infection, leading to major negative social and economic consequences. However, governments worldwide have declared that the closure is effective, which resulted in extended periods.[2]

Notably, Chile has performed poorly in terms of prevention. In this regard, understanding the dynamics of infection transmission is essential because it could determine whether outbreak control measures are having a significant effect. Many governments have incorporated control measures, such as quarantine, travel restriction, and airport inspection for travelers. However, the effectiveness of such measures in controlling the outbreak is inconclusive.[3,4]

Many European countries implemented unprecedented non-pharmacological interventions, such as school closure and national closure. Such interventions and the lockdown exerted a significant effect on the reduction of the transmission of the virus. Restricting the movement of people and reducing contact can help to contain the pandemic. Patterns of change during lockdown periods indicate effectiveness in slowing the spread of the virus. However, it must maintain a continuous lockdown to control the transmission of SARS-CoV-2.[3,5]

Moreover, this pandemic has generated fears of an impending economic crisis and recession. Social-distancing, self-isolation, and travel restrictions have reduced the workforce in all economical sectors and caused many job losses. Schools have closed, and the need for manufactured goods has decreased. In contrast, medical supplies have increased significantly. In addition,

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the food sector has faced increased demands due to panic buying and storage of food products.[6]

After closure, social isolation has led to economic difficulties and adverse psychological reactions, which are often more significant than physical suffering. According to the World Health Organization (WHO), anxiety and distress have been natural psychological responses to the current situation. Stress, anxiety, and depression manifest themselves when people are under life-threatening circumstances and must face the impending problem of death. These conditions have been intensified if families need to be separated due to the uncertainty of disease progression, insufficient supply, financial losses, and increased risk perception, which are typically magnified by incomplete information and inadequate communication through the media in the early phase of the pandemic.[7]

Chile has initiated de-escalation, thus requiring knowledge about the best time for the end of restriction. The study intended to forecast the future of lockdown and its favorable epidemiological conditions by analyzing three elements, such as incidence, prevalence, and polymerase chain reaction (PCR) test positivity. Such elements were vital to the assessment of the progress of the pandemic. Therefore, this information is a prerequisite to the decision-making of policymakers about future strategies.

Method

Data was collected from the COVID-19 database of the Chilean Ministry of Science, Technology, Knowledge, and Innovation. The data are publicly available and adhere to ethical regulations.[8]

The study estimated the post-peak decline curves for each variable of interest: new cases (6,938 as of June 14, 2020), active cases (37,307 as of June 21, 2020), and positive PCR tests (39.63% as of June 10, 2020).

Data for the said variables were subjected to linear and non-linear regression studies to determine which curve best explains the data using analysis of sequential variance. The determination coefficient (R^2), which is the standard deviation of the values of the dependent variable y with respect to the independent variable x in each estimated curve (Sy·x) was calculated. Additionally, regression estimates were made with a confidence interval (CI) of 1% error. The variables under the study trends regarding the explanatory variable (time in days) were estimated using linear and quadratic regressions. The errors in the estimation of the curves were calculated using the error indicators mean absolute percentage error (MAPE), mean absolute deviation (MAD), and mean signed deviation (MSD). Mean absolute percentage error (MAPE) enables the estimation of the magnitude (in percent) of the curve error, whereas two MAD and MSD compare a trend curve with another curve. The lower the indicators are, the better the explanation that the behavior of the data reflects a curve that describes better than others. The program used for the estimates was Minitab 18.0.

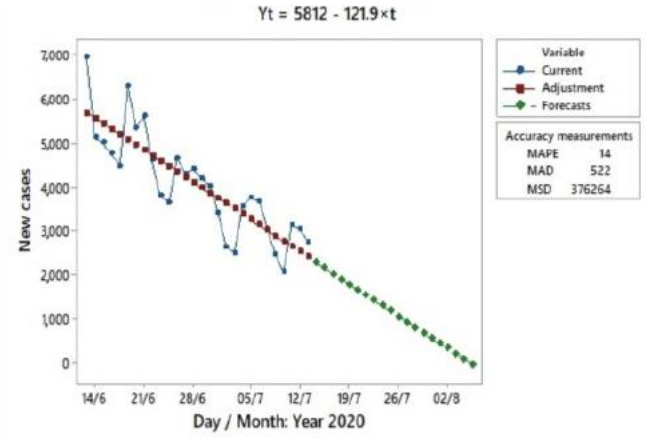

Figure 1. Results of the Trend of Incidence (New Cases) of COVID-19 in Chile at Post-Peak

Results

Figure 1 shows the estimation of the trend curve of new cases over time (in days). A linear curve was observed to represent this behavior best. The R^2 (71.9%) value can be considered relatively high, and this trend curve explains 71.9% of all existing variations. The value of Sy·x was 643.3. The MAPE value reached 14%, and this magnitude of error explains the estimated R^2 value.

Figure 2 depicts the estimation of the active curve of case trend over time (in days). The study observed that a descending quadratic curve best represents this behavior. The R^2 (96%) value was extremely high, such that this trend curve explains 96% of all existing variations. The value of Sy·x was 774.6. The MAPE value reached 2%, and this magnitude of error illustrates the magnitude of the estimated R^2 value.

Figure 3 displays the results of the estimation of the trend curve of the positive PCR tests (%) over time (in days). The study observed that a descending quadratic curve best represents this behavior. The R^2 (72.5 %) value was relatively high. Therefore, the trend curve explains 72.5% of all existing variation. The value of Sy·x was 2.88. The MAPE value reached 7.35%, and this magnitude of error explains the estimated R^2 value. The MAD and MSD values can not be compared with other curves because the literature lacks estimates similar to those in the present study.

Discussion

The mathematical model of any situation aims to describe the essential components and predict certain ge-

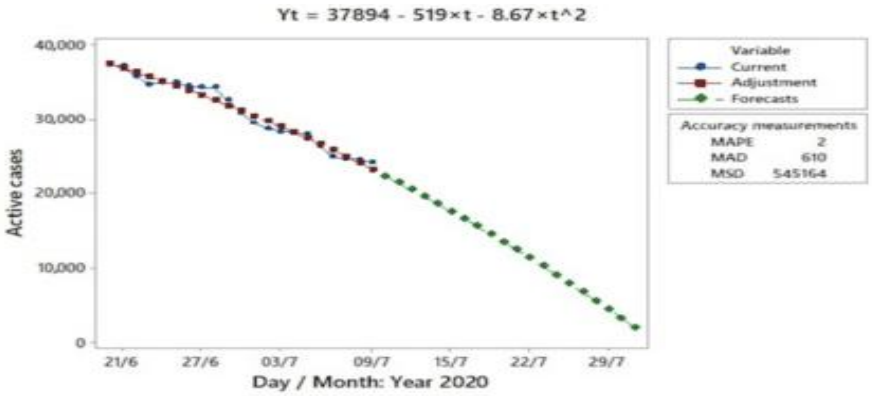

Figure 2. Results of the Trend of Prevalence (Active Cases) of COVID-19 in Chile at Post-Peak

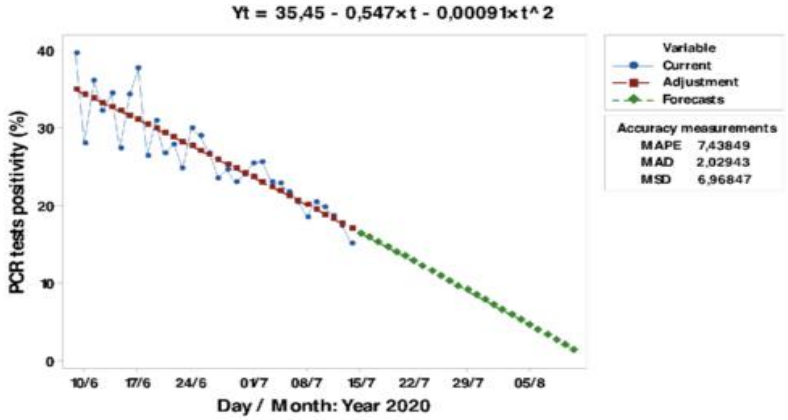

Figure 3. Results of the Trend of Positivity of COVID-19 PCR Tests in Chile, after the Post-Peak of Positivity

neral trends. However, an accurate prediction is impossible. Therefore, the proposed model only provides a basis for obtaining a mechanism for understanding under the type of restrictions and current population conditions. One of the epidemiology tasks is predicting the evolution of infectious diseases using mathematical models. However, such models exclude the specific characteristics of the affected population.[9]

The most effective policy is a combination of screening and blocking. Screening reduces the risk of infection, whereas blocking prevents people from returning to normal life prematurely. Notably, the longer the time of home lockdown, the shorter the period of mandatory restrictions required despite the adverse the consequences of the lockdown. For this relationship to be fulfilled, population behavior is essential. Unfortunately, in Chile, this necessary condition has only been partially respected.[10]

Chile has surpassed the minimum barrier of per capita PCR testing, which several countries reported on the date they finished the lockdown. This difference accentuates the perception of Chile's poor performance in terms of prevention of the pandemic. Nevertheless, the deescalation phase should increase the daily PCR tests. The current analysis indicates that the opposite is happening. European,[11-20] Asian,[21,22] Oceanic,[23,24] and South American countries (Uruguay),[25] have finished their first major period of lockdown upon reaching the following minimum conditions on average in the context of the COVID-19 pandemic: incidence rate = 1.26 (100,000 inhabitants), prevalence rate = 61.05 (100,000 inhabitants), and rate of positive PCR tests = 2.81%.[26]

According to the abovementioned indicators, the study estimates that the start date for the gradual de-escalation of restrictions should begin after July 30, 2020. The reason for this date is to determine the end date of the containment, thus avoiding the saturation of health services and achieving success by taking into account only the criterion of active cases, which is the closest to being reached. However, evidence shows that beginning the end of mandatory de-escalation on August 3, 2020 would be completely safe and successful given the three com-

bined indicators (e.g., incidence, prevalence, and positivity).[4]

The lockdown should be lifted without risk of overwhelming health services. If all restrictions are universally lifted, it could trigger a rapid resurgence of infections and lead to more deaths. Second and third waves are expected after reopening and a considerable time before the development of any effective vaccine, generation of collective immunity, and final resolution of the pandemic. Second waves are predictable and should be managed in proportion. If a return to containment is necessary for mitigation, then it should occur without generating suspicion. With the decrease in the number of active cases, traceability will become easier and presumably more effective. Thus, preparing for future outbreaks is necessary, especially by strengthening primary care services. Such preparation is precisely the function of primary care and nursing staff, which is crucial to the post-peak COVID-19 phase because people do not internalize the social costs of the spread of the virus and opt to return to normal life soon. The estimation indicated 59%–85% of the population should be infected pandemic in the absence of an effective vaccine or treatment. Therefore, the strategy should be managing the spread through phased release measures. Any flexibility in the sudden release of the lockdown or impossibility of achieving contact tracing can lead to exponential transmission, leading to many unmanageable cases given the available health infrastructure and human resources. Simultaneously, evidence-based protocols for possible strategies should be prepared before the end of the lockdown.[27-30]

The study recommends that in the period leading up to the end of the lockdown, teleworking should be intensified, and that as many people as possible should be able to work from home, even without obligation. Potentially, 34% of jobs could be accomplished at home, which implies reduced mobility by nearly the same percentage. Potentially, the younger population could be the first to be released from the lockdown to further alleviate any subsequent stress on the health system and potentially reinforce the collective immunity effect.[1,2]

The results derived from the proposed model can provide useful information on maintaining/releasing containment and avoiding adverse effects in any country. This model is sensitive to health interventions and decisions made, which can lead to variations in predictions. Thus, nations can rely on official databases to reveal biases in case confirmation and information.

Conclusion and Recommendation

The findings emphasize that gradual, cautious steps should be taken with the ease in restrictions to save resources and lives. The work of primary care and nursing staff is crucial in the post-peak COVID-19 phase. Lastly, long-term preparations should be made to contain future waves of new cases.

Abbreviations

COVID-19: coronavirus infection disease; PCR test: polymerase chain reaction test; MAD: mean absolute deviation; MSD: mean signed deviation; MAPE: mean absolute percentage error

Ethics Approval and Consent to Participate

Data are public and available on the Chilean Ministry of Science, Technology, Knowledge, and Innovation website. No committee approval was required because the study adheres to ethical aspects.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance.

Availability of Data and Materials

The data are available on the website of the Ministry of Science, Technology, Knowledge, and Innovation of Chile (http://www.minciencia.gob.cl/covid19) through the open data of the COVID-19 Database.

Authors' Contribution

DS-M-R and AC-N: concept and design of the article, collecting of results, analysing and interpretating data, writing the article, critical review of the article, approving the final version, contributing of patients or study material, statistical advice, and technical or administrative advice. FR-L: concept and design of the article, collection of results, writing of the article, critical review of the article, approval of the final version, the contribution of patients or study material, and technical or administrative advice. PS-M-R: concept and design of the article, collection of results, analysis, and interpretation of data, writing of the article, critical review of the article, approval of the final version, the contribution of patients or study material, and technical or administrative advice. PD-C: conception and design of the article, collection of results, analysis, and interpretation of data, writing of the article, critical review of the article, approval of the final version, statistical advice, and technical or administrative advice. VPD-N: concept and design of the article, collection of results, analysis and interpretation of data, writing of the article, critical review of the article, approval of the final version, and statistical advice.

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Analysis of Measles Vaccination Refusal on Social Media (Facebook) among Anti-Vaccine Communities in Indonesia

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Abstract

Measles is one of the main causes of global mortality in the under-fives. The existence of groups that reject immunization caused a decrease in immunization coverage. Anti-vaccine messages are widely delivered on social media. Identification of vaccine rejection behavior can be used as the basis to formulate effective program strategies. The design of this study used rapid assessment procedures (RAP). The informants were from two anti-vaccine communities in the Facebook group. In-depth interviews and observations were done for data collection, and data analysis was performed using the Framework Method. The results found that determinants, such as knowledge, beliefs in health behavior and disease prevention, religion, culture, and government policies play a role in shaping informants' perceptions of vaccines and disease risks. The design factors of vaccination programs and the reliability of vaccine-producing sources were found to be inhibiting factors for informants to receive vaccines. Also, determinants like media communication, experience with vaccines, health workers' role, and lobbying by anti-vaccine groups strengthened informants' attitude who initially doubted vaccines, causing them to reject vaccines ultimately. It is suggested to the Ministry of Health to improve vaccination campaigns through social media, conduct vaccine development study, and increase health workers' knowledge related to vaccines and make their communication techniques more effective.

Keywords: anti-vaccine, social media (Facebook), vaccine hesitancy

Introduction

Measles is one of the main causes of death in children under five years old globally.[1] In Indonesia, measles immunization coverage is still below the 2015 target set at over 95%. The immunization coverage in 2015 was 94.7% and had decreased in 2014 (92.3 %) compared to 2013 (97.8%).[2] In Indonesia, vaccination programs have been implemented since 1956. However, national immunization coverage in 2015 was still at 86.54%. This percentage has not yet reached the Strategic Plan target in 2015 of 91%. Compared to immunization coverage in the period 2008–2011, the rates for the period 2012–2015 decreased and some regions in Indonesia were still experiencing outbreaks of diseases that can be prevented by immunization.[3] By 2015, there were areas of the country where more than 60% of children were not vaccinated.[4]

One of the causes behind the decline in vaccinations in Indonesia is the presence of groups that reject immunization.[5,6] This anti-vaccine community has been around since the first vaccine was discovered and so far, nothing has changed.[7,8] There are many reasons for vaccine refusal, including lack of access to regular health care, low-income families, fear-based messages, protection of individual liberties, issues around the vaccine's purity, and religious belief.[8,9] Based on a research in America, the anti-vaccine message has been delivered by the anti-vaccine group community on the internet. The information conveyed by anti-vaccine groups on social media can affect one's perception about immunization, that vaccines are actually ineffective and even dangerous.[10] The use of the internet to access health information has been increasing. A study in Ontario, Canada, conducted by Kata, stated that 70% of internet users' information had influenced the decision to obtain health care.[11] Kelly, Jenkinson, and Ziebland,[12] found that health-related websites act as peer-to-peer information channels that provide experiential information including factors like feeling supported, relationships with others, experiencing health services, and affecting behavior. Some groups may use this channel to amplify the misinformation.[12] In Indonesia, the number of active monthly

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users of the social media platform, Facebook, up to January 2019, had reached 136,960,000, which accounts for 50.1% of the entire population.[13] One study conducted in Indonesia found several reasons for parents not to immunize their children. Parental reasons were categorized into three interrelated themes: belief barriers, safety concerns, trust, and misinformation issues.[14] The study conducted by Kata,[11] also described that 80% of internet users use this access to search for health information online, and 16% of them were looking for information about vaccinations. Based on the study above, the internet has become one of society's primary health information sources.[15]

Wahyurnani, *et al.*,[16] in a study of community assessments of measles immunization in the Sleman Regency (Yogyakarta Special Region), the internet media were often used by citizens to search for health information, including measles immunization. The study also concluded that the decision for immunization was influenced by religious scholars' advice and medical personnel' behavior. Moreover, the presence of side effects experienced by individuals was reported.[16]

In 2012, the World Health Organization (WHO) Strategic Advisory Group of Experts (SAGE) formed an immunization working group that aims to identify the vaccine's determinants of hesitancy and what efforts should be made to overcome them. The results of the SAGE Working Group study concluded that vaccine rejection behavior was influenced by three main factors, namely (1) Contextual influences such as communication and media environment, influential leaders, historical reasons, religion, culture, political reasons, lobbying (approach) by anti-vaccine groups, geographical barriers and the pharmaceutical industry, (2) Individual and group influences arising from personal vaccine perception factors such as knowledge, health system and social/peer environment, and (3) vaccine-/vaccination-specific issues.[17]

The purpose of this study was to analyze the determinants related to vaccine rejection behavior, including perceptions of government policies related to immunization, knowledge and beliefs related to immunization, perceived benefits, the dangers of immunization, cultural and religious barriers, and environmental factors (the influence of media, the influence of health workers and the influence of anti-vaccine group lobbying).

Method

This is a study used a qualitative study applying the Rapid Assessment Procedures (RAP).[18-20] The RAP was conducted using observation and in-depth interview methods. For observation, authors had focused for two months, from June 2016 through July 2016, on group Facebook activity among members (anything posted, comments and replies, news feeds). The observation was also held directly at the house of a member of the Facebook "*Stop Vaksin*" group for a day. The house itself was a gathering point for group members and an alternative medicine practice owned by the host. This study was conducted on two anti-vaccine communities on the Facebook social media group, namely "*Stop Vaksin di Indonesia*" and "*Gerakan Anti Vaksinasi dan Imunisasi*/Movement Against both Vaccination and Immunization" (GAVI).

In this study, informants are eight members of the anti-vaccine Facebook group community and four key informants. The informants consisted of one informant from Islamic scholars; which divided into one informant from vaccination activists, one informant from adverse events following immunization (AEFI) working groups, and one informant from the Manager Program in the Immunization Sub-Directorate of the Directorate General of Disease Prevention and Control, Ministry of Health, Republic of Indonesia. Before data collection, informed consent was given by each informant and key informant to comply with the ethics research principles elaborated in the Helsinki Declaration.[21] In addition to the anti-vaccines group members interviewed, four key informants consisted of one religious leader, one Immunization National Commission member, one general practitioner, and one program manager of the Immunization Sub-Directorate.

Data collection was conducted in June–July 2016 by the authors and trained author assistants. The sampling technique used in this study was purposive sampling. Data collection techniques used in this study were in-depth interviews and observations.[22] The authors visited one of the selected anti-vaccine community members. The place was a cupping treatment site, and it was a gathering place for members of the anti-vaccine community. The instrument used was semi-structured questions, and it was taken from The SAGE Working Group on Vaccine Hesitancy,[17] and modified by authors. The questions contained perceptions of government policies related to immunization, knowledge, and beliefs related to immunization, perceptions of immunization benefits and dangers, and perceptions of cultural and religious barriers. This instrument has been tested on two parents who rejected vaccines, and correction has been made based on the trial. Before the data was collected (interviews and recordings), informed consent was obtained from each informant. Data analysis was done using the Framework Method.[23-25]

All interview results were transcribed and coded. After the transcript had been coded, researchers compared it to be developed into a thematic framework that identifies key themes and sub-themes related to research questions. Thematic frameworks were tested and refined with all transcripts to ensure that the framework includes

all data in transcripts relevant to the study question but are not too simplistic. This procedure also ensures that the data in each sub-theme is coherent and that there are apparent differences between the sub-themes. The framework was revised in discussion with the team until all the information was able to be fit in the framework. The revised framework is shown in Table 2. The thematic framework consists of four areas: The first and second areas were perceptions of government policies related to immunization and knowledge and beliefs related to immunization. The third area was perceptions of benefits, the danger of immunization, cultural, and religious barriers. The last area was the environmental factors (the influence of the media and the anti-vaccine group lobby).

Results

There were eight informants in this study. The informants who participated in the in-depth interviews in this study were members of the Facebook social media group's anti-vaccine movement. The average age was 39 years old, and the age range was between 26 and 45 years old. The majority of them were female, and their education level ranged from senior high school to Bachelor of Science. Details of the characteristics of the informants are as shown in Table 1.

The authors also looked at some components of the Health Belief Model theory. This study indicated that the environmental factor related mostly to the media's influence, including mass media and social media. Also, knowledge and beliefs related to immunization were related to individual influence. Similarly, the perceived benefits and dangers of immunization were also included as individual influences. Social influence was represented by both cultural and religious barriers related to immunization. Detailed discussion for each issue was as follows in Table 2.

Two major issues were raised related to policies. The first issue is concerned with clear information regarding both impact and risk of immunization. The other issue was the fact that immunization was obligatory for every child. Some informants argued that the government's policies were not yet transparent, as, on the one hand, it forced and obliged the entire community to vaccinate. However, information about the impacts and risks generated by vaccines was not delivered. They are also well-informed about coverage appointed by the WHO for every child's immunization program, even though they assumed that WHO seems to equalize everything.

Some issues discussed were knowledge of the benefits of immunization, delivery of vaccines, and perceived effectiveness of vaccination. The government has conducted various training sessions to equip health workers with information and knowledge about immunization to deliver to the community. Most of these informants have various knowledge levels regarding the vaccines' effectiveness against diseases, and they got that information from friends, books, and from their experiences. Unfortunately, an informant whose friend told her that even though her daughter has been immunized with the measles vaccine, she still caught the disease.

The informants did not question how the vaccine was administered but were more worried about its content and its consequence for the human body. Some issues of concern were also noted, for example, that the perceived danger of immunization was more significant than the perceived benefit of immunization. Also, most informants voiced concern about how either *halal* or *haram* of the vaccine source. It was likely that all these information elements were connected to their belief and religion. Most informants voiced concern about *halal* and *haram* sources regarding the benefit and danger of immunisation and cultural and religious barriers.

The environmental factor is related mostly to the media's influence, including mass media and now social media and the anti-vaccine group lobby's influence. Media such as television have contributed partial information. Informants sought information about vaccines through new media, such as social media, through testimony or others' experiences, which consequently affected their decision about immunization. Social media also provides freedom for everyone to create a group or fan page with a similar interest.

Discussion

Regarding informants' perception of government policies, it was found that some informants argued that gov-

Table 1. Characteristic of Informants, Member of *Gerakan Anti Vaksinasi* Facebook Group

Code of Informant	Age (Years)	Sex	Occupation	Last Education	Position
Informant HN	26	Female	Housewife	Bachelor graduate	Group's admin
Informant IR	32	Female	Entrepreneur	Bachelor graduate	Member of *Gerakan Anti Vaksinasi dan Imunisasi*
Informant DW	42	Female	Entrepreneur	Bachelor graduate	Group's admin
Informant MA	45	Male	Entrepreneur	Bachelor graduate	Group's admin
Informant BG	44	Male	Entrepreneur	Diploma graduate	Member of *Stop Vaksin*
Informant JW	43	Female	Private company employee	Senior high school	Member of *Stop Vaksin*
Informant WH	44	Female	Housewife	Senior high school	Member of *Stop Vaksin*
Informant NS	42	Female	Housewife	Senior high school	Member of *Stop Vaksin*

Table 2. Theme, Sub-Theme, and Relevant Quotations

Theme	Sub-Theme	Quotations
Perception of government policies related to immunization	Perceived as being nontransparent infomation: Impacts and Risks	"They came to my house and forced me to polio vaccinate my child. She said, if my child were infected with polio, all the village population would be infected with polio too." (Informant WH)
	Perceived as imposing and obliging all people to vaccinate	"Well, this is actually the role of the government. Before implementing the program, they must be honest about what immunization is and what vaccination is. Because all this time we have seen a duping process, a process of omission." (Informant BG) "Yes, the WHO has a target for children, (the vaccine) coverage up to 90% by 2020. I read the WHO project several times, because WHO really seems to equalize everything…" (Informant HN)
Knowledge and belief related to immunization	Knowledge of: - Benefits of vaccination - Consequences of vaccine delivered and not delivered	"For midwives, various training. From various ways, for example, training conducted by *Kesehatan Ibu dan Anak* (Maternal and Child Health Division), it has immunization material. Training conducted by the the Directorate General of Pharmaceutical and Medical Devices and pharmacies also invited the midwife coordinator. The funding sources were from WHO and UNICEF. So, the training continues from various funding sources. Well, we ourselves at the subdistrict of immunization, we also do the same thing." (Key Informant HK)
	Perception of immunization effectiveness against diseases	"… I've read, the antibodies produced by the vaccine did not last long. The benefits are only temporary, and it will not be worth it." (Informant HN) "Many children are immunized against measles but still get sick from measles. I see friends whose children are not vaccinated, they are actually healthy and rarely get sick." (Informant WH)
Perceived benefit and danger of immunization, cultural, and religious barriers	Thought of risks and dangers greater than benefits	"For example, if by injecting children can be safe and healthy 100%, it's not a problem for me. But the problem is the security of the content" (Informant HN)
	Vaccination does not guarantee that children will become immune	"Vaccines, if made from human blood, they are clearly haram especially if it's in contact with pigs. Don't forget that we not only have a problem with *halal-haram* but also *thoyib*…" (Informant WH)
	Informants did not question the way the vaccine was administered but were concerned over vaccine content and the consequences for the body	"In Islam, there are clear rules for using medicinal or food ingredients from *halal* sources." (Key Informant AB) "*Halal* is undoubtedly mandatory for everything consumed. But my choice not to use vaccines was not because of that only, but because I felt that there was no benefit from vaccines." (Informant HN) "To the point where as a treatment we are still in the standard of not using elements that are *haram* or *najis*." (Key informant AB)
Environmental factors	Influence of media	"Actually, there are many cases because of immunization, but the television or the media they rarely reported the cases. But if on the internet, we can see the pro or con news so we can decide for ourselves." (Informant DW)
	Influence of anti-vaccine lobby	"My child often became sick after being vaccinated. I started looking for information, also through the internet, then I found this Facebook group and became a member about a year ago, even I was appointed as an admin in the group." (Informant HN)

ernment policies were not transparent. Increasing the community's knowledge related to vaccines took place through training on immunization of health workers in each primary health care, expecting that health workers could provide a good immunization education to the community. Also, it was found that some informants were well-informed regarding vaccines and about the schedule of immunization and international targets related to vaccines. Furthermore, they were also often exposed to media published by WHO. In this study, the informants' lack of trust in the government has created a negative perception of government policies regarding immunization and became one factor that encouraged informants to dismiss vaccination.

The informants' perception was also influenced by the media, health workers, and anti-vaccine scientists. Culturally, from the informants' statements, the influence of the surrounding environment, including those closest to them, was influential in influencing informants' decisions to reject or accept vaccines. This phenomenon is especially evident for less-educated informants.

In terms of informants' knowledge about vaccination, they all know about the national vaccination schedule recommended by the Indonesian Pediatrics Association (*Ikatan Dokter Anak Indonesia*/IDAI). The perception was also affected by information acquired through social media, health workers, and anti-vaccine scientists. As a result, a perception that vaccination would not guarantee children immunity against diseases could be prevented by immunization.[26] Also, they perceived that their children's health status would not be affected by their immunization status. In other words, as a spokesperson on the government immunization program stated, health workers' tasks within the community were not only to deliver the immunization as scheduled but also to distribute health information and to put straight the disinformation about immunization.

The role of religious scholars, especially in the Islamic

religion, is significant in rejecting vaccines. All informants who are Muslim believe that it is obligatory to pay attention to the *halal* ingredients used for their children, including drugs and vaccines. However, *halal* and another requirement for consuming something was the *thoyib* factor, e.g., the quality and usefulness.

Islam believers will have an interest in vaccine safety issues. Mynors, *et al.,*[27] in their study, found that Jews and Muslims groups in Royal England had concerns about the pork component that could be contained in vaccines. Additionally, Orthodox Christians in the Netherlands and the Amish sect in the United States of America are religious communities well-known for their refusal to vaccinate to prevent disease, which is consistent with the concept of "origin of disease, the need for preventive practice and health-seeking behavior".

In this case, media communication was represented by the messages delivered and received in the news that can cause negative or positive sentiments about vaccines. These include mass media, electronics, and social media that trigger and influence individual vaccination refusal decisions. Informants thought that media reporting on television and in newspapers on vaccines' benefits and risks was not balanced. They assumed that the media only informed the public of the benefits of the vaccine all this time. On the other hand, the risks posed and those adversely affected by the vaccine were rarely reported. Social media such as the internet provide more balanced information, so informants assumed could get the actual news and information about vaccines. The information gathered can be the basis and reference for rejecting or receiving vaccinations.

Most informants, getting in touch, getting acquainted, and joining the anti-vaccine community began with an unpleasant experience with medical treatment and immunization. Consequently, they try to determine whether other people have the same experience and perceptions to support each other and share information. As well as seeking information from people around them, the informants with a higher level of education also looked for information from books, the opinions of leaders and scientists, and social media. The anti-vaccine group lobby's influence has been shown to affect informants who already have doubts about vaccines. The doubt itself happened to informants with higher and lower education levels in affirming their decision to reject the vaccine. What distinguishes this situation is the way to find information that confirms the decision. Most of the informants considered vaccines to have no benefits and risk health because they have many side effects. This perception was formed because the informant received knowledge and influence from various sources, including Facebook, where information with anti-vaccine sentiments was often uploaded.

This study's results are in line with the results of Smith, *et al.*,[28] in Atlanta, Georgia (USA) in evaluating the relationship between parents' beliefs about vaccines and the decision to reject vaccines. Parents who reject vaccination have concerns about vaccine safety and thereby assume that there is little benefit from vaccination.[28] A study conducted by Rahmawati and Umbul,[29] in Krembangan, Surabaya (Indonesia) revealed the same results. Nearly two-thirds (65%) of respondents stated the reason for the incompleteness of primary immunization was fear of side effects of immunization.[29]

The informants' beliefs and prevention behavior who chose natural treatments and avoided chemical drugs also modified the informants' perception that vaccines containing chemicals had more risks than benefits. Besides, the religious determinant that requires the vaccines to be *halal* creates distrust of the reliability of the source of production and the supply. This determinant also becomes a barrier to informants receiving the vaccine. Cultural factors and the habit of following the people's pattern around or the people closest who reject the vaccine have more power to influence informants with low education levels. Informants with higher education levels were looking for various reference sources to convince themselves of the vaccines' reliability, not just following general instructions.

The analysis was conducted more clearly to understand the real reason the informant refused vaccination. Interaction of the determinants that influenced vaccine rejection behavior played a role in influencing and ultimately forming the informants' perceptions of vaccines and diseases that can be prevented by immunization. In this study, the informants formed perceptions that the vaccines were dangerous and not beneficial. Also, they believed that the healthy lifestyle they led was sufficient to protect their children from susceptibility to disease. They assumed that diseases that can be prevented by immunization were not something serious or to be feared; thus, vaccination was not needed.

Conclusion

This study found that knowledge, health and prevention behavior beliefs, religion, culture, and government policies play a role in forming the informants' perceptions of vaccines and risk factors. Factors of vaccination program design and reliability of vaccine-producing sources were inhibiting factors for informants to receive vaccines. Determinants of the media communication, the experience with vaccines, the role of health workers, and the anti-vaccine group lobby strengthened informants' attitude who initially doubted vaccines, causing them to reject vaccines eventually.

Abbreviations

AEFI: Adverse Events Following Immunization; GAVI: *Gerakan Anti Vaksinasi dan Imunisasi* (Movement against both vaccination and immunization); RAP: Rapid Assessment Procedure; SAGE: Strategic Advisory Group of Experts; WHO: World Health Organization.

Ethics Approval and Consent to Participate

Before data collection, informed consent has been given by all the informants and key informants. When the study took place, there was no obligation for ethical clearance for graduate public health students theses.

Competing Interest

The author declares that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

All datasets generated or analyzed in this study are currently available at the request to the University of Indonesia, by contacting Dwi Meilani (dwi.meilani@gmail.com) of the Ministry of Health, Republic of Indonesia.

Authors' Contribution

DM, EM, and HP participated in developing the protocol, design and analytical framework for the study, contacting informants, testing research instruments, collecting data, analyzing data, and contributing to the writing and analyzing manuscripts. IJH and YP contributed to the up dated literature review and correction of the manuscript. SR participated in the literature review and read the final manuscript, final data analyses, and contributed to the manuscript & writing. All authors then discussed the results and contributed to the creation of the manuscript. HP approved the final manuscript and all other authors have read and approved this manuscript.

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Exclusive Breastfeeding History Risk Factor Associated with Stunting of Children Aged 12–23 Months

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Abstract

Stunting (low height-for-age) remains a global and national health problem because it increases the risk of disturbances in growth and development and mortality. Banjar Margo District, Tulang Bawang Regency, has the second-highest prevalence in Lampung Province, Indonesia. This study aimed to analyze the association of exclusive breastfeeding history and stunting in children aged 12–23 months in Banjar Margo District. This study used a cross-sectional design on 193 children aged 12–23 months. It was primary data conducted between April and May 2018 with a questionnaire. Data analysis was performed using the chi-square test and multiple logistic regression. The result showed that of 193 children, 29.5% were stunted. Children who were not exclusively breastfed were 3.1 times (95% CI = 1.5–6.4) more at risk of stunting than those exclusively breastfed, after controlling for mothers with low education and unemployment factors as confounding variables. Health promotion activities in primary/integrated health care should be focused not only on mothers but also on other people involved in child care, such as grandparents, at-home caregivers, and daycares.

Keywords: children aged 12–23 months, exclusive breastfeeding, stunting

Introduction

Stunting is a nutritional status based on the body length-for-age/height-for-age World Health Organization (WHO) Child Growth Standards, where the Z-score value should be less than –2 standard deviations (SD) from the mean.[1] Stunting is a chronic condition on a child's poor linear growth, accumulating the impact of various factors, such as low nutrition and health before and after a child's birth.[2] In 2006, the World Bank stated that stunting is considered chronic malnutrition that occurs in the womb. During the first two years of a child's life, it could lead to lower intelligence and decreased physical capacity, which results in productivity decrease, economic growth slowdown, and prolonged poverty. Stunting could also impact a weak immune system and chronic disease vulnerability such as diabetes mellitus, heart disease, cancer, and maternal reproductive disorders in adulthood.[2,3] Other effects of stunting were related to hypertension, morbidity, and mortality. Stunting occurs in the first two years of life, with increased blood pressure at 7–8 years.[4]

The worldwide prevalence of stunting in children under five years of age was 22.2%, equivalent to 150.8 million children in 2017. Indonesia continued to have a high prevalence of stunting.[3,5,6] Results of data analysis on nutritional status monitoring showed that the prevalences of stunting among children aged 0–59 months in Indonesia were 29%, 29%, and 29.6% from 2015 to 2017, respectively.[7–9] Furthermore, the prevalence of Basic Health Research Surveys was 32.9% in 2013 and 30.8% in 2018, above the WHO-defined limit (20%).[10,11] Tulang Bawang Regency ranked third in stunting in Indonesia,[11] with prevalences of 22.9% in 2015, 30.7% in 2016, and 24.4% in 2017.[8,9] In Tulang Bawang Regency, Banjar Margo District has the highest rate.[9]

The stunting policy brief stated that exclusive breastfeeding is one of the frameworks for action to reduce stunting.[12] Some studies,[1,12–14] revealed that one of the highest risk factors for stunting was exclusive breastfeeding. Babies who were allowed to breastfeed early will get the colostrum, successfully obtain exclusive breastfeeding, and be breastfed longer. Children who were not exclusively breastfed have a 7.86 times risk of stunting

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than those who received exclusive breastfeeding. Furthermore, children with no early breastfeeding initiation history were 2.63 times more likely to have stunting than those with early breastfeeding initiation history.[15] Banjar Margo District has a stunting prevalence above the WHO limit and, based on data analysis results on nutritional status monitoring, even though exclusive breastfeeding coverage is extensive. If this happens continuously, future generations in this region could be threatened. Therefore, this study was conducted after looking at the results of previous studies, theories, programs, and stunting conditions in Banjar Margo District. This study aimed to analyze the relationship between exclusive breastfeeding and stunting in children aged 12–23 months in Banjar Margo District, Tulang Bawang Regency.

Method

This study was approved by the Health Research Ethics Commission, Health Polytechnic, Ministry of Health, Tanjung Karang, with ethical clearance no. 42/EC/KEP-TJK/III/2018. This study used a cross-sectional design. Data collection activities were conducted in 12 active integrated services postes (ISPs)/ *pos pelayanan terpadu* (*Posyandu)* from April to May 2018 in Banjar Margo District, Tulang Bawang Regency. Proportional simple random sampling was used to obtain participants. The study population included mothers who had toddlers aged 12–23 months in Banjar Margo District, totaling 829 children. The calculation of large samples using the two-proportion hypothesis test formula16 obtained 180 samples with an additional 10% to avoid dropping out of samples. A total of 193 mothers who had children under 12–23 months were selected. The inclusion criteria were mothers who had children aged 12–23 months and have a maternal and child health book containing their children's body weight and length at birth. The exclusion criteria were mothers who have children with premature birth and/or spinal abnormalities.

The dependent variable was the incidence of stunting. The child's body was measured using an infant meter (0.1 cm). The dependent variable was divided into two categories: yes (if the Z-score is lower than –2 SD) and no (if the Z-score higher than –2 SD).[1] The Z-score value was determined using the WHO Anthro 2005 software. The independent variable was exclusive breastfeeding history, which was divided into yes (if the child was given breast milk without other food except vitamins, minerals, or drugs from birth to six months old) and no (if the child was given extra food before six months of age). The confounding variables were early breastfeeding initiation history, maternal education, and maternal employment. The early breastfeeding initiation history was categorized into yes and no. Maternal education was low (if less than senior high school) and moderate-high (if senior high school or higher). Maternal employment was divided into yes and no. All variables were collected using a questionnaire with mother characteristics, exclusive breastfeeding history, and early breastfeeding initiation history. The questionnaire was administered to the mothers who visited ISP in Banjar Margo District and had a maternal and child health book.

A chi-square test was used to determine relationships between dependent to independent and confounding variables. Multiple logistic regression with risk factor models was conducted to validate the relationship of the independent variable (exclusive breastfeeding history) with stunting by controlling the confounding variables (early breastfeeding initiation history, maternal education, and maternal employment). Confounding assessment was performed by excluding variables with a p-value of > 0.05, starting from the variable with the highest p-value. Modeling was conducted by considering changes in the odds ratio (OR). If the difference in OR was more than 10%, the variable was returned to the model.

Results

The study results found that 57 (29.5%) children could be categorized as stunted. Over half of the sample of mothers had exclusive breastfeeding history (65.8%), early breastfeeding initiation history (68.9%), low education (68.9%), and unemployment (83.4%). The bivariate analysis with the chi-square test (Table 1) showed a significant relationship between the stunting incidence in children aged 12–23 months with exclusive breastfeeding history, maternal education, and maternal employment with a p-value of 0.01. The stunting incidence of those with nonexclusive breastfeeding history was 32 (48.5%), nonearly breastfeeding initiation history 13 (21.7%), low education 51 (85%), and employment 20 (62.5%).

Furthermore, multivariate analysis was conducted by including all the independent variable candidates with a p-value of < 0.25 (based on bivariate analysis). In this study, all independent variables were eligible for entry into the multivariate analysis. Multivariate analysis was performed to analyze variables related to stunting. Multiple logistic regression test was performed to determine the influence of the exclusive breastfeeding history factor as the main factor. In this analysis, the early breastfeeding initiation history variable had to leave the model because it did not reach 10% upon OR value calculation.

The final model analysis (Table 2) proved the relationship between exclusive breastfeeding history and stunting incidence. Children who were not exclusively breastfeeding were 3.1 times (95% confidence interval 1.5–6.4) more at risk of stunting than those who were exclusively breastfeeding, with a statistically significant p-value of 0.01 after controlling for maternal education

Table 1. Relation of Exclusive Breastfeeding History, Early Breastfeeding Initiation History, Maternal Education, and Employment with Stunting in Children Aged 12–23 Months

Variable	Category	Stunting				Total	p-value	OR
		No		Yes				
		n	%	n	%			
Exclusive breastfeeding history	Yes	102	80.3	25	19.7	127		Ref
	No	34	51.5	32	48.5	66	0.01	3.8
Early breastfeeding initiation history	Yes	89	66.9	44	33.1	133		Ref
	No	47	78.3	13	21.7	60	0.150	0.6
Maternal education	Moderate-high	48	36.1	85	63.9	133		Ref
	Low	9	15.0	51	85.0	60	0.01	3.2
Maternal employment	No	124	77.0	37	23.0	161		Ref
	Yes	12	37.5	20	62.5	32	0.01	5.6

Note: OR = Odds Ratio

Table 2. Final Model of the Relation of Exclusive Breastfeeding History with Stunting in Children Aged 12–23 Months

Variable	Category	p-value	OR	95% CI
Exclusive breastfeeding history	Yes		Ref	
	No	0.01	3.1	1.5–6.4
Maternal education	Moderate-high		Ref	
	Low	0.01	5.5	1.8–16.5
Maternal employment	No		Ref	
	Yes	0.01	12.2	4.2–35.4

Notes: OR = Odds Ratio; CI = Confidence Interval

and employment factors. The results proved the study's hypothesis that exclusive breastfeeding is associated with stunting in children aged 12–23 months compared with children who were not exclusively breastfed in Banjar Margo District. Maternal education and employment factors were confounding variables and substantially significantly related to exclusive breastfeeding.

Discussion

The study's stunting prevalence was 29.5% (children aged 12–23 months), which was higher than the 24.4% report of the Nutritional Status Monitoring in 2017 for Tulang Bawang Regency (children aged 0–59 months).[9] Of 57 children aged 12–23 months with stunting, one 12-month-old toddler had severe stunting with a body length of 68.7 cm. The length and height gauge was not available at the ISP. The availability of measuring instruments for length and height is not available at the ISP, so the length of the toddler's body cannot be monitored every month. Exclusive breastfeeding was defined as the practice of giving an infant only breastmilk for the first six months of life, with no other food, liquid, or even water.[17] It has many widely known benefits; however, social, societal, and environmental factors made this practice challenging for millions of mothers globally.[18] Recall bias on exclusive breastfeeding status may occur in this study because subjects spend more time with caregivers than mothers. Thus, to get accurate information on the mothers' exclusive breastfeeding status and early initiation history, the researchers had to visit on weekends or return in the afternoon when they are home from work. However, the recall bias for early breastfeeding initiation was high as the respondents did not understand the early breastfeeding initiation process.

Exclusive breastfeeding history had a significant association with the incidence of stunting. A similar result was shown by if the study of Wahdah, *et al.*,[13] found that children who were not exclusively breastfeding are at 2.02 times greater risk of suffering stunting than those who were exclusively breastfed.[12,14] In India's Empowered Action Group States, stunting severity showed a decreasing trend as the children were exclusively breastfed.[19] Babies who are allowed to breastfeed early will get the colostrum, obtain exclusive breastfeeding, and take more prolonged breastfeeding. According to the WHO, exclusively breastfeeding babies can avoid digestive tract and respiratory infections.[12,14,20,21] Near-full scale-up of exclusive breastfeeding practices could prevent 823,000 annual deaths in children under five years old.[22] Non-breastfed children are nearly three to four times more likely to die of illnesses in the first six months. There is overwhelming evidence of the positive effects of

breastfeeding in preventing pneumonia and diarrhea in young children.[22]

Barriers to exclusive breastfeeding are that breast milk has not come out on days 1–3 after birth, leading formula milk use, hereditary beliefs in the community to give honey to newborns, and children who cry often are assumed to be hungry. Hence, mothers/caregivers give other foods such as milk formulas, bananas, honey, and filtered porridge.[12] Mother and family understanding of the importance of exclusive breastfeeding for babies 0–6 months needs improvement. Every baby (0–6 months) who receives nutrition according to their needs can avoid infectious diseases. Health promotion can help by providing information on exclusive breastfeeding. The intervention can be done by counseling mothers and caregivers on good infant and young child nutrition and hygiene practices.[18] Optimal feeding of infants and young children includes immediate breastfeeding initiation, early and exclusive breastfeeding until six months of age, and age-appropriate complementary feeding from 6-24 months with continued breastfeeding until two years of age. Good infant and young child feeding and hygiene practices are promoted at various levels: health facilities, community/home settings, and mass media campaigns.[18]

Education level may also affect food consumption through the selection of foodstuff. The father's education level will improve the household economic status as it is closely related to obtaining employment and higher income to increase the households' purchasing power to provide food for family members. Children born to educated women suffer less from malnutrition, manifested as underweight, wasting, and stunting.[23] Mothers with higher education levels are expected to have a positive attitude toward food nutrition to help fulfill adequate nutrition for the family.[13,14,23] Mothers who have higher education tend to be better in child care pattern and infant food type selection. Mothers with higher education have more significant opportunities in accessing information related to nutrition and health.[23,24] Maternal education and maternal employment have a significant relationship with stunting events. Mothers with low education had a greater risk of stunting than those with higher education.[25–27] A study by Shine, *et al.*,[28] suggests that children born to working mothers are at 3.10 times greater risk of stunting than mothers who do not work. A study by Wahdah, *et al.*,[13] revealed that toddlers with low family income are at 24.42 times higher risk of stunting than those with high-income families.

Maternal employment is another risk factor of stunting as toddlers with working mothers are at 11.5 times higher risk of stunting than those with mothers who do not work. These findings are in line with Shine, *et al.*,[28] that children born to working mothers are at 3.10 times greater risk of becoming stunted than nonworking mothers. The role of mothers is significant, namely, as caregivers and family food consumption and nutrition improvement effort regulators. In this study, one mother works as a farmer, entrepreneur, teacher, and household assistant. She admitted that exclusive breastfeeding was challenging because she worked from morning to evening leaving her child with relatives and neighbors. In this study, mothers also said that toddlers' full consumption is regulated by the people who care for them, even though the mothers sometimes do not know what their children consume in one day.

Childhood is a period in which growth and development occur very progressively, especially in times of critical windows, popularly known as "The Window of Opportunity," which is the first 1,000 days of life up to two years.[14] Mothers are critical in this period because of their powerful influence in fulfilling the toddlers' needs and diet. Working mothers face more challenges in nurturing their toddlers and ensuring that they can meet their child's nutritional needs.

Nowadays, providing parenting and fulfilling toddlers' nutritional needs, such as using milked milk placed in the freezer and preparing food menus to monitor dietary intake, are cared for by relatives or other people to support working mothers. However, facts show that there is a lack of information/knowledge between mothers and caregivers when entrusting their child to caregivers. The caregivers often make their own decisions to give any meals to children. Health promotion activities in primary health care (PHC)/ISP should be focused on inviting other people involved in child care, such as grandparents, at-home caregivers, and daycares.

Conclusion

Exclusive breastfeeding history was associated with stunting in children aged 12–23 months in Banjar Margo District, after controlling maternal education and employment factors.

Recommendation

It is recommended that health promotion activities in PHC/ISP be focused on mothers and other people involved in child care, such as grandparents, at-home caregivers, and daycares.

Abbreviations

WHO: World Health Organization; SD: Standard Deviation; ISP: Integrated Services Pos; *Posyandu: Pos Pelayanan Terpadu*; OR: Odds Ratio; PHC: Primary Health Care.

Ethics Approval and Consent to Participate

Respondents were addressed before the survey about the survey's objectives and purposes, and verbal consent to participate in the study was taken from them.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance.

Availability of Data and Materials

Research data can be provided upon request.

Authors' Contribution

NS and MYM conceptualized the study; NS created the methodology; NS, Z, and MR wrote, reviewed, and edited the manuscript; NS and MYM wrote the original draft.

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Parity and Marital Status as Factors Influencing Contraceptive Use among Adolescents in Indonesia

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Abstract

Adolescent pregnancy has a higher health risk compared to adult pregnancy. One approach to control pregnancy among adolescents is through contraceptive use. The data on contraceptive use has increased in 2018 and is still controversial among adolescents. Thus, it is necessary to determine the factors encouraging the use of contraceptives among adolescents. This study aimed to determine the relation of parity and marital status on contraceptive use among adolescents. This quantitative study used a cross-sectional design. The population of this study was adolescents aged 15–19 years in Indonesia. The total sample of 936 adolescents selected from the 2017 Indonesia Demographic and Health Survey (IDHS). Multivariate analysis using binary logistic regression used to analyze the independent variables (parity and marital status) on the dependent variable (contraceptive use) with education, work status, region, and economic status as controls. The results showed a relationship between marital status and parity on contraceptive use in adolescents after being controlled by confounding variables: work status, economic status, and region. The use of contraceptives was one way to control adolescent pregnancy. Counseling and guidance concerning the use of contraceptives should be provided to adolescents.

Keywords: adolescent, contraceptive, marital status, parity

Introduction

Adolescent pregnancy is an issue of public concern as it has a higher health risk than adult pregnancy.[1] Furthermore, adolescents have a higher risk of unintended pregnancy, unsafe abortion, and sexually transmitted infections.[2] One way to control unwanted pregnancies and reduce the number of maternal and infant morbidity is the use of contraceptives.[3,4] Access to and use of contraceptives have been developed in the community.[5]

World Bank data in 2018 revealed that the Age-Specific Fertility Rate (ASFR) for women aged 15–19 years is 42 per 1,000 women. The ASFR in Indonesia has decreased from 48 to 36 per 1,000 women in 2018. However, this figure is still high compared to Malaysia, 13 per 1,000 women; China, 8 per 1,000 women; and Singapore, 4 per 1,000 women.[6]

Based on World Health Organization (WHO) data in 2018 showed that the prevalence of contraceptive use in the world increased from 2015 to 2018. In Asia, the increase was from 60.9% to 61.8% in 2018.[7] Specifically in Indonesia, according to the Indonesia Demographic and Health Survey (IDHS), the use of modern contraceptives among married women increased from 2002/2003 until 2012. However, in 2017, contraception use has decreased but not significantly. Furthermore, Indonesian data shows that the proportion of the age at first sexual intercourse among women increased from 59% in 2012 to 74% in 2017.[8] Based on IDHS data, 11% of women and 15.8% of adolescents with unmet contraception needs in 2018. This data showed that the unmet standard of 6% by the government has not been achieved.[9] In other word, it indicated a failure to make a decision in preventing and canceling a pregnancy. Adolescents who are sexually active and not using contraceptives will have a big chance of pregnancy and childbirth problems.

Studies on contraceptive use have been carried out in several countries. In Bangladesh, authors found the differences in contraceptive use among female adolescents with more than one parity.[10] The study by de Vargas Nunes Coll and her colleagues in 73 low- and middle-income countries revealed that modern contraception methods were still low (below 10%) among married adolescent women without children.[11]

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Restriction of contraceptive access on minimum age was imposed in Nigeria.[12] In this regard, policies of contraceptives among adolescents are related to social and cultural norms, and legal and cultural norms influence adolescents in obtaining and using a contraceptive. Misconceptions about the long- and short-term effects on adolescent health and the ability to give birth in the future are barriers to adolescents being able to get access to contraceptives.[13]

Several rules govern adolescents for accessing and using a contraceptive. Adolescents with an unmarried status will face several obstacles because sexual activity is only considered acceptable in marriage. On the other hand, marriage in adolescents often leads to pregnancy at an early age.[14] Low decision-making power and rigid social norms often result in low use of effective contraceptive methods among married adolescent girls, even though many want to postpone the first birth.[15] Contraceptive use is intended for married couples and to control the rate of population growth, which is expected to be a reference as a strategy for controlling adolescents' health. The problem of contraceptive use in adolescents has not been resolved. This is shown by the unmet need that has not been achieved in women of childbearing age by 6.5%.[16] Based on data from the 2012 IDHS, 11% of currently married women have not had their contraceptive needs.[17] This indicates a gap between contraceptive needs and family planning goals. This study aimed to provide an overview of the scope of contraceptive uses among adolescents in Indonesia and determine the effect of parity and marital status against the use of contraceptives in adolescence that can be input in preparing the reproductive health program strategies.

Method

This study was a cross-sectional design using the IDHS in 2017. This study's population was adolescent women aged 15–19 years in Indonesia and selected from the sample of IDHS in 2017. The number of samples used was 7,936 adolescents taken from the IDHS data for women of reproductive age with inclusion criteria for ages 15–19 years. The samples obtained were based on the availability of data on IDHS, and the sample size was calculated using the Lemeshow formula.

The dependent variable of this study is contraceptive use. Independent variables include parity and marital status. The potential confounder variables are education, work status, region, and economic status. Information from the two types of variables was collected using a questionnaire through structured IDHS interviews with respondents. The questionnaire used in the IDHS is a Demographic and Health Survey (DHS)-standardized questionnaire. Procedures and questionnaires for standard DHS surveys have been reviewed and approved by the informed consent form (ICF) Institutional Review Board (IRB). Additionally, the ICF IRB reviewed country-specific DHS survey protocols and typically by an IRB in the host country. The ICF IRB ensures that the survey complies with the United States Department of Health and Human Services regulations to protect human subjects (45 CFR 46), while the host country IRB ensures that the survey complies with laws and norms of the nation. The data used in this analysis was obtained with the DHS program's permission.

The variables used in this study are taken from the questions to women of childbearing age including: 1) Contraceptive use by the respondent or partner intended for the prevention of unplanned pregnancies, categorized into those who are "Using" and "Not Using"; 2) Marital status is the condition of a woman who has a legally registered marital status and lives with her partner, divided into two categories, "Married" and "Unmarried"; 3) Parity is the number of children born alive, divided into "Zero" and "More or equal to 1"; 4) Education is defined as the last level of education that the respondent completed, categorized into "Primary," "Secondary," and "Higher"; 5) Work status is defined whether the respondent worked in the past 12 months preceding the survey, split into "Working" and "Not Working" categories; 6) Region is classified as the respondent's residence, divided into "Rural" and "Urban" categories; and 7) The economic status of a respondent was calculated based on the index quintile of ownership or assets held in the household that was already available on the IDHS data, categorized into "Very Poor", "Poor" "Middle" "Rich", and "Very Rich".

Furthermore, the variables were analyzed in stages with univariate, bivariate, and multivariate analysis. The univariate analysis displays the percentage of each research variable based on its category. Bivariate analysis was conducted to examine the relationship between the independent variables (marital status and parity) and the dependent variable (contraceptive use). Moreover, the bivariate analysis also evaluates variables that can become confounding variables, namely education, work status, region, and economic status. A multivariate analysis was carried out using binary logistic regression based on the bivariate analysis's selection results.

Results

Respondents were adolescents aged 15–19 years. The total number of respondents was 7,936. There were 3.8% of adolescents who use contraception. Of 8.4% adolescents were married and 5.3% have already married (Tabel 1).

Table 2 presents bivariate analysis results between each independent variable on the dependent variable, namely the use of contraceptives. Based on bivariate

analysis, marital status and parity as independent variables had a partial effect on contraceptive use, whereas candidate confounding variables that influence contraceptive use are education, region, and economic status.

A multivariate analysis was performed to complete modeling between the dependent variables, the main independent variables, and the confounding candidate variables. The independent variables of confounding covariates were removed one after the other, starting from the variable with the biggest p-value. If after the exclusion it turned out that the main variable's OR value has changed by more than 10%, then the variable was declared as confounding and must remain in the model. Thus, the final model contained significant or confounding variables.

Data processing was performed by utilizing multivariate analysis using binary logistic regression. As a result, there is no effect between marital status and parity against the use of contraceptives by confounding variables such as employment, region, and economic status. The odds ratio of married adolescents using contraception was 35 times compared to unmarried adolescents after being controlled by confounding variables. Meanwhile, the odds ratio of adolescents who have children to use contraception was four times compared to adolescents who have not had children (Tabel 3).

Discussion

The percentage of adolescents aged 15–19 years who had never used contraceptives is 3.8%, while 96.4% of contraceptive users were married adolescents. The data obtained was larger than the data of the study conducted by Basic Health Research in 2013.[18] The percentage of adolescents who have children is 5.3%. It showed that the earlier a woman is married, the more it increases her reproductivity and birth rates.

The analysis demonstrated that marital status and parity were associated with contraceptive use among adolescents. Married adolescents had more opportunities to use contraceptives than those who were not married. The percentage of adolescents who were married and were using contraceptives is 43.73%, while the remaining 56.27% are not using the contraceptive. This result is in line with a study conducted in Zimbabwe, which showed that married adolescents could use contraceptives 2.5 times more than unmarried.[19] Furthermore, a study in Indonesia in 2013 found out that

Table 1. Distribution of Respondent Characteristics

Variable	Category	Total	Percentage
Contraceptive use	Not using	7,632	96.2
	Using	304	3.8
Marital status	Unmarried	7,266	91.6
	Married	670	8.4
Parity	0	7,518	94.7
	≥ 1	418	5.3
Education	Primary	467	5.9
	Secondary	6,625	83.5
	Higher	844	10.6
Work status	Not working	5,677	71.5
	Working	2,259	28.5
Region	Rural	3,584	45.2
	Urban	4,352	54.8
Economic status	Very poor	1,866	23.5
	Poor	1,592	20.1
	Middle	1,479	18.6
	Rich	1,433	18.1
	Very rich	1,566	19.7

Table 2. Relation of Adolescent Characteristics with Contraceptive Use

Variable	Category	Contraceptive Use				Total	p-value	OR	95% CI
		Not Using		Using					
		n	%	n	%				
Marital status	Married	377	56.3	293	43.7	670	< 0.001	512.5	278.3 – 944.1
	Unmarried	7,255	99.8	11	0.2	7,266	< 0.001	Ref	
Parity	≥ 1	157	37.6	261	62.4	418	< 0.001	289.0	201.8 – 413.9
	0	7,475	99.4	43	0.6	7,518	< 0.001	Ref	
Education	Secondary	6,402	96.6	223	3.4	6,625	< 0.001	0.2	0.1 – 0.2
	Higher	840	99.5	4	0.5	844	< 0.001	0.0	0.0 – 0.1
	Primary	390	83.5	77	16.5	467	< 0.001	Ref	
Work status	Working	2,168	96.0	91	4.0	2,259	0,563	1.11	0.8 – 1.4
	Not working	5,464	96.2	213	3.8	5,677	< 0.001		
Region	Urban	4,231	97.2	121	2.8	4,352	< 0.001		
	Rural	3,401	94.9	183	5.1	3,584	< 0.001	Ref	
Economic status	Poor	1,529	96.0	63	4.0	1,592	0,002	0.6	0.4 – 0.8
	Middle	1,414	95.6	65	4.4	1,479	0,015	0.7	0.5 – 0.9
	Rich	1,396	97.4	37	2.6	1,433	< 0.001	0.4	0.3 – 0.6
	Very rich	1,545	98.7	21	1.3	1,566	< 0.001	0.2	0.2 – 0.3
	Very poor	1,748	93.7	118	6.3	1,866	< 0.001	Ref	

Notes: OR = Odds Ratio; CI = Confidence Interval

Table 3. The Relationship between Parity and Marital Status with Contraceptive Use in Adolescents

Variable	Category	β	OR	SE	95% CI	p-value
Marital status	Married	4.6	100.0	35.15	50.2 - 99.2	< 0.001
	Unmarried		*Ref*			
Parity	≥ 1	3.0	20.4	4.52	13.2 - 31.5	< 0.001
	0		*Ref*			
Work status	Working	0.1	0.9	0.18	0.6 - 1.4	0.739
	Not working		*Ref*			
Region	Urban	0.1	0.8	0.25	0.6 - 1.3	0.460
	Rural		*Ref*			
Economic status	Poor	-0.2	0.8	0.20	0.5 - 1.3	0.403
	Middle	0.8	2.8	0.65	1.3 - 4.0	0.004
	Rich	0.3	1.4	0.45	0.7 - 2.7	0.310
	Very rich	0.3	1.5	0.59	0.6 - 3.2	0.353
	Very poor		*Ref*			

Notes: OR = Odds Ratio; CI = Confidence Interval; SE = Standar Error

54.2% of adolescents who have been married are still using contraceptives.[18] Two factors lead to low contraceptive use among adolescents: low decision-making power and social norms.[11] Otherwise, most married adolescents do not use contraceptives, which puts them at risk for adolescent pregnancy; this may further lead to health risks for both mother and baby.[1]

Contraceptive users are dominated by the kind of modern contraceptive (96%). Modern contraceptives consist of sterilization, Intrauterine Device (IUD), injections, implants, oral, and condoms. Primary reasons for contraceptive use among married adolescents are delaying pregnancy, continuing their education, and employment.[20] Contraceptive use is believed to be effective for the prevention of pregnancy. However, modern contraceptive use comes with risks, among others the risk of developing pelvic inflammatory disease and infertility in IUD users.[21] Likewise, other risks include irregular bleeding with implants and a decrease in bone density with the use of oral contraceptives.[22-24]

Based on Table 2, the percentage of married adolescents is 8.44%, showing that sexually active adolescent women are almost one-tenth. The percentage of married women who use contraceptives is 43.7%, in contrast to 0.2% of unmarried adolescents who also use contraceptives. The latter contravenes the existing laws in Indonesia where unmarried young people are not allowed to use contraceptives.[25] This study showed the contraceptive used by parity, 62.4% of adolescents had a child or children, whereas 99.4% of adolescents who had no child and not using contraceptives is 99.4%. This was in line with a study conducted in the United States which asserted that the number of children was a strong predictor of contraceptive use in adolescents and young adults.[26] This result shows that contraception in married women is used to regulate birth spacing and control children's number.

Marital status and parity have been identified to affect contraceptive use by women. However, values and cultural norms also affect a person's decision to use contraceptives.[27,28] Knowledge about health recovery, counseling, and effective contraception in increasing adolescent knowledge related to sexual health, contraceptive use, and reducing adolescent pregnancy.[29] As a result, counseling for adolescents about reproductive health and the effectiveness of using contraception that is safe in married adolescents is needed.[30] The use of modern contraceptives to support first birth is widely accepted for women who are still students, young, unmarried, and women in unstable marriages. However, long-term reversible methods such as implants and contraceptives are considered inappropriate methods for accepting first births, because they involve delaying returning to fecundity, termination as soon as a woman's marital status changes, and remaining uncertain for future fertility.[31]

This study showed that contraceptive use in adolescents was influenced by marital status and parity. However, most married adolescents do not use contraceptives even though this puts them at high risk for adolescent pregnancy. This study has not shown why married adolescents do not use contraceptives because of secondary data.

The analysis has several limitations. Moreover, this study uses secondary data with a variable limitation issue. There need to be variables that are not directly observable such as social, knowledge, family support, and environment. Unreported contraceptive use may also bias estimates. However, women who would not report contraceptive use because of social norms were less likely to say they did not want children right away. In this study, the findings showed that nearly 10% of adolescent girls were sexually active. The use of contraceptives is still found in adolescents who have an unmarried status.

It is necessary to do a more in-depth analysis of contraceptives' factors among adolescents based on knowledge and access to contraceptives.

Conclusion

The aim of using contraceptives to prevent pregnancy, especially in adolescents, was still not compatible with reality. Most married adolescents do not use a contraceptive. The biggest use of contraceptives is found in adolescents who never had a child. Educational and health promotion needs to be more encouraged to adolescents.

Abbreviations

IDHS: Indonesia Demographic and Health Survey; ASFR: Age-Specific Fertility Rate; WHO: World Health Organization; DHS: Demographic and Health Survey; ICF: Informed Consent Form; IRB: Institutional Review Board; OR: Odd ratio; CI: Confidence Interval; IUD: Intrauterine Device.

Ethics Approval and Consent to Participate

The ethical clearance number of this study is Institutional Review Board Findings Form ICF IRB FWA00000845 with ICF Project Number 132989.0.000.

Competing Interest

The author declares that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

Data and materials of this study can be provided upon request.

Authors' Contribution

AFM: Designed, prepared, and revised the manuscript; TYRP: Data analysis and revised the manuscript; SA: Reviewed and revised the manuscript. All the authors have read and approve the final manuscript.

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Low Knowledge and Unawareness of the Health Promotion as the Determinant Factors in Non-Compliance to the Mass Drug Administration Program

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Abstract

The mass drug administration (MDA) program has been demonstrated its effectiveness in many filariasis-endemic regions. However, Kuningan as a filariasis-endemic area had the MDA program coverage lower than the government targeted. One of a district in Kuningan, Cilimus District was a filariasis-endemic area with the MDA program coverage in 2017 lower than government targeted (higher than 86%). The purpose of this study was to analyze the determinant factors of compliance with the MDA program. The study was an analytical study with a cross-sectional design and was conducted from May to June 2018. The sample of 106 people was taken from the population living in Cilimus District, Kuningan Regency, using a simple random sampling technique. The independent variables were collected by a constructed questionnaire included age, education level, knowledge, attitude, health promotion, and family support. A questionnaire also measured compliance with MDA as a dependent variable. Data analysis consisted of univariate, bivariate (chi-square and Fisher exact test), and multivariate analyses (multiple logistic regression). The results showed that the variables of knowledge, attitude, MDA health promotion, and family support influence compliance with the MDA (p-value < 0.05). Low knowledge and unawareness of the MDA health promotion proved to be the dominant factors in non-compliance with the MDA program.

Keywords: determinant factors, compliance, Mass Drug Administration

Introduction

Lymphatic filariasis (LF) is one of the oldest and most debilitating neglected tropical diseases that continue to be a significant cause of morbidity in many parts of the world. In 2002, it was estimated that LF is responsible for the loss of 4.4 million Disability Adjusted Life Years (DALYs) in men and over 1.3 million DALYs in women.[1] In 2000, the World Health Organization (WHO) launched the Global Programme to Eliminate Lymphatic Filariasis (GPELF), aiming to eliminate LF as a public health problem by 2020. The GPELF includes two strategies, 1) to interrupt LF transmission by conducting mass drug administration (MDA) in all disease-endemic regions; and 2) morbidity management and disability prevention for infected people.[2] Mass drug administration aims to treat entire populations at risk of the disease with a combination of albendazole plus ivermectin or albendazole plus diethylcarbamazine administered as a single dose once a year for at least five years.

Mass drug administration has been demonstrating its effectiveness in many filariasis-endemic regions. Thailand, as an endemic area for LF, over the years 2002 to 2011, conducted extensive MDA with high coverage rates. It delineated LF transmission areas at the sub-village level through periodic and regular monitoring surveys. It demonstrated through its evaluation surveys–the Stop-MDA surveys and Transmission Assessment Surveys (TAS)–below transmission threshold rates that enabled its validation of LF elimination.[3]

A recent study in India proved that participation in MDA programs was a behavioral factor that can affect the occurrence of filariasis (OR = 1.8 and OR = 13.75).[4] In Indonesia, after the fifth year of the MDA program in Pekalongan City, the area is no longer included in the filariasis-endemic areas and the transmission parameters have no potential in causing the spread of filariasis. Because the microfilaria rate was 0.32% with an average microfilariae density of 167/mL blood; the antigen prevalence of the calculation was 0%; the infection rate was 0.06%; and the infective rate was 0%.[5] Therefore, people's awareness and their willingness to participate in the MDA program is the key factor in preventing the filaria-

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sis transmission.

West Java is one of the provinces that has become an endemic area of LF in Indonesia. Nationally, West Java has the fourth-highest number of filariasis cases in 2017, with a total case of 907. These cases were distributed in 11 endemic districts/cities in West Java with a microfilaria rate of more than 1%.[6] Meanwhile, in 2018, West Java was in the third position as a province with the highest number of chronic cases of filariasis after Papua and East Nusa Tenggara.[7]

One of the regencies in West Java which is a filariasis endemic area is Kuningan Regency. In 2017, there were 30 chronic cases of filariasis that were distributed in 15 districts in Kuningan Regency. Since 2015, Kuningan has participated in MDA programs. The coverage of MDA program in 2017 showed that percentage of people who take a drug from the total population was 78.61%, while the percentage of people who take a drug from the total target was 89%. This result showed that the percentage of people who take a drug from the total population in Kuningan was still below the government's target > 86%.

Cilimus District became an endemic filariasis area in Kuningan, with two cases of filariasis found there. Meanwhile, the percentage of communities in Cilimus taking drugs from the total population was 72.39% (below government target). Cilimus District is the second-highest number of filariasis cases in Kuningan Regency. There were four cases in 2017.

The success in national programs aimed at eliminating Lymphatic Filariasis (LF) could be determined by many factors. Community participation has been found to be one of the major challenges to the success of the MDA program. A lack of community participation hampers program implementation of all drug administration programs rather than only MDA for LF.[8]

A recent study demonstrated that demographic factors (age, sex, income level, and area of residence) were often associated with individual's compliance. The cause of non-compliance was mostly due to fear of side effects,[9-11] lack of awareness of the benefits of MDA, non-attendance of health staff in the villages,[11] and the individual has not received MDA education.[10] The purpose of this study is to analyze the determinant factors (education level, knowledge, attitude, socialization, family support) of compliance to MDA for LF in Cilimus District, Kuningan Regency, Indonesia.

Method

This study was an analytic observational using cross sectional design conducted from May to June 2018. Population in this research was all citizens living in Cilimus District, Kuningan Regency. The total population was 15,066 households in Cilimus District. The sampling was done using a simple random sampling technique. Initially, 106 subjects who met the study's inclusion criteria and approved informed consent were invited to participate in this study. Each sample comes from every different household. The inclusion criteria were as follows: 1) the subject does not suffer from filariasis, 2) the subject is aged 2 to 70 years, 3) he or she does not suffer from severe illness, 4) the woman is not pregnant and should not get pregnant during the MDA program, and 5) he or she is willing to become a sample in this study. The collection of the data was done by face-to-face interviews using a constructed questionnaire. The enumerators were the public health workers who had been previously trained to conduct data collection in the community.

Independent variables and dependent variables were the primary data. Independent variables consisted of age, education level, knowledge, attitude, MDA health promotion, and family support. This study measured knowledge about filariasis and the benefits of the MDA program in preventing the spread of filariasis. The family support variable indicates whether there was support for taking filariasis drugs from family members who live in one house. Families being close to one another are always ready to provide information, rewards, instrumental and emotional support. Family support in the study comes in different forms: encouragement, informing family members about the benefits and risks of medication non-adherence, and reminding family members when the respondents forget to take medication.

The level of education was divided into two categories: In the low education category are included respondents who are either illiterate or graduated from elementary school and junior high school; in the high education category are included respondents who graduated from high school and college. Knowledge and attitude variables were obtained from the score when they answered questions in the questionnaire. The score of knowledge and attitude was then compared with the median value because they were not normally distributed. If the score was less than the median value, the respondent has low knowledge and a negative attitude. Conversely, if the score of knowledge and attitude was higher or equal to the median value, the respondent has a high level of knowledge and positive attitude. The MDA health promotion, as an independent variable, was divided into respondents who have received MDA health promotion and the respondents who were not informed of the health promotion. Family support was grouped into two categories–the respondents who were encouraged by their family members to take filariasis drugs and the respondents who were not assisted by their family. The compliance to MDA for LF as a dependent variable was also measured by a constructed questionnaire. The definition of compliance to MDA in this study was adherence to fi-

lariasis preventive medication until the end of treatment following the Regulation of the Minister of Health of the Republic of Indonesia Number 94 of 2014 concerning filariasis control.

Before conducting data analysis, data management processes are first carried out consisting of editing, coding, processing, and cleaning. The data including univariate, bivariate, and multivariate were analyzed using the chi-square, Fisher exact test, and multiple logistic regression. The Ethics Committee has approved this study from Kuningan Health Science Institute/*Sekolah Tinggi Ilmu Kesehatan Kuningan* (No. 012/EP/STIKKU/2018).

Results

The univariate analysis results (Table 1) showed that, of 106 respondents, most of them received low education (59.4%). For knowledge, respondents with low and high knowledge had almost the same proportion (50.9% and 49.1% respectively). Similarly, the proportion of respondents who had negative and positive attitudes was equal, at 50% of each. The majority of respondents received support from their families to take filariasis drugs (65.1%). Most of the respondents received socialization about filariasis from health workers (70.8%). Most respondents (94.3%) received filariasis drugs. For the dependent variable, majority of the respondents took the preventive drug in the MDA program in 2017.

Bivariate analysis shown in Table 2 indicated that the variables of knowledge (OR = 25; 95% CI = 3.255–199.75), attitude (OR = 4.8; 95% CI = 1.484–15.76), family support (OR = 3.23, 95% CI = 1.163–8.945), and MDA health promotion (OR = 11.53; 95% CI = 3.64–36.428) had significant relationship with compliance to the MDA program. With regard to the variables of age and level of education, there was no significant relationship with compliance to MDA (p-value > 0.05).

After bivariate analysis, five variables can enter into the multivariate model (p-value ≤ 0.25). These variables include age, level of knowledge, attitude, family support, and the MDA health promotion. From the multivariate analysis process with multiple logistic regression, the results of the final multivariate model were obtained as shown in Table 3.

The final model of multivariate analysis by multiple logistic regression demonstrated that the level of knowledge (p-value = 0.015) and MDA health promotion (p-value = 0.004) had p-value ≤ 0.05. Therefore, the level of knowledge (OR = 13.68; 95% CI = 1.648–113.565) and MDA health promotion from health workers (OR = 5.95, 95% CI = 1.754–20.196) were the dominant variables affecting compliance to MDA program (p-value ≤ 0.05).

Table 1. Characteristic of Respondent and Compliance with the Mass Drug Administration Program

Variable	Category	n	%
Age	> 43 years	46	43.4
	≤ 43 years	60	56.6
Level of education	Low	63	59.4
	High	43	40.6
Level of knowledge	Low	54	50.9
	High	52	49.1
Attitude	Negative	53	50.0
	Positive	53	50.0
Family support	No	37	34.9
	Yes	69	65.1
MDA health promotion	No	31	29.2
	Yes	75	70.8
Compliance to MDA	Do not take drugs	19	17.9
	Take drugs	87	88.1

Note: MDA = Mass Drug Administration

Table 2. Relation of Respondent Characteristic and Compliance with the Mass Drug Administration Program for Lymphatic Filariasis in Kuningan Regency

Variable	Category	Compliance with MDA						p-value	OR (95% CI)
		Did not Take Drugs		Took Drugs		Total			
		n	%	n	%	n	%		
Age	> 43 years old	12	26.1	34	73.9	46	100	0.055	2.672
	≤ 43 years old	7	11.7	53	88.3	60	100		(0.957–7.461)
Level of education	Low	13	20.6	50	79.4	63	100	0.379	1.603
	High	6	14.0	37	86.0	43	100		(0.557–4.612)
Level of knowledge	Low	18	33.3	36	66.7	54	100	0.0001	25.00
	High	1	1.9	51	98.1	52	100		(3.255–199.747)
Attitude	Negative	15	28.3	38	71.7	53	100	0.004	4.836
	Positive	4	7.5	49	92.5	53	100		(1.484–15.760)
Family support	No	11	29.7	26	70.3	37	100	0.016	3.226
	Yes	8	11.6	61	88.4	69	100		(1.163–8.945)
MDA health promotion	No	14	45.2	17	54.8	31	100	0.0001	11.529
	Yes	5	6.7	70	93.3	75	100		(3.64–36.428)

Notes: MDA = Mass Drug Administration; OR = Odds Ratio; CI = Confidence Interval

Table 3. Final Model of Multivariate Analysis by Multiple Logistic Regression

Variable	p-value	Exp (B)	95% CI
Level of knowledge	0.015	13.679	1.648–113.565
MDA health promotion	0.004	5.952	1.754–20.196

Notes: MDA = Mass Drug Administration; CI = Confidence Interval

Discussion

An information bias might occur in this study when asking about attitude variables. During the study, the respondents were sometimes hesitate to answer the questions, because of a fear for a bad score if the answers given were not appropriated. So, there was a possibility that the answers given by the respondents were not sincere. Therefore, authors explained repeatedly to respondents to answer truthfully and answer according to what was experienced by respondents and not compete to get the highest score. This information bias can be a weakness in this study. The strength of this study was the examination of the effect of predisposing/enabling (age, education level, knowledge, and attitude), reinforcing (family support), and enabling (MDA health promotion) factors that influence people's behavior to adhere to the MDA program.

This study proved that knowledge of MDA plays a key role in determinating compliance with the MDA program, which was also demonstrated in previous studies.[10,11] Adhikari, in his study at an endemic district of Nepal, concluded that respondents who understood the side effects during an MDA campaign had a lower prevalence of non-compliance compared to those who have not understood (9.4% vs. 33.2%, p-value < 0.001).[12] Likewise, a study in Burdwan District of West Bengal, India, showed that the lack of community awareness regarding MDA activity is also an influencing factor of compliance to the MDA program with 16.88% of the respondents unaware of the MDA.[13] Hussain within the study in India revealed that the cause of non-compliance is lack of awareness of the benefits of MDA.[11]

According to the theory of Lawrence Green, health behavior can be influenced by three main factors, which are (1) predisposing factors manifested by knowledge, attitudes, beliefs, values, and so on; (2) enabling factors manifested by the physical environment, availability of health facilities such as health services, medicines, latrines, and so on; and (3) reinforcing factors manifested by the attitudes and behavior of health workers or other officers, which are reference groups of community behavior. Knowledge was included in the predisposing factor as it can determine compliance with the MDA program. Knowledge can be influenced not only by the respondent's formal education level but also by accessing information on the MDA program. The information could either be obtained on social media (Facebook, Instagram, Twitter, etc.), print media (newspapers, magazines), electronic media (television, internet, radio, etc.), or more importantly by healthcare workers.[10] Despite having low education level, the respondents increased their knowledge by seeking information about filariasis through various media sources or at least having heard information about filariasis. This knowledge, ultimately, is the most significant factor that affects the decision of participants.

Apart from knowledge, attitude toward MDA is also a major factor that will determine respondents' behavior. In this study, half of the respondents demonstrated a positive attitude, and half showed a negative attitude. This study also indicated that the respondents' attitudes had a significant relationship with compliance to the MDA program, consistent with previous studies. The study in India found out that the subjects who did not consume the medication feared experiencing side effects and they "don't have faith in a tablet".[14] Perceived vulnerability, perceived severity, perceived benefits, and perceived barriers were determinants of adherence to the MDA program based on a study conducted by Widjanarko, *et al.*[15] In general, the majority of respondents had a good perception and most of them felt the need to take preventive medicine for filariasis.[15]

Several MDAs in various countries have encountered the mistrust of the communities in the MDA program. These include suspicions that the drugs are being used to poison children, being used as birth control, and even cause erectile dysfunction.[8] Another reason for non-compliance was not receiving the drug, not being ill, or feeling healthy. Cabral, *et al.*,[10] stated that some previous studies showed about two-thirds of infected people remain asymptomatic; thus, they did not see the benefits of treatment. Also, individuals do not see any morbidity caused by filariasis in their immediate surroundings. For this reason, they did not follow the instruction they received.[10]

Furthermore, the most popular reason for drug non-compliance in the MDA program is the fear of side effects, which was reported in prior studies.[8,11,16,17] In the Pabean area, Indonesia, the respondents, most of whom were batik factory workers, were afraid of suffering from dizziness, nausea, and muscle pain after taking the drugs, which may prevent them to continue their work at the factory later.[16] The percentage of people who experienced side effects was tiny which should not be the biggest concern. Therefore, the information on side effects should be well explained in any educational program to help the people understand and overcome their unnecessary fear of side effects; and recognize the importance of taking the drugs to protect not only themselves but also their family members.

The study conducted by Ojha, *et al.*,[18] showed that the national LF program in Nepal provided additional health education to drug distributors about drug dosage. So they obtained clear information about potential drug side effects and what they should do if they find a drug side effect case in the population. Comprehensible information on drug side effects was also shared with the community in Nepal. People were advised to go to the nearest health facility immediately if they experienced nausea, fever, headache, dizziness, or other symptoms after taking the drug.

The present study found that family support was also one of the factors associated with compliance to MDA. Family support in the study included encouragement, informing family members about the benefits and risks of not taking the medication as instructed, and reminding family members when the respondents forget to take medication. Families are generally close to one another and have a great influence on each other's decisions. They can effectively share their knowledge about MDA and always support or remind respondents to take drugs to prevent filariasis. Hence, to improve MDA compliance in general, it is important to educate other family members to raise their LF awareness.

The MDA health promotion is a wide range of health services, which the main goal is to raise public knowledge about filariasis, together with other actions to contain filariasis. In this study, the MDA health promotion was a determinant factor in compliance to the MDA program, similar to previous studies. In the study of Adhikari, *et al.*,[12] the respondents who were visited by health workers in their homes during the MDA campaign (75.9% vs 24.1% p-value < 0.001, ORadj = 4.85 (95% CI = 2.448–9.594) had significantly higher compliance than those who did not. A study conducted by Marathe in India,[19] showed 255 persons did not consume the drug among them 11.67% of the households had prior information regarding MDA. Information, education, and communication (audiovisual aids) activity reached only 31.67% of households.

Hussain, *et al.*,[11] illustrated in his study that the inadequate training of drug distributors, poor health communication activities before the MDA campaign commenced, and the absence of follow-up by health workers following MDA were a few of the operational difficulties encountered during the MDA campaign. Although the MDA health promotion benefits MDA compliance among respondents, it should be well planned and followed up by health workers.[11] For successful implementation of MDA programs, good planning, educational campaigns promoting the benefits of MDA, adoption of measures to minimize the impact of adverse effects, and improvement of drug distribution logistics are needed.[10,20,21]

Additionally, regular and continual health information about MDA should be conducted through interpersonal communication by frontline health workers and mass media communication.[22] Likewise, retraining of service providers before MDA activities may help improve the MDA program's outcomes.[11,22] The results of a study conducted by Silumbwe in Africa,[23] found out that the main factors facilitating the implementation of MDA for filariasis programs were awareness creation through innovative health education programs in the community, creation of partnerships and collaborations, integration with existing programs, creation of morbidity management programs, the motivation of community drug distributors (CDDs) through incentives and training, and management of adverse effects.[23]

Conclusion

Low knowledge and unawareness of the MDA health promotion proved to be the most dominant factor in non-compliance to the MDA program.

Recommendation

Based on the findings, it is suggested that the government can improve health promotion programs by conducting counseling activities or distributing brochures and leaflets to the community to increase public knowledge about the benefits of the MDA program for filariasis and for the community to participate actively in the MDA program. Besides, it is hoped that it will further enhance the systematic post-MDA surveillance using TAS for epidemiological assessment of recent LF transmission and monitoring/evaluation activities of the MDA program to find out how the program's obstacles are faced along with formulating solutions to the problems that occur.

Abbreviations

MDA: Mass Drug Administration; TAS: Transmission Assessment Surveys; LF: Lymphatic Filariasis; DALYs: Disability Adjusted Life Years; WHO: World Health Organization; GPELF: Global Programme to Eliminate Lymphatic Filariasis; OR: Odds Ratio; CDDs: Community Drug Distributors.

Ethics Approval and Consent to Participate

This study has been approved by the Ethics Committee from *Sekolah Tinggi Ilmu Kesehatan Kuningan*/Kuningan Health Science Institute (No. 012/EP/STIKKU/2018). Respondents have been informed of the purpose of this study and filled out informed consent as a form of their willingness to participate in this study.

Competing Interest

The author declares that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

Data in this study can be provided by the corresponding author at a reasonable request.

Authors' Contribution

NNA and ISA were involved in conceptualizing the study, searching the literature, and collecting data. NNA performed data analysis. NNA and HTPD compiled and reviewed the manuscript.

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Yulyani *et al. Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)*. 2021; 16 (1): 45-50
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Patterns and Determinants of Open Defecation among Urban People

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Abstract

At the present time, million people still defecate in the open, not in private. Indonesia is a densely populated country with a lot of open defecation (OD) both in urban and rural areas. Tanjung Karang Pusat District is an area in Bandar Lampung City with the highest percentage of OD practice. This study aimed to explore and explained the patterns and determinants of OD among urban people in the Tanjung Karang Pusat District involving 377 respondents for quantitative analysis. Quantitative data were analyzed using chi-square and regression analysis. After controlling the economic status and education level variables, the data revealed that urban communities were still practicing OD (23.3%) with land ownership, latrine ownership, conative attitude, and occupation as influential factors. Statistical test results showed that the most influential factor in the behavior of OD in the community was latrine ownership (p-value < 0.001, AOR = 58.2). These findings suggest that stakeholders must take action on landowners who do not allow sanitation facilities to be built on their land.

Keywords: open defecation, pattern, urban people

Introduction

An estimated 673 million people in 2017 still defecated in the open, not in private. This practice is known as open defecation (OD).[1,2] There is always a high number of population (more than 58 million) in Indonesia still practicing open defecation both in urban areas and rural areas.[3,4] Open defecation has a severe impact on children's health and contributes to a large number of premature deaths.[5-9]

In this day and age, there are still many people who practice OD.[10] Technological developments and the easy exchange of information are no guarantees in changing peoples' behavior, even in urban areas with internet access.[11-13] Tanjung Karang Pusat District, as a mother district in Bandar Lampung, has the highest number of OD. It is estimated that around 45% of the population in this subdistrict still practices OD using a plastic bag to defecate and dump it outside the home ("flying plastic"). In the same subdistrict, there are latrines without a connected septic tank.[14]

The Ministry of Health of the Republic of Indonesia has come up with a regulation known as the Community-Based Total Sanitation (CBTS) since 2008.[15] Thirty-four out of 126 villages in the city of Bandar Lampung have not done CBTS, and a further 90 out of 126 communities have not been declared Open Defecation Free (ODF).[16] The Public Work Service also has a program on sanitation in urban communities known as Community Sanitation (*Sanitasi Berbasis Masyarakat*/SANIMAS).[17] However, the complexity of OD problems in Bandar Lampung City continues to occur.

Several studies have determined the cause of OD, but this study will focus on rural areas; however, studies on urban areas are scarce.[18-21] There has been a scant study to explore OD at municipal levels.[22] The findings of the present study can be used to design or conduct follow up intervention of access sanitation and reduce OD in urban areas. Therefore, to answer this emerging gap in the background of this study, which aims to explore and explain the patterns and determinants of OD in urban areas, a cross-sectional survey was conducted to answer the questions in the jurisdiction of the Palapa Primary Health Care, Tanjung Karang Pusat District. The number of quantitative samples reached 377 respondents distributed across four subdistricts–Palapa, Kaliawi, Gotong Royong, and Durian Payung–in the Tanjung Karang Pusat District.

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Method

The community-based cross-sectional study design was utilized among the randomly selected households in the study area. The total population of this study was drawn from 7,707 entire families in the Tanjung Karang Pusat District located in the jurisdiction of the Palapa Primary Health Care. Quantitative sampling using the Lemeshow formula with p1 (0.62) and p2 (0.46) was utilized from the study conducted by Yulyani V, *et al.*[19,23]

The minimum sample is 179. However, based on the calculation, 377 households required to get a plausible result. Therefore, we took a sample of 377 to describe the population better. The samples were distributed across all four subdistricts among the working areas of the Palapa Primary Health Care using proportional random sampling (Table 1).

Subdistricts with higher population densities were sampled at proportionally higher rates. Purposive sampling was conducted after determining the number of samples required per subdistrict with inclusion criteria of households in the poverty pocket, and the respondents agreed to be involved in the study.

Two trained enumerators carried out this study in each subdistrict. The questionnaire was developed based on Precede Lawrence Green Model, the SaniFOAM framework, and previous studies.[18,19,24] Education, economic status, occupation, land ownership, latrine access, and attitude (cognitive, affective, and conative) were the primary factors influencing health-related behaviors according to those references.

The open defecation behavior category was divided into "OD" and "Non-Open Defecation (Non-OD)". Level of education was divided into "None," "Elementary School," "Junior High School," and "Higher or equal than Senior High School." The respondents' economic status category corresponded to "lower" if the total monthly household income was less than USD 175. Occupation is divided into "Unemployed" and "Employed". The status of land ownership was divided into "Rent" and "Private Property". Ownership of latrine was split into "None" and "Yes." The attitude category (cognitive, affective, and conative) was divided into "positive" and "negative," which identified a respondent having a positive attitude if the T-score is ≥50.

Validity and reliability tests were undertaken on 30 households in the jurisdiction of Simpur Primary Health Care, Tanjung Karang Pusat District. The resulting questionnaire was found to be valid and reliable for use in this study. The results of the validity and reliability tests are used to test attitude questions with the following results:

a. Cognitive attitude: Initially, 10 question items became seven valid question items with corrected items totaling more than r table 0.361.
b. Affective attitude: The number of questions conducted by the validity test was 13 questions with nine valid questions resulting in corrected items totaling more than r table 0.361.
c. Conative attitude: From a total of nine questions tested for validity, the number of valid questions was as many as six items with corrected items totaling more than r table 0.361.

The chi-square test was used to describe cross-tabulation between variables OD and non-OD. The dependent variable is OD, while the independent variables are demographic, cognitive, affective, and conative attitudes. A binary logistic regression was used to determine the most dominant variable.

Results

Out of 377, an estimated 289 of the households used a latrine for defecation, and 88 families did not use a toilet. This section presents and discusses the relationships between the practice of OD and household socioeconomic, demographic and geographic factors in communities that are in the jurisdiction of the Palapa Primary Health Care. The factors that influence OD practice are presented in Table 2. The variables examined in this study include the level of education, economic status, occupation,

Table 1. Sample Size per Subdistrict of Tanjung Karang Pusat District

Subdistrict	N	n
Kaliawi	1,046	107
Palapa	2,342	63
Durian Payung	1,387	157
Gotong Royong	2,932	50
Total	7,707	377

Table 2. Descriptive Statistic of Variables Influencing Open Defecation

Variable	Category	Frequency	Percentage
Open Defecation (OD)	OD	88	23.3
behavior	Non-OD	289	76.7
Level of education	None	21	5.5
	Elementary school	108	28.1
	Junior high school	97	25.2
	≥ Senior high school	159	41.2
Economic status	Lower	177	53.8
	Higher or equal	152	46.2
Occupation	Unemployed	243	64.4
	Employed	134	35.6
Land ownership	Rent	152	39.6
	Private property	232	60.4
Ownership of latrine	None	133	34.8
	Yes	249	65.2
Cognitive	Negative	191	49.6
	Positive	194	50.4
Affective	Negative	233	60.5
	Positive	152	39.5
Conative	Negative	160	41.6
	Positive	225	58.4

Table 3. Influencing Factors of Open Defecation

Variable	Category	Open Defecation		p-value
		Open Defecation (%)	Non Open Defecation (%)	
Education	No school	9 (10.2)	11 (3.8)	< 0.001
	Elementary school	47 (53.4)	59 (20.4)	0.957
	Junior high school	24 (27.3)	69 (23.9)	0.092
	≥ Senior high school	8 (9.1)	150 (51.9)	< 0.001
Economic status	< USD 171.5	54 (90)	121(45.3)	< 0.001
	≥ USD 171.5	6 (10)	146 (54.7)	
Occupation	Unemployed	64 (72.7)	179 (61.9)	0.064
	Employed	24 (27.3)	110 (38.1)	
Land ownership	Rent	82 (95.3)	47 (16.3)	< 0.001
	Private property	4 (4.5)	241 (83.7)	
Latrine ownership	No	82 (95.3)	47 (16.3)	< 0.001
	Yes	4 (4.7)	241 (83.7)	
Attitude: Cognitive	Negative	61 (69.3)	124 (42.9)	< 0.001
	Positive	27 (30.7)	165 (57.1)	
Attitude: Affective	Negative	55 (62.5)	174 (60.2)	0.794
	Positive	33 (37.5)	115 (39.8)	
Attitude: Conative	Negative	61 (69.3)	93 (32.2)	0.000
	Positive	27 (30.7)	196 (57.8)	

Table 4. Patterns and Determinants of Open Defecation in Urban People

Variable	Category	β	p-value	AOR	95% CI for OR	
					Lower Limit	Upper Limit
Land ownership	Rent	2.896	< 0.001	17.38	4.24	71.23
Latrine ownership	None	4.065	< 0.001	58.28	13.49	251.73
Attitude: Conative	Negative	1.473	0.013	4.37	1.36	14.03
Economic status	< USD 171.5	0.080	0.918	1.08	0.23	4.99
Occupation	Unemployed	1.201	0.048	3.32	1.01	10.90
Education	No School		0.012			
	Elementary school	0.483	0.685	1.62	0.15	16.80
	Junior high school	-2.332	0.006	0.09	0.01	0.51
	≥ Senior high school	-0.676	0.376	0.50	0.11	2.27

Notes: AOR = Adjusted Odds Ratio; CI = Confidence Interval; OR = Odds Ratio; USD = US Dollar

land ownership, latrine ownership, attitude (cognitive, affective, and conative). The majority of respondents (76.7%) did not practice OD, compared to the 23.3% who practiced OD. Most of the respondents (41.2%) had completed higher or equal than senior high school, followed by those who completed elementary school (28.1%), junior high school (25.2%), and none (5.5%). More than half of the respondents (53.8%) had lower than regional minimum wage (USD 171.5). Most of the respondents (64.4%) are unemployed, and the number of respondents who rent (or tenants) is 39.6%. There were 34.8% of respondents who did not have a toilet.

Data on Table 3 indicates statistical significance variables that influence OD, such as economic status, land ownership, lantrine ownership, cognitive attitude, and attitude, have p-value ≤ 0.001. Open defecation is not influenced by job status and affective attitude with a p value of more than α (0.05).

Tabel 4 shows that the most influence OD was latrine ownership (AOR = 58.28). People who do not own a toilet have 58 times more chance of doing OD than those who have a toilet. People whose lands are leased (AOR = 17.38) have 17 times more chance to do OD than those who own private land. Variables that are not included in the final model include cognitive and affective attitudes. The economic status (AOR = 1.08) and education level (AOR Elementary school = 1.62; Junior high school = 0.09; Senior high school = 0.50) variables were confounding variables in this study with p-value more than α (0.05).

Discussion

Based on the results, approximately 23.3% of respondents practice OD. Findings from this study showed that OD in urban areas is caused by access and ownership of latrines not allowed by landowners. Access and availability of restrooms represent a key external or environmental factor.[18] Allowing construction of sanitation facilities on leased land must be examined as a critical aspect in reducing OD in urban areas.[25] These results are in line

with a previous study conducted in Ghana where OD was reduced when there is access to the toilet.[26] Attitude and injunctive norm are the psychological predictors of latrine ownership, and consistent latrine use was associated with attitude, cleanliness of the latrine, and its privacy.[27]

Logistic regression analysis shows that the most influential factor in OD behavior is latrine ownership (p-value < 0.001, AOR = 58.28). These results are in line with a research conducted in India on urban communities where the leading cause of OD is access to water and sanitation facilities.[28] Social networks such as caste, education, and income influence the ownership of a toilet.[29] The results of this study are in line with the study that has been done where people who do not have latrines are indeed in the same area with similar social characteristics.

Building latrines at the household level is very important in eliminating OD.[30] The construction dependents on education, soil conditions, social cohesion, the perception that many other community members have a restroom, and high confidence in personal abilities.[31] The interventions so far carried out by the Ministry of Health are always focused mostly on individual-level determinants such as attitudes and behavior, instead of considering all possible social determinants of latrine ownership.[32]

Public toilets built by stakeholders are often grossly inadequate and of low quality that shortly after commissioning, maintenance provision was not part of the contracts.[12] Providing communal toilets can reduce but not end the problem of OD in urban poverty pockets.[33] What is interesting in the latrine ownership data is that there are people who already have latrines but are still practicing OD (4.7%) because usually they live near the river, and OD has become a habit. Health authorities must continue to promote and raise awareness about the importance of using latrines.[34-36]

Toilet ownership is usually related to the respondent's land ownership status. The results of in-depth interviews show that most landowners do not allow septic tanks to be built because they are still leasing the land they live in. Furthermore, if the land is located in a mountainous area and the ground is perforated in building septic tanks, the landowner fears this could cause landslides and reduce the selling price of land. The study indicates that latrine ownership is a variable that needs to be considered in lowering OD in urban poverty areas. The result is identical to earlier literature, which found that dwelling space and household latrine ownership are important conditions that reduce OD.[32]

Intending to increase ODF areas, from the results of this study, it is necessary that the city government implement a firm policy that every house occupied should be equipped with sanitation facilities. This study also found that people are concerned about the difficulty of siphoning a toilet. Mountainous areas with very dense houses will make it difficult for people to siphon septic tanks. Urban poor communities are more likely to be affected by these problems–siphoning and constructing the septic tank.[28] A modern technology that does not pollute the environment is needed so that this complex sanitation problem can be resolved.

The Public Works Department has a work program that focuses on sanitation installations in urban areas known as SANIMAS.[17] Meanwhile, the Ministry of Health's CBTS is a program that focuses on interventions to change values and people's beliefs about sanitation.[37] The integration of the two programs will result in new sanitation technologies that will improve sanitation access for the city's communities.

There is a need for a policy shift toward empowering households and communities, especially in collaboration with landowners, to help resolve OD together.[38] This study has some significant limitations. It is based on the bias in data collection resulting from a non-random sample. This sampling technique can illustrate the real reason respondents who are in poverty pockets in urban areas practice OD.

Conclusion

People in urban communities still defecate in the open, and the main factor is the ownership of latrines, especially among immigrants whose ownership status is that of a tenant. City governments should promote policies ensuring that every house, owned or rented, must be equipped with sanitation facilities. This program can work well if it involves communities, local stakeholders, and landowners. Suggestions for further research should determine to what extent the city government is committed to improving access to sanitation, reducing the number of ODs.

Abbreviations

OD: Open Defecation; CBTS: Community-Based Total Sanitation; ODF: Open Defecation Free; SANIMAS: *Sanitasi Berbasis Masyarakat* (Community Sanitation); Non-OD: Non-Open Defecation; AOR: Adjusted Odds Ratio.

Ethics Approval and Consent to Participate

The study ethics was obtained from the Ethics Committee Politeknik Kesehatan Tanjungkarang with the study protocol code 147/EA/KEPK-TJK/V/2019.

Competing Interest

The author declares that there is no significant competing financial, professional, or personal interest that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

The data supporting the findings and the material of this study are available on request from the corresponding author. The data are not publicly available due to information that could compromise the research participant's privacy/consent.

Authors' Contribution

VY has devised the project, the main conceptual ideas, the proof outline, also worked out the technical and quantitative study. CAF worked out technical details on qualitative research. SMS made corrections in English and improved the manuscripts. DH supervised the findings of his work. All authors discussed the results and contributed to the final manuscript.

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Risk Perception for Developing Erectile Dysfunction Among Malaysian Men with Type 2 Diabetes Mellitus

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Abstract

Risk perception for developing erectile dysfunction (ED) is an appreciation of the susceptibility to having ED and its severity. This study examined this risk perception and its associated factors among 180 men with type 2 diabetes mellitus (T2DM), who claimed not to have ED. This cross-sectional study was conducted at a public health clinic using a validated self-administered questionnaire, which assessed participant characteristics, perceived susceptibility to developing ED, perceived severity of ED, and knowledge on risk factors for ED. About 71.1% had an inaccurate perception of susceptibility to developing ED and their perception on its severity was moderate (median (IQR) score: 10.0 (6.0); range score: 3–15; midpoint: 9). In multiple linear regression, having ED symptoms (p-value < 0.001) and secondary (p-value = 0.045) or tertiary education (p-value: 0.022) significantly contributed to a higher perception of susceptibility. A higher perception of severity was significantly found in Malays (p-value < 0.001), the employed (p-value = 0.026), and those with better knowledge on risk factors for ED (p-value < 0.001). Risk perception for developing ED among men with T2DM appears poor and it was significantly influenced by sociocultural factors, educational attainment, ED symptoms, and knowledge on risk factors for ED. Thus, to improve their risk perception, they should be provided appropriate counseling and education.

Keywords: Diabetes mellitus, disease susceptibility, erectile dysfunction, perception, risk

Introduction

Erectile dysfunction (ED) is defined as the inability to achieve and/or maintain a penile erection sufficient for satisfactory sexual intercourse.[1] The global prevalence of ED for all age groups ranges between 13% and 21%.[2] As ED is commonly considered a loss of manhood, patients usually suffer significant psycho-social impacts such as depression, anger, and guilt of letting down their partner, which can contribute to a low quality of life (QOL).[3] However, some men attribute ED to the normal process of aging and fate.[4] Erectile dysfunction is more prevalent among patients with type 2 diabetes mellitus (T2DM). In Malaysia that prevalence is up to 89.2%.[5] These patients are more likely to have severe ED, which is less responsive to medical treatment and leads to lower QOL.[6,7]

Due to its significance, risk perception for developing ED is important to evaluate because it potentially affects their help-seeking behavior. Risk perception is one's belief about a risk (potential harm or loss) through subjective judgment, and it is a construct of the mind.[8] It is a core component of the Health Belief Model (HBM), influencing behavioral change. It comprises two domains: (1) perceived susceptibility and (2) perceived severity. According to the HBM, individuals who feel susceptible to health threats would regard the potential outcomes as severe and would take action to reduce the risk.[8] In this context, theoretically, when a patient with T2DM feels threatened to have diabetic complications, including ED, he will take precautions and implement actions to reduce his risk by taking steps to achieve optimal glycaemic control to slow down or halt complications of diabetes. A randomized controlled trial conducted among 526 men with T2DM found that participants who perceived themselves at risk of having diabetes-related complications showed better self-care behavior.[9] Besides, participants with high levels of risk knowledge and low levels of optimistic bias showed significant dietary, exercise, and medication adherence changes.[9] In the previous study, optimistic bias was defined as one's belief of having less chance to develop diabetes-related complications than those with similar characteristics.[9] Similarly, Pereira, *et*

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al.,[10] showed that those with a higher perception of having diabetes-related complications tended to have better foot care adherence.

However, the risk perception for diabetes-related complications was generally low, as shown in a recent systematic review of 18 studies.[11] In this review, the studies were performed among men with T2DM in developed countries, and the risk perception assessed was mainly for cardiovascular and eye complications. The review also highlighted the presence of optimistic bias that could lead to their poor risk perceptions.[11] However, how men with T2DM perceive their risk of having ED has not been well studied in Malaysia. A local study related to ED risk perception noted that men with T2DM perceived a higher impact of ED on QOL than non-diabetics.[12] This study indicated that men with diabetes might perceive the seriousness of ED.

The present study aimed to determine the risk perception of ED among men with T2DM through examining their perceived susceptibility to develop ED and their perceived severity of ED. This study also aimed at determining factors associated with their risk perception. Information obtained from the research could provide a baseline understanding of how Malaysian men with T2DM perceive their risk of acquiring ED. This information would help to design concerted health education to improve their risk perception, resulting in better illness perception and adherence to self-care management.

Method

This study was a cross-sectional study conducted at a public health clinic in Selangor, Malaysia, between August and October 2019. This clinic provides primary care service to 150,000 people of the surrounding communities. About 5,638 patients with T2DM are followed up by a dedicated team trained to provide personalized and comprehensive diabetes care. Based on the registry in 2018, the total number of male patients with T2DM was 2,352.

Participants for this study were men with T2DM, who came for their clinical visit during the data collection period (one day in a week) and claimed not to have ED. Those who answered "No" to the question: "Do you think you have erection problem?" were invited to participate in this study. Those with self-perception of having ED were not included in this study, because it was not logical to evaluate their risk as they have already perceived having ED. The exclusion criteria were patients who required urgent treatment during their clinic visit and those who could not read English or Bahasa Malaysia.

This study used a bilingual self-administered questionnaire, which consisted of four sections (A-D) and a clinical data collection sheet. The participants took about 10–15 minutes to complete the questionnaire. Section A assessed participant sociodemographic data such as age, ethnicity, education level, employment status, and total monthly household income. Section B assessed risk perception for developing ED, which comprises two domains: (1) perceived susceptibility of ED (1 item) and (2) perceived severity of ED (3 items). Section C assessed participant knowledge of the risk factors of ED (12 items). Section D assessed their erectile function using the International Index of Erectile Function-5 items questionnaire (IIEF-5©). The clinical data collection sheet captured data on participant weight and height (to calculate body mass index (BMI)), HbA1c and total cholesterol within one year, smoking status, and comorbidities by reviewing their electronic medical records.

The perceived susceptibility of ED was assessed with the question, "What do you think your chances of getting erectile dysfunction within five years from now?". The response was from the options of the five-point Likert scale and the corresponding scores were "no chance"= 1, "slight chance"= 2, "moderate chance"= 3, "high chance"= 4, and "very high chance"= 5. The higher the score, the higher the perceived susceptibility. Meanwhile, the perceived severity of ED was measured through agreement to three statements: (1) "I think that ED is a severe problem", (2) "Compared to other illness, erectile dysfunction is a minor problem", (3) "Erectile dysfunction gives serious impact on me". These items had five-point Likert scale responses, ranging from "strongly disagree (score of 1) to "strongly agree" (score of 5). Question two was reversely scored. The total score for the perceived severity of ED ranged between 3 and 15. The higher the score, the higher the perceived severity of ED.

Participant knowledge of ED risk factors was measured through 12 items with "yes", "no", or "do not know" answers. A score of 1 was given for a correct answer and 0 for an incorrect or "do not know" answer. The total score ranged between 0 and 12. The higher the score, the higher the knowledge.

All the items for sections B and C were developed based on literature review,[12-15] HBM,[8] and discussions with a family physician. The questionnaire's content validation was tested by a panel of experts consisting of two family physicians with a particular interest in men's health and one clinical psychologist. Subsequently, face validation was conducted on ten male patients of different ethnicities, educational backgrounds, and comorbidities. Construct validity and internal consistency were tested among 49 men with T2DM from June to August 2019 at a university-based primary care clinic. Exploratory factor analysis was performed for all four risk perception items for developing ED (section B) using Principal Axis Factoring with Direct Oblimin rotation. The analysis revealed only one construct, in which Item 1, Item 2, and

Item 3 assessed the perceived severity of ED had a loading factor of 0.58, 0.52, and 0.73, respectively. However, the item that assessed the perceived susceptibility of ED had a loading factor of 0.26. Due to this, two domains of risk perception were measured independently: (1) the perceived susceptibility with one item and (2) the perceived severity with three items. The Cronbach's α for the section assessing perceived severity of ED and the knowledge section was 0.64 and 0.67.

The IIEF-5© questionnaire is a copyrighted tool by Pfizer Inc. to assess erectile function within the past four weeks. It comprises five items with 5- and 6-point Likert scale responses. A score of 0–5 was awarded to each item with the total score ranging between 1 and 25. The total score can be categorized into (1) No ED (score 22–25), (2) Mild ED (score 17–21), (3) Mild to Moderate ED (score 12–16), (4) Moderate ED (score 8–11), and (5) Severe ED (score 1–7). In this study, ED's presence was defined as men with mild to severe ED (IIEF-5© scores of 1–21). Permission to use the IIEF-5© was obtained from Pfizer Inc. Previous studies have demonstrated the accuracy of the IIEF-5© in diagnosing ED compared to the self-reported claims of the sufferers.[16,17]

The sample size was calculated using a one-mean formula, as the dependent variables (perceived susceptibility and perceived severity) were continuous data. Authors estimated the sample size based on assumed mean sum score and standard deviation of perceived susceptibility of 2.61 and 1.2, respectively, and for perceived susceptibility of 9.71 and 2.8, respectively. The calculated sample size was 154. Authors recruited 184 participants to account for 20% of incomplete data.

Data analysis was performed using statistical software. Since all continuous variables were not normally distributed, the data were presented in the median and inter-quartile range (IQR). Categorical variables were described in frequency (n) and percentage (%). The dependent variables were the perceived susceptibility and the perceived severity of ED. The associations between these dependent variables and the independent variables were examined using simple linear regression. The independent variables were age, ethnicity, educational level, employment status, monthly household income, smoking status, presence of hypertension, presence of dyslipidemia, total cholesterol, BMI, HbA1c, presence of ED based on IIEF-5©, and knowledge score. The independent variables with clinical significance or a p-value of < 0.25 from the bivariate analysis were selected into multiple linear regression analysis to determine their independent association with the dependent variables. Dummy tables were created for categorical independent variables. The significance level was set at p-value < 0.05.

Approval to conduct the study was obtained from the Medical Research and Ethics Committee (MREC) of the Ministry of Health Malaysia (NMRR-18-3896-45035) and the Research Ethics Committee of Universiti Kebangsaan Malaysia (UKM FF-2019-146). Permission was obtained from the Selangor Director of Health and Family Medicine Specialist in charge of the clinic. The participants were required to sign an informed consent before participating in the study. Their anonymity was maintained throughout the research process. All patients with ED, either through self-reporting during the eligibility screening or identification using the IIEF-5© questionnaire, were briefly counseled about the availability of treatment and were referred to the treating team if the participants agreed.

Results

A total of 195 male patients with T2DM were screened for study eligibility. Ultimately, 184 consented patients who did not perceive to have ED were recruited for this study. However, four participants were excluded from the analysis, because they did not have HbA1c taken within the past year, which left only 180 participants for the analysis. The response rate was 97.8%.

Table 1 shows the sociodemographic and clinical characteristics of the participants. The median (IQR) age of the participants was 58.0 (14.0) years. The proportions of Malay (41%) and Chinese (40%) were similar. The remaining participants were Indian (18.9%). Less than two-thirds attained secondary education (61%) or were employed (58%). The median (IQR) total monthly household income was RM 2,000 (2675.0), which was considered a low-class income. Besides diabetes, most of them also had hypertension (91%) or hypercholesterolemia (90%). The median (IQR) HbA1c and total cholesterol levels were 7.2% (2.3%) and 4.7 (1.7) mmol/L. About 87.3% were overweight or obese and only 27% were smokers. Even though all the participants claimed not having ED, 43.9% (79/180) had ED when assessed using IIEF-5© (Table 1). Among those who had ED, 40.5% (32/79) had moderate to severe ED.

About half of the participants (51.7%) perceived having no chance of getting ED within five years, whereas 19.4% perceived their chance was slight (Figure 1). The median (IQR) score for perceived susceptibility was 1.0 (2.0), which indicates a slight chance of getting ED. The median (IQR) score for the perceived severity of ED was 10.0 (6.0), which indicates a higher than "neutral" perception of ED severity. There was no relationship between perceived susceptibility and perceived severity (Spearman's rho correlation: -0.008, p-value = 0.292).

The median (IQR) of the total score for knowledge on ED risk factors was 9.0 (4.0). Most of the participants could correctly identify the risk factors of ED (Figure 2). However, the five least recognized risk factors were high cholesterol levels (43.9%), heart problems (41.7%), al-

Table 1. Sociodemographic and Clinical Characteristics of the Participants (N = 180)

Variable	Category	n (%)	Median (IQR)
Age (years)*			58.0 (14.0)
Ethnicity	Malay	74 (41.1)	
	Chinese	72 (40.0)	
	Indian	34 (18.9)	
Education level	No/primary	32 (17.8)	
	Secondary	110 (61.1)	
	Tertiary	38 (21.1)	
Employment status	Unemployed	76 (42.2)	
	Employed	104 (57.8)	
Monthly household income (RM)*			2,000.0 (2,675.0)
Smoking status	Non-smoker/former	131 (72.8)	
	Active smoker	49 (27.2)	
Comorbidities	Hypertension	165 (91.7)	
	Hypercholesterolemia	163 (90.6)	
	Ischemic heart disease	2 (1.1)	
	Stroke	1 (0.6)	
HbA1c (%)*			7.2 (2.3)
Total cholesterol (mmol/L)*			4.7 (1.7)
BMI (kg/m²)*			27.5 (6.8)
BMI classification	Underweight/normal (BMI < 22.9)	23 (12.8)	
	Overweight (BMI 23–27.4)		66 (36.7)
	Obese (BMI ≥ 27.5)	91 (50.6)	
IIEF-5 score*			23.0 (9.0)
Presence of ED (based on IIEF-5)	No ED	101 (56.1)	
	Have ED	79 (43.9)	

Notes: IQR = Inter-quartilie Range; RM = Ringgit Malaysia; BMI = Body Mass Index; ED = Erectile Dysfunction; *All continuous data were not normally distributed.

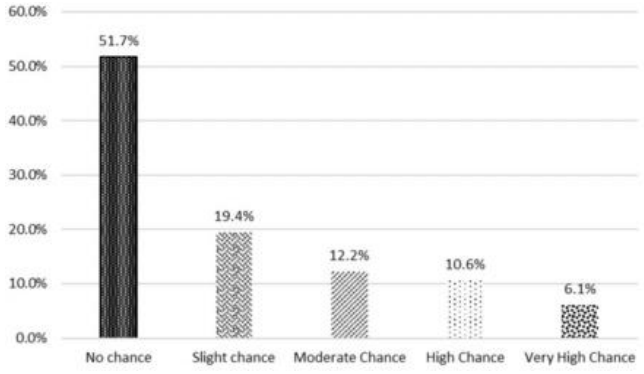
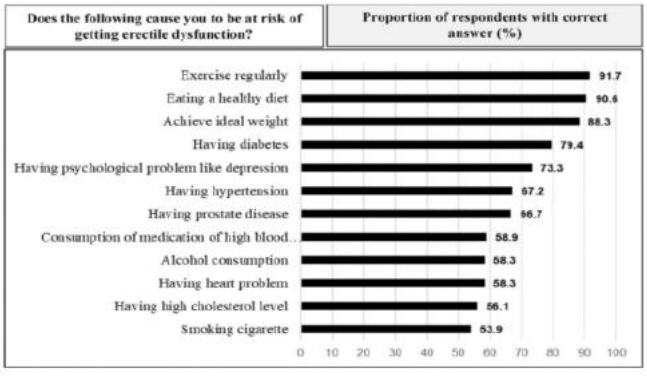


Figure 1. Participants' Perceived Susceptibility to Have Erectile Dysfunction (N = 180)



Total knowledge score: 12, Median: 9, Midpoint: 6

Figure 2. Participant Knowledge of Risk Factor of Erectile Dysfunction

cohol (41.7%), smoking cigarettes (46.1%), and anti-hypertension medications (41.1%).

Independent variables with clinical significance or a p-value of < 0.25 identified using SLR were included in MLR to determine factors that significantly influenced perceived susceptibility or perceived severity of ED. For perceived susceptibility of ED, the variables were age, educational level, and presence of ED, whereas, for the perceived severity of ED, the variables were age, ethnicity, educational level, employment status, BMI, presence of actual ED, and knowledge of ED risk factors (Table 2). Only educational level (secondary education vs. no or primary education: p-value = 0.045; tertiary education vs. no or primary education: p-value = 0.022) and presence of ED (p-value < 0.001) were found to be significantly associated with perceived susceptibility of ED (Table 3). Those who attained secondary education or tertiary education had a significantly higher perceived susceptibility score than those who had no education or primary education by 0.19 and 0.21, respectively. Similarly, participants with ED had significantly higher perceived susceptibility score by 0.30 compared to those who had no ED. For perceived severity of ED, the significant independent factors were ethnicity (Chinese vs. Malay: p-value < 0.001 and Indian vs. Malay: p-value < 0.001), employed (p-value = 0.026), and knowledge

Table 2. Factors Associated with Perceived Susceptibility and Perceived Severity of Erectile Dysfunction (N = 180)

Variable	Perceived Susceptibility			Perceived Severity		
	Standardized β	95% CI	p-value*	Standardized β	95% CI	p-value*
Age (years)	0.14	-0.01, 0.04	0.068	-0.28	-0.14, -0.05	< 0.001
Malay	1			1		
Chinese	-0.04	-0.51, 0.32	0.651	-0.41	-3.58, -1.72	< 0.001
Indian	-0.01	-0.53, 0.51	0.967	-0.42	-4.54, -2.20	< 0.001
No/primary education	1			1		
Secondary education	0.21	0.05, 1.05	0.031	0.23	0.24, 2.73	0.020
Tertiary education	0.20	0.03, 1.22	0.040	0.21	0.14, 3.12	0.032
Unemployed	1			1		
Employed	-0.07	-0.56, 0.20	0.344	0.23	0.54, 2.39	0.002
Monthly household income (RM)	0.05	0.00, 0.00	0.543	0.14	0.00, 0.00	0.063
Non/former smoker	1			1		
Active smoker	-0.05	-0.56, 0.28	0.512	0.02	-0.92, 1.20	0.794
No hypertension	1			1		
Hypertension	0.05	-0.46, 0.90	0.527	-0.03	-2.06, 1.34	0.678
No hypercholesterolemia	1			1		
Hypercholesterolemia	0.06	-0.38, 0.90	0.425	0.02	-1.35, 1.86	0.752
Total cholesterol (mmol/L)	0.08	-0.07, 0.23	0.279	-0.05	-0.51, 0.24	0.484
Body mass index (kg/m²)	-0.01	-0.04, 0.03	0.875	0.15	0.01, 0.16	0.047
HbA1c (%)	0.02	-0.09, 0.12	0.772	0.13	-0.03, 0.47	0.089
No erectile dysfunction (based on IIEF-5)	1			1		
Presence of erectile dysfunction	0.32	0.45, 1.17	< 0.001	-0.18	-2.11, -0.25	0.013
Knowledge score	0.07	-0.04, 0.10	0.346	0.39	0.30, 0.61	< 0.001

Notes: *Significance: p-value < 0.05; CI = Confidence Interval; RM = Ringgit Malaysia

Table 3. Multiple Linear Regression: Factors Associated with Perceived Susceptibility and Perceived Severity of Erectile Dysfunction

Variable	Perceived Susceptibility[a]			Perceived Severity[b]		
	Standardized β	95% CI	p-value*	Standardized β	95% CI	p-value*
Age (years)	0.09	-0.01, 0.03	0.236	-0.11	-0.09, 0.01	0.151
Malay				1		
Chinese				-0.32	-2.98, -1.14	< 0.001
Indian				-0.31	-3.70, -1.36	< 0.001
No/primary education	1			1		
Secondary education	0.19	0.01, 0.97	0.045	0.08	-0.56 1.60	0.345
Tertiary education	0.21	0.10, 1.23	0.022	0.05	-1.01, 1.83	0.568
Unemployed				1		
Employed				0.17	0.14, 2.10	0.026
Monthly household income (RM)				-0.03	0.00, 0.00	0.663
Body mass index (kg/m²)				0.04	-0.05, 0.10	0.516
HbA1c (%)				0.10	-0.05, 0.38	0.128
No erectile dysfunction (based on IIEF-5)	1			1		
Presence of actual erectile dysfunction	0.30	0.39, 1.13	< 0.001	-0.10	-1.49, 0.16	0.114
Knowledge score				0.27	0.16, 0.47	< 0.001

Notes: *Significance: p-value < 0.05; CI = Confidence Interval; RM = Ringgit Malaysia

[a] Variables included in multiple linear regression (MLR) for perceived susceptibility: Age, Education, Presence of actual erectile dysfunction (ED); R^2 for perceived susceptibility: 0.135; MLR using enter method

[b]Variables included in MLR for perceived severity: Age, Ethnicity, Education, Employment status, Monthly household income, BMI, HbA1c, Presence of actual ED, Knowledge score; R2 for perceived severity: 0.377; MLR using enter method.

score (p-value < 0.001) (Table 3). Chinese and Indians had lower perceived severity scores compared to Malay by 0.32 and 0.31, respectively. Employed men had a higher perceived severity score by 0.17 compared with unemployed. For every increment of 1 score in knowledge, there was an increase in perceived severity score by 0.27.

Discussion

In this study, assessing perceived susceptibility and perceived severity of ED among men with T2DM could explain how these patients appreciated their risk to develop ED. Participants in this study were mainly middle-aged Malay and Chinese men with secondary education and low socioeconomic classes. Apart from having T2DM as a risk factor of ED, many had other risk factors,

including hypertension, dyslipidemia, and overweight or obesity.

It is found that 43.9% of the participants did not seem aware of their ED condition. In fact, many reported that they did not have ED but had moderate to severe ED. A similar discrepancy between self-reported ED and the presence of ED assessed using IIEF-5 was observed in a local study.[18] These findings suggest under-reporting of ED by the participants, which can be due to socially-biased responses when asked by the investigator about erection problems during eligibility screening. They could also underestimate the ED symptoms they experienced and did not consider themselves as having ED to preserve their masculine image.[19,20] Misunderstandings about ED as a total loss of response and inability to perform a sexual activity could make them feel that they did not have ED, especially if they were still able to initiate sex.[4,21] There was a possibility that these men might have confused ED with other types of male sexual dysfunction, namely premature or retrograde ejaculation.

According to the HBM, people should feel susceptible to certain diseases by evaluating their susceptibility to contracting the disease and understanding the negative consequences. If they perceive susceptibility to and the severity of the disease, they could appreciate the risk and, thus, feel threatened and vulnerable. Generally, many participants had an inaccurate perception of susceptibility, as 71.1% had no or slight perception of susceptibility. The median score for perceived susceptibility was only 1.0, equivalent to a slight chance of getting ED. However, their perception of ED severity was moderate. It appears that they were aware of the severity and the impacts of ED, but felt less vulnerable to suffering from ED, which was contrary to our hypothesis. Insufficient appreciation of vulnerability could be due to their optimistic bias or unrealistic optimism, which is a positive belief of being less likely to experience health risks.[22] Men tend to underestimate their risk of having ED and ignore its importance to maintain their masculine and macho identities as having ED is often portrayed as being weak.[19,20] This unrealistic optimism is quite worrying because it might lead to poor health-seeking behavior.[23] The unique relationship between perceived susceptibility and perceived severity of ED in this study, which was shown to be non-significant, may also indicate the representation of different concepts with what is conceptualized by the HBM. This complex relationship was also demonstrated by El-Toukhy, *et al.*[24]

The moderate level of perceived severity of ED in the participants was consistent with other local studies,[12,19] which highlight that men with T2DM realized the seriousness of ED. They appreciated its negative impact on QOL and on the relationship with their partner.[12,19] Nevertheless, no previous study assessed the perception of susceptibility to develop ED among patients with T2DM; therefore, it is difficult to compare and interpret the significance of our findings. There was a nearly similar study, but it was conducted among different populations, e.g., patients with localized prostate cancer.[25] The study assessed the risk perception to develop ED due to various prostate cancer treatments. An inaccurate perception of susceptibility was found to be expected, which was thought to be due to the lack of information provided during counseling.[25]

Since most of the participants could correctly recognize most of the risk factors of ED and their average total score was above the midpoint of the range score, their knowledge could generally be regarded as acceptable. The knowledge of ED risk factors was significantly associated with participant perception of ED severity, emphasizing the importance of knowledge in influencing one's risk perception. Our study's acceptable level of knowledge was similar to local research, but different from overseas studies conducted in Switzerland and Poland.[12,26,27] In the Swiss study, about half of their participants could not name even one single risk factor of ED,[26] whereas the study in Poland showed that two-fifths of high-risk male patients were unable to name any modifiable risk factors for ED, including smoking, diabetes, hyperlipidemia, hypertension, obesity, and physical inactivity.[27] Only 6% could list all six of the risk factors correctly.[27] Good knowledge among these high-risk patients could be due to health education provided by healthcare providers.[12] In the era of the internet, the patients might have been exposed to ED information from various social media and websites.[26] Level of education may also influence their knowledge and appreciation of risk. In this study, those with higher education were significantly associated with a higher level of perceived susceptibility, which further emphasized the role of intellect in appreciating risk. Nevertheless, our study also demonstrated the gaps in knowledge among participants that need to be addressed during counseling on ED risk factors: smoking, alcohol, anti-hypertensive medications, heart disease, and high cholesterol.

Compared to those who did not have ED assessed using IIEF-5©, the participants who actually had ED perceived higher susceptibility to getting ED in the next five years. With the presence of symptoms, they could appreciate their vulnerability, but the experience might not be enough to make them aware of their ED. These findings suggest that they may have under-recognized or underestimated the symptoms that they experienced. Men might normalize the condition as part of the aging process.[19] This normalization was observed in a study conducted in the United Kingdom, US, France, Germany, Italy, and Spain, which revealed that men with ED did not seek treatment as they believed ED is a normal part of the ag-

ing process.[28] Another explanation could be due to hegemonic masculinity identity demonstrated by men, in which they denied ED symptoms as it implies weakness.[22]

As suggested by our findings, the perception of ED severity may also be influenced by culture, which is in line with Low, *et al.*,[4] in demonstrating differences in ethnicity perception. In the study, Malays regarded ED as an illness and felt that the impacts of ED on their relationship with their spouse were significant, and were thus motivated to seek treatment. However, Chinese and Indian perceptions of ED imply that ED was a less severe problem. The Chinese believed that psychological problems, low self-esteem, and anxiety were the cause of ED, and they tended to be more accepting if it was due to aging. Indians attributed ED to fate and experienced less impact on their relationship.

To date, this study was among the initial studies conducted in Malaysia that examined risk perception of ED among men with T2DM using both domains of risk perception, e.g., perceived susceptibility and perceived severity. Therefore, this study's findings could reveal the complex connection between perceived severity and perceived susceptibility to informing one's risk perception. The findings also highlight the importance of knowledge on the risk factor of ED, thus education should be provided on risk factors. This study identifies the under-recognition or underestimation of ED symptoms. Therefore, men with T2DM should be educated on the symptoms of ED to ensure good health-seeking behavior. The findings could also provide essential information for future studies.

The present study had several limitations. First, the recruitment of men who did not perceive having ED was made through a single direct question: "Do you think you have erection problem?". This question could result in social desirability biased responses, which may have led to imprecision in recruiting of the sample population. This effect could be minimized by using a self-administered screening tool. Secondly, the convenience sampling of this study limits the generalization of the findings due to selection bias. Probabilistic sampling should be considered for upcoming research. Thirdly, this study used one item to assess ED's perceived susceptibility, reducing the item's ability to capture and fully represent the construct. Future studies should develop a tool with multiple items that can validly assess perceived susceptibility. Fourthly, a self-administered questionnaire could lead to response bias and recall bias, which might influence findings' accuracy.

Conclusion

Generally, many men with T2DM who claimed to have no ED had an inaccurate perception of susceptibility to develop ED in five years. Besides, their perception of ED severity was only moderate. These findings imply poor risk perception among them, which was significantly influenced by cultural and socioeconomic factors, education attainment, knowledge on ED risk factors, and presence of ED symptoms. Under-recognition or underestimation of ED symptoms was observed as many did experience moderate to severe ED symptoms.

Recommendation

Thus, risk perception of ED among men with T2DM should be assessed in a clinical setting to identify their misperception. Appropriate counseling and education should also be provided to improve their risk perception. Future studies should consider both domains of risk perception of ED (perceived susceptibility and perceived severity) in other populations to improve our understandings of the complex interactions between the two domains informing one's risk perception.

Abbreviations

ED: Erectile dysfunction; T2DM: Type 2 diabetes mellitus; HBM: Health Belief Model; QOL: Quality of Life; IIEF-5©: International Index of Erectile Function-5 items questionnaire; BMI: Body mass index; MLR: Multiple logistic regression; IQR: Inter-quartile range.

Ethics Approval and Consent to Participate

Approval to conduct the study was obtained from the Medical Research and Ethics Committee (MREC) of the Ministry of Health Malaysia (NMRR-18-3896-45035) and the Research Ethics Committee of Universiti Kebangsaan Malaysia (UKM FF-2019-146).

Competing Interest

The author declares that there is no significant competing financial, professional, or personal interest that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

Data and materials of this study can be obtained upon request.

Authors' Contribution

AM: designed, developed the study tool, collected and analyzed data, prepared the manuscript; HT: designed, developed the study tool, analyzed data, prepared the manuscript, revised the manuscript; SA: developed the study tool, reviewed and revised the manuscript; SFT: reviewed and revised the manuscript; MA: reviewed and revised the manuscript. All authors reviewed and approved the final manuscript.

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Determinants of Exclusive Breastfeeding Practices of Female Healthcare Workers in Jakarta, Indonesia

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Abstract

The World Health Organization in 2019 recommended that mothers worldwide exclusively breastfeed their infants for the child's first six months to achieve optimal growth, development, and health. Indonesia had not fulfilled the global standard of breastfeeding rate, so that there was low coverage of exclusive breastfeeding in East Jakarta, especially for female health care workers. This study aimed to determine the factors associated with exclusive breastfeeding practices of health care workers. This study was a quantitative study using a cross-sectional design. The recruited sample consisted of 85 female primary healthcare workers with infants aged 6-24 months. Data were collected using self-administered questionnaires. Logistic regression analysis was applied to identify factors associated with exclusive breastfeeding. The results showed that the proportion of exclusive breastfeeding was 54.1%. Variables associated with exclusive breastfeeding were knowledge, attitude, family support, co-worker support, and healthcare worker support. Multivariate analysis showed that knowledge and age were the dominant factors of exclusive breastfeeding practices with an odds ratio (OR) adjusted OR of 14 and 5, respectively. Knowledge was an influential factor in the success of exclusive breastfeeding. Therefore, creating a training program related to breastfeeding would be expected to improve knowledge. Besides, a supportive policy such as providing breastfeeding facilities was needed.

Keywords: exclusive breastfeeding, female healthcare worker, knowledge, support

Introduction

The health status of a country can be determined from the maternal mortality rate (MMR) and infant mortality rate (IMR). The main causes of infant mortality are respiratory infection and diarrhea. According to World Health Organization (WHO) data, 53% of acute pneumonia and 55% of infant deaths are due to diarrhea caused by poor nutrition during the first six months of life (not exclusive breastfeeding/suboptimal breastfeeding).[1]

One of the efforts to reduce IMR is through the promotion of exclusive breastfeeding.[2] Indonesia has committed to implement such a program. Various policies have been ratified to support exclusive breastfeeding programs, including Law No. 33 of 2012 concerning Exclusive Breastfeeding, Government Regulation Number 3 of 2010 concerning the Application of Ten Steps to Breastfeeding Success, and Government Regulation No. 15 of 2014 concerning Administrative Sanctions for Healthcare Personnel Inhibiting the Success of Exclusive Breastfeeding.[3] Basic Health Research in 2018 showed that the exclusive breastfeeding rate in Indonesia up to six months was only 41%.[4] This figure is still far from the national coverage target of 75%. Based on data from the 2012 World Breastfeeding Trend Initiative on breastfeeding conditions, Indonesia ranked 49th of 51 countries with a breastfeeding rate of only 27.5%.[5]

Working mothers is one of the causes of exclusive breastfeeding failure.[6,7] Basic Health Research in 2013 showed that 89.6% of working mothers in Indonesia gave prelacteal feeds to their babies.[8] Low coverage of exclusive breastfeeding in East Jakarta (28%) was found especially among healthcare workers (50%).[9] A study conducted in Ethiopia among 178 healthcare workers (doctors, nurses, and midwives) showed that only 35.9% of respondents practiced exclusive breastfeeding,[10] while equivalent study in Nigeria among 626 doctors showed that only 11% practiced exclusive breastfeeding.[11]

World Health Organization (WHO) recommends mothers worldwide to exclusively breastfeed infants for the child's first six months to achieve optimal growth,

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development, and health.[12] Thereafter, they should be given nutritious complementary foods and continue breastfeeding up to the age of two years or beyond. Factors inhibiting breastfeeding success are categorized as internal and external. Internal factors include a lack of knowledge about lactation management, the benefits of breastfeeding, and the negative impact of not breastfeeding. External factors are related to everything that does not need to happen if the internal factors are met.[13] This correlates with the low coverage of breastfeeding in East Jakarta, which impacts on underweight children, which is 13.8% and malnutrition is 2.92%.[9]

Preliminary studies conducted by Mehkari S, *et al.,*[14] showed that among four healthcare workers in Karachi-Pakistan, only one was practicing exclusive breastfeeding. Several inhibiting factors were lack of knowledge of lactation management, mothers' nipple and breast pain, low breast milk supply, attitude towards breastfeeding, and confidence. The success of healthcare workers in providing exclusive breastfeeding is very important because it plays an important role in promoting and supporting the implementation of exclusive breastfeeding. One of the success factors is influenced by knowledge, and personal experience referred to as learning by experience.[14] The low coverage of breastfeeding among healthcare workers in particular correlates with underweight (below the red line). The incidence of severe malnutrition in Jakarta, according to authors, is very important to study because healthcare workers play a key role in the promotion and support for exclusive breastfeeding. The study aims to determine the factors related to exclusive breastfeeding behavior among healthcare workers at the primary health care throughout East Jakarta.

Method

This observational study was conducted using the correlational method. The study design was cross-sectional and the data collection technique was total sampling. The study population included all female health workers who had babies ages 6–24 months. The sample of 85 female healthcare workers was drawn from the total population. The inclusion criteria were not taking pregnancy leave and agreeing to participate in this study (by providing written informed consent). The exclusion criteria were healthcare workers who had delivered severely ill or stillborn babies, had twins, or were on leave, study. The respondents comprised female physicians, dentists, nurses, midwives, nutritionists, pharmacists, public health experts/environmental health experts, and laboratory analysts.

Data collection occurred from April to May 2015 in 10 primary health care in East Jakarta. Data collection used a structured questionnaire consisting of the determinant variable of exclusive breastfeeding (predisposing, enabling, and reinforcing factors). Predisposing factors consist of several variables. Age at-risk categories were 20–35 years, risk-free categories were 20 to 35 years, parity in good multipara categories (women who have given birth more than once), poor categories of primipara (women who have given birth once), types of labor were vaginal delivery and cesarean section, supportive knowledge was "good", the supportive attitude was positive. Enabling factors consisted of the availability of good facilities and had followed lactation management. Reinforcing factors were the support of family, superiors, friends, and health workers.

The data collected was then inputted and cleaned, so that they could be analyzed. These variables were univariate, bivariate, and multivariate. Univariate analysis was done for each variable with the proportional results of each. Bivariate analysis with chi-square with the results whether there was a relationship between each independent variable and the dependent variable if the p-value was less than 0.05 was considered to statistical significance. Multiple logistic regressions with backward determinant modeling found significant determinant factors. All independent variables had the same position since no independent variables were considered as the main variable. The principle of modeling was to produce a significant, valid, and parsimonious model. There are five steps in backward stepwise regression. Step one was identifying potential covariates; step two was analyzing each covariate on the dependent variable where p-value < 0.25 entered into the logistic regression model; step three was getting the model to eliminate the independent variable starting from the variable with the highest p-value, the confounder was considered if there was a change of 10% or more odds ratio (OR); step four the confounding remained in the model. The final step was finding the significant determinant factor.

Results

Table 1 showed that the proportion of respondents who provided exclusive breastfeeding was 54.1%. Predisposing factors related to exclusive breastfeeding were knowledge and attitude. The enabling factor was the availability of facilities. The reinforcing factor was family supports, colleague supports, and health worker supports.

The knowledge questions on Table 2 showed that almost all respondents knew of exclusive breastfeeding. Only two questions receive incorrect answers, namely "Reducing the risk of osteoporosis" (25.9%) and "How long can breast milk sit out at room temperature?" (47.1%).

The logistic regression results (Table 3) showed that the determinants for providing exclusive breastfeeding were maternal knowledge and age. The dominant factors

Table 1. Predisposing, Enabling, and Reinforcing Factors for Exclusive Breastfeeding among Female Healthcare Workers

Variable	Category	Total (N = 85)	Non-Exclusive Breastfeeding (N = 39)	Exclusive Breastfeeding (N = 46)	p-value	OR (95% CI)
Predisposing						
Age (year)	< 20 or > 35	22	59.1	40.9	0.232	2.1 (0.7 – 5.5)
	20–35	63	41.3	58.7		
Parity good	Primipara	48	50.0	50.0	0.517	1.5 (0.6 – 3.4)
	Multipara	37	40.5	59.5		
Types of labor	Cesarean section	51	49.0	51.0	0.625	1.4 (0.5 – 3.2)
	Vaginal delivery	34	41.2	58.8		
Knowledge	Good enough	37	78.4	21.6	0.001*	13.8 (4.8 – 39.3)
	Good	48	20.8	79.2		
Attitude	Negative	39	59.0	41.0	0.044*	2.7 (1.1 – 6.5)
	Positive	46	34.8	65.2		
Enabling						
Availability of facilities	No	11	73.1	26.9	0.002*	5.3 (1.9 – 14.7)
	Yes	74	33.9	66.1		
Lactation management training	Never	51	46.8	53.2	0.899	1.5 (0.3 – 6.5)
	Ever	34	37.5	62.5		
Reinforcing						
Family supports	No	23	78.3	21.7	0.001*	7.0 (2.3 – 21.6)
	Yes	62	33.9	66.1		
Supervisor supports	No	20	65.0	35.0	0.088	2.8 (0.9 – 7.9)
	Yes	65	40.0	60.0		
Colleague supports	No	34	61.8	38.2	0.029*	2.9 (1.2 – 7.3)
	Yes	51	35.3	64.7		
Health worker supports	No	29	65.5	34.5	0.017*	3.4 (1.3 – 8.7)
	Yes	56	35.7	64.3		

Notes: OR: Odd Ratio; CI: Confidence Interval; *Variables that were significantly related, p-value < 0.05

Table 2. Distribution of Respondents According to Mothers' Knowledge of Correct Answers about Exclusive Breastfeeding

Knowledge	Correct	
	N	%
Definition of exclusive breastfeeding	84	98.8
Actions are taken when breast milk has not come out	84	98.8
Factors affecting breast milk production		
- Mother's psychological condition	79	92.9
- Mother's diet	80	94.1
- Family/husband support	66	77.6
Benefits of breastfeeding for mother		
- Reducing the risk of breast cancer	72	84.7
- Reducing the risk of osteoporosis	22	25.9
- Bonding and attachment with babies	81	95.3
- Saving on household expenses	78	91.8
How long breast milk can sit out at room temperature	40	47.1
When lactation management be started	62	72.9
The cause of failure to do exclusive breastfeeding	68	80.0
Risks of feeding baby solid food too soon		
- Indigestion	48	56.5
- Increasing the chance the baby will get sick	79	92.9
Risks of introducing solids too late		
- Babies may do not get the nutrients they need	74	87.1
- Risk of malnutrition	46	54.1

related to the exclusive breastfeeding practices were also knowledge and age. Female healthcare workers with good knowledge had a 15 times greater likelihood of providing exclusive breastfeeding than those with less knowledge. After controlling for the availability of facilities, family support, colleague support, and healthcare workers supports variables, mothers aged 20–35 years had five times more likelihood of providing exclusive breastfeeding than those aged < 20 years or > 35 years.

Based on the results of thequantitative study, it was found that 40.9% of respondents provided exclusive breastfeeding and 59.1% did not. These results only il-

Table 3. Multivariate Analysis of Exclusive Breastfeeding Practices among Female Healthcare Workers

Variable	β	p-value	Adjusted Odds Ratio	Confident Interval (95%)
Age 20–35 years	1.601	0.035	4.9	1.1 – 21.9
Good knowledge	2.699	0.000	14.8	4.0 – 54.4
Have available facilities	1.015	0.177	2.7	0.6 – 12.1
Have family support	1.026	0.230	2.7	0.5 – 14.9
Have colleague support	0.373	0.600	1.4	0.4 – 5.8
Have health worker support	0.541	0.443	1.7	0.4 – 6.8

lustrated the percentage of exclusive breastfeeding for healthcare workers and more excavations were carried out for reasons that give exclusive breastfeeding.

The result revealed that respondents who did not breastfeed because of abrasions while breastfeeding had a little of breast milk, such that they felt that it was not enough for the baby. Respondents who managed to give exclusive breast milk said that it was very important for babies. Most of all, it represented a strong commitment to continue to provide exclusive breastfeeding, so it could be concluded that the success of breastfeeding for women healthcare workers influenced not only the knowledge factor but also the presence of a strong commitment factor.

Discussion

This study showed that the exclusive breastfeeding rate among female healthcare workers in primary health care throughout East Jakarta in April-May 2015 was 54.1%. This result was higher than the rates based on the Basic Health Research in 2013 (30.2%),[8] and the exclusive breastfeeding coverage throughout East Jakarta (28.0%).[9] However, these rates should be higher because the respondents were healthcare workers who should have better knowledge than people who were not in the health care profession. This difficulty of nurses and midwives to successfully practice exclusive breastfeeding may impair their ability and effectiveness in promoting breastfeeding.[14]

The present study continued to find out the reason(s) health care workers did not give exclusive breastfeeding. A previous study by Akodu, *et al.*,[15] demonstrated that 35% of mothers stopped breastfeeding several weeks postpartum because they felt their breast milk was deficient and the baby was dissatisfied. So the type of fluid given to the babies before breast milk secreted were formula milk (11.7%) and dextrose (1.2%). Authors have similarly mentioned in the study that bottle feeding was practiced by 77.4% of health professionals; however, only 21.9%,[16] was due to bottle feeding-related hazards. Diarrhea, vomiting, and acute respiratory infection (ARI) were the commonly identified illnesses found among the children on bottle feed, as concluded from their results that bottle feeding was mostly practiced by educated mothers, where healthcare providers, despite their education and awareness, were practicing bottle feeding. Respiratory infections were identified as the important risks associated with bottle feeding, and that it was the leading cause of malnourishment among children.

To support the success of breastfeeding in working women, the Ministry of Manpower's regulation, Article 83 of Law No. 13 of 2003, those female employees who are still breastfeeding are allowed to breastfeed or at least pump breast milk during working hours.[17] Companies are also encouraged to have a proper nursing room. Besides, the Regulation of the Minister of Health of the Republic of Indonesia Number 15 of 2013 concerning Procedures for Providing Special Facilities for Breastfeeding and/or Pumping Breast milk.[3]

World Health Organization program entitled Ten Steps to Successful Breastfeeding,[17]: 1. Contains an infant feeding policy that is routinely communicated to staff and parents. Establishes ongoing monitoring and data-management systems; 2. Ensures that staff have sufficient knowledge, competence, and skills to support breastfeeding; 3. Discusses the importance and management of breastfeeding with pregnant women and their families; 4. Facilitates immediate and uninterrupted skin-to-skin contact and encourages mothers to initiate breastfeeding as soon as possible after birth; 5. Supports mothers to initiate and maintain breastfeeding and manage common difficulties; 6. Encourages mothers not to provide breastfed newborns any food or fluids other than breast milk, unless medically indicated; 7. Enables mothers and their infants to remain together and practice rooming-in 24 hours a day; 8. Encourages mothers to recognize and respond to their infants' cues for feeding; 9. Counsels mothers on the use and risks of feeding bottles, teats, and pacifiers; and 10. Coordinates discharge so that parents and their infants have timely access to ongoing support and care. This program is relevan with study by Shandi, *et al.*,[18] demonstrated that mothers with a practicing skin-to-skin contact with early initiation and (rooming-in) were more likely to exclusively breastfeed

(OR = 2.36).

Other findings included bivariate analysis indicated that a mother's age is not significantly associated with exclusive breastfeeding practices. This finding was confirmed in a previous study,[16] while other result showed different findings that age was significantly associated with exclusive breastfeeding.[19] Delivery by cesarean section inhibited breastfeeding. Another study showed that mothers who had had cesarean delivery tended to delay breastfeeding compared to mothers experiencing vaginal delivery.[20] Parity was not significantly associated with exclusive breastfeeding practices. This finding was confirmed in a previous study,[21] while several studies stated that parity was significantly associated with exclusive breastfeeding practices.[22,23] Exclusive breastfeeding associated significantly with a place of delivery and maternal education.[20]

Lactation management training aimed to increase knowledge and to solve problems found while breastfeeding, especially for healthcare workers. This training was valuable because respondents in this study were healthcare workers expected to have better knowledge than the general public. After all, health workers had an important role that should promote, support the implementation of exclusive breastfeeding.[14,26] Lactation management including breastfeeding technique, breastfeeding technology, breastfeeding problem solving, and infant issues.[26] Bivariate analysis showed that lactation management training was not significantly related to exclusive breastfeeding behavior. Based on the quantitative results, only eight respondents (9.4%) attended training related to breastfeeding.

The availability of policy, breastfeeding guidelines, and training for most staff on exclusive breastfeeding contributed to higher exclusive breastfeeding knowledge and counseling skills among health workers.[24,26] This, in turn, might have led to women seeking support for breastfeeding issues immediately after delivery. During these times, healthcare workers also reinforced the idea of exclusive breastfeeding and its importance. This result differed from a previous study.[25]

Mothers needed support to achieve breastfeeding success.[22] Family support would influence the mother's decision to provide exclusive breastfeeding. Family support was significantly related to exclusive breastfeeding practices related to a study in Yogyakarta. Family support was significantly associated with a higher likelihood of mothers practicing exclusive breastfeeding.[23] This result was in line with the previous study that stated that the husband plays an important role in supporting breastfeeding success and increasing breastfeeding rates.[27] Mothers required paternal support because fathers could also help in sourcing information on breastfeeding, provide encouragement and motivation, and involve in decision-making, practical support, and emotional support for breastfeeding. A husband's attitude toward breastfeeding, whether positive or negative, could influence the mother's breastfeeding practices.[27]

Failure of exclusive breastfeeding for female healthcare workers often occured after three months of leave and starting to work. Many experienced a decrease in breast milk production because mothers felt tired at work, causing husbands and families to worry about insufficient breast milk. Finally, the family provided formula milk to the baby.

The multivariate analysis showed that the mother's knowledge and attitude were significantly associated with exclusive breastfeeding behavior. Mothers having good knowledge were 14.8 times more likely to provide exclusive breastfeeding than mothers with good-enough knowledge. This result was similar to study findings from Ethiopia,[28] Nepal,[29] and Tanzania,[25].This impact could be partly explained by mothers' improved knowledge of the benefits of breastfeeding for themselves and their infants, as well as the risks of not breastfeeding, thus improving the likelihood that mothers will breastfeed. Previous studies showed that mothers with good knowledge had 2.6 and 2.7 times the likelihood of providing exclusive breastfeeding than good enough knowledge and negative attitudes, respectively.[28]

Various studies have been conducted in the past covering this topic, but the present study's setting was mothers from healthcare backgrounds who were assessed about their breastfeedings. There were some limitations in this study, especially the sample size, as it was difficult for us to find mothers who fulfilled our inclusion criteria. Others had children of more than ten years of age, which may have caused recall bias. It was also difficult to ask study participants to fill in the forms as they were not interested in sharing their personal experiences. Data were collected through self-administered questionnaires, so there was a chance of subjective bias. Future study avenues to look into this topic were from the study's point of view and highlighted the problem faced by healthcare providers for practicing appropriate breastfeeding and weaning practices.

Conclusion

The description of healthcare workers in East Jakarta who provided exclusive breastfeeding was relatively low (under 50%). Several factors influenced exclusive breastfeeding practices in healthcare workers, including knowledge, attitudes, availability of facilities, family support, support from co-workers, and support from other healthcare workers. Based on the above factors, the most influential factor was mother knowledge.

There was low coverage of exclusive breastfeeding for healthcare workers in East Jakarta, even though authors

know that healthcare workers are role models for the community. If healthcare workers have high success in exclusive breastfeeding and good knowledge, they would likely be more supportive of mothers providing exclusive breastfeeding to their babies. An inhibiting factor is family support, especially husbands and colleagues support. Health inhibiting factors in exclusive breastfeeding is lack of the mothers' commitment, lack of knowledge among family members, and problems in breastfeeding, including limited hours of rest. By contrast, a supporting factor in exclusive breastfeeding was colleagues' support.

Lactation management training makes it possible to improve health knowledge about lactation. This training is very important because good knowledge will greatly influence the success of exclusive breastfeeding. Practicing for themselves and having good knowledge will provide high self-confidence to promote exclusive breastfeeding. Providing ideas for healthcare workers who are still breastfeeding, allowing them to be more flexible in doing tasks, should be considered. Writing policies related to supervisor and colleague support for mothers to provide exclusive breastfeeding should be considered. Enacting "Lactation Breaks" that provide time for breastfeeding or expressing milk 30–60 minutes per day should be considered. Optimizing "exclusive breastfeeding corners" and using them as places to share experiences between healthcare workers who breastfeed and offering rewards to female healthcare workers who successfully provide exclusive breastfeeding should be considered.

Abbreviations

MMR: Maternal Mortality Rate; IMR: Infant Mortality Rate; WHO: World Health Organization; WBTI: World Breastfeeding Trend Initiative; OR: Odd Ratio; CI: Confidence Interval; ARI: Acute Respiratory Infection.

Ethics Approval and Consent to Participate

Informed consent was obtained individually from all respondents. The study was approved by the Health Service Office with a letter-number: 972–1-1.777-11.

Competing Interest

The author declares that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

The authors confirm that the data supporting the finding of this study available within the article and its supplementary materials.

Authors' Contribution

SR conceived the idea, sampling design, and data collection, and analyzed and interpreted the study results. NM performed data collection, critically analyzed and interpreted the study results, drafted the manuscript, and submitted it. B gave his expert opinion in sampling design and critically analyzed the data for important intellectual content. PY gave her input in the manuscript drafting.

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