MEDIA GIZI
Indonesia

Departemen Gizi Kesehatan
Fakultas Kesehatan Masyarakat
Universitas Airlangga

Media Gizi Indonesia (MGI) Media Gizi Indonesia (MGI) / National Nutrition Journal (ISSN International Centre ; p-ISSN 1693-7228 ; e-ISSN 2540-8410) is a scientific journal on nutrition that has been published since 2004. It is periodically published every 4 months, in January, May, and September. MGI also collaborates with Food and Nutrition Society of Indonesia (PERGIZI PANGAN Indonesia). MGI serves as communication media for disseminating information on research results and literature reviews which focus on community nutrition, clinical nutrition, institutional nutrition, food service management, food technology, and current issues on food and nutrition.

INTRODUCTION TO THE EDITOR

Media Gizi Indonesia (MGI) / National Nutrition Journal is a scientific journal published regularly every 4 months that provides articles regarding the research and the development of nutrition knowledge including community nutrition, clinical nutrition, institutional nutrition, food service management, food technology, and current issues on food and nutrition. Media Gizi Indonesia tries to always present a variety of scientific articles in the scope of Nutrition and Health.

This issue provides both literature review and original research in the field of nutrition across the human life cycles. For the past 2 years, we have been battling with COVID-19 pandemic and thus also highly correlated to nutrition. This edition covers one review and three research related to COVID-19 pandemic and nutrition. In addition, topics related stunting was also covered considering Indonesian effort in alleviate stunting reduction. In this edition, the contributing authors address the impact of nutrition intervention among adolescents and also pregnant women. Papers under the topic of sport nutrition, food loss and food waste, and child nutrition were also presented.

We do hope MGI scientific journals can leverage the development of writing culture and communicative scientific studies as well as attract readers and writers to participate in MGI for future issues. Media Gizi Indonesia / National Nutrition Journal will maintain its role in providing current, relevant, and topical issues in food and nutrition. Hopefully, the works displayed by MGI can provide benefits and enrich the readers' knowledge.

Editorial Team

Media Gizi Indonesia
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ROLES OF VITAMINS IN IMMUNITY AND COVID-19: A LITERATURE REVIEW

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ABSTRACT

SARS-CoV-2 is a severe acute respiratory virus that causes Coronavirus Disease-19 (COVID-19). Even before the COVID-19 pandemic, diet was undeniably important in immunity. In order to be more resilient during and after the pandemic, understanding the role of vitamins is crucial. This review aims to explore the role of vitamins in supporting the immune system and its correlation to COVID-19. The article search was done using five electronic databases (i.e., Google Scholar, Semantic Scholar, ScienceDirect, PubMed, and PMC). Some of the keywords utilized in the literature search were "vitamin A and immunity" OR "vitamin B and immunity" OR "vitamin C and immunity" OR "vitamin D and immunity" OR "vitamin E and immunity" OR "vitamin A and covid19" OR "vitamin B and covid19" OR "vitamin C and covid19" OR "vitamin D and covid19" OR "vitamin E and covid19". A total of 51 articles was assessed in this literature review. Research finds vitamin A plays a role in both innate immune system cell function and humoral immunity by regulating, differentiating, and maturing immune system cells. Vitamin B complex primarily reduces inflammation by lowering serum C-reactive protein levels (CRP), while vitamin C strengthens epithelial barriers, phagocytes, T and B lymphocytes, and inflammatory mediators, to improve the immune system. Vitamin D acts as a mediator in the vitamin D receptor (VDR), an inner immune system component that regulates the humoral and adaptive immune systems through unique genetic transcriptions. Finally, vitamin E acts as an antioxidant, lowering the production of reactive oxygen and nitrogen species (ROS and RNS). In conclusion, all vitamins are essential in improving individual's immune system that prevent from infectious diseases including COVID-19.

Keywords: COVID-19, immunity, infectious disease, vitamin

INTRODUCTION

Coronavirus Disease-19 (COVID-19) is a respiratory disease caused by SARS-CoV-2) virus. Droplets from the respiratory system secretions easily propagate COVID-19 causing fever, dry cough, dyspnea (shortness of breath), headache, disorientation, fatigue, vomiting, and diarrhea (Huang et al., 2020; Shi et al., 2020). Within three months of its discovery, the World Health Organization (WHO) designated COVID-19 a pandemic. Until this paper was written, there were 523 million confirmed cases worldwide according to the WHO, with more than six million deaths (WHO, 2020). As many as 87% of COVID-19 patients aged 30–79 had one or more comorbidities, such as cardiovascular disease, diabetes mellitus, and hypertension. Those with comorbidities had a greater death risk than those without (Mungroo et al., 2020).

It is unarguable that nutrition plays a crucial role in immunity, even before the COVID-19 pandemic. The cells in the body, particularly those in the immune system, require adequate nutrients to function at their best. However, the degree of malnutrition, especially micronutrient deficiency was still high. Despite recent efforts in the prevention and control of micronutrient deficiency, vitamin A, iodine, and/or iron deficiencies indicate that over two billion individuals worldwide are at risk (Ramakrishnan, 2002). Pregnant women and young children are most at danger in Southeast Asia and Sub-Saharan Africa, where the frequency is exceptionally high. For example, the number of pregnant anemic women in Indonesia accounted for 48.9% (Ministry of Health, 2019).

Micronutrient status, host immune response, and virus pathogenicity all have complicated and multidimensional relationships. One

of the major roles of micronutrients is for the coordinated recruitment of innate and adaptive immune responses to viral infections, as well as the modulation of pro- and anti-inflammatory host responses (Gorji & Ghadiri, 2021).

Several vitamins and minerals, such as vitamins A, B, C, D, E, folate, zinc, iron, selenium, and copper, play a role in supporting both innate and adaptive immunities. The deficiency of the nutrients further influences the immune system functions and decreases the resistance against infections (Calder et al., 2020; Gombart et al., 2020). Malnourished people have a higher risk of having infectious diseases and impaired wound healing, which increases the morbidity and mortality. Some studies have discussed the role of vitamins and minerals within the immune system and their relation to infectious diseases (Gombart et al., 2020; Wintergerst et al., 2007). Furthermore, insufficient micronutrients not only decrease the immune system's ability to fight viral infections, but also contribute to the formation of more virulent strains by altering the viral genome's genetic makeup (Beck & Levander, 2000). This review explores the role of vitamins in supporting the immune system and its correlation to COVID-19.

METHOD

Article searching was done using five electronic databases (i.e., Google Scholar, Semantic Scholar, ScienceDirect, PubMed, and PMC). The keywords used were "vitamin A and immunity" OR "vitamin B and immunity" OR "vitamin C and immunity" OR "vitamin D and immunity" OR "vitamin E and immunity" OR "vitamin A and covid19" OR "vitamin B and covid19" OR "vitamin C and covid19" OR "vitamin D and covid19" OR "vitamin E and covid19". The purpose of this literature review is to answer the research question, "How do vitamins affect immunity and COVID-19?" Only English-language research was taken into consideration. The data was delivered narratively. Fifty-one articles were included in this paper. Articles in line with the study objective were included.

RESULTS AND DISCUSSION

Vitamin A

Vitamin A is a fat-soluble vitamin that was discovered in 1928 and has a role in the immune system that is called "anti-infective" vitamin (Green & Mellanby, 1928). Three active forms of vitamin A in the body are retinol, retinal, and retinoic acid, in which the latter has the most prominent biological activity. Vitamin A's mechanism of action toward immunity still cannot be fully understood; however, some literature disclosed the possibility of mechanisms that make vitamin A stimulate the immune system. In the innate immune system, furthermore, retinoic acid plays an indispensable role in the regulation of differentiation, maturation, and the innate immune system cell functions.

The innate immune cells consist of macrophage and neutrophil, which start a direct response on the pathogenic invasion through phagocytosis and "natural killer" T cell activation that performs immunoregulatory functions through cytotoxic activities (Chang & Hou, 2015; Wynn & Vannella, 2016). Moreover, vitamin A also plays a role in humoral immunity by immunoglobulin synthesis. Prior research revealed that retinoic acid synergizes with gut-associated lymphoid tissues of dendritic cells from IL-6 or IL-5 to secrete IgA (Huang et al., 2018). Besides IgA, retinoic acid also plays a role in increasing the IgG antibody production by activating Th2 response through the increase in expression of costimulatory molecules, CD86, and natural killer T cell population (NKT) that is correlated with IL-4 secretion increase (Ross & Restori, 2013).

Studies regarding the provision of vitamin A to COVID-19 patients have not yet been found; nonetheless, numerous researches have concluded that vitamin A provides positive effects on many types of infectious diseases. Semba et al. (1999), for example, reported that vitamin A supplementation is capable of reducing morbidity and mortality of various infectious diseases, including measles, diarrhea, measles pneumonia, HIV, and malaria with numerous

mechanisms of activation of innate and adaptive immune cell responses. The administration of vitamin A supplementation can also increase the antibody response toward vaccines and protect life-threatening complications due to infection, including lung disease, malaria, and HIV (Jayawardena et al., 2020; Zhang & Liu, 2020). Studies on animals indicated that chickens fed with a low amount of vitamin A are more susceptible to coronavirus infection than those fed with a high amount of vitamin A (Zhang & Liu, 2020).

The Recommended Dietary Allowance (RDA) of vitamin A is 900 mcg for adult males and 700 mcg for adult females (Institute of Medicine, 2000). Several foods recognized as containing high amount of vitamin A are chicken liver (23,000 mcg), mango (16,400 mcg), papaya leaf (18,250 mcg), moringa leaf (10,020 mcg), and carrot (7,125 mcg) (Ministry of Health, 2018).

Vitamin B

Vitamin B is a water-soluble vitamin that also has a role as a cofactor and coenzyme. Vitamin B can be obtained from the diet and the microbial synthesis such as intestinal microbiota (Yoshii et al., 2019). A study in animals revealed that vitamin B6 deficiency decreases the proliferation and differentiation of lymphocyte T cells, reduction in IL-2, and the increase in IL-4 (Qian et al., 2017). Cross-sectional studies from the NHANES 2003-2004 data and HIV-infected people data showed a correlation between vitamin B intake and inflammation. A higher niacin, pyridoxine, or cobalamin intake is related to the lower serum C-reactive protein (CRP) level (Morris et al., 2010; Poudel-tandukar, 2016). The provisions of a high dose of vitamin B6, namely 50 mg/day for critically ill patients for 14 days can increase the immune responses, including lymphocyte T cells, T-helper, and T-suppressor increases (Cheng et al., 2006).

Folate deficiency can affect the immune response, especially cell-mediated immunity, by reducing the lymphocyte T cells circulation and its proliferation. Folate deficiency also reduces the capacity of CD8$^+$ cell proliferation in response to mitogen activation (Shetty, 2010). Meanwhile, vitamin B12 deficiency reduces the amount of lymphocyte and CD8$^+$ cells as well as its proportion to CD4$^+$. A low CD4$^+$/CD8$^+$ ratio

can reduce the activity of NK cells (Shetty, 2010). An in silico study revealed that vitamin B12 could obstruct the viral replication by inhibiting the RNA-dependent-RNA polymerase activity of nsp12 from SARS-CoV-2 (Narayanan & Nair, 2020). This study brings up an opportunity to be continued to in vitro, in vivo studies and clinical studies. Vitamin B12 contributes to the immune response through T cells CD8 and NK cells. The provision of vitamin B12 to anemic patients with vitamin B12 deficiency increases the number of lymphocyte cells and CD8$^+$ besides the CD4/CD8 ratio and the suppressed activity of NK cells (Tamura et al., 1999). In the meantime, the in vitro study suggested that riboflavin and ultraviolet light reduce the infectious titer of MERS-CoV and SARS-CoV-2 in human blood plasma (Keil et al., 2016; Ragan et al., 2020). During COVID-19, it is recommended as much as 100% RDA for age and gender in addition to a well-balanced diet (Fernandez-Quintela et al., 2020).

Vitamin C

Vitamin C can optimize the immune system through some mechanisms; namely, increasing epithelial barriers, phagocyte, T and B lymphocytes, and inflammatory mediators (Carr & Maggini, 2017). In its relation to the epithelial barriers increasement, vitamin C functions in the stabilization of collagen, the protection against ROS-caused damages, triggering keratinocyte differentiation and lipid synthesis, the increase in proliferation and fibroblast migration, and the decrease in wound healing time (Kishimoto et al., 2013; Lauer et al., 2013; Mohammed et al., 2016).

The role of vitamin C in phagocytic function begins by increasing the neutrophilic migration as a response toward chemotaxis increases. Lacking vitamin C conditions, thus, can affect the decrease in phagocytic function to migrate to the infected cells. After that, the phagocytosis process is continued with the ROS increase and pathogenic killing. The chemotaxis neutrophil ability during the phagocytosis process is also influenced by the antihistamine function from vitamin C. After the phagocytosis and pathogenic killing processes, neutrophils undergo a process of programmed cell death called apoptosis. Vitamin C then continues

to the apoptosis process by increasing the uptake and clearance by macrophage as well as preventing the occurrence of necrosis and excessive tissue damage (Fisher et al., 2012).

B and T lymphocytes also accumulate vitamin C in high doses through sodium-dependent vitamin C transporter 2 (SCVT2). It is further elaborated that vitamin C plays a vital role in modulating T cells' maturation. Moreover, vitamin C also functions in increasing antibody levels (IgM and IgG) (Tanaka et al., 1994). The last role of vitamin C in the immune system, additionally, is the modulator of inflammation, which is also known as cytokines. Cytokines are further explained as primary cells signaling molecules secreted by various immune cells, both innate and adaptive, in response to infections and inflammation consisting of multiple molecules, including chemokines, interferons (IFNs), interleukin (IL), lymphokines, and TNF that modulate the humoral and cellular-based immune responses. Cytokines, moreover, can generate both pro-inflammation and anti-inflammation responses (Carr & Maggini, 2017). Vitamin C, therefore, roles as a potent antioxidant toward the occurrence of oxidative stress caused by COVID-19; hence, it can prevent inflammation and cell damage besides enhancing the phagocytic ability of the immune system cells and contributing to the demolition of hazardous pathogens (Hancer et al., 2020). In other words, vitamin C helps in easing the cytikune storm in COVID-19 patients.

The role of vitamin C in improving the coronavirus symptoms has been exposed since 1978 in a study that concluded that vitamin C increases the endurance of chicken embryo trachea toward avian coronavirus (Atherton et al., 1978). An observational study carried out to 17 moderate-severe COVID-19 patients disclosed that the administration of intravenous vitamin C for as many as 1 gram per eight hours for three days as part of COVID-19 medication reduces the inflammatory markers, which include ferritin, D-dimer, and the fraction of inspired oxygen (FiO_2). Therefore, it can be affirmed that, clinically, it is feasible to administer intravenous vitamin C to moderate-severe COVID-19 patients (Hiedra et al., 2020). However, research regarding intravenous vitamin C provision for as many as 12 grams, compared to the placebo to severe pneumonia patients due to COVID-19 twice a day for seven days, is still being carried out as of September 2020 (Clinical trials identifier: NCT04264533). As a consequence, the effects of vitamin C administration cannot yet be enforced.

The recommended vitamin C intake for adult males is 90 mg and 75 mg for adult females with daily addition of 35 mg for smokers (Institute of Medicine, 2000). There is also a recommendation of vitamin C intake up to 200 mg to avoid infections (disease susceptibility and the maintenance of an adequate immune function); and 1–2 g/day for infected patients (Fernandez-Quintela et al., 2020). Some foods are high in vitamin C (per 100 gr), such as cashew fruit (197 mg), soybean (121 mg), mustard greens (102 mg), ketip bananas (95 mg), and guava (87 mg) (Ministry of Health, 2018).

Vitamin D

Vitamin D is one of the fat-soluble vitamins that can be synthesized by the body with the help of UVB rays, or obtained from food. Vitamin D is acknowledged as having an essential role in the immune system. Vitamin D has a role as the mediator in the Vitamin D Receptor (VDR), an inner part of the immune system to modulate the humoral and adaptive immune system through specific-genetic transcriptions (Koivisto & Hanel, 2020). VDR can be found in almost all immune cells, for instance, B and T lymphocytes, monocytes, macrophage, and dendritic cells.[90] In the humoral immune system, VDR plays a role in cathelicidin antimicrobial peptides (CAMP) and defensin β2 formations (Koivisto & Hanel, 2020). Besides, VDR is a component of the pattern-recognition receptor (PRR) and used to suppress inflammatory cytokines release.[92] Furthermore, vitamin D through VDR also influences the adaptive immune system activity by suppressing the T helper cell production and T1 by stimulating T2 release. These activities, then, will enhance the adaptive immune system activation (Dimitrov & White, 2016; Sassi et al., 2018).

Some studies argued that vitamin D has a negative correlation with respiratory tract infections. Pham et al. (2019) revealed that subjects with serum 25 (OH)D levels of less than 37.5 mg have a higher risk for acute respiratory infections. Zitterman et al. (2016) added that vitamin D

deficiency increases the risk of severe airways infection. A study conducted to workers in Japan showed that vitamin D level was related to the risk for influenza to the subject group that did not get vaccinated (Nanri et al., 2016). The same pattern, additionally, was found in a recent study involving COVID-19 patients in Switzerland, which revealed that a lower 25(OH)D level was found more in PCR-positive patients than in PCR-negative patients in SARS-CoV-2 examinations (D'Avolio et al., 2020). Furthermore, vitamin D deficiency is discovered more in high-risk groups for COVID-19, such as obese , smokers, and elderly (de Jongh et al., 2017; Ghosh et al., 2020; Jiang et al., 2016; Roizen et al., 2019; Zhang et al., 2016).

Due to its significant functions in the immune system, numerous researchers assumed vitamin D provides protective effects toward SARS-CoCV-2 infections (Grant et al., 2020; McCartney & Byrne, 2020), which hypotheses the assumption of using vitamin D metabolic pathways in the immune system. Vitamin D increases Angiotensin Converting Enzyme 2 (ACE2) production in the alveolus cells that can reduce lung tissue damages. ACE2 is an enzyme in the Renin-Angiotensin, which functions to regulate lung vasodilation besides acting as the SARS-CoV-2 receptor. The bond between ACE2 and SARS-CoV-2, causing a decrease in the number of ACE2 in lung cells, which will lead to an increased risk of lung damage and pneumonia (Mahdavi, 2020). Vitamin D also produces cathelicidin in alveolar epithelial cells that can reduce viral replication by activating the mechanism of autophagy (Chieosilapatham et al., 2018; Crane-godreau et al., 2020; Grant et al., 2020; Jiang et al., 2020). Cathelicidin can also minimize lung damage due to hypoxia (Jiang et al., 2020).

Vitamin D can suppress the cytokine storm through suppression of Th1 cytokines and interferon γ formulations (Grant et al., 2020). As a result, vitamin D plays a role in preventing COVID-19 severity by suppressing the cytokine storm. Although vitamin D has a promising effect for COVID-19 treatment, until recently, there have been no studies confirming the outcome of the optimal dose of vitamin D supplementation under COVID-19 conditions. Thus, further research is needed to prove the role of vitamin D as a strategy

for the prevention and treatment of COVID-19. For recommendation intake, 10,000 IU over few weeks, followed by 5000 IU (until 25–hydroxyvitamin D concentrations rise above 40–60 ng/mL (equivalent to 100–150 nmol/L) (Fernandez-Quintela et al., 2020).

Vitamin E

Vitamin E is one of the fat-soluble vitamins consisting of tocopherol and tocotrienol that also has a role as an antioxidant. Nonetheless, only the α-tocopherol form t can meet human needs since α-tocopherol has 5–10 times of bioavailability and a better metabolism than γ-tocopherol (Dayong Wu et al., 2019). Amongst the foods containing vitamin E are beans, seeds, vegetable oils (soybean, sunflower, corn), and green leaves (spinach and broccoli) (Lee & Han, 2018; Muscogiuri et al., 2020; Wu et al., 2019).

Several studies on humans and animals discovered that vitamin E deficiency can damage the immune system (Wu & Meydani, 2018). Vitamin E increases the immunity by taking oxygen in oxidants to reduce oxidative stress so that it can reduce the impact of inflammatory damage (Lee & Han, 2018; Wu & Meydani, 2018). Other roles of vitamin E are protecting PUFA in membrane cells from the oxidation, managing the ROS and reactive nitrogen species (RNS) productions, and controlling the transduction signal (message delivery) so that when the body undergoes inflammation, it will automatically respond to it (Coquette et al., 1986; Wu et al., 2019).

In the elderly, increasing vitamin E intake is beneficial for better immune function by giving resistance to infection and reducing pain due to infection (Gavazzi et al., 2011; Hemilä, 2016; Meydani et al., 2018). The elderly tend to experience diseases due to the decreased immune system caused by old age (immunosenescence) (Ginaldi et al., 2001). Therefore, the administration of vitamin E and combining it with vitamin C is highly possible for antioxidant therapy in complications due to COVID-19 (Wang et al., 2020).

The study carried out by Meydani et al. (2004) argued that a high dose of vitamin E (800 mg/day in one study and 60, 200, and 800 mg/day in other study) increases the T-helper 1 in the cellular

immunity. Another study added that the provision of vitamin E supplementation (200 IU/day or 135 mg/day) for a year reduces the risk of respiratory tract infections in the elderly (Meydani et al., 2004). Although vitamin E is highly recommended as a potential nutrient to fight against COVID-19, nevertheless, until recently, the estimated exact dose for a specified target has not yet been discovered. Therefore, further studies regarding the proper doses for vitamin E supplementation for every age group need to be carried out (Zhang & Liu, 2020). An RCT study in Iran was conducted to analyze the impact of administering vitamin A, B, C, D, and E supplementations to the mortality rate of COVID-19 patients in the ICU (Beigmohammadi et al., 2020).

CONCLUSION

In conclusion, all vitamins are essential in improving an individual's immune system that prevents from infectious diseases including COVID-19. Even though the pandemic has almost come to an end, maintaining adequate vitamin intake should be reached because maintaining the immune system is not only for preventing COVID-19 but other hundreds of infectious diseases. Thus, in order to be more resilient after pandemic, vitamin intake should reach requirements. Strengthening the immune system becomes one of the goals in preventing or reducing illness severity as well.

The role of vitamin A both in innate immune system cell function is by regulation, differentiation, and maturation of immune system cell functions and also synthesizing immunoglobulin as the humoral immunity. Vitamin B complex mainly plays a role in reducing inflammation level by lowering serum C-reactive protein (CRP). Vitamin C improves the immune system by strengthening epithelial barriers, phagocytes, T and B lymphocytes, and inflammatory mediators, among other things. Vitamin D functions as a mediator in the Vitamin D Receptor (VDR), an inner element of the immune system that regulates the humoral and adaptive immune systems via unique genetic transcriptions. Last but not least, vitamin E acts as an antioxidant, reducing the generation of reactive oxygen and nitrogen species (ROS and RNS).

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EFFECTIVENESS OF PLANT-BASED DIET ON REDUCING THE RISK OF TYPE 2 DIABETES MELLITUS: A LITERATURE REVIEW

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ABSTRACT

Prevalence of Type 2 Diabetes Mellitus (T2DM) disease in Indonesia is still classified as high. Dietary pattern is a factor that affects the occurrence of T2DM, hence patients' dietary pattern must be monitored to avoid further health complications. One of the interventions that can be applied is a plant-based diet, with a consumption pattern of plant-food such as fruit, vegetable, nut, and seed. The aim of this literature study is to identify the effectiveness of plant-based diet in patients with T2DM. This study was conducted using literature review method that resulted in six relevant journals within the last ten years from *Google Scholar, PubMed/Medline, Science Direct,* and *Wiley Online Library*. The results of this study show that a plant-based diet affects weight loss, body mass index, blood glucose (HbA1C, fructosamine, fasting plasma glucose), and hormones (insulin, GLP-1, PYY, PP, amylin). It proves that plant-based diets have a positive impact on people with T2DM patients.

Keywords: dietary pattern, type 2 diabetes mellitus, plant-based diet

INTRODUCTION

Diabetes Mellitus (DM) is a metabolic disease marked by high sugar level in the blood called hyperglycemia due to abnormalities in insulin action, insulin secretion, or both. Indonesia is a country that has a high prevalence of Diabetes Mellitus. In 2018, the prevalence in Indonesia increased by 1.6% from 2013 which was from 6.9% to 8.5% (Saputri, 2020). Based on data from Indonesia Basic Health Research (2018), the prevalence of Diabetes Mellitus in women is greater (1.7%) than men (1.4%). In addition, Diabetes Mellitus diagnosed in urban communities is also greater than in rural areas, 2.0% and 1.0%, respectively (Saputri, 2020).

There are two types of Diabetes Mellitus, namely type 1 Diabetes Mellitus (T1DM) and type 2 Diabetes Mellitus (T2DM). T1DM or Insulin-Dependent Diabetes Mellitus caused by insufficient insulin production, while T2DM or Non-Insulin-Dependent Diabetes Mellitus is caused by the ineffective use of insulin (Mahfudzoh et al., 2019). T2DM dominates 90% of all Diabetes Mellitus cases in Indonesia. T2DM usually occurs in individuals aged >45 years. Some of the risk factors for T2DM include dyslipidemia, lack of physical activity, obesity, hypertension, and an unhealthy diet (Mahfudzoh et al., 2019).

Diet is highly influential on the occurrence of Diabetes Mellitus. To prevent its complications or severity, the diet for people with Diabetes Mellitus must be considered. Blood sugar content in Diabetes Mellitus patients tends to be uncontrolled. It rises dramatically when a person with Diabetes Mellitus eats meals high in carbohydrates and/or glucose, hence diet must be closely monitored to keep blood sugar levels under control (Mahfudzoh et al., 2019). The type of diet that can be given to T2DM patients is by increasing fiber intake to improve glycemic control (Yosmar et al., 2018).

Plant-based diet has existed for a long time, but there has been an increase in demand as a result of awareness increment. The popularity of this diet is motivated by the concern of animal prosperity as well as the health benefits delivered by the diet, such as weight loss. Plant-based diet trend is also influenced by environmental, economic, and religious factors, as a result of rising concern about the impact of animal food production on greenhouse gas emission (Tran et al., 2020). The aim of a plant-based diet is to eat as many nutrient-dense plant foods as possible while reducing processed food,

animal food, and oil. Whole plant foods, including nut, fruit and vegetable, and seed, are emphasized in plant-based diet (Tuso et al., 2013). This food is both nutrient-dense and low in calories. Fiber, flavonoid, vitamin C, vitamin B1, potassium, magnesium, and folic acid all can be found in plant-based diet. Furthermore, it has low saturated fat and cholesterol level (Bowman, 2020).

Plant-based diet is related to a better weight control and blood lipid profile, and it is frequently recommended for chronic disease prevention. It has been proven that a plant-based diet could lower the risk of heart disease, hypertension, Diabetes Mellitus, and certain cancers (Tran et al., 2020). The benefit for diabetic patients is that a lower-fat diet with little or without meat can help to avoid and manage diabetes by increasing the insulin sensitivity and reducing the insulin resistance. In addition to its effect on Diabetes Mellitus, switching from an omnivorous diet to a plant-based diet resulted in weight loss in the majority of people (Tran et al., 2020). This is due to a high fiber and low fat diet, which leads to the reduction of energy intake, an improvement in the thermic effect of food, and weight loss. Plant-based diet is commonly related with a higher risk of malnutrition than omnivore diet. However, this may be overcome with a well-balanced diet, careful planning, practice of reading food labels, and self-discipline (Tuso et al., 2013).

Many studies on the development of plant-based food have been performed in Indonesia. According to Avianty and Ayustaningwarno (2014), black soybean sweet potato snack bar has a low glycemic index and glycemic load, making it suitable as a diabetic snack. Complex carbohydrate in the black soybean sweet potato snack bar helps to manage blood sugar increment, while isoflavone and anthocyanin act as antioxidant. Winarsi et al. (2021) published another study that can be applied to enhance people's transition to plant-based diet. The latest results are vegetable yogurt product derived from mung bean containing 525.96±48.9 mg GAE/L phenolic antioxidant and 43.18±1.87% soluble protein. Also, this mung bean milk yogurt product contains 3.50% dietary fiber. People with degenerative disorders, such as Diabetes Mellitus, certainly take benefit from the presence of phenolic antioxidants. These studies show that a plant-based diet is beneficial to health, especially for diabetic people.

The aim of this literature review is to identify the efficacy of plant-based diet in patients with T2DM. Additionally, to raise awareness about the effect of plant-based diet on patients with T2DM.

METHODS

The literature review is used as the design method in this study. To conduct this literature review, researchers compiled research publications from the last ten years with cross-sectional, cohort, case-control, crossover randomized and prospective study design (2011–2021). The electronic databases used to obtain the research paper include *Google Scholar, PubMed/Medline, Science Direct* and *Wiley Online Library*. Plant-based diet; Type 2 Diabetes Mellitus; glycemic index; non-insulin dependent were the keywords selected in this literature review, which were found in English-language international journals and could be read in full text using the AND search approach. People with Type 2 Diabetes Mellitus who adopted a plant-based diet and saw improvements to their health were included as the selected paper. At-risk groups, those with pre-diabetes, people with type 1 Diabetes Mellitus and utilized diets other than plant-based diet were not included in the study.

This literature review was conducted following PRISMA guidelines which consists of a four-phase flow chart (Figure 1). In the first phase, there were 2838 journals obtained, then several journals were eliminated because the same journal appeared more than once and for other reasons, such as not English-language journals, the year published before 2011 or after 2021, and not research articles so that in the second phase there were 791 journals. Several journals were eliminated because the title/abstract was irrelevant to the research question:184 journals were eliminated and 607 journals were left in the third phase.

Several research articles were excluded because they were not fully accessed, leaving 28 journals in the fourth phase. After reviewing 28 journals, in the fourth phase some research articles were excluded for several reasons including the sample in the study was not type 2 diabetes patients, the study design was wrong, and the study

did not explain the plant-based diet intervention. After going through the screening, six relevant journals were obtained.

RESULTS AND DISCUSSION

In total, six research articles were included in this review after selecting the inclusion and exclusion criteria according to Table.1. Those six research articles are analyzed regarding the impact of the plant-based diet in people with T2DM. There are relations between the plant-based diet and T2DM. The consumption of a plant-based diet by patients can decrease weight and body mass index, blood glucose rate, in addition to influence hormones like insulin, intestinal hormone, etc.

Identification

Records identified from:
    Databases (n = 2838)
    ScienceDirect (n=428)
    Pubmed (n=409)
    Google Scholar (n=1910)
    Wiley Online Library (n=91)

Records removed before screening:
    Duplicate records removed (n = 477)
    Records marked as ineligible by automation tools (n = 0)
    Records removed for other reasons (n = 1570)

Screening

Title/Abstract records screened (n = 791)

Title/Abstract records excluded (n = 184)

Reports sought for retrieval (n = 607)

Full-text articles unable to retrieve (n = 579)

Full-text articles assessed for eligibility (n = 28)

Full-text articles excluded:
    Not T2DM patiens (n = 6)
    Incorrect study design (n = 5)
    the study did not describe a plant-based diet intervention (n = 11)

Included

Studies included in review (n = 6)

Figure 1. PRISMA flow chart of the literature review

Weight Loss

Patients with T2DM are mostly overweight or obese, which can lead to an increase in the incidence of hypertension, dyslipidemia, and unable to control glycemic level, so a high-intensity diet, physical activity, and behavioral change strategies to lose weight are recommended (Bangalore et al., 2018). Change in the dietary pattern or commitment to a specific diet program is prevailing in people who want to lose weight. The low carb and fat diet for six months can be one of the other interventions for losing weight (Johnston et al., 2014). Wright et al. (2017) suggested a whole food plant-based diet to change the dietary in patients with T2DM. A whole plant-based diet is based on cereals, nuts, vegetables, and fruits (around 7–15% energy total from fat). In consumption of food without limiting it until replete, a patient that commits to a whole food plant-based diet in twelve month s was proven effective and safe to lose weight and decrease a little bit of blood glucose rate without doing rigorous physical exercise.

Body Mass Index

Body Mass Index (BMI) is a calculation usually used to define characteristics of height/weight and categorize people as underweight, regular, or overweight (Nuttal, 2015). The way to calculate BMI is to divide the weight (kilograms) by the height squared (meters) (Alsulami et al., 2021). Enhancement of BMI is usually related to several diseases, such as T2DM disease. BMI is discovered to be an independent variable that is significant for diabetes in multivariate regression research models (Alqurashi et al., 2011). Therefore, the BMI number can be lowered by doing a diet program for people with T2DM. One of those diets is a plant-based diet, which is known to lower BMI. Research by Wright et al. (2017) indicates that the body mass index group of patients with a plant-based diet intervention had a higher average

than patients with standard interventions. A plant-based diet has lower fat, higher water, and fiber and there was a reduction in energy density from food consumed by patients. The group with a plant-based diet as an intervention also stated feeling less hungry.

Blood Glucose

Fiber, both soluble and insoluble, can prevent an increase in blood glucose level. This is because fiber serves to bind excess blood glucose in the blood along with feces. In addition, it will be beneficial for carbohydrate metabolism so that it can lower blood glucose level (Made et al., 2017). As mentioned in a study conducted by Abubakari et al. (2014) in Ghana the average capillary glucose result dropped to near normal after 21 days of being given the Ma-Pi macrobiotic dietary intervention in T2DM patients. It also showed that fructosamine level dropped significantly. In the study conducted by Yang et al. (2021), they stated that they believed a plant-based diet would overcome to some extent inflammation and insulin secretion and improve blood glucose control. This can reduce the risk of T2DM. Research by Alsulami et al. (2021) also showed that increasing plant protein intake is an effective way to manage the level of blood glucose, especially in India, Asia, in individuals with high genetic susceptibility to T2DM.

Study by Wright et al. (2017) showed there was a difference in HbA1C in the intervention group, with a 5 mmol decrease in six months. In the group that received the intervention, two individuals were no longer included in the diagnostic criteria at six and 12 months of intervention.

HbA1C reduction supported the intervention and all diabetes patients who adhered to the intervention experienced improvement, two of whom had improved condition based on HbA1C. Research conducted by Alsulami et al. (2021), stated that among individuals with a lower plant-based diet, individuals with risk allele >1 had higher-

Table 1. Result of Literature Review on the Association between Plant-Based Diet with Type 2 Diabetes Mellitus

Research Title	Author	Year	Method	Instrument	Sample	Outcomes	Results
Ma-Pi 2 Macrobiotic Diet Intervention During 21 Days in Adults with Type 2 Diabetes Mellitus, Ghana 2011.	Braimah Baba Abubakari et al.	2014	Prospective 21 days dietary intervention study	Assessment of blood pressure, anthropometry, blood biochemical tests, and urine tests.	23 patients aged 25-70 years old with T2DM were given the Ma-Pi 2 macrobiotic dietary intervention for 21 days.	Blood sugar, fructose-mine, and insulin.	The Ma-Pi 2 macrobiotic diet affects the treatment of T2DM as evidenced by a rapid decrease in hyperglycemic and fructosemic values, marked by a decrease in blood glucose (47%) and fructosamine (27%). In addition, there was a decrease in insulin consumption by 44%
The BROAD Study: A Randomized Controlled Trial Using A Whole Food Plant-Based Diet in the Community for Obesity, Ischemic Heart Disease or Diabetes.	Wright et al.	2017	Randomized Controlled Trial	Stadiometer, calibrated medical scale, and T-Lab Gisborne.	65 subjects were randomized (control n = 32 i.e. group given standard media care, intervention n = 33 i.e. group given standard medical care and added diet change program), 75.4% (49 subjects) completed the study up to 6 months and 70% (23 subjects) intervention participants were followed up at 12 months.	Body weight, cholesterol and HbA1C.	Within one month, the reduction in BMI was higher on the WFPB diet compared to the normal treatment. The average reduction in cholesterol was higher with the WFPB diet compared to normal treatment, but these two groups had no significant difference. In patients diagnosed with diabetes within 6 months of intervention, there was a reduction in the value of HbA1C and an improvement in quality of life.
A Plant-Based Meal Increases Gastrointestinal Hormones and Satiety More Than an Energy- and Macronutrient-Matched Processed-Meat Meal in T2D, Obese, and Healthy Men: A Three-Group Randomized Crossover Study	Klementova et al.	2019	Randomized crossover study	Measuring anthropometry and blood pressure, also gastrointestinal and appetite hormones.	It consisted of 60 men divided into 20 men diagnosed with T2DM aged 30-65 years old with a BMI between 25-45 kg/m2 and taking diabetes medication, 20 obese men with BMI and men of the same age as diagnosed T2DM (obesity), and 20 control of the same age (healthy) given two interventions namely fasting for 10-12 hours for all men, whereas men with T2DM were ordered to skip their diabetes medication in the evening and the morning before assessment. Then, they were given a meal consisted of processed meat and cheeseburger (M-meal), or a vegetable tofu burger (V-meal).	Gastrointestinal and appetite hormones.	There was an increase in satiety and gut hormones, after consuming a plant-based meal with tofu when compared to a processed meat and cheese meal that was appropriate for energy and macronutrients fulfillment and 16-week plant-based diet intervention in T2DM patients could increase postprandial GLP-1 concentration especially in participant with T2DM.

Continued Table 1.   Result of Literature Review on the Association between Plant-Based Diet with Type 2 Diabetes Mellitus

Research Title	Author	Year	Method	Instrument	Sample	Outcomes	Results
A Plant-Based Meal Stimulates Incretin and Insulin Secretion More Than an Energy- and Macronutrient-Matched Standard Meal in Type 2 Diabetes: A Randomized Crossover Study	Kahleova et al.	2019	Randomized crossover study	Assessment of anthropometry and blood pressure, beta-cell hormone function, plasma glucose, gastrointestinal insulin resistance and appetite.	T2DM men aged between 30 and 65 years old, BMI 25 & 45 kg/m2, using oral hypoglycemic agent for at least one year such as metformin and/or sulfonylurea or treated with lifestyle modification alone, had an HbA1C of 42 to 105 mmol/mol (≥6 0.0 to 11.8%), at least had three symptoms of metabolic syndrome, and treated overnight fasting for at least 10-12 hours and the night or morning before assessment, and were not taking any diabetes medication. Then subjects were given a meal which consisted of processed meat burgers (M-meal), or vegetable tofu burgers (V-meal).	Postprandial incretin, insulin secretion of T2DM patients, and pancreas beta-cell	An increase of insulin secretion and postprandial incretin in individuals with T2DM after consuming V-meal suggests the therapeutic potential of plant foods to repair beta-cell function in T2DM.
Lower Dietary Intake of Plant Protein Is Associated with Genetic Risk of Diabetes-Related Traits in Urban Asian Indian Adults	Alsulami et al.	2021	Cross-sectional epidemiological study	Weight scale, height measure, Hitachi-oqw Auto Analyzer, high-performance liquid chromatography on a Variant machine (Hercules, USA, CA, Bio-Rad), glucose oxidase-peroxidase, FFQ form, Phenol chloroform technique, SPSS application.	1062 individuals (496 individuals with NGT and 566 individuals with T2DM).	HbA1C, Fasting Plasma Glucose (FPG), and reduced risk of T2DM in individuals consuming plant protein.	Vegetable protein intake is an effective way to regulate the level of blood sugar in individuals with higher genetic susceptibility to T2DM in India.
Association of Plant Based Diet and Type 2 Diabetes Mellitus in Chinese Rural Adults: The Henan Rural Cohort Study	Yang et al.	2021	Cohort study	Sociodemographic related information, medical history was collected using a questionnaire, and lifestyle factors.	37,985 of 39,259 women and men aged 18–79 years. Excluding participants who had too low or too high energy intake.	Blood glucose, plant based-diet index, and insulin secretion.	In comparison to participants who had a lower plant-based diet index, participants who had a high plant-based diet index had a lower risk of T2DM.

—HbA1C and FPG levels rather than individuals with risk allele ≤1. HbA1C is glucose attached to red blood cells, where HbA1C levels in the blood will describe the average blood glucose level from the last three months (Fauzi, 2013).

Hormone

Lifestyle intervention in patients with T2DM, especially regarding dietary patterns, has more effectiveness than insulin treatment. This is evidenced by a study conducted by Abubakari et al. (2014) which stated that diet is important in the therapy of Diabetes Mellitus. This study uses a dietary intervention that contains plant-based ingredients so this diet has high fiber content, adequate protein, low fat, and high complex carbohydrate. This diet provides a longer feeling of fullness. In addition, this diet also normalizes the function of beta cells and improves insulin sensitivity by limiting energy intake. This statement is supported by study conducted by Kahleova et al. (2019). Diet that contains plant-based foods can increase post-prandial insulin secretion, so it affects the treatment of diabetic people. Lifestyle intervention, especially in diet, needs to be used as the first choice of treatment. In addition to having a healthy effect, dietary changes are considered cheaper than the use of drugs and bariatric surgery.

Plant-based foods, especially those containing complex carbohydrates and low in fat can slow the absorption of glucose in the intestine. The fiber in food is useful to improve glycemic control that reduces insulin needs. So that insulin sensitivity increases (Abubakari et al., 2014). In addition to being high in fiber, plant-based foods also contain antioxidants, like polyphenol, which can trigger insulin secretion by inhibiting the absorption of glucose in the intestine. It causes decreased postprandial glycemic response and increased insulin sensitivity (Yang et al., 2021).

Food that enters the body gives a signal to the digestive tract to secrete the incretin hormone. This hormone consists of Glucagon-like Peptide-1 (GLP-1) or also known as the hormone that causes a feeling of satiety and Gastric Inhibitory Peptide (GIP). These two hormones help in the secretion of insulin and maintain glucose homeostasis in the

body. Besides GLP-1, other satiety hormones are Pancreatic Polypeptide (PP), Peptide YY (PYY), and amylin which serve to regulate appetite and energy homeostasis. The secretion of this hormone depends on diet composition and body condition disorder. The effect given by the incretin hormone in patients with T2DM will be lower due to a decrease in beta-cell sensitivity. This condition can be detrimental to the body because the incretin hormone contributes to 50-70% of the total postprandial insulin secretion. Study by Klementova et al. (2019) found that high levels of GLP-1 were found in respondents who had T2DM who intervened using plant-based tofu burgers. High levels of PYY were also found in respondents with T2DM. The increase in this hormone indicates the regulation of satiety in individuals with insulin resistance. However, the increase in this hormone also has a relationship with the presence of free fatty acids (FFA) and other nutrients in the intestine. Amylin level is known to regulate glucose homeostasis and provide a feeling of satiety to reduce eating (Klementova et al., 2019).

Plant-based foods can provide a higher feeling of fullness than animal-based foods. This is due to the presence of fiber and bioactive compounds, like polyphenol. Fiber can increase the secretion of PYY, causing a feeling of fullness, while polyphenol plays a role in increasing GLP-1 secretion, then increasing the half-life by increasing insulin secretion and inhibiting dipeptidyl peptidase-4. Animal-based foods can cause postprandial hyperlipidemia, postprandial hyperinsulinemia, increased lipoperoxide, and lower GLP-1 hormone secretion.

Negative Impact of Plant-Based Diet

A plant-based diet rich in refined carbohydrates, sugar, sweet beverages, and salty vegetables is an unhealthy sort of plant-based diet. This sort of diet has been linked to metabolic syndrome such as obesity, hypertriglyceridemia, low HDL level in the blood, and high blood pressure, all of which lead to non-communicable diseases. These findings are supported by research from the Nurses' Health Study (NHS) in the United States, which found a link between unhealthy

plant-based diet and excess weight gain as well as a high risk of T2DM. Research by Wright et al. (2017) reported there were no major side effects from the intervention, but one participant experienced hypoglycemia during the first week of the plant-based diet intervention, and two others showed a decrease in serum vitamin B12 level so they had to be given supplements.

The limitations of the research articles that we used are a small sample and not taken at random from several papers, as well as the presence of a sample who decided to leave in the middle of the study, measurement bias in the assessment of eating history, ethnic and economic differences that may not apply to other ethnic populations, the short intervention period and does not really describe the sample's eating pattern. In addition, several papers did not examine the bioavailability of micronutrients from the food that is given at the time of the intervention. The limitation of this literature study is there are many types of plant-based diet so that the discussion in this literature is less specific.

CONCLUSION

Food intake has a major impact on T2DM. Plant-based diet is effective to decrease the risk of T2DM in patients. It can decrease the body weight and body mass index (BMI) because this diet is low in carbohydrate and fat, and also high in fiber. The high amount of fiber in the plant-based diet can decrease the blood glucose rate which is marked by the reduction of fructosamine and HbA1C, it can endure hunger and increases the secretion of insulin and incretin.

ACKNOWLEDGMENT

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THE EFFECT DIFFERENCES OF 30-MINUTES VERSUS 60-MINUTES TELE-EXERCISE ON FITNESS LEVEL OF OBESE EMPLOYEES

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ABSTRACT

The ongoing COVID-19 pandemic causes lower physical activity while exercise intensity also decreases. At the same time, the stress level is increasing, causing low physical fitness level. Due to the importance of human health and company cost to increase their employees' physical fitness level, and with regard to the limited time of office employees, this research aimed to analyze the effect of tele-exercise duration on the fitness level of obese employees. The design of this study was pre-posttest quasi-experimental design. The subjects of this research were male and female obese employees, aged 18–45 years old, from Fast Moving Consumer Goods (FMCG) company in Jakarta, Indonesia. Subjects then were randomly assi gned to a 30-minutes exercise session group (n = 20) or 60-minutes exercise session group (n = 19). Statistical analysis included paired t-test and independent t-test to analyze differences between groups. All aspects of fitness analyzed in this study (strength, flexibility, and cardiorespiratory endurance) were increased in both groups significantly ($p<0.05$). It was shown that 60-minutes exercise sessions improve overall aspects of fitness better than 30-minutes exercise sessions, except for cardiovascular fitness (VO$_2$ Max). Using an independent t-test, there were no significant differences between 30-minute and 60-minute exercise sessions in terms of mean changes ($p>0.05$). This study showed that tele-exercise, even if it is done in a short period, 30-minute duration, may improve the overall aspect of fitness level significantly for obese employees. Moreover, in this pandemic time, this kind of program is a better alternative than face-to-face, direct exercise intervention.

Keywords: body composition, combined exercise, fitness level, obesity, tele-exercise

INTRODUCTION

For office employees, an unhealthy lifestyle may affect the risk of cardiovascular disease and other chronic diseases, as well as having a negative effect associated with the workplace. Physical activity that does not fulfill the WHO's requirement of minimum 150 minutes per week is negatively associated with physical work capacity (Ilmarinen, 2001), while it is also positively associated with time spent off sick (Proper et al., 2006). Thus, the aforementioned conditions are an important push on the indirect cost of the employer (Andersen et al., 2010; Katzmarzyk & Janssen, 2004; Schmier et al., 2006). Therefore, a unified approach to management is essential for preventing the negative effects of a sedentary lifestyle and improving the fitness level of office employees. On the other hand, one of the greatest obstacles for wellness programs intended to improve fitness levels is maintaining individual compliance or adherence to the program itself, with limited time being the leading cause of low compliance (Trost et al., 2002).

Physical fitness is one of the main factors that affect the health status of every individual (Lipecki & Rutowicz, 2015). Simply put, fitness can be defined as the ability of a person to do a specific task with maximal effort but still in an efficient form without experiencing extreme fatigue, as well as not doing that task with the risk of health-related disorder (Bile & Suharharjana, 2019). The current COVID-19 pandemic that has been affecting Indonesia for the past two years is causing the closing of fitness centers, stadiums, swimming pools, dance studios, physiotherapy centers, and playgrounds. Due to this condition, many people, including office employees, cannot exercise in a group or even outside of their living place or home. In this condition, both physical activity and exercise intensity are reduced. While at the same time, the stress level is increasing, causing low physical fitness level (Almandoz et al., 2020), screen time is simultaneously increasing (Qin et al., 2020; ten Velde et al., 2021; Wagner et al., 2021).

The problem of physical inactivity, to this day, is still a growing problem With over 30% of adults failing to attain their goals of the required physical activity level (Bachmann et al., 2015). This condition indicates that the accumulation of physical activity in a day due to work routine is not sufficient to maintain general physical fitness. Thus, it is required for employers to make a routine physical activity or exercises for their employees, such as in the form of wellness programs, systematically and continuously (Irianto, 2007), to improve or maintain the physical fitness level of employees at an optimal level (Bile & Suharharjana, 2019).

With regard to the COVID-19 pandemic, the effort to maintain optimal physical fitness must be done as a preventive measurement to improve the immune system specifically and maintain health generally (Hale et al., 2018). It cannot be denied that the Working from Home (WFH) system in this pandemic time is heavily affecting the intensity of physical activity performed by office employees. The easiness of access to online working material due to smartphones and computers utilization, as well as other electronic media, indirectly implicates low physical activity level. These conditions may induce a tendency to shift employee lifestyle to become more sedentary, which will increase the risk of having a health disorder such as increased body mass index (BMI), cardiovascular disease, as well as lowering immunity and other degenerative diseases (Knaeps et al., 2018), which will cause the employee, mainly the obese ones, in having a low fitness level, further increasing the risk of having a COVID-19 disease.

In this case, online intervention during working hours that is done at every subject's house can be an effective solution to the problem of limited time for exercise and low level of physical activity motivation. In this pandemic situation, implementing a workplace wellness program is one way to provide this intervention, primarily in every subject's house; with an online system (i.e. live, synchronous video conference), which will provide a series of physical practices from work activity that is done during working hours. This type of intervention, which is called tele-exercise (Hong et al., 2017), is aimed to balance body structure changes during work; strengthen muscles that are not used during work; and maintain strength and flexibility, which are parts of fitness level (Hayden et al., 2005). Due to the importance of human health and company cost to increase employees' physical fitness level, and with regard to the limited time of office employees, this study aims to analyze the effect of tele-exercise duration on the fitness level of obese office employees.

METHODS

The subject of this study is obese male and female office employees, aged 18–45 years old, from FMCG company in Jakarta, Indonesia. During the duration of tele-exercise by using Zoom application, subjects can exercise either in the office or at home, depending on the office schedule regarding Work From Home (WFH) and Work From Office (WFO) system, which was planned by the office. The design of this study is pre-posttest quasi-experimental design. This study was done on two groups without involving a control group, covering both male and female employees. Screening for subjects was done beforehand with BMI criteria > 23 kg/m² is required since it is the minimal range of an individual in Asia-Pacific countries to be categorized as obese (Pan & Yeh, 2008). Inclusion criteria were subject is an office employee who worked from morning till early evening without physical activity other than what was given in this intervention, having a healthy heart (which was screened by medical check-up beforehand), did not have any severe diseases that may be worsened by doing exercise, commuting to the office with public transportation or walking less than 2 km per day, not having a problem on doing high-intensity exercises, not currently on a specific diet and/or regular exercises program, and willing to adhere to the intervention until the conclusion of the trial without compulsion or pressure from others. Exclusion criteria were pregnant, currently have a chronic disease, did not complete the intervention protocol until the end, and having an injury. Sampling was done purposely, while the total subjects that met the criteria and were willing to be intervened were 39 people. Subjects then were randomly assigned to a 30-minutes exercise session group (n = 20) or 60-minutes exercise session group (n = 19).

Exercises that were given are the kind of intervention that did not have a high risk of injury considering that subjects are prone to injury since they are obese. The exercises were done according to the subjects' capability of doing exercise, accompanied by a professional fitness coach. All interventions use the combined strength and cardio protocol. Subjects performed combined strength and cardiovascular tele-exercise for 30 minutes every session, three times per week, for 12 weeks. The exercise duration was doubled for the 60-minutes exercise group. Exercise interventions consist of four kinds of exercise: high-intensity interval training (HIIT), low-high impact aerobic exercise, circuit training, and Zumba. Exercises were started by doing a 2-5 minutes warm-up, followed by main training for 20 to 25 minutes, then ended by a 2-5 minutes cooling down session.

Every Tuesday and Thursday, strength workouts were performed, and every Saturday cardio exercises were performed. Baseline data were collected at weeks 0 and 12, before and after the intervention, respectively. Output variables were VO_2 Max, 1-minute push-up count, 1-minute sit-up count, and sit-and-reach distance. Data were collected by a professional coach with VO_2Max being processed from beep test result using the formula by Ramsbottom et al. (1988), with beep test being performed before work in the morning.

VO_2 Max was assessed by counting the number of returns and processed by (Ramsbottom et al.'s (1988) formula: VO_2 Max = 12.1 + (Number of Returns x 3.48). The descriptive distribution of the data was determined through univariate analysis. Output data for week 0 and t-test to prove this study hypothesis. Independent sample t-tests were done on the mean difference between the two groups of intervention. All analyses were done using SPSS 26.0 for Windows. This study protocol is approved by the Research Ethic Committee Faculty of Medicine Universitas Indonesia - RSUPN Dr. Cipto Mangunkusumo No. 20-10-1309.

RESULTS

Table 1 shows the baseline characteristics of subjects. Most of subjects are female (n = 26, 66.67%). The mean body weight for the 30-minutes exercise group was 69.6±10.65 kg, while for the 60-minutes exercise group was 72.65±11.65 kg. The mean initial BMI was slightly lower for the 30-minutes group (25.98±2.43 kg/m^2) than the 60-minutes group, being 27.92±4.98 kg/m^2.

Table 2 shows the changes of body weight (BW) and BMI for all groups. There's a decrease on body weight and BMI for both groups. Body weight on 30-minute intervention group decreased from 69.60±10.65 kg to 68.40±10.55 kg (Δ = -1.20 kg), while for 60-minute intervention group, the body weight decreased from 72.65±11.65 kg to 68.49±11.18 kg (Δ = -4.16 kg). BMI for 30-minute group decreased from 25.98±2.43 kg/m^2 to 25.54±2.70 kg/m^2 (Δ = -0.44 kg/m^2), while for 60-minute group the BMI decreased from 27.92±4.98 kg/m^2 to 26.44±4.33 kg/m^2 (Δ = -1.48 kg/m^2).

Table 1. Baseline characteristics

| Group | n (%) | Age | Sex | | Initial Body Weight (kg) | Initial BMI (kg/m^2) |
			Male (n (%))	Female (n (%))		
30 minutes	20 (51.28)	31.60±6.04	8 (20.51)	12 (30.77)	69.6±10.65	25.98±2.43
60 minutes	19 (48.72)	37.85±10.50	5 (12.82)	14 (20.51)	72.65±11.65	27.92±4.98
Total	39 (100)		13 (33.33)	26 (66.67)		

Table 2. Changes in subject's body weight and BMI on both intervention groups

Group	BW*1	BW*2	Δ	BMI**1	BMI**2	Δ
30 minutes	69.60±10.65	68.40±10.55	-1.20	25.98±2.43	25.54±2.70	-0.44
60 minutes	72.65±11.65	68.49±11.18	-4.16	27.92±4.98	26.44±4.33	-1.48

*BW:Body Weight
**BMI: Body Mass Index

Table 3 shows the fitness level of subjects before and after the intervention. All aspects of fitness analyzed in this study (strength, flexibility, and cardiorespiratory endurance) were increased in both groups significantly (p<0.05). It is shown that 60-minutes exercise session improves overall aspects of fitness better than 30-minutes exercise session, except for cardiovascular fitness (VO_2 Max). However, there are no significant differences in mean changes of overall aspect of fitness between 30-minutes and 60-minutes exercise sessions, which was analyzed using independent t-test (p>0.05).

Table 3. Fitness level before and after intervention

Fitness test	30-minutes				60-minutes				p-value for independent t-test
	Pre	Post	Delta	p-value	Pre	Post	Delta	p-value	
Push-up count (n)	27.8±6.31	34.85±7.94	6.89[a]	<0.001*	19.26±7.19	29.79±7.46	10.53[a]	<0.001*	0.152
Sit-up count (n)	22.45±8.24	29.7±7.71	7.25[a]	<0.001*	18.89±5.22	28.74±9.57	9.84[a]	<0.001*	0.222
Sit-and-Reach distance (cm)	-0.48±8.05	7.58±5.79	8.05[a]	<0.001*	3.79±10.05	14.82±9.41	11.03[a]	<0.001*	0.085
VO_2 Max (ml/kg.min)	21.58±2.51	24.17±3.54	2.59[a]	<0.001*	20.78±1.82	22.92±3.14	2.14[a]	<0.001*	0.445

* p-value denotes significant difference between pre- and posttest ab) independent t-test between groups' mean changes show significant differences if it has a different letter

DISCUSSION

Our findings show that both duration of exercise improves the overall aspect of fitness significantly (p<0.05). Mean push-up count for 30-minute group was categorized as good for before and after intervention (>22), while for 60-minutes group, beforehand it was categorized as average, then became categorized as good. Mean sit-up count for 30-minutes group and 60-minutes group was beforehand categorized as below average (<22), then became categorized as good (>26). Sit-and-reach distance before intervention in both groups was categorized as below average (<13 cm), and stayed still for 30-minute group while became average for 60-minute group (14-16 cm) (International Fitness Association, 2004). VO$_2$max (Heyward, 1997) for both groups was categorized as very poor (<22.8 ml/kg/min) before intervention, and became poor (22.8–26.9 ml/kg/min) after intervention.

It is also shown that 60-minutes exercise sessions improve fitness better than 30-minutes exercise. However, the insignificant results of mean differences between the two groups indicate that even short-duration exercise sessions can induce improvement in fitness level.

Cohort prospective studies with large and diverse populations show clearly that approximately 1000 kilocalories per week energy expended by moderate-intensity physical activity, or equal to 150 minutes per week (30 minutes/day for five days) is correlated with lower cardiovascular disease rate as well as lowered premature mortality (Lee et al., 2001; Manson et al., 2002; Sesso et al., 2000; Tanasescu et al., 2002). This also may be achieved with vigorous-intensity physical activity performed equal to or more than three days per week for equal to or more than 20 minutes per day, for a total of equal to 75 minutes/week, according to the stand of the American College of Sports Medicine (ACSM) on prescribed exercise to meet fitness requirement (Garber et al., 2011). This was done in the current intervention.

More intense physical activity done by an individual means more energy is needed for muscles to contract. The heart as a blood pump to transport nutrients and oxygen must work harder to compensate for the need of that. Higher and faster heart pulses while exercising cause the heart muscle to increase in size (hypertrophic) so that the heart will be stronger. With a stronger heart, the quality of the heart as a blood pump will also

be increased. The heart does not have to work harder to supply the need for energy to skeletal muscle. The improvement of heart quality can also be seen by the decrement in pulse during rest after exercise. With endurance and resistance exercise, the number of capillary blood vessels in skeletal muscles will increase, enabling easier oxygen diffusion. Thus, for a trained person, they can transport and use oxygen more efficiently than an untrained person, marked by increased VO_2 Max. Therefore, the endurance aspect of fitness will also be increased (Prativi et al., 2013).

Stretching aims to prepare muscles and joints before the main exercise is performed. Other than that, routinely performed exercise may affect the body's flexibility generally. Muscles that are routinely stretched will increase their flexibility. Joints that are routinely stretched will also be increased in range of motion (ROM) (Prativi et al., 2013).

Every exercise in this intervention repeated the flexibility session for cooling down. Since 2-4 flexibility exercise is effective, joint range of motion will be enhanced, especially if done at least for 3–12 weeks (Bandy et al., 1997; Decoster et al., 2005; Nelson et al., 2007). It is recommended that each flexibility exercise includes a total stretching time of 60 seconds, adjusted to repetition and duration to meet the needs of each individual. Stretching exercise should be performed to 2-3 days per week to be induced more flexibility score (Decoster et al., 2005; Kramer & Erickson, 2007), but greater gains in joint ROM may be induced with flexibility exercise daily (Feland et al., 2001; Guissard & Duchateau, 2004; Porter et al., 2002; Rees et al., 2007; Willy et al., 2001).

Strength in each group was notably and significantly increased, marked by 1-minute sit-up count and 1-minute push-up count. This may happen due to muscle hypertrophy as a result of muscle overload since strength is trained. Step-by-step muscle training induces hypertrophy because the number of muscle fibers increases (Prativi et al., 2013). It is known that the general population favorably responds to 2–4 sets of resistance exercises per muscle group (Kraemer et al., 2002; Wernbom et al., 2007) which was done in this study. However, even a single exercise set can significantly increase muscle size and strength, especially in beginners. (Kraemer et al., 2002; Pollock et al., 1998). Total number of targeted muscle groups per set can be accomplished with a single resistance exercise or a combination of multiple resistance exercises. Overall, the tele-exercise aspect of this intervention does not hinder participant's willingness to exercise, and improves the overall fitness aspect of the subject in this intervention. This is in accordance with research by Kuswari et al. (2022), stating that tele-exercise may improve fitness level significantly.

CONCLUSION

This study shows that tele-exercise, even if it is done in a short, 30-minute duration, may improve the overall aspect of fitness level significantly for obese office employees. There was no significant difference between mean changes of fitness level between 30-minutes and 60-minutes tele-exercise groups. Employees could choose between 30-minutes or 60-minutes tele-exercise as they felt suitable for their exercise program. Moreover, in this pandemic time, this kind of program could be a better alternative than face-to-face, direct exercise intervention. We recommend e future research to use a control group with a better and more complex design such as a randomized controlled trial.

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RELATIONSHIP OF PHYSICAL ACTIVITY AND BALANCED DIET WITH NUTRITIONAL STATUS OF STUDENTS AT SMA NEGERI 3 BALIKPAPAN DURING ONLINE LEARNING

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ABSTRACT

The students experience the impact of the COVID-19 virus transmission. One of it was school from home. Online learning conditions allow adolescents to experience shifts in physical activity and diet patterns. This study analyzed the relationship between physical activity and a balanced nutritional diet with nutritional status in students at SMA Negeri 3 Balikpapan. This type of research was quantitative research with explanatory surveys and using a cross-sectional design. In this research, all active students of SMA Negeri 3 Balikpapan were involved as a population. The number of samples obtained was 92 people using purposive sampling techniques. An instrument for measuring activity level variables was the International Physical Activity Questionnaire-Short Form (IPAQ-SF). A balanced nutrition diet was assessed using Semi Quantitative-Food Frequency (SQ-FFQ) and the Balanced Nutrition Index 3 Levels (IGS3-60). Measurement of nutritional status through self-reporting based on body mass index by age z-score (BMI/Age). The statistical test used was a chi-square to test the research hypothesis. Based on the results of the chi-square statistical test, there was a relationship between physical activity and nutritional status (p=0,014), and there was no relationship between a balanced nutritious diet and the nutritional status (p=0,212). Physical activity is closely related to the nutritional status of adolescents. Therefore, to maintain optimal nutritional status, implementing a healthy lifestyle and physical activity patterns are need to be done.

Keywords: physical activity, balanced nutrition diet, nutritional status

INTRODUCTION

The SARS-Cov-2 virus pandemic has had an impact on most aspects in various worldwide from late 2019. Coronavirus Disease (COVID-19) is a disease caused by the SARS-Cov-2 virus transmission. The virus could affect the human respiratory system and is transmitted by droplets, air, and contaminated surfaces. (Kim et al., 2020; Chan et al., 2020; Huang et al., 2020). The government of the Republic of Indonesia conducted a large-scale social restriction policy (PSBB) that were stated in the Regulation of the Minister of Health of the Republic of Indonesia number 9 of 2020 to overcome and break the COVID-19 transmission chain. This regulation directly influences student learning in schools, where students are expected to transition to online learning methods from home entirely (Goldschmidt, 2020).

Nutritional problems in Indonesia, such as undernutrition and overnutrition, had a fairly high prevalence long before the COVID-19 pandemic (UNICEF, 2019). Adolescents are one age group at risk of malnutrition. According to Aflah (2010), factors that cause malnutrition in adolescents include unbalanced food intake and physical activity and lack of attention to other integrated aspects such as psychological aspects, namely body image, depression, and gender. This is in accordance with the research of Iftita & Merryana (2018) which states that there are changes in social behavior, lifestyle, and even diet in adolescence. According to Indonesian Basic Health Research (2018), the prevalence of obesity among adolescents aged ≥ 15 Indonesia were 21.8 %. According to the Health Research and Development Agency of the Indonesian Ministry of Health, 8.1 percent of adolescents aged 16 to 18 years in Indonesia were thin and very thin (Ministry of Health of the Republic of Indonesia, 2018).

Adolescents conditions such as psychological and consumption behaviors may change due to the COVID-19 pandemic's impact (Marwoko, 2019). Based on studies that analyzed food consumption in adolescents during the pandemic and online

learning due to restricted access constraints, most of the respondents seldom consumed balanced, nutritious food. (Dewi et al., 2020). That can undoubtedly trigger various nutritional problems both undernutrition and overnutrition due to an unbalanced diet pattern (Almatsier, Soetardjo, & Soekatri, 2011).

It is essential to enhance healthy living behaviors such as exercise, not smoking, and consume healthy and nutritious foods throughout social limitations to prevent the transmission of COVID-19 (Atmadja, 2020). The Ministry of Health has recommended a balanced nutrition menu during the COVID-19 pandemic. In each food menu contains complete nutrients, include macronutrients such as carbohydrates, proteins, fats, and micronutrients from vitamins and minerals. (Kemenkes RI, 2020).

The demands of online learning activities have a profound impact on students' activity levels. Utami et al. (2021) stated from the results of her study, 85.1% of respondents experienced a decrease in physical activity due to the tendency of limited activity, such as sitting > 8 hours a day during online learning. Reduced levels of physical activity contribute to increased body weight, then increasing the risks of obesity. Even worse, , obesity had potential to increase the risk of complications due to SARS-Cov-2 infection. According to Rebello, Kirwan, & Greenway (2020), excess body weight was a significant risk factor for diabetes, cardiovascular disease, and lung disease that were often found as a concomitant disease in individuals infected SARS-Cov-2 virus.

SMA Negeri 3 Balikpapan is a secondary school under the Ministry of Education and Culture of East Kalimantan Province's auspices. East Kalimantan province has overnutrition problems higher than the national prevalence in 2013 (RISKESDAS, 2013). In our knowledge, the agency of SMA Negeri 3 Balikpapan has never received information related to the level of physical activity and balanced diet from local health officials. Besides SMA Negeri 3, Balikpapan applied an online learning policy to all of students during a period of social restrictions.

Based on the description above, it is known that physical activity and a balanced nutritious diet are very important to improve the nutritional status of adolescents, especially in conditions of social restrictions due to the COVID-19 pandemic. Therefore, this study was conducted to determine the relationship between physical activity and a balanced diet with the nutritional status of students during the online learning period.

METHOD

This research used a cross-sectional design and was conducted at SMA Negeri 3 Balikpapan, East Kalimantan, in June 2021. The population of this study was 1041 students at SMA Negeri 3 Balikpapan. The sampling technique used in this study was purposive sampling, with the number of the sample were 92 students. The inclusion criteria in this study were students aged <17 years and ≥ 17 years, actively studying at SMA Negeri 3 Balikpapan, and did not consume appetite-lowering supplements or laxatives during the study. Characteristics of parents measured including parental education, parental occupation, and family income. Characteristics of students include age, grade level, and gender. Exclusion criteria in this study was students who are sick and are undergoing a certain diet in order to minimize bias.

The instrument used for data collection was the International Physical Activity Questionnaire-Short Form (IPAQ-SF). Physical activity variables were divided into three categories: low activity (<600 MET/minute), medium (600-1499 MET/minute), and high (≥1500 MET/minute) (Prijo, 2013). To determine balanced nutritional intake, we used semi-quantitative food frequency (SQ-FFQ), consisting of 52 items of food items and a Balanced Nutrition Index of 3 Levels (IGS3-60). The categorization of balanced nutrition diet into three categories, namely unbalanced diet (score<32), moderate diet (score 33-41), and balanced diet (score≥41). These three categories were modifications of Rahmawati (2015), which categorized balanced nutrition diets into five categories based on *Mutu Gizi Pangan* (MGP). For the nutritional status, we measured based on Body Mass Index by age z-score, <-2 SD to <-3 SD (undernutrition), -2SD to +1SD (normal nutrition), and >+1SD (overnutrition) (Ministry of Health of the Republic of Indonesia, 2020). To collect data on the weight and height of students

in order to remain valid, students send evidence of measurements to the researcher.

The measurement data were analyzed descriptively to see the frequency distribution and analyzed statistically inferential to see the relationship between variables using the chi-square test. The significance of the chi-square test was determined if the p-value of the test was ≤ 0.05. The entire analysis process used SPSS 20 version software. The Ethics Commission of the Faculty of Dentistry, Airlangga University, Surabaya, has approved this research with reference number 317/HRECC. FODM/VI/2021 on June 21, 2021.

RESULTS AND DISCUSSION

Table 1 presented the characteristics of 92 respondents, including respondent data and family characteristics. Based on the data, the majority of respondents (75%) have normal nutritional status. The rest are respondents with undernutrion (9.8%) and respondents with overnutrition (15.2%).

Table 1. Characteristics of Families and Students

Variable	Nutritional Status						p-value
	Total	Undernutrition		Normal		Overnutrition	
	n (%)	n	(%)	n	(%)	n	(%)	
N	92 (100)	9	9.8	69	75	14	15.2	
Students Characteristic								
Gender								
Male	32 (34.8)	2	2.2	25	27.2	5	5.4	0.584
Female	60 (65.2)	7	7.6	44	47.8	9	9.8	
Age (Years)								
<17	68 (73.9)	11	12	45	48.9	12	13	0.149
≥17	24 (26.1)	7	7.6	16	17.4	1	1.1	
Grade Level								
First level	46 (50)	2	2.2	37	40.2	7	7.6	
Second level	27 (29.3)	2	2.2	19	20.7	6	6.5	0.045*
Third level	19 (20.7)	5	5.4	13	14.1	1	1.1	
Family Characteristic								
Family Income								
Low (<Minimum Wage)	60 (65.2)	6	6.5	46	50	8	8.7	0.584
High (≥Minimum Wage)	32 (34.8)	3	3.3	23	25	6	6.5	
Father's Occupation								
Employed	81 (88)	9	9.8	60	65.2	12	13	0.447
Unemployed	11 (12)	0	0	8	8.7	2	2.2	
Mother's Occupation								
Employed	24 (26.1)	2	2.2	20	21.7	2	2.2	0.538
Unemployed	68 (73.9)	7	7.6	49	53.3	12	13	
Father's Education								
Did not graduated from high school	(26 (28.3)	4	4.3	17	18.5	5	5.4	0.849
Graduated from high school	66 (71.7)	5	5.4	52	56.5	9	9.8	
Mother's Education								
Did not graduated from high school	28 (30.4)	2	2.2	23	25	3	3.3	0.814
Graduated from high school	64 (69.6)	7	7.6	46	50	11	12	

Note: UMK or *Upah Minimum Kerja* (Minimum Wage). *Significant p-value: <0.05

Among the characteristics of respondents and families in Table 1, only respondents' education showed a significant relationship with nutritional status (p<0.05).

Respondent Characteristics

The age of adolescents in this study was divided into two, namely those aged <17 years and >17 years. Most of the adolescents aged <17 years had problems of undernutrition or overnutrition. . Adolescents are one of the age groups that are prone to nutritional problems. At this stage, adolescents are in rapid development and growth cycles that require many nutrients (Setyawati et al., 2015).

Table 1 showed a significant relationship between the respondent's grade level and nutritional status (p=0.045). First grade was dominated respondents who experienced nutritional problems. This is related to the lowest level of first grade education compared to respondents with other grade levels. The higher the education, the more comprehensive the knowledge of nutrition (Kurniasari, 2017). That is in line with Hakim (2016), who stated a significant relationship between the education level and nutritional status.

In this study, adolescents who experienced undernutrition (7.6%) and overnutrition (9.8%) problems were girls . Girls are at risk of malnutrition because, physiologically, girls have higher body fat levels (22-26%) compared to boys (Sutriani, 2013). Moreover, girls pay more attention to body image than boys (Brown, 2011). A study in India by Mitra and Nao (2017) proves that adolescent girls are more at risk of experiencing nutritional problems than boys. The results of this study showed an insignificant relationship between gender and nutritional status (p=0.584). This is in line with Hakim (2016)'s research which states that there is no relationship between gender and nutritional status.

Family Characteristics

Related to the respondent's family characteristics, the researchers collected data such as family income level, father's education level, and maternal level of education. On employment status, most fathers are working, and most mothers are not working. The family income level was calculated by the number of Minimum Wage in East Kalimantan province, Rp 3,069,315. Table 1

shows that the family income level is relatively low (<Rp 3,069,315) and more dominant adolescents with undernutrition and overnutrition problems. Nutritional status is not directly influenced by family income. The small amount of income in a family can affect daily consumption patterns—high income were in line with the food purchase expenditure (Desi et al., 2018).

In table 1, the level of education of fathers and mothers is mainly dominated by high school graduation rates of 67.4% and 64.1%. Nutritional status can also indirectly be influenced by parents' level of education, but the level of parents' education can describe the level of knowledge. The high level of education is in line with the knowledge possessed (Kurniasari, 2017). Parents with a high degree of education have attitudes that align with the nutritional quality of the food given, resulting in improved family nutrition (Permaesih, 2005).

Table 2. Frequency Distribution of Physical Activity Level, Balanced Diet, and Nutritional Status

Variable	Total	
	n	(%)
Physical Activity Level		
Low	34	36.9
Medium	25	27.2
High	33	35.9
Balanced Nutritional Diet		
Unbalanced	68	73.9
Moderate	19	20.7
Balanced	5	5.4
Nutritional Status		
Undernutrition	9	9.8
Normal	69	75
Overnutrition	14	15.2

Table 2 showed the distribution of variables studied, that are physical activity, balanced nutritional diet, and nutritional status. The results showed that the majority of respondents had a low level of physical activity (36.9%). Low level of physical activity are possible due to social restriction policies and the demands of online learning that require sitting all day. In comparison, the measurement of a balanced nutritional diet resulted in most respondents having an unbalanced diet during the online learning period (73.9%). The low quality of balanced nutrition in the diets of respondents is possible due to the decrease in

purchasing power of food and a lack of knowledge about balanced nutrition (Nobre et al., 2012). Then, for the results of nutritional status measurement obtained, most respondents had a normal nutritional status (75%).

Table 3. Relationship between Physical Activity and Balanced Nutritional Diet with Nutritional Status

| Variable | Nutritional Status | | | | | | Total | | p-value |
| | Undernutrition | | Normal | | Overnutrition | | | | |
	n	(%)	n	(%)	n	(%)	N	(%)	
Physical Activity Level									
Low	2	2.2	24	26.1	8	8.7	34	36,9	0.014*
Medium	2	2.2	18	19.6	5	5.4	25	27.2	
High	5	5.4	27	29.3	1	1.1	33	35.9	
Balanced Nutrition Diet									
Unbalanced	8	8.7	50	54.3	10	10.9	68	73.9	0.212
Moderate	1	1.1	16	17.4	2	2.2	19	20.7	
Balanced	0	0	3	3.3	2	2.2	5	5.4	
Total	9	9.8	69	75	14	15.2	92	100	

Note: Significant p-value <0.05

Table 3 shows the relationship between physical activity and balanced nutritional diet with the nutritional status of students at SMA Negeri 3 Balikpapan. The majority of respondents had low levels of physical activity (36,9%). This situation is in line with the results of research by Deschasaux-Tanguy et al. (2020), where there was a decrease in physical activity levels (53%) and an increase in sedentary activity rate (63%) during the COVID-19 pandemic.

Overall, the percentage of respondents with normal nutritional status was very dominant at all respondents' physical activity levels. The tendency for undernutrition (2.2%) and overnutrition problems (8.7%) was found in mild activity. That is undoubtedly a concern for researchers because the high percentage of mild activity in respondents can cause overnutrition problems (Mainous, et al. 2019). A number of studies have also shown that low physical activity can reduce immunity (Luzi & Radaelli, 2020). Therefore, maintaining physical activity patterns is very important during the COVID-19 pandemic because, indirectly, physical activity affects the body's immunity (Jones & Davison, 2018).

In the results, it can be seen that the tendency of respondents with low physical activity to have normal nutritional status. This is not in accordance with similar studies which explain that individuals with low physical activity should have an overnutrition (Suryadinata et al., 2019; Hasnizar et al., 2020).

Regarding the phenomenon in this study, Fadhilah et al. (2018) stated that the factors that affect the nutritional status of adolescents are eating behavior, knowledge, attitude, availability of facilities, physical activity, pocket money, role teachers and the role of parents. It can be seen that nutritional status is not only influenced by physical activity.

Statistical test results with chi-square test showed p-value=0.014 (p<0.05). It can be concluded that there was a relationship between physical activity and the nutritional status of students at SMA Negeri 3 Balikpapan during online learning. The respondents' low level of physical activity was due to compliance with social restriction regulations, lack of knowledge regarding the importance of physical activity, and the demands of learning activities that require sitting throughout the day (Fredriksson, 2018; Utami et al. 2021) . However, we do not measure the respondents' level of physical activity knowledge during the online learning period. The results of this study are certainly in line with research conducted by Rukmana et al. (2021), who stated that there is a relationship between physical

activity and the nutritional status of adolescents during the COVID-19 pandemic.

Analysis of chi-square test data between balanced nutritional diet variables and nutritional status did not result in a significant relationship. The result of the p-value was obtained at 0.212 (p>0.05). In Table 3, respondents with an unbalanced diet dominated the occurrence of undernutrition problems (8.7%) and overnutrition problems (10.9%). On the other hand, most respondents with normal nutritional status also have an unbalanced diet (54.3%). This result is similar to the study by Hafiza et al. (2020) and Pujiati et al. (2015) which resulted in the dominance of respondents with poor diets having normal nutritional status. There are several factors that affect nutritional status directly i.e., food intake and infection while indirectly i.e., resistance family food, parenting and health environment (Bakri, B., Fajar, I., & Supariasa, D. N. 2013). Research by Putri (2014) stated that there is no relationship related to diet with nutritional status. Respondents who have nutritional status in the normal category have a diet pattern in the unbalanced category than the respondents who have over or under nutritional status.

The results of this insignificant test are in line with research by Sagala & Noerfitri (2021), which found there is no significant relationship between diet pattern and balanced nutritional knowledge with nutritional status. Another study that strengthens the results of statistical tests is research conducted by Noviyanti (2017) and Matias et al. (2017) in Brazil, which reported no relationship between diet pattern and nutritional status in adolescents.

This study has several limitations. First, the use of cross-sectional studies limits our view of causal relationships between variables. However, the collection of research data is very up-to-date in accordance with online learning conditions due to the COVID-19 pandemic. Second, anthropometric data collection is self-reported which allows for data bias. However, this policy was taken by researchers in order to minimize physical contact that allows the transmission of SARS-Cov-2.

CONCLUSIONS

In this study, it was found that the majority of respondents had normal nutritional status. Most

of the respondents' education levels were at the first level. The level of education relates to the respondent's nutritional knowledge. Therefore, the education level of respondents plays a role in the nutritional status.

Based on the results of the data analysis there was a relationship between physical activity and nutritional diet balanced with nutritional status at SMA Negeri 3 Balikpapan during the online learning period, students' level of physical activity has a relationship with nutritional status. At the same time, the test of the relationship between a balanced nutritional diet also has no relationship with nutritional status. Therefore, the recommendations are that students be more to increase their physical activity and maintain a balanced diet to improve their nutritional status during the online learning period.

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PHYSICAL HOME FOOD ENVIRONMENT AND ITS CORRELATION WITH IRON AND VITAMIN C INTAKE AMONG CHILDREN IN PEJAGALAN

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ABSTRACT

Despite the fact that Indonesia has established nutrition and health measures to prevent childhood malnutrition, more than 70% of children aged 2 to 5 consume less iron than the Indonesian dietary recommendations. Iron deficiency harms children's cognitive and motor development, and increases morbidity. Sixty-five to 72% of children's daily calories are consumed at home, hence the environment is crucial. The purpose of this study is to observe if the iron and vitamin C consumption of children aged 2 to 6 in Pejagalan, North Jakarta, is related to their eating environment. A total of 191 samples was examined. To assess children's intake, 2x24h food recalls were performed. A modified version of the NHANES CBQ was used to assess the home food environment. SPSS Version 20 was used to perform Spearman correlation and multiple linear regression. The iron and vitamin consumption of the subjects was lower than the estimated average requirement (EAR) for Indonesia. It was shown that children who had more access to fruits and vegetables ingested more iron and vitamin C. Iron consumption was enhanced by fruits, vegetables, sweets, and sugar sweetened beverages. Fruit accessibility ($p<0.05$) and availability ($p<0.05$) were related to vitamin C consumption. A variety of home food environment characteristics such as the availability and accessibility of food, are related to a child's consumption, particularly of micronutrients.

Keywords: food availability, home food environment, toddler intake, vitamin C, iron intake

INTRODUCTION

Iron deficiency, often known as ID, is most common in children younger than five years old (Subramaniam & Girish, 2015). More than 50% of urban children had an iron intake that was lower than the recommended daily allowance for children in Indonesia, while the iron intake of children aged two to five years was more than 70% lower than the RDA (Sandjaja et al., 2013). Anemia, poor academic performance, and a diminished capacity to concentrate for extended periods can all be caused by a deficiency in iron (Cerami, 2017). Children who don't consume enough iron have poorer brain and motor development, and they are more likely to get sick. Iron deficiency also makes children more susceptible to infections (Subramaniam & Girish, 2015).

Iron deficiency anemia (IDA) is a condition that exists even in developed countries. Children under the age of five in Indonesia have higher rates of anemia each year (Ministry of Health Indonesia, 2018). Insufficient iron in the diet, along with deficits in other nutrients including lipids, protein, and vitamin C, can lead to iron deficiency anemia (IDA). The substantial correlation between insufficient dietary vitamin C consumption and anemia may have a potential explanation in the fact that vitamin C is known to aid the conversion of ferric ion to ferrous, which is a form of ferric that is more readily absorbed by the body (Sunardi et al., 2021). Therefore, getting enough vitamin C through food is helpful in protecting prevent anemia.

Children might get iron deficiency if they do not get enough iron in their diet. Because children consume between 65 and 72% of their daily calorie intake at home, the atmosphere of the home is quite important (Herawati et al., 2019). Numerous researches have found a correlation between diet and home food environment (Ansem et al., 2017; Ding et al., 2012; Prasetyaningrum

et al., 2018; Quick et al., 2018; Trofholz et al., 2016; Vereecken et al., 2010). Increased fruit and vegetable consumption was shown to be positively correlated with the frequency with which parents feed their children aged 2-5 years old these meals as well as their accessibility and availability in the house, according to an Australian research (Wyse et al., 2011). There is a lack of study in Indonesia on how the home food environment affects children between the ages of 2 and 6 in their consumption of micronutrients, notably iron and vitamin C. It appears that the food availability in the neighborhood influences the availability of food in households. The presence of a locally owned food shop (warung) was shown to be associated with higher levels of calorie consumption as well as consumption of foods high in energy density that were devoid of diversity and micronutrients (Taylor & Emmett, 2020). In a research conducted in East Jakarta, it was shown that low-income urban dwellers mostly relied on buying ready-to-eat foods from neighborhood food stands and frequently bought foods from outside that were high in calories and/or low in nutrients (e.g. fewer fruits and vegetables) (Sufyan et al., 2019). This study will investigate whether there is a correlation between the intake of iron and vitamin C by children ages 2 to 6 and the food environment in their homes in Pejagalan, which is located in North Jakarta.

METHOD

This observational study uses a cross-sectional design and secondary data collection. Throughout this study, the relationship between the dependent and independent variables is investigated concurrently. This research was conducted in the province of Jakarta, specifically in the Penjaringan subdistrict of North Jakarta's urban hamlet Pejagalan. Data collection was conducted from January to April 2020. The neighborhood of Pejagalan, which is located in North Jakarta, was chosen as the study's location by multistage random selection process. Four were Posyandu selected by consecutive random and made a list of children based on the Posyandu's registered children and family certificates (*kartu keluarga*). Progressively, inclusion-eligible children were

chosen. Completed questionnaires, data on the characteristics of the caregiver and child, and two 24-hour food recalls were included as samples; 191 samples were available for data analysis after the data were cleaned and 195 samples were required based on sample size calculations. The intake of children was determine utilizing a 2x24h food recall and the conversion of RDI to EAR was performed using a conversion factor of RDI =1.2 x EAR (Hamner & Moore, 2020). Using a modified version of the NHANES CBQ (CDC, 2011), the home food environment was studied by obtaining information on food availability and family food features. Ethical approval was obtained from the Ethic Commission at Universitas Indonesia's Faculty of Medicine with No. Protocol: 22-02-0142 dated 13 January 2022, No. Ethical Approval: KET-311/UN2.F1/ETIK/PPM.00.02/2022 dated 28 March 2022.

Food availability was determined by asking respondents how often they had food at home over the previous week (CDC, 2011). This research modified the food category to include a range of vegetables and fruits, along with salty and sweet snacks and sugar-sweetened beverages, excluding low fat milk, as its consumption is uncommon in Indonesia (Birahmatika et al., 2020). Food accessibility was measured by determining the frequency with which foods were stored in an easily accessible location for children and in a ready-to-eat state. A four-point Likert scale (never, sometimes, usually, always) was utilized for survey responses. Each answer was graded on a scale of 1 to 4, with 1 indicating "never" and 4 indicating "always," and a total score for each food group was calculated. As this component of accessibility involves two unique types of questions, the mean score for each food category was calculated. SPSS Version 20 was utilized to conduct the Spearman correlation and multiple linear regression analysis.

RESULTS AND DISCUSSIONS

The total number of eligible participants was 191. Table 1 lists the broad characteristics of the participants. More than half of participants were between the ages of four and six, with boys comprising 56% of the total. A great

majority of caregivers possessed only secondary education, and the vast majority of them were unemployed. Majority of fathers were employed. The majority of the participants' families earn less than the minimum wage of Rp 4,200,000. Sociodemographic and socioeconomic characteristics of the participants in this study appeared to be very similar.

This study identified the physical aspects of the home food environment based on the availability and accessibility. The median score of 3 in Table 2 indicates that the availability of fruit and salty snacks was low. In contrast, the median score for vegetables, sweet food, and sugar-sweetened beverages reached a maximum of seven days, showing that these products are often available at homes. Vegetables and sugary beverages were always available in the homes of the respondents. The availability of vegetables from mobile vendors, regardless of price, was the key reason vegetables were always available in the homes of our respondents. In contrast, fruits are often more costly and harder to get. This was supported by Marty et al.'s (2015) discovery that fruits were the most costly source of energy. In low-income neighborhoods, a common perception was that healthy food was too expensive. This finding was bolstered by an evaluation of the obstacles to healthy eating, which revealed that the perception that bad diets are more affordable than healthy diets increased as a result of financial insecurity (Birahmatika et al., 2020).

Table 1. Respondent Characteristics

Variables	Median(Q1-Q3)	n(%)
Children's age (years old)	4.21(3.26–5.34)	
2–3 years old		86(45)
4–6 years old		105(55)
Children's Sex		
Male		107(56)
Female		84(44)
Caregiver's age (years old)	33.58(28.83–37.34)	
Caregiver education		
Low education level		66(34.6)
Intermediate education level		120(62.8)
High education level		5(2.6)
Mother Occupation		
Unemployed		130(68.1)
Employed		61(31.9)
Father Occupation		
Employee		83(43.5)
Laborer		50(26.2)
Self-employed		23(12)
Other		35(18.3)
Family income (Rp)	3,000,000 (2,000,000–4,200,000)	
Below and minimum wage		145(75.9)
Above minimum wage		46(24.1)

Consequently, it is likely that the cost of providing some food categories, notably fruits, was a disincentive for the group. Prior studies in Jakarta have repeatedly highlighted the features of the food environment in a typical densely populated urban slum neighborhood, which were substantially the same as the present research in that kitchen facilities were limited (Birahmatika et al., 2020). The neighborhood was frequently surrounded by food enterprises, many of which

were locally owned and run, as well as grocery stores. Vegetables may have been readily available at home most of the time due to the prevalence of traditional wet markets and mobile vegetable vendors in our research area. Unfortunately, the abundance of food outlets in urban slum areas increased the availability of snack foods and sugar-sweetened beverages, which was damaging to the community's health. In families led by jobless moms with a low level of education, there may be more access to highly appetizing "junk" foods, notably soda and sweetened beverages (Fernández-Alvira et al., 2013). This is consistent with the findings of our study, which revealed that homes headed by unemployed moms had a larger supply of sugary beverages.

Food accessibility, according to Nepper et al. (2014), is defined as retrievable, ready-to-eat, and reachable food. Food accessibility in the study is defined by Boles et al. (2013) as the capacity of children to reach, physically touch, and receive a food. The median score for food accessibility is 2-4, suggesting that food is occasionally stored at home and is not always stored in a ready-to-eat state. The sweet food earned the highest score overall. This is achievable because sweet foods are abundantly available surrounding the location. Mothers were regularly observed providing sweet snacks such as cookies and biscuits, and these treats were usually supplied alongside sweet beverages (Birahmatika et al., 2020; Putri et al., 2021).

Using a 24-hour food recall questionnaire, the children's nutritional consumption was calculated. Even though there are participants who fall into the under-eating and over-eating categories by using equation for calculation BMR in children, they are included in the analysis to guarantee that the number of subjects does not fall below the minimum number of samples. There were 30% children that have under-eating and 12% over-eating. The average vitamin C and iron intakes of the individuals were calculated using the results of two 24-hour food recalls. Overall, the vitamin C and iron intakes of the participants were lower than the 2019 Indonesian RDIs, with the median iron consumption being 6.71 mg and the 2019 Indonesian EARs for iron being 5.8 mg for the 1–3 years-old group and 8.3 mg

for the 4–6 years-old group. While the median consumption of vitamin C in Indonesia is 20.30 mg, the EAR is 33.3 mg for the 1-3 years-old group and 37.5 mg for the 4-6 years-old group. We can observe that the median consumption of both iron and vitamin C is below the EAR, indicating that children's intake is insufficient. Anemia, difficulty concentrating, a short attention span, and poor academic performance might arise from iron deficiency (Cerami, 2017). In iron-deficient children, it can also impede psychomotor and mental development, increase susceptibility to infection, and cause several other issues (Subramaniam & Girish, 2015). Iron deficiency is the leading cause of anemia, accounting for 50% of all instances (Mj & Mt, 2021). Even in developing nations, iron deficiency anemia (IDA) remains a severe health concern. In Indonesia, the prevalence of anemia among children under five years of age is growing annually (Ministry of Health Indonesia, 2018). The prevalence of anemia in Indonesia was significantly associated with inadequate dietary intake of nearly all key nutrients, namely, more than 30% of deficient iron and vitamin C consumption (Sunardi et al., 2021).

According to national studies conducted in Brazil, Germany, Russia, and the United States, poor intakes in toddlers are still prevalent (Hilger et al., 2015). In terms of iron consumption, 4% of 2-year-old Brazilian children fall below the EAR for iron consumption. A Brazilian multicenter study found that the diversity of children's nutritional intake is influenced by their age and body mass index (Carvalho et al., 2015). According to the statistics in Germany, 18.50% of the population consumes less iron than is recommended (Report, 2008). While the comparable statistics of children who consumed less than EAR for Russia and the United States are 13.9% and 10.92%, respectively (Butte et al., 2010; Eussen et al., 2015). In Europe, a comprehensive review of iron intakes in children aged 6–36 months revealed deficient intakes ranging from 10% to 50% below EAR (Eussen et al., 2015). Statistics from the German VELS research and the implementation of the UK EAR result in considerably more defects (range: 33.1% to 43.6% below EAR) (Report, 2008).

Vitamin C is heat-labile and may be damaged by cooking; it is believed that the poorer vitamin C status of Indians and Malays residing in Singapore is partially attributable to its breakdown by more extensive cooking, especially prolonged high heat cooking, such as grilling and making soup (Carr & Rowe, 2020). This method of cooking is highly common in Indonesia, where many meals are prepared with soup and cooked at sustained high temperatures. In the United States, another study was done to assess the vitamin C consumption of toddlers. The 2017–2018 survey indicated that 4.9% of toddlers aged 1–3 years did not consume enough vitamin C, while 13.5% of toddlers aged 4–8 years did not get enough vitamin C (Brauchla et al., 2021).

Table 2. Physical Aspects of Home Food Environment Distribution

Variables	Median(Q1–Q3)
Food availability	
Fruit	3.00(1.00–4.00)
Vegetables	7.00(4.00–7.00)
Salty snacks	3.00(0.00–7.00)
Sweet food	7.00(2.00–7.00)
Sugar-sweetened beverages	7.00(7.00–7.00)
Food accessibility	
Fruit	4.00(3.00–4.00)
Vegetables	2.00(1.00–4.00)
Salty snacks	3.00(2.00–4.00)
Sweet food	4.00(3.00–4.00)
Sugar-sweetened beverages	3.00(1.00–4.00)
Micronutrient Intake	
Iron (mg)	6.71(4.49-10.91)
Vitamin c (mg)	20.30(8.18-79.51)

After conducting a bivariate statistical test on Spearman's average iron intake, it was shown that several aspects are associated, including the availability of fruit, vegetables, and sweet food, and sugar-sweetened beverages. In contrast to the association results for vitamin C, the variables with p-value less than 0.05 are the availability of fresh fruits and vegetables in the diet. Children are likely getting more iron and vitamin C due to the increasing availability of fruits and vegetables at home.

Environments surrounding food that are child-friendly are ones that encourage children to engage or interact with the food in some way. Depending on how they are constructed, they have the ability to either improve or worsen the nutritional health of children in a variety of different ways. It was discovered that the availability of fruits and vegetables, sweet food and sugar-sweetened beverages all had a correlation with the amount of iron that was consumed. Because of the significant use of iron-fortified dairy products such as milk, increasing availability of sugar-sweetened beverages was correlated with higher iron intake (Subramaniam & Girish, 2015). The availability of fruits and vegetables is one of the factors that are connected with the two variables that are an issue. This is due to the fact that fruits and vegetables are both strong sources of vitamin C and iron. A number of other studies have found a positive link between the availability and accessibility of fruits and vegetables and the amount of fruit and vegetable consumption by children (Bassul et al., 2020; Bogl et al., 2017). These findings are consistent with the findings of previous research.

This finding highlights the significant role that parents play in supporting the eating of fruits and vegetables by making these items readily available to their children. Several studies have indicated that children's vegetable and fruit consumption is linked to their parents' consumption of these foods (Trofholz et al., 2016; Wyse et al., 2011). The findings also show that there is great potential to further enhance the amount of fruit and vegetables that children consume by encouraging more frequent supply (Ding et al., 2012; Wyse et al., 2011). In addition, the findings of this study as well as the findings of previous research including children who were older suggest that there is a larger possibility for children to consume fruits and vegetables if they are stored at home in a form that is ready to eat (Ansem et al., 2017; Trofholz et al., 2016). Because time spent preparing fruits and vegetables is a barrier that is frequently noted (Yeh et al., 2008), having ready-to-eat fruits and vegetables on hand may improve the probability that parents would offer their preschool child these foods rather than quick, pre-packaged snack meals (Wyse et al., 2011).

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https://doi.org/10.204736/mgi.v17i3.258–265

Table 3. Correlation of Home Food Environment and Iron and Vitamin C Intake

Variables	R	
	Iron intake	**Vitamin C intake**
Physical aspect		
Fruit availability	0.206**	0.308**
Vegetable availability	0.179*	0.246**
Salty snack availability	0.092	0.065
Sweet food availability	0.214**	0.117
Sugar-sweetened beverages availability	0.265**	0.089
Fruit accessibility	0.020	0.088**
Vegetable accessibility	0.037	0.035
Salty snack accessibility	0.067	0.088
Sweet food accessibility	0.116	0.085
Sugar-sweetened beverages accessibility	0.000	-0.057

*significance level at P-value<0.005, **significance level at P-value <0.01

CONCLUSION

According to the findings, it is clear that toddlers in Pejagalan did not consume the adequate amounts of iron and vitamin C that are advised. A child's consumption, in particular of micronutrients, is connected to a range of aspects of the home food environment linked with the availability and accessibility of food. One of the treatments that may be included in plans for improving child health is home gardening, which can be done to increase availability and accessibility in the home.

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ANXIETY, DEPRESSION, MACRONUTRIENT INTAKE AND NUTRITIONAL STATUS OF CANCER SURVIVORS LIVING IN SHELTER HOUSES AFTER CHEMOTHERAPY: A CROSS-SECTIONAL STUDY

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ABSTRACT

Depression and anxiety are common in cancer patients due to metabolism alteration and the side effects of chemotherapy. These mental health problems could be even worse in patients with low economy status and living in shelter houses. The aim of the research was to analyze the relationship of anxiety, depression, and macronutrient intake with nutritional status in cancer survivors undergoing chemotherapy at shelter houses. A total of 42 cancer patients aged 40–60 years old at shelter houses was recruited using consecutive sampling under a cross-sectional study design. Anxiety and depression data were taken using the Hospital Anxiety and Depression Scale (HADS) questionnaire, while energy, protein, fat, and carbohydrate data intakes were using Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ). The nutritional status data was examined based on Mid Upper Arm Circumference (MUAC). The data were analyzed using Pearson and Rank Spearman tests. Results of the study indicate that there were significant relationships between energy (p=0.040; r=0.318) and fat (p=0.001; r=0.490) with nutritional status. However, there was no relationship between anxiety and depression with macro-nutrient adequacy; also protein and carbohydrate intake with nutritional status. Anxiety and depression with nutritional also did not relate as evidenced by the value (p>0.05). To sum up, although there were no correlations between anxiety and depression with nutritional status, correlations occurred between energy and fat with nutritional status. Further research is suggested to analyze variables underlying anxiety and depression such as family support, stage, duration of diagnosis and frequency of chemotherapy so that these variables can be controlled.

Keywords: anxiety, chemotherapy, depression, food intake, nutritional status.

INTRODUCTION

Cancer is a condition where cells grow abnormally at uncontrollable rate and at the same time suppress the normal cells (National Cancer Institute, 2021). These abnormal cells can form lumps that can develop in any part of the body. Basic Health Research conducted in Indonesia showed an upward trend of cancer prevalence, from 1.4 in 2013 to 1.79 in 2018 out of 1000 population.

The most common cancers in Indonesia are lung cancer, followed by breast cancer, colorectal cancer, cervical cancer, liver cancer, and oral cancer. Several treatments to cure cancer are being introduced such as surgery, radiotherapy, hormone therapy, and chemotherapy. Chemotherapy is the most common procedure for cancer among all.

Chemotherapy has been a highly recommended treatment for cancer as it effectively kills cancer cells using drugs (Boucher et al., 2015). On the other hand, chemotherapy also brings some side effects such as changes in body appearance, hair loss and difficulty in performing certain activities (Bardwell and Fiorentino, 2012). During such condition, patients often feel lacking of self-confidence and start to worry about their future, which trigger stress and even depression. Anxiety and depression are commonly experienced by people who suffer from illness due to fear. A study conducted in Egypt showed that cancer survivors usually expect bad things to happen in the future (Aly, ElLatief and Mohamed, 2017).

Anxiety and depression affect patient's appetite at the beginning before declining their nutritional status. A research conducted in Amsterdam involving pancreatic cancer survivors showed that anxiety and depression were factors that reduce patient's appetite (van der Werf et al., 2018). Furthermore, a research done in California stated that low nutritional status is the main cause of death in patients with cancer (Jou et al., 2020).

Seen from patients' backgrounds, the economic factor is a major risk factor for anxiety and depression. Coleman (2005) found 24% of cancer patients with low average incomes experienced severe depression as they had to deal with financial problems while undergoing cancer treatment. They were concerned with the huge medical costs.

Concerning this problem, non-profit movements have been established to assist cancer survivors with low economic status to complete their cancer treatments and to distribute social aid. Not only for providing the shelter houses as temporary residential while they get their treatments in the near type A hospital, but also equipping with free transportation from their home town to the shelter houses and the hospital. All expenses during their treatment are being helped by these non-profit organizations, while for the treatment itself it is covered by their National Health Insurance. After finishing the therapy session, patients left the shelter house and went back to their home.

The present research was conducted to analyze the prevalence of anxiety and depression among cancer survivors at shelter houses, and examined how anxiety and depression relate to macronutrient adequacy and nutritional status.

METHOD

Research Design and Setting

This cross-sectional research was conducted from July to October 2021. An ethical permit was issued by the Commission of Medical/Health Research Bioethics, Medical Faculty, Universitas Islam Sultan Agung Semarang, accession number 203/VII/2021/Bioethics Commission. This research was held at five shelter houses located in Semarang (Central Java), four in Special Region of Yogyakarta, and one from Malang (East Java)

Sampling

A total of forty-two cancer patients was recruited using correlation coefficient formula of 0.489 based on previous study (Alkan, Artaç and Rakıcıoğlu, 2018). Respondents were cancer survivors aged 40-60 years and were in the shelter houses when the data were collected. Several inclusion criteria were set; men or women aged 40–60 years being assisted survivors at the shelter houses, willing to become research subjects by filling out informed consent, undergoing a series of chemotherapy, able to communicate well, and having been diagnosed with cancer. During the study, no respondents were excluded.

Data Collection

Data were collected directly by visiting shelter houses to gain subject's personal data, measure Mid Upper Arm Circumference (MUAC) and interview about their anxiety and depression problem using the Hospital Anxiety and Depression Scale (HADS), as well as their food consumption using the Semi Quantitative Food Frequency Questionnaire (SQ-FFQ) questionnaire. Health protocols were applied during direct measurement by using face mask, face shield, gloves, and gown. Prior the data collection, these two questionnaires had been validated using respondents from shelter houses other than the respondents.

However, due to Small-Scale Social Restrictions during the COVID-19 pandemic, respondents in several locations were not able to be visited. Therefore data were also collected using phone call and then submitted to Google Form, while MUAC measurement was carried out by a trained shelter house administrator officer. HADS and SQ-FFQ questionnaires were filled out by researchers during online interviews via Zoom or WhatsApp Call. These two questionnaires took more or less 25 minutes in total to be finished.

In terms of SQ-FFQ data collection, respondents were also being introduced with household size to emphasize how much food they consumed for the last one month. Additionally, validations were made by engaging cancer patients' relatives or someone who helps them in consuming food on a daily basis.

Anxiety and Depression Scale

HADS consist of 14 questions, which is seven questions regarding anxiety, while the other seven are related to depression. If the score obtained is 0–7, then respondents were categorized as normal, followed by mild (8–10), moderate (11–15), and severe (16–21) (Rudy et al., 2015).

Food Consumption Measurement

SQ-FFQ was used to determine macronutrient intake adequacy (energy, carbohydrate, protein, and fat). In order to obtain the adequacy, total intake was divided by the total need of each macronutrient, and finally multiplied by 100%. Nutrient adequacy was indicated as normal if the percentage was 80 to 110%. Otherwise it is deficit (<80%) or over (>110%) (Handayani et al., 2015).

MUAC Measurement

MUAC was measured to the closest 1 mm using a non-stretchable tape 'Onemed.' A trained enumerator marked subject's midpoint in their upper arm located between the tips of their shoulder and elbow. After a visible sign was given using a non-invasive marker, then wrapped the measuring tape to the skin right in the middle of the dot and recorded the MUAC. Nutritional status according to MUAC was formulated by dividing the actual MUAC with the Harvard standard and multiplying it by 100%. For proportion purposes, nutritional status was divided into five categories, which are obese (>120%), overweight (110-120%), normal (90-110%), underweight (60-90%), and severely underweight (<60%) (Handayani et al., 2015).

Data Analysis

Data analysis was performed using IBM SPSS Version 25 software. Meanwhile, food intake data were analysed using *Nutrisurvey* application. Correlational test was performed using the Pearson's test and Rank Spearman test.

RESULTS AND DISCUSSIONS

Table 1. Subject's Characteristics (N=42)

Characteristics	n	%
Aged		
40–50	24	57.1
51–60	18	42.9
Sex		
Male	5	11.9
Female	37	88.1

Characteristics	n	%
Formal Education		
Elementary school	15	35.7
Junior high school	10	23.8
Senior high school	8	19.0
Bachelor	5	11.9
No formal education	4	9.5
Cancer Type		
Breast cancer	18	42.9
Cervical cancer	9	20.5
Nasopharyngeal cancer	7	15.9
Skeletal cancer	1	2.3
Ovarian cancer	2	4.5
Thyroid cancer	1	2.3
Colon cancer	2	4.5
Lung cancer	1	2.3
Pancreatic cancer	1	2.3
Time Diagnosed		
< 1 years	8	19.0
> 1 years	34	81.0
Stage of Cancer		
I	8	19.0
II	7	16.7
III	20	47.6
IV	7	16.7
Marital Status		
Married	42	100.0
Not married yet	0	0.0
Job		
Farmer	7	16.7
Labor	7	16.7
Do not work	18	42.9
Others	10	23.8
Income/Month		
<Rp. 900.000	4	9.5
Rp. 900.000 – Rp.1.500.000	38	90.5
Anxiety Score		
Normal	17	40.5
Low	9	26.2
Moderate	14	33.3
Severe	2	4.8
Depression Score		
Normal	20	47.6
Low	11	26.2
Moderate	10	23.8
Severe	1	2.4

The majority of respondents (88.1%) were female and more than half of these (57.1%)

were aged 40-50. In addition, nearly half of the respondents (42.9%) were diagnosed with breast cancer, and with stage III (47.6%). All of the respondents have been married (100%). As much as 53.7% of the respondents had elementary school, 42.9% did not work and 90.5% had an income of around IDR 900,000–1,500,000 per month. Based on Table 1, it is known that there were more cancer survivors in the shelter houses with the category of normal anxiety (40.5%). In the depression score, it is known that as many as 20 cancer survivors in the shelter houses are in the normal category (47.6%).

Previous study explained that, at first, anxiety and depression occurred as side effects of chemotherapy and other factors such as economy, family support, cancer stage, duration of diagnosis and frequency of chemotherapy (Suwistianisa, Huda and Ernawaty, 2015). A research conducted in Ethiopia as one of the low income country showed the prevalence of major depression was 16.4%. This study also suggested that severe pain and moderate pain were significantly related with major depression, and almost 70% of respondents with depression had uncontrolled pain (Alemayehu et al., 2018). However in this study, less than 5% were severely anxious and depressed. Despite the fact that they came from a family with low economic status, they used the National Health Insurance to get their disease treated. Financial support can reduce anxiety levels in cancer survivors (Adipo, Jumaini and Rahmalia, 2015).

Moreover, the majority of the respondents had been diagnosed with cancer for over a year (Table 1). This will give enough time for the patients to tackle their anxiety and depression. A person who has been diagnosed with cancer for the first time will experience depression which stimulates the survivors to develop coping strategies such as by getting closer to the God, discussing the situation with a partner

or family and sharing with other cancer survivors at shelter houses (Widianti, 2016).

According to Table 2, the food intake of cancer survivors at shelter houses was dominantly lacking in energy (47.7%), protein (69.0%) and carbohydrates (57.1%), while fat adequacy was dominantly good (35.7%). Notably, although fat adequacy reached nearly 100%, the median of energy was only 71.79% (Table 3). In addition, the nutritional status of cancer survivors in shelter houses was also dominantly lacking (71.4%) (Table 2). As also mentioned in Table 3, the average of their MUAC measurement was still in underweight category.

Table 2. Macronutrient Intake Adequacy and Nutritional Status of Respondents

Variables	n	%
Energy Adequacy		
Severe deficit	21	47.7
Moderate deficit	4	9.5
Low deficit	6	13.6
Normal	6	13.6
Over	5	11.9
Fat Adequacy		
Deficient	13	31.0
Normal	15	35.7
Over	14	33.3
Protein Adequacy		
Deficient	29	69.0
Normal	6	14.3
Over	7	16.7
Carbohydrate Adequacy		
Deficient	24	57.1
Normal	3	7.1
Over	15	35.7
Nutritional Status		
Deficient	30	71.4
Normal	10	23.8
Over	2	4.8

Table 3. Median / Average (± Standard Deviation), Minimum and Maximum

Variable	Median/Average (±SD)	Min	Max
Anxiety	8.83(±4.80)	0	19
Depression	7	0	16
Energy Adequacy (%)	71.79	20	150
Fat Adequacy (%)	94.37(±30.64)	29	157
Protein Adequacy (%)	57.67	10	125
Carbohydrate Adequacy (%)	86.26(±43.54)	22	183
Nutritional Status using MUAC (%)	82.54(±16.51)	50	120

* Normal distribution data is presented in average (±SD), while other is presented in median

The Correlation between Anxiety, Depression, Macronutrient Intake Adequacy, and Nutritional Status

No relationship was found between anxiety, macronutrient intake and nutritional status or between depression, macronutrient intake and nutritional status, as shown in Table 4.

Similarly, other researchers also found that factors influencing the food intake of cancer survivors were nausea and vomiting due to chemotherapy (Dewi and Aryawan, 2017; Gebremedhin et al., 2021). It can be inferred that anxiety and depression are not the only factors that affect the food intake among cancer survivors. In addition, most of the respondents in this study did not experience anxiety and depression.

The correlation between macronutrient intake adequacy and nutritional status

As shown in Table 4, there was a weak correlation between energy adequacy and nutritional status, while the correlation between fat adequacy and nutritional status is moderate. This was in line with research conducted in Surabaya with cancer survivors which showed that energy adequacy and fat adequacy were related to nutritional status (Darmawan and Adriani, 2019). Energy is the main fuel for body metabolism. Excessive energy intake will be stored in adipose tissue in the deep layer of the skin. The weight of fat stored in the body can be measured by calculating the percentage of body fat and how it affects the body weight. It is clear that body fat is related to nutritional status (Zaenudin, Dewi and Effendi, 2012).

This study also showed that the energy is mainly contributed from fat as seen in Table 3. It is possible if dietary fat may alter subjects' visceral fat. A study conducted in animal fed high fat diet showed the increase of visceral adiposity compared with isocaloric-low fat diet (Bojková, Winklewski and Wszedybyl-Winklewska, 2020)

In this study, carbohydrate and protein adequacy were not found correlated to nutritional status, similar to what has been found in a study conducted in Lampung involving patients suffering from various types of cancer (Endang, 2020). Carbohydrate adequacy and nutritional status do not correlate because cancer cells take up glucose through the glycolysis pathway, preventing pyruvate from entering the Krebs cycle and preventing the conversion of pyruvate to lactate. This process shows that cancer cells obtain most of their energy from glycolysis, meanwhile *pyruvate hydrogenase* has been inhibited, which decreases the ability of pyruvate to enter oxidative phosphorylation. In such situation, the body lacks of glucose and becomes vulnerable to have low nutritional status (Wu and Zhao, 2013).

Protein adequacy was also not found correlated to nutritional status, because cancer patients are very susceptible to cachexia. Thus, decreased food intake makes the body search for a substitute energy source from total body protein stored as muscle mass. Protein is not the main source of energy, yet it can be converted into energy when food intake is insufficient. However, no direct relationship between protein adequacy and nutritional status is found (Norman et al., 2011).

Several studies showed a distinct level of anxiety and depression in cancer survivors according to their cancer stage, family support, length of diagnosis, and the frequency of

Table 5. The correlation between macronutrient adequacy and nutritional status

Variable	Nutritional Status	
	r	p
Energy adequacy	-0.318	0.040*
Fat adequacy	-0.490	0.001*
Protein adequacy	-0.266	0.088
Carbohydrate adequacy	-0.950	0.548

Pearson; significance level p<0.05 r=correlation value; negative value indicate inverse correlation

Table 4. The correlation between anxiety, depression, macronutrient intake adequacy, and nutritional status

Variable	Energy		Fat		Protein		Carbohydrate		Nutritional Status	
	r	*p*	r	*p*	r	*p*	r	*p*	r	*p*
Anxiety	0.041	0.798	0.176	0.264	-0.55	0.728	0.156	0.325	-0.281	0.072
Depression	-0.117	0.460	-0.31	0.844	-0.162	0.304	-0.003	0.983	-0.193	0.220

chemotherapies. A research conducted among breast cancer survivors in Egypt showed that a higher level of anxiety and depression was experienced in respondents with advanced stage of cancer (stage III and IV) compared to the lower one (stage I and II) (Alagizy et al., 2020). However, in this research showed a different result. Cancer survivors with stage I, II, and III tended to have a normal level of anxiety and depression, while cancer survivors with stadium IV had mild anxiety and normal depression level. This might be due to the time the patients had been diagnosed with cancer. Over 80% of the respondents had been diagnosed more than one year ago, and nearly half of the subjects were in stage III.

Additionally, frequency of chemotherapy was also associated with nutrition status. A research in Denpasar, Bali, Indonesia, among cancer survivors showed that the higher frequency of chemotherapy, the lower level of anxiety and depression experienced in these respondents (Soares, 2013). The overall advantage of this study is knowing how many cancer patients suffer from anxiety and depression, and knowing whether this affects food intake or not. However, those factors had not been controlled in this research due to COVID-19 restriction which limits cancer survivors to visit the shelter houses and have their treatment in hospital.

CONCLUSIONS

More patients in the shelter houses are in the normal category of anxiety and depression. These also did not correlate to either macronutrient adequacy or nutritional status. Furthermore, this study did not find protein and carbohydrate adequacy correlated to nutritional status. However, energy adequacy and nutritional status were found to share weak correlation, while fat adequacy and nutritional status were moderately correlated. Further research is suggested to analyze the variables that underlie anxiety and depression such as family support, stage, duration of diagnosis and frequency of chemotherapy so that these variables can be controlled.

ACKNOWLEDGMENT

DECLARATION OF INTEREST

The authors declare no conflict of interest with other person or institution.

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DOES EMOTIONAL EATING MEDIATE THE EFFECT OF PHYSICAL ACTIVITY AND SLEEP DURATION ON FAT INTAKE IN PREGNANT WOMEN?

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ABSTRACT

Pregnant women need nutrients, one of which is fat. High fat intake might occur due to emotional eating. Emotional eating and excessive fat intake are assumed to be caused by low physical activity and insufficient sleep duration. This study purposed to investigate whether emotional eating mediates the effect of physical activity and sleep duration on fat intake in pregnancy. This study used an analytic survey method with a cross-sectional approach. The population of this study was pregnant women in the second and third trimesters who lived in Bondowoso Regency. Sampling was conducted with a *cluster* random sampling technique, and 105 subjects were obtained. The research instruments included a 24-hour food recall form, Emotional Eater Questionnaire (EEQ), Pregnancy Physical Activity Questionnaires (PPAQ), and four sleep duration questions from the Pittsburgh Sleep Quality Index (PSQI) form. Statistical test used path analysis. The direct influences in this study were shown by the variables of physical activity and sleep duration on emotional eating (p-values 0.027 and <0.001), and emotional eating on fat intake of pregnant women (p-value <0.001), respectively. Emotional eating can explain the effect of physical activity and sleep duration on fat intake with the indirect effect value greater than that with the direct effect. The conclusion of this study is that there is a role for emotional eating to mediate the indirect effect of physical activity and sleep duration on fat intake. Women who are pregnant should be able to do dietary habit, regulate sleep, and physical activity.

Keywords: pregnant women, physical activity, sleep duration, emotional eating, fat intake

INTRODUCTION

Pregnant women need adequate intake of nutrients during pregnancy, one of which is fat (Eren *et al.*, 2015). The need for fat increases along with gestational age due to the rapid growth and development of the fetus (Darawati, 2017). Fat intake in the second and third trimesters increases by 2.3 g/day, thus meaning the recommended amount is ≤74.03 g/day (Kemenkes RI, 2019). FAO's data (2017) show that the countries with highest fat intake in the world were the United States (US) and Germany, reaching 167.2 g/person/day (Roser and Ritchie, 2017). Indonesia has an average fat intake of 55.3 g/person/day. The results of the Basic Health Research report 2018 showed that East Java was a province with a relatively high fat intake of 48.5% (Kemenkes RI, 2018). A preliminary study by researchers in pregnant women in Bondowoso Regency demonstrated that the average fat intake was 90.4 g/day.

Excessive fat intake in the preliminary study was due to the high number of fried foods such as fried sweet potatoes, cassava chips, and consumption of more than one serving. The research of Xiang *et al.* (2019) shows that excessive oil consumption leads to an increase in fat intake during pregnancy. Fried foods such as fried cassava and fried sweet potato and cassava chips also contribute to a high amount of fat in daily food intake. Cassava and sweet potatoes are the main agricultural products in Bondowoso Regency (Riawati, 2018) .

High fat intake might occur as a result of emotional eating (Zhang *et al.,* 2020). Persons with emotional eating are unable to differentiate hunger due to response on negative emotions and want to consume energy-dense foods such as high-fat snack (Antoniou *et al*., 2017). Pregnant women with high emotional eating tend to have excessive food intake, especially fat due to increment in appetite frequency (Blau *et al*., 2018). Negative

emotions are common in pregnant women, which is caused by an increased risk of psychological symptoms that occur during pregnancy (Ahmed *et al.*, 2017).

The increment of high-fat foods intake in pregnant women might be caused by low physical activity due to the positive relationship between depression and stress (Eichler *et al.*, 2019). Low physical activity induces higher emotional eating (Smith *et al.*, 2020). During pregnancy, pregnant women can experience a decrease in physical activity caused by an enlarged stomach and fatigue (WHO, 2014).

High fat intake might also occur due to less sleep duration (Kleiser *et al.*, 2017). Less sleep duration during pregnancy results in changes of hormones secretion, which relates to appetite, high *ghrelin* hormone (stimulate of appetite) and low *leptin* hormone (suppressant of appetite) (Balieiro *et al*., 2019). Changes in hormone secretion induce emotional eating during pregnancy. Pregnant women's sleep length is often disturbed so that the hours of sleep at night are less than normal (<7 hours), which is caused by physical discomfort and pain such as due to weight gain (Hill *et al.*, 2020).

Low physical activity (Wesołowska *et al.*, 2019), less sleep duration (Gong *et al.*, 2017), and negative emotions (Antoniou *et al*., 2017) can increase food consumption, especially of foods high in energy and fat. This increase has an impact on the health of the mother and fetus, one of which is excess weight gain while pregnant (Hirko *et al*., 2020).

There is a study that examined the role of mediator of emotional eating in the effect of physical activity and sleep duration on fat intake during pregnancy. Previous study has focused solely on weight gain. Fat intake in pregnant women is the basis of this study. This study purposed to investigate whether emotional eating mediates the effect of physical activity and sleep duration on fat intake during pregnancy.

METHOD

This research used an analytic survey method with a cross-sectional approach. This study was carried out in Bondowoso Regency, East Java,

in June 2021. The population of this study was 2,568 women in their second and third trimesters of pregnancy. This study included 105 pregnant women from 60 villages obtained through a cluster random sampling technique. Inclusion criteria were lived in Bondowoso Regency, were able to read, write and communicate well. Exclusion criteria were pregnant women with chronic energy deficiency, cancer, cardiovascular disease, hyperemesis gravidarum, living apart from spouse, and withdrawing at the time of the study. The screening process was carried out by taking population data of pregnant women from puskesmas in Bondowoso Regency. Then 50% of the sub-districts were selected, and from the sub-districts, 50% of the villages were randomly selected. A calculation of sample allocation in each village was carried out. Sampling was done by lottery. The researcher visited the sample houses that were selected to be screened based on inclusion and exclusion criteria. Subjects were then asked to fill out an informed consent as proof of respondents' willingness to participate in this study.

Exogenous variables were physical activity and sleep duration. The mediator was emotional eating. Meanwhile, the endogenous variable was fat intake. The research instruments included a 24-hour food recall form, Emotional Eater Questionnaire (EEQ), Pregnancy Physical Activity Questionnaires (PPAQ), and four sleep duration questions on the Pittsburgh Sleep Quality Index (PSQI). The questionnaire was validated for validity and reliability before being used in this study. The 24-hour food recall method was carried out three times in a non-consecutive timeframe.

Fat, protein, carbohydrate, and energy intake was considered high when the Recommended Dietary Allowances (RDA) exceeded 110% (Gibson, 2005). López-Galán and de-Magistris (2019) classified emotional eaters as non-emotional eaters, low emotional eaters, emotional eaters, and very emotional eaters. The sleep duration score was divided into two categories: enough and less (<7 hours/night) (Kalmbach *et al.*, 2019). The score of physical activity was categorized into enough (≥436.756 MET-hour/week) and less (≥436.756 MET-hour/week) (Chandonnet *et al*., 2012).

Data were collected with two techniques. Interview technique aimed to obtain data on fat intake, emotional eating, and sleep duration. Self-report technique aimed to obtain physical activity data. The data collection procedure was carried out by visiting the respondents' house according to the COVID-19 health protocol. The Jember State Polytechnic's Ethics Commission have given their clearance to this study (3350/PL17/PG/2021).

The data analysis techniques used were path analysis with the STATA 14 application. This analysis was used to determine the value of direct and indirect effects between variables.

RESULTS AND DISCUSSION

Pregnant women with fat intake >110% RDA was 72 respondents (68.6%). The highest peak of fat intake occurred in pregnancy might be due to an excessive oil consumption (Xiang *et al.*, 2019). The high fat intake in pregnant women is also caused by surrounding environment and socioeconomics (Wesołowska *et al.*, 2019). Pregnant women who only work at home will spend more time consuming high-fat foods (Xiang *et al.*, 2019). This can be shown by the high distribution of pregnant women of 81.0% as housewives. The majority of respondents (68.6%) were 19-29 years old, with gravidity in first pregnancy (41.0%). The average income of respondents was <1 million IDR (50.5%).

The physical activity of most respondents was included in the less category (70.5%). They only performed household activity with little exercise, which was their habit before pregnancy. Doing exercise before pregnancy can help attain an adequate level of physical activity during pregnancy (Xiang *et al.*, 2019).

The distribution of sleep duration frequency in pregnant women shows little difference. The highest percentage is shown in the category of enough sleep duration (52.4%). Sleep duration can be categorized as sufficient, namely 7-8 hours a night to achieve optimal health (Kalmbach *et al.*, 2019).

Most of the respondents were included in the emotional eaters category (42.9%). Individuals who are emotional eaters have eating behavior according to their mood but are able to control their eating patterns (López-Galán and de-Magistris, 2019). Pregnant women experience a significant increase in the appetite frequency due to changes in mood, which causes emotional eating and increases food intake (Blau *et al.*, 2018).
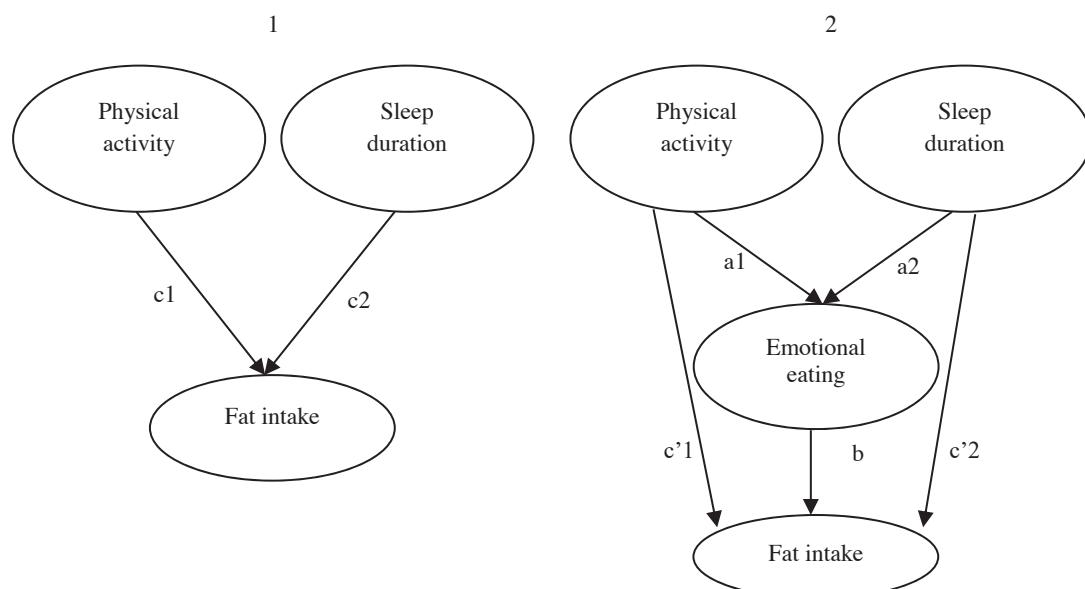

Figure 1. Graphic illustration of emotional eating mediating in the effect of physical activity and sleep duration on fat intake. (1) Physical activity and sleep duration affect fat intake (2) Emotional eating is hypothesized to exert indirect effects physical activity and sleep duration on fat intake.

Table 1. Distribution of Respondents' Characteristic

Variables	Amount (n)	Percentage (%)
Age		
19–29 years old	72	68.6
30–41 years old	33	31.4
Gravidity		
1	43	41.0
2	40	38.1
3	14	13.3
4	6	5.7
5	2	1.9
Profession		
Housewives	85	81.0
Teacher	8	7.6
Health workers	5	4.8
Private employees	5	4.8
Farmers	1	1.0
Trade	1	1.0
Income		
>2 million IDR	35	33.3
1–2 million IDR	17	16.2
<1 million IDR	53	50.5
Physical activity		
Enough	31	29.5
Less	74	70.5
Sleep duration		
Enough	55	52.4
Less (<7 hours/night)	50	47.6
Emotional eating		
Non emotional eater	19	18.1
Low emotional eater	29	27.6
Emotional eater	45	42.9
Very emotional eater	12	11.4
Fat intake		
≤ 110% RDA	33	31.4
> 110% RDA	72	68.6
Protein		
≤ 110% RDA	28	26.7
> 110% RDA	77	73.3
Carbohydrate		
≤ 110% RDA	37	35.2
> 110% RDA	68	64.8
Energy		
≤ 110% RDA	34	32.4
> 110% RDA	71	67.6

*IDR=Indonesian Rupiah

Table 2 shows the direct effect of physical activity on emotional eating of pregnant women with a p-value of 0.027 and a large effect of 0.212. This is in line with the findings of the study by Mutiek *et al.* (2021) which states that low physical activity affects the occurrence of emotional eating. Low physical activity causes the serotonin hormone to decrease, which can affect the occurrence of stress and mood disturbances so that it has an impact on the occurrence of emotional eating (Al-Musharaf, 2020). The hormone serotonin plays an important role in regulating emotions and controlling appetite in pregnant women (Eichler *et al.*, 2019). Doing physical activity as recommended can reduce the risk of emotional eating (Richards and Specker, 2020).

Table 2. Direct Effects Between Variables

Direct Effects Between Variables	β	p-value
Emotional eating <-- physical activity	0.212	0.027
Emotional eating <-- sleep duration	0.672	<0.001
Fat intake <-- emotional eating	25.57	<0.001
Fat intake <-- physical activity	2.817	0.493
Fat intake <-- sleep duration	3.168	0.501

Pregnant women's emotional eating can also be directly affected by sleep duration with a p-value <0.001 and the size effect of 0.672. This is consistent with research conducted by Alrefaai *et al.* (2016) which confirms that insufficient sleep is associated with greater emotional eating score in pregnant women with gestational diabetes. Insufficient sleep duration causes emotional dysregulation (Saleh-Ghadimi *et al.*, 2019). This emotional dysregulation leads to the increment of the desire to eat; therefore, it can influence the decision to consume energy-dense, tasty, and high-fat foods (Dashti *et al.*, 2015).

This study demonstrates that there is a direct effect of emotional eating on fat intake of pregnant women with a p-value <0.001 and a large effect of 25.57. This is in line with the research of Zhang *et al.* (2020) which shows that emotional eating in pregnant women during the COVID-19 pandemic is associated with increased consumption of oil and high-fat foods. During a negative emotional state, individuals tend to consume high-calorie foods, especially fat, because negative emotions motivate individuals to eat (Alalwan *et al.*, 2019), which eventually causes the increment of appetite frequency (Blau *et al.*, 2018).

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https://doi.org/10.204736/mgi.v17i3.273–280

Data analysis indicates that physical activity had no effect on fat intake of pregnant women with a p-value of 0.493. The results of this study are inconsistent with the research of Eichler *et al.* (2019) which shows that low physical activity leads to an increase in high-fat foods intake during pregnancy. Low physical activity does not directly affect appetite regulation (Dorling *et al.*, 2018); however, physical activity has a part to play in the mechanism of decreasing serotonin hormone production (Al-Musharaf, 2020). The low serotonin hormone causes a degression in appetite suppressant hormones such as *peptide tyrosine tyrosine* (PYY), *glucagon-like peptide-1* (GLP-1), and *pancreatic polypeptide* (PP) as well as an increase in the hormone *ghrelin* (Quezada *et al.*, 2017).

This study also indicates that there was indirect effect of sleep duration on fat intake of pregnant women with a p-value of 0.501. This result is different from previous study of Hill *et al.* (2020), which mentions that less sleep duration during pregnancy is associated with excess weight gain due to high fat intake. The difference in this study among most of the respondents was having enough sleep. Less sleep duration alters the perception of hunger and appetite through mechanisms of hormonal dysfunction (Córdova *et al.*, 2018). This affects individual eating patterns in the form of habit in consuming high-fat foods during guard time (Gong *et al.*, 2017).

The differences between our results and previous findings may be due to other factors. Other factors that also influence the high fat intake in pregnant women are stress and sleep quality during pregnancy, socioeconomic environment, and lifestyle before pregnancy (Wesolowsla *et al.*, 2019). It can also be caused by differences of the research instruments. In this study, we used a physical activity questionnaire that reflects time and intensity.

Table 3. Emotional Eating's Role as a Mediator in the Effect of Physical Activity and Sleep Duration on Fat Intake of Pregnant Women.

Variables	β	p-value
Fat intake <-- emotional eating <-- physical activity	5.413	0.037
Fat intake <-- emotional eating <-- sleep duration	17.189	0.000

Based on path analysis results, emotional eating acts as a mediator in the indirect effect of physical activity on fat intake of pregnant women, because it has an indirect effect value of 5.413 which is greater than the direct effect of 2.817, with p-value 0.037. Low physical activity reduces the production of hormone serotonin which results in mood disturbances and poor appetite regulation (Smith *et al.*, 2020). Therefore, it has an impact on emotional eating (Al-Musharaf, 2020). Due to poor appetite regulation, pregnant women with high emotional eating tend to have excessive food intake, especially fat (Blau *et al.*, 2018).

Emotional eating also plays a role in mediating the indirect effect of sleep duration on fat intake of pregnant women with an indirect effect value of 17.189 and p-value < 0.001. This is due to sleep duration, which does not directly affect fat intake. The emotional eating which mediates in an indirect effect of sleep duration on fat intake is due to the mechanism of emotional dysregulation (Al-Musharaf, 2020). This mechanism triggers a person to be unable to differentiate hunger as a result of a negative emotion's response (Antoniou *et al.*, 2017), the frequency of appetite increases harshly, and there is a high desire to consume fatty food (Hill *et al.*, 2020), which causes excess fat intake (Blau *et al.*, 2018).

During the COVID-19 pandemic, pregnant women, as a vulnerable group, are advised to reduce outdoor activities and stay indoors. This has an impact on several lifestyle changes, such as reduced physical activity, sleep deprivation, and increased food intake during pregnancy (Whitaker *et al.*, 2021). The existence of the COVID-19 pandemic also has an impact on the psychology of pregnant women (Davenport *et al.*, 2020). Pregnant women are very worried about being infected with COVID-19, which can have an impact on the health of the fetus (Favre *et al.*, 2021). This psychological impact can cause negative emotions (Al-Musharaf, 2020).

The advantage of this study is that it is the first study focused on the role of mediators of emotional eating in the effect of physical activity and sleep duration on fat intake of pregnant women. However, this study has a limitation, specifically that the measured fat intake was non-specific.

CONCLUSION

The direct effect in this study was shown by the variables of physical activity and sleep duration on emotional eating, and emotional eating on fat intake of pregnant women. Emotional eating mediates the indirect effect of physical activity and sleep duration on fat intake. Women who are pregnant should be able to do dietary habit, regulate sleep, and physical activity.

ACKNOWLEDGMENT

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PROGRAM PENCEGAHAN STUNTING DI INDONESIA: A SYSTEMATIC REVIEW

Stunting Prevention Program in Indonesia: A SYSTEMATIC REVIEW

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ABSTRAK

Stunting atau kekurangan gizi kronis adalah masalah gizi akibat kekurangan asupan gizi dari makanan yang berlangsung cukup lama. Stunting masih menjadi masalah gizi utama di negara berkembang seperti Indonesia. Berdasarkan data dari SSGBI tahun 2021, prevalensi balita stunting di Indonesia menurun dari tahun 2019 hingga 2021 yaitu dari 27,67% menjadi 24,4%. Dalam upaya penurunan prevalensi stunting ini, pemerintah banyak mengeluarkan program untuk mewujudkannya. Oleh sebab itu, sangat diperlukan suatu penelitian yang dapat menyajikan fakta secara komprehensif mengenai program pencegahan stunting di Indonesia, agar bermanfaat bagi pemerintah dalam pembuatan kebijakan mengenai program pencegahan stunting yang lebih tepat dan efisien. Penelitian ini bertujuan untuk mengidentifikasi program pencegahan stunting di Indonesia. Penelitian ini menggunakan metode *systematic review* yang disusun berdasarkan *Preferred Reporting Items for Systematic Reviews and MetaAnalyzes* (PRISMA). Pencarian artikel dilakukan pada lima database yaitu *PubMed, Google Scholar*, Portal Garuda, Perpustakaan Nasional (Perpusnas) Indonesia dan *ScienceDirect*. Kriteria inklusi penelitian ini adalah artikel yang diterbitkan pada tahun 2011–2020, populasi di wilayah Indonesia. Penilaian kualitas studi dalam penelitian menggunakan *The Joanna Briggs Institute (JBI) Critical Appraisal*. Hasil telaah dari 15 artikel didapatkan pencegahan stunting yang efektif dapat dilakukan dengan cara pemberian edukasi gizi pada pihak yang berpengaruh (kader, ibu balita, ibu hamil dan calon ibu), pembentukan kelompok belajar untuk ibu balita, dan pemberian makanan tambahan untuk balita. Program atau intervensi yang dilakukan untuk pencegahan stunting harus memperhatikan dengan baik aspek masukan dan prosesnya agar mendapatkan keluaran yang optimal, serta harus melibatkan semua pihak mulai dari ibu balita hingga lintas sektoral.

Kata kunci: pencegahan stunting, *systematic review*, program stunting

ABSTRACT

Stunting or chronic undernutrition is a consequence of a lack of nutrition for a long time. Stunting is still a main isu in developing countries such as Indonesia. According to SSGBI 2021, the prevalence of stunting in Indonesia was decreased from 2019 to 2021 that is 27.67% to 24.4%. Government has many programs to decrease stunting. Thus, research that can present facts comprehensively about stunting prevention program is needed to make policies regarding the precise and efficient program. The research aims to identify stunting prevention program in Indonesia. This research used a systematic review method arranged based on Preferred Reporting Items for Systematic Reviews and MetaAnalyzes (PRISMA). Five databases are used for searching articles that are PubMed, Google Scholar, Portal Garuda, Perpustakaan Nasional (Perpusnas) Indonesia, and ScienceDirect. Research inclusion criteria are articles were published from 2011 to 2020 with the population in Indonesia. For articles assessing quality we used The Joanna Briggs Institute (JBI) Critical Appraisal. Form 15 articles we found that effective program for preventing stunting is nutrition education for influential parties (cadre, children's mother, pregnant women, and mother to be), establishing a study group for children's mother, and supplementary feeding for children. Stunting prevention program must be paying attention to input and process aspects for better outputs and must involve all parties from children's mothers to cross-sectoral.

Keywords: *stunting prevention, systematic review, stunting program*

PENDAHULUAN

Masalah gizi pada balita masih menjadi masalah utama dalam tatanan kependudukan. Permasalahan gizi pada balita diantaranya stunting, *wasting dan overweight* (*World Health Organization*, 2020). Stunting masih menjadi masalah gizi utama di negara berkembang seperti Indonesia. Stunting atau kekurangan gizi kronis adalah masalah gizi akibat kekurangan asupan gizi dari makanan yang berlangsung cukup lama (Andriani *et al.*, 2017). Balita pendek (*stunting*) dilihat dari panjang badan atau tinggi badan yang kurang dari -2 SD menurut referensi global WHO untuk anak-anak dibandingkan dengan anak lain seusia mereka *(World Health Organization*, 2013).

Kejadian stunting akan memberikan dampak yang tidak baik bagi balita. Dampak stunting jangka pendek berupa perkembangan fisik dan mental terganggu, kecerdasan menurun, hingga masalah metabolisme. Sedangkan, dampak stunting jangka panjang berupa menurunnya kemampuan kognitif, menurunnya daya tahan tubuh sehingga tubuh rentan terserang penyakit, dan berisiko terserang penyakit degeneratif seperti diabetes militus, penyakit kardiovaskular, kanker, *stroke*, serta tidak dapat bersaing dalam bekerja yang akan berakibat pada rendahnya produktivitas (Unicef Indonesia, 2012).

Stunting pada balita dipengaruhi oleh beberapa faktor yaitu umur, panjang badan pada saat lahir, kecukupan makronutrien (protein, karbohidrat) dan mikronutrien yaitu (kalsium, vitamin A, zat besi dan *zinc)*. Faktor utama penyebabnya ialah tingkat kecukupan protein (Siringoringo *et al.*, 2020). Penelitian yang dilakukan oleh Sutriyawan dan Nadhira tahun 2020 menyatakan faktor yang mempengaruhi kejadian stunting atau pendek ialah pengetahuan ibu, ASI eksklusif dan sanitasi dasar (Sutriyawan dan Nadhira, 2020).

Prevalensi balita yang mengalami stunting di dunia menurut WHO adalah sebesar 21,9%. Sebagian besar balita stunting ini berasal dari Asia (*World Health Organization*, 2020). Berdasarkan data dari Survei Status Gizi Balita Indonesia (SSGBI) tahun 2021, prevalensi balita stunting di Indonesia menurun dari tahun 2019 hingga 2021 yaitu dari 27,67% menjadi 24,4%.

Penanganan kejadian stunting merupakan salah satu prioritas pembangunan nasional yang dijelaskan dalam RPJMN 2020–2024, target pemerintah ialah menurunkan prevalensi stunting menjadi 14% pada tahun 2024 (Badan Perencanaan Pembangunan Nasional, 2019). Dalam upaya penurunan prevalensi stunting ini pemerintah banyak mengeluarkan program untuk mewujudkannya. Upaya yang dilakukan pemerintah ialah mencegah dan mengurangi gangguan secara langsung (intervensi gizi spesifik) hingga gangguan secara tidak langsung (intervensi gizi sensitif). Sasaran prioritas upaya ini ialah orang-orang terlibat dalam 1000 Hari Pertama Kehidupan (HPK) yaitu ibu hamil, ibu menyusui dan anak usia 0–2 tahun. Sedangkan sasaran pentingnya ialah anak usia 24–59 bulan, remaja dan wanita usia subur (Satriawan, 2018).

Dalam membuat kebijakan, pemerintah tidak bisa berkaca pada satu hasil penelitian saja. Namun diperlukan data dari beberapa penelitian yang dapat menjadi latar belakang pembuatan kebijakan. Oleh sebab itu, sangat diperlukan suatu penelitian yang dapat menyajikan fakta secara komprehensif mengenai program pencegahan stunting di Indonesia, agar penelitian ini bermanfaat bagi pemerintah dalam pembuatan kebijakan mengenai program pencegahan stunting yang lebih tepat dan efisien. Penelitian *systematic review* bertujuan untuk mengidentifikasi hasil penelitian yang telah dipublikasi untuk interpretasikan datanya secara komprehensif (Rosmalina et al., 2018). Penelitian ini bertujuan untuk mengidentifikasi program pencegahan stunting di Indonesia. Hasil penelitian ini dapat digunakan Pemerintah Indonesia dalam membuat kebijakan untuk mencegah stunting.

METODE PENELITIAN

Penelitian ini menggunakan metode *systematic review* yang disusun berdasarkan *Preferred Reporting Items for Systematic Reviews and MetaAnalyzes* (PRISMA) (Gambar 1). Pencarian artikel menggunakan lima database yaitu *PubMed, Google Scholar*, Portal Garuda, Perupustakaan Nasional (Perpusnas) Indonesia dan *ScienceDirect*. Kata kunci pencarian artikel disusun berdasarkan *PICOS Framewok*, adapun kata kuncinya adalah "balita", "anak stunting", atau *"children",*

"toddler", "*stunted children*", "*stunted toddler*", "intervensi", "program", atau *"intervention"*, *"*pendek" dan "*stunting*". Kriteria inklusi penelitian ini adalah artikel yang diterbitkan pada tahun 2011–2020, populasi di wilayah Indonesia. Kriteria ekslusinya adalah artikel yang berbayar, *textbook*, artikel yang menggunakan bahasa selain Bahasa Inggris dan Bahasa Indonesia. Artikel yang telah melalui seleksi hingga kriteria inklusi dan eksklusi akan dinilai kualitasnya menggunakan *The Joanna Briggs Institute (JBI) Critical Appraisal* sesuai dengan desain studi pada artikel tersebut. Penelitian kualitas artikel akan dilakukan oleh kedua peneliti. Artikel yang telah melewati pengujian kualitas akan dianalisis menggunakan teknik analisis deskriptif yaitu menginterpretasikan dan menjelaskan lebih mendalam terkait hasil penelitian dan hubungannya satu dengan yang lainnya melalui narasi.

HASIL DAN PEMBAHASAN

Pencarian literatur melalui lima *database* menghasilkan 1232 artikel yang sesuai dengan kata kunci yang digunakan oleh peneliti. Terdapat 20 artikel yang sama (duplikasi) dan 1134 artikel tidak relevan karena populasinya bukan di Indonesia dan tidak menggunakan Bahasa Indonesia atau Bahasa Inggris, sehingga didapatkan 79 artikel untuk diseleksi secara keseluruhan isi artikel. Dari hasil seleksi tersebut didapatkan 16 artikel yang sesuai dengan tujuan penelitian, kriteria inklusi dan kriteria eksklusi, sehingga dimasukkan dalam penelitian ini dan dapat dilanjutkan ke tahap penelitian kualitas studi. Setelah penilaian kualitas studi dilakukan, satu artikel dikeluarkan dikarenakan penilaian kualitas studinya bernilai dibawah 50%. Hal ini dilakukan oleh peneliti untuk menghindari bias dalam validitas hasil dan rekomendasi usulan. Setelah melewati berbagai
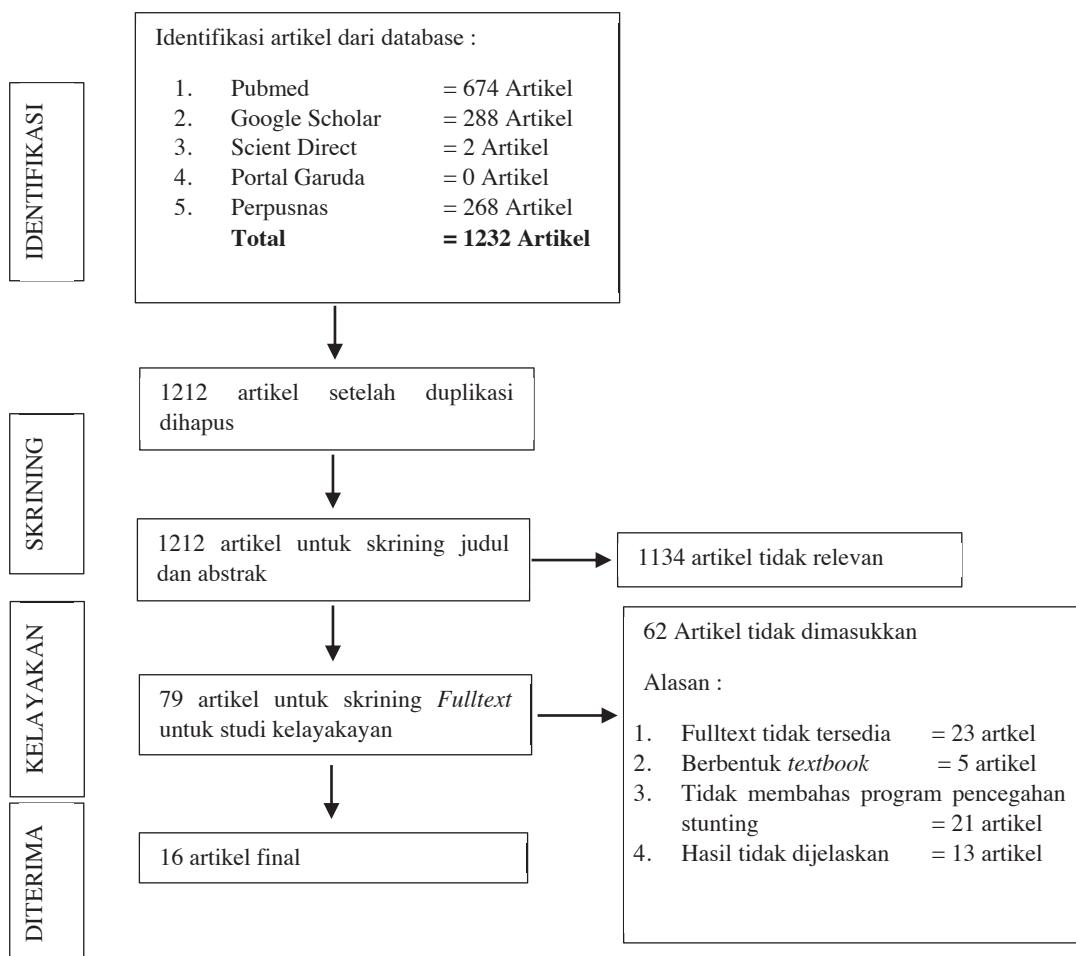
Gambar 1. Alur Penelitian

Tabel 1. Daftar Penelitian Rujukan

Peneliti	Judul	Tujuan	Intervensi/ Program	Desain Studi	Hasil
Wijayanti dan Fauziah (2019)	Dampak Pelatihan PMBA pada Kader Posyandu dalam Meningkatkan Status Gizi Anak Stunting	Mengetahui dampak pelatihan PMBA (Pelatihan Pemberian Makan pada Bayi dan Anak) pada kader Posyandu dalam meningkatkan status gizi balita stunting di Puskesmas Wilayah Kabupaten Sleman	Pelatihan PMBA pada Kader Posyandu	Kualitatif	Pelatihan PMBA dapat meningkatkan pengetahuan kader mengenai cara memberikan konseling kepada masyarakat sehingga dapat memberikan konsultasi kepada sasaran program stunting secara baik. Kegiatan konsultasi ke kader ini dapat memperbaiki pola asuh ibu balita balita terutama dalam hal memberikan makan pada anaknya secara tepat dan benar sesuai dengan pedoman gizi seimbang. Pelatihan ini mampu mencegah dan mengurangi angka stunting serta meningkatkan status gizi balita.
Abdillah *et al.* (2020)	Edukasi Gizi pada Ibu Oleh Kader Terlatih Meningkatkan Asupan Energi dan Protein Pada Balita	Menganalisis pengaruh edukasi gizi yang diberikan ke ibu oleh kader terlatih terhadap asupan dan protein balita di pusat pemulihan gizi di Kecamatan Sedayu, Kabupaten Bantul, Daerah Istimewa Yogyakarta.	Edukasi gizi	*Quasi-Eksperimen*	Asupan energi meningkat sebesar 513,74 kkal dan protein balita meningkat sebesar 15,35 g setelah ibu balita diberikan edukasi gizi oleh kader terlatih. Edukasi gizi oleh kader merupakan upaya efektif serta berkelanjutan untuk mengatasi gangguan secara langsung (intervensi gizi spesifik).
Angraini *et al.* (2020)	Edukasi Kesehatan Stunting di Kabupaten Bengkulu Utara	Mengetahui pengaruh pendidikan kesehatan stunting terhadap pengetahuan dan sikap ibu balita tentang kejadian stunting di Puskesmas Argamakmur Kabupaten Bengkulu Utara.	Edukasi gizi	*Quasi-Eksperimen*	Pengetahuan ibu meningkat dari rerata 4,95 menjadi 7,89 setelah diberikan edukasi serta sikap ibu meningkat dari rerata 24,21 menjadi 29,58 setelah diberikan edukasi. Edukasi gizi menggunakan media *flipchart* dapat meningkatkan pengetahuan serta sikap ibu mengenai stunting agar dapat melakukan pencegahan stunting pada anaknya.
Muthia *et al.* (2019)	Evaluasi Pelaksanaan Program Pencegahan Stunting Ditinjau dari Intervensi Gizi Spesifik Gerakan 1000 HPK Di Puskesmas Pegang Baru Kabupaten Pasama	Menganalisis bagaimana evaluasi pelaksanaan program pencegahan stunting dilihat dari intervensi gizi spesifik Gerakan 1000 Hari Pertama Kehidupan (HPK)	Intervensi Gizi Spesifik (PMT balita, PMT ibu hamil KEK, kegiatan pengukuran antropometri, pemberian vitamin A dan garam beryodium).	Kualitatif	Program intervensi gizi spesifik untuk pencegahan stunting dilakukan sudah cukup baik, namun belum dapat menurunkan angka stunting dibawah 20%. Hal ini dikarenakan berbagai kendala, yaitu tidak adanya anggaran khusus untuk program, masih terbatasnya sumber daya manusia untuk menjalankan intervensi, belum ada pedoman dan SOP, perencanaan tidak dilakukan secara *bottom up* dan belum ada pencatatan laporan.

Continued Tabel 1.   Daftar Penelitian Rujukan

Peneliti	Judul	Tujuan	Intervensi/ Program	Desain Studi	Hasil
Khoeroh *et al.* (2017)	Evaluasi Penatalaksanaan Gizi Balita Stunting Di Wilayah Kerja Puskesmas Sirampog	Mengevaluasi penatalaksanaan status gizi balita stunting di wilayah kerja Puskesmas Sirampog Kabupaten Brebes berdasarkan aspek (*input, process, output*).	Penatalaksanaan status gizi balita, program sehat bagi wanita hamil, pemberian ASI eksklusif, pemantauan tumbuh kembang bayi, PMT, pemberian vitamin A dan taburia	Kualitatif	Prevalensi stunting sudah menurun, yang dimana tahun 2014 dan 2013 prevalensi stunting mencapai 30% lebih, sedangkan tahun 2015 prevalensi stunting dapat mencapai angka 16,74%. Namun, program-program yang ada belum berjalan dengan optimal dikarenakan berbagai kendala, yaitu sumber daya manusia masih kurang dan belum ada tenaga gizi. Program taburia prosesnya belum terkoordinir sama sekali.
Suntari dan Gama (2020)	Kegiatan "Rumah Belajar" Sebagai Media Menganalisis Perilaku Keluarga dengan Risiko Kejadian Balita Stunting	Menganalisis perbedaan perilaku berisiko pada keluarga dengan risiko kejadian stunting sebelum dan sesudah dilakukannya kegiatan "Rumah Belajar"	Kelompok belajar	*Quasi-Eksperimen*	Adanya perbedaan perilaku kelompok perlakuan sebelum dan sesudah kegiatan "rumah belajar". Sedangkan kelompok kontrol tidak ada perbedaan yang berarti pada perilaku sebelum dan sesudah belajar dengan media pamflet. Adanya perbedaan perilaku antara kelompok yang mengikuti kegiatan "rumah belajar" dengan kelompok yang tidak mengikuti. Dengan adanya kegiatan "Rumah Belajar", keluarga mampu menggali kemampuannya untuk memahami faktor-faktor yang dapat memicu kejadian stunting pada anak.
Effendy *et al.* (2020)	*Nutrition education in Southeast Sulawesi Province, Indonesia: A cluster randomized controlled study*	Mengevaluasi dampak dari intervensi edukasi gizi terhadap pemberian makan balita dan status gizi balita.	Edukasi Gizi	*RCT*	Terdapat perubahan DDS (*Dietary Diversity Score*) pada balita setelah diberikan edukasi gizi dari rerata 2,37 menjadi 3,87. Namun, tidak ada perbedaan yang berarti TB/U antar kelompok perlakuan dengan kelompok kontrol. Hasil ini menunjukkan edukasi gizi yang disampaikan melalui kelas gizi dikombinasikan dengan kunjungan rumah rutin oleh kader berpotensi diadopsi untuk melengkapi program gizi lainnya di pusat kesehatan masyarakat dalam pencegahan *stunting*.
Irwan *et al.* (2020)	Pemberian *Cookies* Tepung Daun Dan Biji Kelor Terhadap Berat Badan dan Status Gizi Anak Balita di Wilayah Kerja Puskesmas Tampa Padang	Melihat perbedaan berat badan dan status gizi balita setelah diberikan *cookies* tepung daun kelor dan *cookies* tepung biji kelor.	Pemberian makanan tambahan	*RCT*	Adanya perubahan berat badan balita selama 3 bulan diberikan *cookies* biji kelor dan *cookies* daun kelor dengan nilai dengan nilai p=0,025 (p-value<0,05). Terdapat perbedaan peningkatan BB kedua kelompok sampel, namun secara statistik belum bisa memperbaiki status gizi, baik yang diberi *cookies* biji kelor maupun yang diberi *cookies* daun kelor dengan nilai p=0,495 (p-value>0,05).

Continued Tabel 1.   Daftar Penelitian Rujukan

Peneliti	Judul	Tujuan	Intervensi/ Program	Desain Studi	Hasil
Muliawati dan Sulistyawati (2019)	Pemberian Ekstrak *Moringa Oleifera* sebagai Upaya Preventif Kejadian Stunting pada Balita	Mengetahui manfaat pemberian ekstrak *moringa oleifera* atau daun kelor terhadap peningkatan tinggi badan balita	Pemberian makanan tambahan	*Quasi-Eksperimen*	Terdapat peningkatan tinggi badan balita sebesar 0,342 cm atau 16,2% setelah diberikan ekstrak *moringa oleifera* atau daun kelor. Masyarakat dapat memanfaatkan daun kelor untuk memenuhi nutrisi balita dan mencegah stunting pada anak.
Doloksaribu dan Simatupang (2019)	Pengaruh Konseling Gizi Prakonsepsi terhadap Pengetahuan dan Sikap Wanita Pranikah di Kecamatan Batang Kuis	Menganalisis efek konseling gizi prakonsepsi terhadap pengetahuan dan sikap wanita pranikah di Kecamatan Batang Kuis	Konseling gizi	*Quasi-Eksperimen*	Konseling gizi yang diberikan kepada wanita pranikah sebanyak tiga kali dalam seminggu akan memperlihatkan pengaruh yang besar terhadap peningkatan pengetahuan dan sikap mengenai gizi prakonsepsi.
Arini *et al*. (2017)	Pengaruh Pelatihan Pemberian MP ASI Kepada Ibu dengan Anak Baduta Di Kecamatan Sukmajaya Kota Depok Terhadap Pengetahuan dan Perilaku Pemberian MP ASI	Menganalisis pengaruh pelatihan pemberian MP-ASI terhadap pengetahuan dan perilaku ibu baduta dalam pemberian MP-ASI yang akan berdampak pada status gizi anak	Pelatihan pemberian MP-ASI	*Quasi-Eksperimen*	Terdapat perbedaan pengetahuan sebelum dan setelah kegiatan baik pada kelompok yang mendapatkan penyuluhan dan pelatihan MP-ASI maupun kelompok yang hanya mendapatkan penyuluhan saja. Terdapat perbedaan pengetahuan antara kelompok kelompok yang mendapatkan penyuluhan dan pelatihan MP-ASI dan kelompok yang hanya mendapatkan penyuluhan saja setelah pemberian penyuluhan dan pelatihan MP-ASI. Akan tetapi, tidak ada perbedaan perilaku antara kelompok penyuluhan dan pelatihan dan kelompok penyuluhan saja baik sebelum maupun sesudah perlakuan. Peningkatan pengetahuan lebih baik pada kelompok yang diberikan penyuluhan dan pelatihan.
Tambuwun *et al*. (2019)	Pengaruh Promosi Kesehatan Terhadap Pengetahuan Ibu Hamil Tentang 1000 HPK di Kelurahan Molas Kecamatan Bunaken Kota Manado	Mengetahui efek promosi kesehatan terhadap pengetahuan ibu hamil mengenai 1000 HPK di Kelurahan Molas Kecamatan Bunaken Kota Manado	Promosi Kesehatan (penyuluhan)	*True-Eksperiment*	Promosi kesehatan yaitu penyuluhan dengan metode ceramah dan media *leaflet* efektif dalam memberikan pengetahuan kesehatan yang dapat meningkatkan pengetahuan ibu hamil, dikarenakan informasi disampaikan tidak hanya melalui lisan namun juga melalui tulisan.
Rahmad dan Miko (2017)	Peningkatan Pengetahuan Calon Pengantin Melalui Konseling ASI Eksklusif di Aceh Besar	Meningkatkan pengetahuan calon pengantin dengan cara konseling mengenai ASI eksklusif	Konseling	*Quasi-Eksperiment*	Konseling ASI ekslusif mampu meningkatkan pengetahuan calon pengantin. Peningkatan pengetahuan ini dapat dilakukan dengan cara konseling dengan media *leaflet*.

Continued Tabel 1. Daftar Penelitian Rujukan

Peneliti	Judul	Tujuan	Intervensi/ Program	Desain Studi	Hasil
Andriani *et al.* (2017)	Perbedaan Pengetahuan, Sikap, Dan Motivasi Ibu Sesudah Diberikan Program *Mother Smart Grounding* (MSG) dalam Pencegahan Stunting Di Wilayah Kerja Puskesmas Puuwatu Kota Kendari Tahun 2017.	Mengetahui perbedaan pengetahuan, sikap, dan motivasi ibu balita sesudah mendapatkan program *Mother Smart Grounding* (MSG) untuk pencegahan *stunting* di wilayah kerja Puskesmas Puuwatu Kota Kendari tahun 2017.	Program *Mother Smart Grounding* (MSG) yaitu penyuluhan dan demonstrasi.	*Pre-Eksperimental*	Terdapat perbedaan pengetahuan, sikap dan motivasi ibu balita sebelum dan setelah mendapatkan intervensi yaitu program *Mother Smart Grounding* (MSG).
Purwanti (2019)	Program GASTIZI 1000 Dalam Meningkatkan Kapasitas Kader Posyandu	Menganalisis efektivitas program Cegah Stunting dengan Perbaikan Gizi pada 1000 HPK (GASTIZI 1000) untuk meningkatkan kapasitas kader posyandu	Program GASTIZI 1000 yaitu pelatihan untuk kader posyandu mengenai stunting dan gizi 1000 HPK	*Quasi-Eksperimen*	Pengetahuan serta keterampilan kader posyandu terkait stunting dan gizi pada 1000 HPK meningkat seusai diberikan program GASTIZI 1000.

tahapan dalam *systematic review*, didapatkan 15 artikel yang akan dibahas dalam penelitian ini.

Berdasarkan Tabel 1 dapat dilihat bahwasanya artikel yang ditelaah sebanyak 15 artikel, terdiri dari tiga artikel penelitian kualitatif, delapan artikel penelitian *quasi eksperiment*, dua artikel penelitian RCT (*Randomized Control Trial*), satu artikel penelitian *true eksperiment*, dan satu artikel penelitian *pre-eksperimental*. Dari hasil telaah didapatkan beberapa intervensi atau program gizi yang dilakukan untuk pencegahan stunting yaitu edukasi gizi melalui pelatihan, penyuluhan dan konseling pada ibu, wanita usia subur atau calon pengantin dan kader, pembentukan kelompok belajar bagi ibu-ibu balita, dan pemberian makanan tambahan pada balita.

Berdasarkan penelaahan artikel didapatkan sepuluh artikel yang membahas mengenai program pencegahan stunting melalui edukasi gizi. Edukasi gizi adalah suatu proses melatih kemampuan dan meningkatkan pengetahuan peserta secara formal dalam menentukan makanan, kegiatan fisik serta perilaku yang berhubungan dengan pemeliharaan

atau perbaikan kesehatan (*Academy of Nutrition and Dietetics*, 2013). Sepuluh artikel yang ditelaah menyatakan bahwasanya edukasi gizi berpengaruh positif untuk pencegahan stunting. Berdasarkan hasil penelitian Wijayanti dan Fauziah (2019), edukasi gizi yang diberikan kepada kader melalui pelatihan, mampu meningkatkan pengetahuan kader mengenai cara pemberian konseling dan penyampaian informasi kepada masyarakat dengan baik dan benar. Kader memiliki peran yang besar dalam pembinaan masyarakat melalui kegiatan di Posyandu. Pelatihan untuk kader ini sangat efektif untuk mencegah stunting terutama di masa pembentukan janin atau masa kehamilan sampai pertumbuhan 0–2 tahun (1000 HPK). Selain itu pelatihan ini sangat efektif untuk peningkatan status gizi balita, karena informasi yang disampaikan menyangkut pemberian makanan pada anak sesuai dengan usia, frekuensi, jumlah, tekstur hingga variasi makanan yang nantinya akan berpengaruh pada status gizi. Hal ini linier dengan penelitian Purwanti *et al.* (2014) yang menyatakan bahwasanya peran kader posyandu

akan berpengaruh terhadap status gizi balita, semakin tinggi peran kader semakin tinggi, maka angka gizi buruk pada balita akan menurun.

Kader posyandu yang terlatih memberikan edukasi gizi kepada ibu balita dapat meningkatkan pengetahuan ibu mengenai gizi, selanjutnya ibu akan mempraktikannya untuk memenuhi kebutuhan energi dan protein buah hatinya, sehingga edukasi gizi ini mampu meningkatkan pemenuhan kebutuhan energi dan protein pada balita yang dapat mencegah stunting (Abdillah et al., 2020). Dalam penelitian di negara Etiopia ditemukan bahwa peningkatan praktik gizi pada anak dapat terjadi karena peran kader kesehatan di posyandu, ibu balita dapat menerima informasi dan berdiskusi dengan kader tanpa batasan waktu dan dengan bahasa sehari-hari yang digunakan sehingga ibu balita lebih mudah memahaminya (Agize et al., 2017).

Edukasi kesehatan mengenai stunting memberikan dampak yang positif terhadap pengetahuan ibu. Peningkatan pengetahuan ibu akan menggambarkan kesehatan dan kesejahteraan anak serta menjadi penentu masa depan anak. Ibu yang sering terpapar dengan informasi mengenai stunting akan memiliki pengetahuan yang lebih informatif dibandingkan dengan ibu yang kurang terpapar (Angraini et al., 2020). Penelitian oleh Suryagustina et al. (2018) juga menyebutkan hal yang sama bahwasanya pendidikan kesehatan mengenai pencegahan stunting akan berdampak terhadap pengetahuan ibu, serta ibu yang minim informasi mengenai pencegahan stunting maka pengetahuannya mengenai pencegahan stunting juga akan kurang. Penelitian yang sama juga menyebutkan bahwasanya pendidikan kesehatan memberikan pengaruh terhadap sikap ibu dalam pencegahan stunting. Sikap ibu akan menentukan perilaku konsumsi makanan ibu selama masa kehamilan yang akan berdampak pada berat badan lahir bayi. Bayi dengan berat badan lahir rendah akan berisiko terkena stunting (Angraini et al., 2019).

Edukasi gizi tidak hanya diberikan kepada ibu balita, namun dalam pencegahan stunting edukasi gizi juga dapat diberikan kepada calon ibu yaitu wanita usia subur atau wanita pranikah. Edukasi gizi dengan metode konseling gizi mampu meningkatkan pengetahuan dan sikap pada calon ibu. Peningkatan pengetahuan calon ibu akan berdampak pada tumbuh kembang janin dan kondisi kesehatan bayi selama proses melahirkan (Doloksaribu dan Simatupang, 2019). Edukasi gizi pada wanita pranikah sangat diperlukan sebagai bekal pada saat periode prakonsepsi. Periode prakonsepsi akan menentukan kondisi bayi yang dilahirkan, kunci dari kelahiran bayi normal dan sehat ialah calon ibu yang memperoleh gizi yang baik pada periode prakonsepsi (Susilowati dan Kuspriyanto, 2016). Adanya edukasi gizi pada calon ibu membuat risiko generasi selanjutnya untuk terkena stunting dapat dicegah.

Pelatihan pembuatan MP-ASI lebih efektif dalam peningkatan pengetahuan ibu mengenai pemberian MP-ASI dengan gizi seimbang pada balita dibandingkan dengan pemberian penyuluhan menggunakan modul MP-ASI. Apabila pengetahuan dan perilaku ibu mengenai pemberian MP-ASI baik, maka status gizi anak akan mengalami peningkatan sehingga dapat mencegah terjadinya permasalahan gizi (Arini et al., 2017).

Edukasi gizi terkait stunting merupakan salah satu program yang sudah dilakukan pemerintah untuk penurunan angka stunting di Indonesia. Edukasi gizi ini termasuk dalam intervensi gizi spesifik yang sasarannya adalah ibu hamil, ibu menyusui, remaja putri dan wanita usia subur. Namun, belum ada program untuk penguatan edukator yaitu kader. Berdasarkan hasil telaah artikel diatas dapat kita ketahui bahwasanya kader yang terlatih dapat menurunkan kejadian stunting. Oleh sebab itu, pemerintah perlu melakukan penguatan kader melalui pelatihan agar pencegahan stunting melalui edukasi gizi lebih optimal.

Pencegahan stunting juga dapat dilakukan dengan pembentukan kelompok belajar. Kegiatan pada kelompok belajar ini berupa diskusi yang dilakukan oleh ibu balita yang didampingi oleh fasilitator. Diskusi yang dilakukan memiliki topik tertentu seputar stunting seperti faktor risiko stunting, mengenal dan menyiapkan makanan bergizi untuk balita dan mendisiplinkan balita. Pada kegiatan ini, ibu-ibu balita akan bercerita mengenai pengalaman mereka seputar topik yang nantinya akan ditanggapi oleh yang lainnya. Diakhir kegiatan fasilitator akan menyimpulkan dan menegaskan kembali hasil diskusi yang telah

dilakukan. Sehingga ibu-ibu balita mendapatkan pengetahuan dan pemahaman baru mengenai topik yang sesuai dengan permasalahan dan kebutuhan mereka. Interaksi yang dibangun dalam kelompok belajar mampu menggali kemampuan para keluarga untuk memahami stunting pada balita (Suntari dan Gama, 2020).

Pembentukan kelompok belajar ibu balita ini belum masuk dalam program pemerintah. Namun, dalam pelaksanaan posyandu seringkali kelompok belajar seperti ini terbentuk dengan sendirinya tetapi belum ada fasilitator. Oleh sebab itu, pemerintah dapat mempertimbangkan program kelompok belajar ibu balita ini untuk mencegah stunting dengan cara penyediaan fasilitator yang berkualitas dan mampu mendampingi ibu balita.

Dalam penelitian Widyaningsih *et al*., (2018) menyatakan bahwasannya terdapat hubungan antara kejadian stunting dengan panjang badan lahir, pola asuh makan dan keragaman pangan, dengan faktor risiko yang paling dominan ialah keragaman pangan. Faktor risiko pola asuh makan dan keragaman makan dapat diminimalisir dengan kegiatan kelompok belajar yang difasilitasi oleh tenaga kesehatan.

Pemberian makanan tambahan pada balita merupakan salah satu cara pencegahan stunting. Berdasarkan penelitian Irwan *et al*. (2020) dan Muliawati dan Sulistyawati (2019) pemberian makanan tambahan berbahan dasar tanaman kelor atau *moringa oleifera* dapat meningkatkan berat badan dan tinggi badan balita. Hal ini linier dengan penelitian Luthfiyah *et al*. (2011) yang menyatakan bahwasanya tepung daun kelor dapat dijadikan pangan alternatif untuk meningkatkan berat badan balita yang mengalami kekurangan berat badan, selain itu juga dapat meningkatkan anti-bodi balita dikarenakan kandungan zat besi (Fe) dan protein yang tinggi sehingga balita tidak mudah terserang penyakit.

Tanaman kelor atau *moringa oleifera* memiliki banyak manfaat. Daun kelor yang sudah dikeringkan atau dijadikan ekstrak mengandung 1600–2200 mg kalsium, zat besi, protein, vitamin A yang sama dengan vitamin A pada wortel, vitamin B, dan vitamin C yang sama dengan vitamin C pada 7 jeruk (Mahmood *et al*., 2011). Kandungan gizi yang sangat banyak dan bermanfaat pada

tanaman kelor ini dapat dimanfaatkan untuk pertumbuhan dan perkembangan balita. Oleh sebab itu, masyarakat terutama ibu balita dapat menggunakan tanaman kelor atau *moringa oleifera* untuk memenuhi kebutuhan gizi balita dan dapat mencegah stunting pada balita.

Program pencegahan stunting yang telah dijalankan di Indonesia belum dapat memberikan dampak yang optimal terhadap prevalensi stunting di Indonesia. Hal ini dikarenakan berbagai kendala yang ditemukan di lapangan. Berdasarkan penelitian Muthia *et al*. (2019) program pencegahan stunting belum mampu menurunkan prevalensi stunting dikarenakan tidak adanya dana khusus untuk intervensi atau program, masih kurangnya sumber daya manusia untuk menjalankan intervensi atau program, belum adanya pedoman dan Standar Operasional Prosedur (SOP), perencanaan tidak dilakukan secara *bottom up* dan belum ada pencatatan dan pelaporan intervensi atau program. Kendala-kendala ini menyebabkan program tidak mampu mencapai targetnya untuk menurunkan prevalensi stunting. Penelitian yang dilakukan oleh Khoeroh dan Indriyanti (2017) juga menyatakan bahwasanya program-program pencegahan stunting belum berjalan dengan optimal dikarenakan berbagai kendala yaitu sumber daya manusia yang masih kurang dan belum ada tenaga gizi.

Pemberian makanan tambahan pada balita merupakan salah satu program yang sudah dilakukan oleh pemerintah untuk penurunan kejadian stunting. Makanan tambahan yang diberikan oleh pemerintah berupa biskuit siap makan. Namun, masih terdapat kendala dalam pelaksanaan programnya. Berdasarkan penelitian yang dilakukan oleh Sugianti (2017) dan Aryani dan Wahyono (2020) menyatakan bahwasanya sasaran program PMT kurang tepat. Sasaran program kurang tepat karena terdapat anggota keluarga yang ikut serta mengonsumsi makanan tambahan yang diberikan. Diperlukan peningkatan pengawasan untuk program ini. Pemberian makanan tambahan juga dapat dilakukan menggunakan bahan dasar pangan lokal yang dekat dengan masyarakat seperti tanaman kelor untuk memenuhi kebutuhan gizi balita sehingga dapat mencegah stunting.

Pencegahan stunting dapat dilakukan dengan berbagai upaya yaitu memberikan edukasi pada pihak terlibat pencegahan stunting seperti kader, ibu balita, ibu hamil, dan wanita usia subur atau wanita pranikah yang merupakan calon ibu. Edukasi dapat dilakukan dengan berbagai metode seperti konseling, ceramah dan pelatihan. Untuk memberdayakan para ibu balita, pencegahan stunting juga dapat dilakukan dengan cara pembentukan kelompok belajar yang akan menjadi wadah belajar dan berdiskusi ibu-ibu balita secara mandiri yang didampingi oleh fasilitator kesehatan. Selain itu, pencegahan stunting dapat dilakukan dengan pemberian makanan tambahan pada balita yang dimana bahan dasarnya mudah ditemukan di lingkungan masyarakat, seperti tanaman kelor atau *moringa oleifera*.

Agar Program pencegahan stunting optimal harus diperhatikan aspek masukan dan prosesnya, seperti masukan sumber daya manusia yang harus dipenuhi kuantitas dan kualitasnya. Pada aspek proses harus dilibatkan semua pihak mulai dari ibu balita hingga lintas sektoral untuk perencanaan hingga pelaporan program. Pemenuhan yang optimal pada aspek masukan dan proses akan memberkan hasil yang optimal terhadap keluarkan program (Rusdianah dan Widiarini, 2019).

KESIMPULAN DAN SARAN

Pencegahan stunting yang efektif dapat dilakukan dengan cara pemberian edukasi gizi pada pihak yang berpengaruh (kader, ibu balita, ibu hamil dan calon ibu), pembentukan kelompok belajar untuk ibu balita, dan pemberian makanan tambahan untuk balita. Sepuluh dari enam belas artikel yang ditemukan menyatakan edukasi gizi dapat dijadikan alternatif pencegahan stunting yang efektif. Pembentukan kelompok belajar dinilai juga efektif untuk mencegah stunting dikarenakan kelompok belajar akan menjadi wadah belajar dan berdiskusi ibu-ibu balita secara mandiri yang didampingi oleh fasilitator kesehatan. Selain itu, pemberian makanan tambahan pada balita dengan bahan dasar yang mudah ditemukan oleh masyarakat, seperti tanaman kelor atau *moringa oleifera* dapat menjadi upaya dalam pencegahan stunting di Indonesia.

Program atau intervensi yang dilakukan untuk pencegahan stunting harus memperhatikan dengan baik aspek masukan dan prosesnya agar mendapatkan keluaran yang optimal serta harus melibatkan semua pihak mulai dari ibu balita hingga lintas sektoral.

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PERUBAHAN AKTIVITAS FISIK DAN KONSUMSI MAKANAN ULTRA PROSES PADA MAHASISWA SELAMA PANDEMI COVID-19: PENELITIAN OBSERVASIONAL

Changes of Physical Activity and Ultra-Processed Food Consumption in College students during COVID-19 Pandemic: An Observational Study

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ABSTRAK

Pemerintah menerapkan pembatasan aktivitas selama pandemi COVID-19, sehingga dapat mengakibatkan perubahan gaya hidup, termasuk aktivitas fisik dan konsumsi makanan. Perubahan aktivitas fisik dan konsumsi makanan ultra proses telah terjadi di beberapa negara selama pandemi COVID-19. Perubahan gaya hidup tersebut mampu mempengaruhi obesitas, dimana 32,5% penduduk yang berusia diatas 18 tahun di Samarinda, Kalimantan Timur mengalami obesitas. Kebiasaan makan remaja akan mempengaruhi kesehatannya baik saat ini maupun di masa dewasa. Oleh karena itu, penelitian *cross-sectional* dengan 378 mahasiswa bertujuan untuk mengetahui perubahan aktivitas fisik dan konsumsi makanan ultra proses pada mahasiswa di Samarinda selama pembatasan sosial (Pemberlakuan Pembatasan Kegiatan Masyarakat/PPKM) saat pandemi COVID-19. Pengumpulan data menggunakan kuesioner *online* selama 2 bulan. Analisis data menggunakan uji *wilcoxon* dan *chi- square* dengan tingkat kepercayaan 95% (α= 0.05). Hasil penelitian menunjukkan prevalensi status gizi normal sebanyak 60,1%, status aktivitas fisik tidak aktif sebanyak 89% dan tingkat konsumsi makanan ultra proses rendah sebanyak 82.5%. Hasil uji statistik diperoleh nilai p perbedaan sebelum dan selama pembatasan sosial, aktivitas fisik (p=<0.001) dan perbedaan konsumsi makanan ultra proses (p=0,034). Pendidikan ibu (p=0.004) dan jumlah penghuni dalam rumah (p=0,001) berpengaruh signifikan terhadap konsumsi makanan ultra proses. Berdasarkan hasil penelitian, terdapat perbedaan aktivitas fisik dan konsumsi makanan ultra proses sebelum dan sesudah pembatasan sosial serta ada hubungan pendidikan ibu dan jumlah penghuni dalam rumah dengan konsumsi makanan ultra proses. Oleh karena itu, remaja perlu memperhatikan aktivitas fisik dan konsumsi makanan agar kesehatan tetap optimal.

Kata kunci: aktivitas fisik, makanan ultra proses, remaja, pandemi COVID-19

ABSTRACT

The government has developed initiatives to restrictive activity during the COVID-19 pandemic, which have led to changes in lifestyle habits, especially those involving physical activity and food consumption. Changes of physical activity and ultra-processed foods consumption have occurred in several countries during the COVID-19 pandemic. The changing of lifestyle might affect obesity that 32.5% of the population (>18 years) in Samarinda, East Kalimantan, Indonesia are obese. Good eating behaviours in the early stages of life and adolescence can influence the current health status and the predisposition to non-communicable diseases in adulthood. Therefore, this cross-sectional study with 378 college students aimed to determine changes of physical activity and ultra-processed foods consumption in college students during restrictive activity in the COVID-19 pandemic. Data was collected using an online questionnaire for two months. Further, data was analyzed using Wilcoxon and chi-square test with 95% confidence level (α= 0.05). This study showed that the prevalence of normal nutritional status was 60.1%, inactive physical activity status was 89.4%, and the consumption level of ultra-low processed foods was 82.5%. Statistical tests obtained p-value differences in physical activity (p=<0.001) and differences in ultra-processed food consumption (p=0.034) before and after the restrictive activity in the COVID-19 pandemic. Additionally, mother's educational level (p=0.004) and the number of occupants in the house (p=0.001) significantly affected the consumption of ultra-processed foods.

Keywords: *physical activity, ultra-processed food, adolescent, pandemic COVID-19*

PENDAHULUAN

Masa remaja merupakan periode yang sangat penting, dimana kebiasaan gaya hidup saat remaja dapat menentukan kualitas kesehatannya. Sebuah penelitian *review* dengan 31 studi menyimpulkan bahwa semakin tinggi kegiatan aktivitas fisik berhubungan dengan semakin baiknya kualitas hidup dan kesehatan pada remaja (Wu *et al.*, 2017). Kebiasaan konsumsi makanan juga sangat mempengaruhi kesehatannya, dimana kecukupan gizi merupakan faktor yang sangat penting untuk pertumbuhan dan perkembangan remaja (Corkins *et al.*, 2016).

Selain itu, dengan terjadinya peningkatan populasi global telah mengakibatkan pengembangan teknik yang melibatkan pengolahan, pengawetan, pengemasan, dan distribusi pangan. Makanan ultra proses adalah makanan yang diformulasikan melalui proses industri dan penambahan zat aditif seperti pengawet, pewarna, pengemulsi, perasa, dan lain-lain. Makanan ultra proses dianggap nyaman, mudah disiapkan, dan menyediakan lebih banyak pilihan. Makanan ultra proses cenderung mengandung lemak, gula, dan garam tingkat tinggi untuk meningkatkan kelezatannya, yang dapat menyebabkan konsumsi energi yang berlebihan dan akibatnya meningkatkan risiko obesitas (Monteiro, Moubarac, Cannon, Ng, & Popkin, 2013). Konsumsi makanan ultra proses merupakan penyebab potensial dari kejadian obesitas pada remaja di Argentina, Australia, Brazil, Chili, Kolombia, Meksiko, Inggris dan Amereka Serikat (Neri *et al.*, 2022).

Kebiasaan makan yang tidak berdasarkan prinsip gizi seimbang dan kurangnya aktivitas fisik dapat menyebabkan kelebihan gizi di Indonesia. Data dari Survei Riset Kesehatan Dasar Nasional 2018 menunjukkan konsumsi buah dan sayur masih kurang memadai (95.4%), mengkonsumsi mie instan hampir setiap hari sebesar 63.3% dan hanya 33.5% yang melakukan aktivitas fisik (Badan Penelitian dan Pengembangan Kesehatan Kementerian RI, 2019). Sebuah literatur review menyimpulkan bahwa kurangnya aktivitas fisik dan tingginya konsumsi makanan/camilan yang digoreng berhubungan dengan kejadian kegemukan dan obesitas di Indonesia (Rachmi, Li, & Alison Baur, 2017).

Perubahan gaya hidup terjadi di seluruh dunia sejak munculnya SARS-CoV-2. Pemerintah setiap negara memberlakukan pembatasan aktivitas untuk mencegah penyebaran penyakit. Demikian pula terjadi di Indonesia, dimana pemerintah menerapkan Pemberlakuan Pembatasan Kegiatan Masyarakat (PPKM) atau masyarakat dihimbau untuk mengurangi kegiatan di luar rumah. Pembatasan aktivitas sosial selama pandemi COVID-19 telah mengubah gaya hidup, khususnya pada konsumsi makanan dan aktivitas fisik (Ruiz-Roso *et al.*, 2020; Scarmozzino & Visioli, 2020).

Perkuliahan di Samarinda, Indonesia, juga dilaksanakan secara daring sejak bulan Maret tahun 2021 atau sejak diterapkannya PPKM. Berdasarkan hasil studi pendahuluan yang peneliti lakukan pada mahasiswa Universitas Mulawarman pada bulan Maret 2021 dengan melakukan penyebaran kuesioner *online* kepada 30 mahasiswa, didapatkan hasil bahwa sebanyak 24 orang atau 80% mengalami kenaikan berat badan dan sebanyak 22 orang atau 73,3% mengalami penurunan tingkat aktivitas fisik selama PPKM saat pandemi COVID-19. Didapatkan pula hasil dari konsumsi makanan ultra proses selama 7 hari terakhir terhitung pada saat responden mengisi kuesioner *online*, bahwa proporsi tertinggi kelompok makanan ultra proses yang dikonsumsi oleh mahasiswa yaitu minuman kemasan dan kecap (86,7%), mie instan dan kerupuk atau keripik (83,3%), biskuit (80%) dan saos (73,3%). Hal ini disebabkan karena mahasiswa lebih memilih untuk memasak di rumah, namun keterampilan memasaknya masih kurang sehingga memilih makanan yang praktis, kurangnya kesadaran akan makanan sehat, dan terpaparnya iklan televisi seperti pada mahasiswa di Brazil, Spanyol, Chili, Kolombia dan Italia pada saat pandemi COVID-19 (Dezanetti, Quinaud, Caraher, & Jomori, 2022; Ruiz-Roso *et al.*, 2020). Oleh karena itu, dapat dikatakan bahwa dengan diberlakukannya PPKM di Kota Samarinda menyebabkan kegiatan perkuliahan harus dilaksanakan secara daring sehingga memicu terjadinya kenaikan berat badan dan penurunan tingkat aktivitas fisik yang dialami oleh mahasiswa Universitas Mulawarman.

Berdasarkan pemaparan diatas, menjadi latar belakang peneliti ingin mengetahui adanya perubahan aktivitas fisik dan konsumsi makanan

ultra proses pada mahasiswa Universitas Mulawarman selama PPKM saat pandemi COVID-19.

METODE

Penelitian ini merupakan penelitian *cross sectional*, dengan 378 partisipan. Kriteria inklusi sebagai berikut: mahasiswa aktif Universitas Mulawarman, berusia 18–24 tahun, belum menikah, sedang tidak melakukan program diet penurunan berat badan atau penyakit tertentu, sedang tidak dalam kondisi sakit, dan bersedia menjadi sampel dalam penelitian. Adapun kriteria eksklusinya adalah tidak berpartisipasi sampai akhir dalam penelitian dan tidak menjawab pertanyaan aktivitas fisik dan konsumsi makanan. Populasi dalam penelitian ini adalah seluruh mahasiswa Universitas Mulawarman, Samarinda, Kalimantan Timur, sebanyak 23.886 orang. Teknik pengambilan sampel dalam penelitian ini adalah *stratified random sampling*, dimana dilakukan secara random dan bertingkat pada setiap fakultas dan semester perkuliahan. Seluruh responden telah menulis kesediaan mengikuti penelitian dan protokol penelitan ini telah disetujui oleh komisi etik penelitian kesehatan Fakultas Kedokteran Universitas Mulawarman (No. 56/KEPK-FK/V11/2021).

Data dikumpulkan melalui survei secara daring menggunakan *self-administered questionnaire dengan google form* selama dua bulan yaitu Mei hingga Juni 2021. Terdapat 383 responden yang mengisi kuesioner, namun 5 responden drop out karena beberapa data tidak valid (aktifitas fisik dan usia), sehingga jumlah seluruh responden sebesar 378. Data yang dikumpulkan meliputi karakteristik responden, kuesioner IPAQ (*International Physical Activity Questionnaire*) mengenai aktivitas fisik yang telah divalidasi pada umur 18-55 tahun di 12 negara dan merupakan instrumen yang tepat untuk studi prevalensi aktifitas fisik tingkat nasional dan memiliki reliabilitas dan validitas yang baik (Craig *et al.*, 2003) dan kuesioner FFQ (*Food Frequency Questionnaire*) mengenai pola konsumsi makanan ultra proses sebelum dan selama PPKM saat pandemi COVID-19. Tingkat aktivitas fisik dihitung dari nilai skor MET (*Metabolic Equivalents of Task)*, dimana aktivitas ringan=

3.3 MET, aktivitas sedang= 4.0 MET dan aktivitas berat= 8.0 MET, yang dikalikan dengan intensitas dalam menit dan hari, lalu dijumlahkan sehingga didapatkan skor akhir untuk aktivitas fisik. Adapun kategori aktifitas fisik menurut IPAQ, antara lain sebagai berikut: 1) Aktivitas ringan jika melakukan aktivitas fisik dengan total skor MET <600 METs-menit/minggu; 2) Aktivitas sedang jika melakukan aktivitas fisik dengan total skor MET 600-1500 METs-menit/minggu; 3) Aktivitas berat jika melakukan aktivitas fisik dengan total skor MET >1500 METs-menit/minggu (Hallal & Victora, 2004). Makanan pada FFQ diperoleh dengan studi pendahuluan pada 30 mahasiswa dengan perwakilan fakultas mengenai makanan ultra proses yang biasa dikonsumsi. sehingga mampu mewakili makanan responden. Studi pendahuluan menggunakan kuesioner online (*goggle form*). Setiap soal FFQ dinyatakan valid (p<0,005) dan reliabel (cronbach's alpha=0,932). FFQ mengukur makanan yang dikonsumsi responden selama seminggu terakhir sebelum dan selama pandemi COVID-19, dengan kriteria ≥5 kali/minggu=tinggi konsumsi makanan ultra proses dan <5 kali/minggu=rendah konsumsi makanan ultra proses (Santaliestra-Pasias *et al.*, 2012).

Analisis univariat dilakukan untuk menggambarkan karakteristik subjek penelitian dengan menggunakan distribusi frekuensi dan persentase dari setiap variabel. Uji *wilcoxon* digunakan untuk mengetahui apakah ada perbedaan tingkat aktivitas fisik dan konsumsi makanan ultra proses pada mahasiswa Universitas Mulawarman sebelum PPKM dan selama PPKM saat pandemi COVID-19. Selain itu, uji *chi-square* dilakukan untuk mengetahui hubungan karakteristik responden dengan status aktivitas fisik dan tingkat konsumsi makanan ultra proses selama PPKM saat pandemi COVID-19. P value < 0,005 (*two-tailed)* dianggap bermakna. Analisa menggunakan *Statistical Package for Social Science (SPSS, versi 25)*.

HASIL DAN PEMBAHASAN

Sebagian besar responden berusia 22 tahun, perempuan, berstatus gizi normal dan mengalami perubahan kenaikan berat badan selama PPKM, bersuku Jawa, berasal dari Fakultas Matematika

Tabel 1. Distribusi Karakteristik Mahasiswa di Universitas Mulawarman Tahun 2020 (n=378)

Karakteristik Individu	n	(%)
Usia (tahun)		
< 21	143	37,8
≥ 21	235	62,2
Jenis kelamin		
Laki-laki	105	27,8
Perempuan	273	72,2
Peningkatan Berat Badan		
Ya	226	59,8
Tidak	152	40,2
Fakultas		
Kedokteran	3	0,8
Kesehatan Masyarakat	91	24,1
Farmasi	11	2,9
MIPA	170	45
FKIP	17	4,5
Teknik	20	5,3
Perikanan	4	1,1
Ilmu Komputer	4	1,1
Kehutanan	4	1,1
Pertanian	10	2,6
Hukum	4	1,1
Ilmu Budaya	2	0,5
Ilmu Sosial Politik	27	7,1
Angkatan		
2015-2017	149	39,4
2018-2020	229	60,5
Tempat tinggal sebelum PPKM		
Kost/kontrakan	136	36
Bersama orang tua	222	58,7
Asrama	20	5,3
Tempat tinggal selama PPKM		
Kost/kontrakan	42	11,1
Bersama orang tua	330	87,3
Asrama	6	1,6
Pendidikan Ibu		
Tidak sekolah	3	0,8
SD	69	18,3
SMP/SLTP	50	13,2
SMA/SLTA	166	43,9
Perguruan tinggi	90	23,8

Karakteristik Individu	n	(%)
Pekerjaan Ayah		
Buruh	18	4,8
Nelayan	10	2,6
Ojek	4	1,1
Pegawai swasta	70	18,5
Pensiunan	11	2,9
Petani	29	7,7
PNS	74	19,6
TNI	2	0,5
Wiraswasta	113	29,9
Honorer	1	0,3
Tidak bekerja	36	9,5
Meninggal	10	2,6
Pekerjaan ibu		
IRT/Tidak bekerja	259	68,5
Pegawai swasta	16	4,2
Wiraswasta	43	11,4
PNS	48	12,7
Honorer	4	1,1
Pensiunan	1	0,3
Petani	2	0,5
Meninggal	5	1,3
Jumlah Penghuni dalam rumah		
1-3 orang	74	19,6
4 orang atau lebih	304	80,4
Pendapatan ayah		
< UMP	186	49,2
≥ UMP	192	50,8
Pendapatan ibu		
< UMP	312	82,5
≥ UMP	66	17,5

*UMP=upah minimum regional, IRT=ibu rumah tangga, PPKM= Pemberlakuan Pembatasan Kegiatan Masyarakat, SD=sekolah dasar, SMP/SLTP=sekolah menengah pertama/sekolah lanjutan tingkat pertama, SMA/SLTA=sekolah menengah atas/sekolah lanjutan tingkat atas.

rumah sebagian besar berjumlah 4 orang atau lebih, pendapatan ayah di atas sama dengan UMP Kalimantan Timur (Rp. 2.981.378), pendapatan ibu di bawah UMP. Terdapat peningkatan tempat tinggal untuk bersama orang tua sebelum dan selama PPKM (Tabel 1).

Tidak ada perbedaan yang bermakna antara usia, jenis kelamin, pekerjaan ayah dan ibu, indeks massa tubuh, dengan konsumsi makanan ultra proses pada mahasiswa Universitas Mulawarman selama PPKM saat Pandemi COVID-19 (Tabel 2). Konsumsi makanan ultra proses paling tinggi pada

Ilmu Pengetahuan Alam, angkatan 2017, pendidikan terakhir ibu SMA/SLTA, pekerjaan ayah sebagai wiraswasta, pekerjaan ibu yaitu sebagai IRT/tidak bekerja, jumlah penghuni dalam

Tabel 2. Hubungan Karakteristik Mahasiswa dengan Aktifitas Fisik dan Makanan Ultra Proses di Universitas Mulawarman selama PPKM saat Pandemi COVID-19 (n=378)

Karakteristik responden	Aktivitas Fisik selama PPKM saat pandemi COVID-19 (%)		p-value¹	Makanan Ultra Proses Selama PPKM (%)		p-value¹
	Tidak Aktif	Aktif		Rendah	Tinggi	
Usia (tahun)						
18–20	90	10	0,696	80	20	0,267
21–24	89	11		84	16	
Jenis Kelamin						
Laki-laki	87	13	0,281	81	19	0,614
Perempuan	90	10		83	17	
Indeks Massa Tubuh						
Sangat kurus-kurus	86	14		85	15	
Normal	89	11	0,052	82	18	0,733
Gemuk-Obesitas	98	2		81	19	
Pendidikan Ibu						
Tidak sekolah	100	0		100	0	
Sekolah Wajib (SD-SMP-SMA)	89	11	0,813	79	21	0,005
Perguruan Tinggi	90	10		93	7	
Pekerjaan Ayah						
Tidak Bekerja	87	13		80	20	
Bekerja Tidak Tetap (Buruh, Nelayan, Petani)	87	13	0,610	75	25	0,221
Bekerja Tetap (PNS, TNI, Pegawai Swasta)	90	10		85	15	
Pekerjaan Ibu						
Tidak Bekerja	89	11		81	19	
Bekerja Tidak Tetap (Buruh, Nelayan, Petani)	100	0	0,694	50	50	0,134
Bekerja Tetap (PNS, TNI, Pegawai Swasta)	91	9		88	13	
Jumlah Penghuni dalam Rumah						
1–3 orang	88	12	0,622	96	4	0,001
4 orang atau lebih	90	10		79	21	
Pendapatan Ayah						
Di bawah UMP²	90	10	0,574	81	19	0,340
Di atas UMP	89	12		84	16	
Pendapatan Ibu						
Di bawah UMP	88	12	0,079	81	19	0,106
Di atas UMP	96	4		89	11	

¹Uji test yang digunakan adalah uji chi-square dengan p-value yang bermakna adalah <0,05. Angka yang dicetak tebal berarti bermakna.

²UMP= Upah Minimum Propinsi Kalimantan Timur sebesar Rp 3.014. 497,22.

ibu dengan pendidikan rendah (dibawah SMP/SLTP).

Jika dihubungkan dengan aktivitas fisik, maka tidak ada satupun karakteristik responden yang berhubungan dengan aktivitas fisik selama PPKM saat pandemi COVID-19 (Tabel 2). Hal ini berbeda, jika dikaitkan dengan konsumsi makanan ultra proses, dimana terdapat hubungan pendidikan ibu dan jumlah penghuni dalam rumah dengan konsumsi makanan ultra proses. Ibu yang berpendidikan tinggi yaitu tamat SMA dan perguruan tinggi, cenderung lebih rendah mengkonsumsi makanan ultra proses. Hal ini sesuai dengan penelitian di Brazil, Spanyol, Chili,

Kolombia dan Italia yang menyimpulkan bahwa rendahnya tingkat pendidikan ibu berhubungan dengan tingginya konsumsi makanan ultra proses (Ruiz-Roso et al., 2020). Sebuah studi yang dilakukan di Swedia dan Brazil menyimpulkan bahwa anak-anak yang orang tuanya berpendidikan rendah cenderung mengkonsumsi makanan yang lebih murah dan kurang sehat (Mais, Warkentin, Latorre, Carnell, & Taddei, 2017; Ryden & Hagfors, 2011). Hubungan ini mungkin menunjukkan bahwa ibu dengan pendidikan yang lebih rendah mungkin memiliki lebih banyak kesulitan dalam mengakses informasi untuk memilih makanan yang lebih sehat.

Dalam studi ini, ditemukan pula bahwa jumlah penghuni dalam rumah 1–3 orang cenderung mengkonsumsi lebih rendah makanan ultra proses. Pada variabel jumlah penghuni dalam rumah, hasil penelitian ini sejalan dengan penelitian di Korea yang menyatakan bahwa ada hubungan pendapatan keluarga berdasarkan jumlah penghuni dalam rumah dengan tingkat konsumsi makanan ultra proses (Shim, Shim, Cha, Kim, & Kim, 2021). Pekerjaan orang tua dan pendapatan orang tua tidak berhubungan dalam studi ini, dan hal tersebut bertolak belakang dengan di Korea, yang menyatakan bahwa status sosial ekonomi terbukti menjadi faktor yang signifikan terkait dengan konsumsi makanan ultra proses (Shim et al., 2021).

Hal ini dapat dikaitkan dengan perbedaan harga pangan, keterjangkauan, dan aksesibilitas makanan tersebut antar negara (Baker *et al*., 2020). Makanan ultra proses relatif murah di negara-negara berpenghasilan tinggi, sehingga makanan tersebut tampaknya menarik bagi orang miskin di negara-negara tersebut. Namun, di negara-negara berpenghasilan menengah atau rendah, makanan ultra proses masih lebih mahal daripada makanan alami, dan orang miskin terus memilih untuk menyiapkan makanan mereka dengan makanan

alami yang relatif murah (Zagorsky & Smith, 2017).

Terdapat penurunan tingkat aktivitas fisik pada mahasiswa Universitas Mulawarman selama PPKM saat pandemi COVID-19 (Tabel 2 dan Tabel 3). Sejalan dengan hasil penelitian sebelumnya pada remaja di Denpasar dan Mojokerto, yang menemukan bahwa ada penurunan aktivitas fisik sebelum dan pada masa pandemi COVID-19 (Annisa, 2021; Heleen, 2020).

Adanya perubahan aktivitas fisik sebelum dan selama pandemi dikarenakan penutupan sekolah dan kampus yang mengakibatkan para remaja melakukan sekolah melalui daring dan terjadi penurunan tingkat aktivitas fisik (Nurhadi, 2020). Menurut Kementerian Kesehatan RI melalui panduan gizi seimbang pada masa pandemi covid-19 menyarankan untuk meningkatkan daya tahan tubuh agar tidak tertular COVID-19 dengan melakukan aktivitas fisik yang teratur (Kemenkes RI, 2020). Aktivitas fisik yang terbatas sebagai dampak dari pemberlakuan karantina yang ketat dapat dikaitkan dengan efek metabolik yang dapat meningkatkan risiko penyakit seperti diabetes, kanker, osteoporosis, dan penyakit kardiovaskular (Lippi, Henry, & Sanchis-Gomar, 2020).

Kekurangan aktivitas fisik dapat berpengaruh pada kekebalan tubuh karena pada dasarnya ketika tubuh tidak dipaksa melakukan aktivitas fisik maka imunitas dalam tubuh juga dapat menurun serta mudah terserang penyakit/virus (Abdulloh, 2020). Pada masa pandemi seperti ini sangat penting untuk menjaga pola aktivitas fisik yang baik karena hal tersebut sangat berpengaruh pada imunitas seseorang sehingga mampu terhindar dari berbagai virus dan penyakit lainnya. Rutin melakukan aktivitas selama 30 menit setiap hari dapat meningkatkan sistem kekebalan tubuh untuk melawan infeksi virus dan penyakit lainnya (Wicaksono, 2020).

Aktivitas fisik yang dapat dilakukan di rumah pada masa pandemi COVID-19 diantaranya adalah latihan aerobik dan anaerobik. Latihan aerobik berguna untuk membuat fungsi kerja jantung lebih baik, membuat tekanan darah menurun dan meningkatkan pembakaran lemak yang baik. Contoh beberapa latihan aerobik di rumah adalah jalan cepat sekeliling rumah, naik turun tangga di dalam rumah selama 10–15 menit dalam 2–3 kali

Tabel 3. Perubahan Tingkat Aktivitas Fisik selama PPKM saat Pandemi COVID-19.

Aktivitas Fisik	mean	p value
Sebelum PPKM	1,27	<0,001
Selama PPKM	1,11	

*uji *Wilcoxon* dan bermakna jika p ≤ 0,05

Tabel 4. Perubahan Skor MET (*metabolic equivalents of task*) Aktivitas Fisik selama PPKM saat pandemi COVID-19

Variabel	Mean	Min.	Max.	p value
Sebelum	4307	50	28949	<0,001
Selama	2568	60	136461	

*Bermakna jika p ≤ 0,05.

sehari, senam aerobik, loncat tali dan olahraga dengan sepeda statis atau *treadmill*. Latihan anaerobik berguna untuk melatih kekuatan otot. Contoh beberapa latihan anaerobik di rumah adalah *push up*, *squat* (jongkok-berdiri), *lunges* dan *crunches* (Kemenkes RI, 2020).

Dalam berolahraga di rumah selama pandemi, beberapa hal yang harus diperhatikan yaitu dianjurkan untuk melakukan aktivitas fisik dalam intensitas sedang, seperti berjalan cepat (kecepatan 5 km/jam) pada permukaan rata di dalam atau di luar rumah, memindahkan perabot ringan, mencuci mobil, bulu tangkis, dansa, tenis meja, bersepeda dan bermain skate board karena dapat meningkatkan imunitas yang sangat diperlukan tubuh saat pandemi COVID-19 (Kemenkes RI, 2020).

Studi ini memiliki kelebihan dimana sepengetahuan terbaik kami, merupakan studi pertama yang mengeksplore hubungan aktivitas fisik dan makanan ultra proses di Indonesia. Pandemi COVID-19 membuat perubahan gaya hidup, sehingga mempelajari perubahan aktivitas fisik dan makanan ultra proses sangat penting dilakukan. Kelebihan kedua adalah jumlah sampel yang merupakan representative mahasiswa di Universitas Mulawarman. Kelebihan ketiga adalah penggunaan kuesioner yang telah valid dan reliabel.

Walaupun demikian, studi ini memiliki kekurangan. Pertama adalah adanya bias pada *recall*, dimana data mengenai aktivitas fisik dan konsumsi makanan ultra proses terbatas pada ingatan responden, khususnya pada saat sebelum PPKM. Kedua adalah jenis penelitian *cross-sectional* yang tidak mampu menjelaskan hubungan sebab akibat dan analisa lebih pada deksriptif tanpa adanya penyesuaian pada beberapa analisa data (*mulptiple testing)*. Dengan demikian,

penggunaan penilaian status gizi secara biokimia dapat digunakan pada studi selanjutnya.

KESIMPULAN DAN SARAN

Berdasarkan hasil penelitian pada mahasiswa Universitas Mulawarman selama PPKM saat pandemi COVID-19, ditemukan adanya penurunan aktivitas fisik (*p-value:*<0,001) dan peningkatan frekuensi konsumsi makanan ultra proses (*p-value:* 0,034). Tidak ada hubungan antara karakteristik responden dengan aktivitas fisik, sementara pendidikan ibu (*p-value:* 0,004) dan jumlah penghuni dalam rumah (*p-value:* 0,001) yang berhubungan dengan konsumsi makanan ultra proses selama PPKM. Peneliti menyarankan kepada mahasiswa untuk memperbanyak aktifitas fisik secara rutin dengan intensitas sedang dan mengurangi konsumsi makanan ultra proses. Selain itu, pihak universitas diharapkan untuk mensosialisasikan perilaku hidup sehat dan menerapkannya dalam kegiatan akademik dan kemahasiswaan. Prospek riset selanjutnya yang perlu diteliti yaitu mengenai riset jangka panjang mengenai dampak konsumsi makanan ultra proses dan faktor yang mempengaruhinya agar dapat melihat perubahan pada biomarker sindrom metabolik dan inflamasi yang terjadi di 10 tahun yang akan datang.

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ESTIMASI JUMLAH, KEHILANGAN GIZI DAN EKONOMI DARI *FOOD LOSS* DAN *WASTE* UNTUK KETAHANAN PANGAN DI JAWA BARAT

The Estimated Amount, Nutrition, and Economies of Food loss and Food waste for Food Security in West Java

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ABSTRAK

Salah satu tantangan dalam ketahanan pangan yaitu tingginya jumlah *food loss* dan *waste*. Mengurangi setengah *food loss* dan *waste* sepanjang rantai pangan merupakan bagian dari SDGs tujuan ke-12. Berdasarkan data The Economist Intelligence Unit (EIU) tahun 2017, Indonesia merupakan negara peringkat kedua tertinggi dengan FLW sebesar 300 kg/orang/tahun. Jawa Barat adalah provinsi dengan jumlah penduduk tertinggi di Indonesia dan berperan penting dalam pemenuhan kebutuhan pangan nasional sehingga diperlukan ketersediaan pangan yang cukup. Penelitian bertujuan untuk menganalisis jumlah, kerugian gizi serta ekonomi dari *food loss* dan *waste* untuk ketahanan pangan di Jawa Barat. Studi ini memanfaatkan data sekunder dengan desain analisis deskriptif kuantitatif. Metode perhitungan *food loss* dan *waste* menggunakan rumus persentase estimasi *food loss* dan *waste* Asia Selatan dan Tenggara oleh FAO. Hasil dari penelitian ini menunjukkan estimasi jumlah total *food loss* dan *waste* pangan strategis di Jawa Barat tahun 2018 sebesar 2,04 juta ton. Selain itu, *food loss* dan *waste* menyebabkan adanya kehilangan kandungan zat gizi seperti energi sebesar 335,61 kkal/hari, protein sebesar 9,38 gram/hari dan lemak sebesar 3,98 gram/hari serta kerugian ekonomi sebesar 32,89 triliun rupiah. Pengurangan *food loss* dan *waste* sangat penting untuk mencapai ketahanan pangan.

Kata kunci: *food loss*, *food waste*, ketahanan pangan, kerugian gizi, kerugian ekonomi

ABSTRACT

One of the challenges in food security is the high amount of food loss and food waste. Reducing food loss and food waste in half along the food chain is part of the twelfth SDGs goal. Based on data from The Economist Intelligence Unit (EIU) in 2017, Indonesia was the second highest ranked country with an FLW of 300 kg/person/year. West Java is the province with the highest population in Indonesia and plays an important role in meeting national food needs so that sufficient food availability is required. This study aims to analyze food loss and food waste for food security in West Java. While the specific objectives of this study are to estimate the amount of food loss and strategic food waste in each food chain in West Java, and macronutrients and economic losses from FLW. This study utilizes secondary data with a quantitative descriptive analysis design. The method of calculating food loss and waste uses the formula for the estimated percentage of food loss and waste in South and Southeast Asia by the FAO. The results of this study indicate the estimated total food loss and strategic food waste in West Java in 2018 was 2,04 million tons. In addition, food loss and waste cause a loss of nutritional content such as energy of 335,61 kcal/day, protein of 9.38 grams/day and fat of 3,98 grams/day as well as economic losses of 32,89 trillion rupiah. Food loss and waste must be reduced for greater food security.

Keywords: *food loss, food waste, food security, nutritional losses, economic losses*

PENDAHULUAN

Pangan merupakan kebutuhan dasar manusia yang harus dipenuhi setiap hari. Terdapat beberapa pangan yang memiliki peran penting dalam pembentukan angka inflasi yang disebut pangan strategis (Surya, 2015). Menurut Peraturan Presiden No 66 Tahun 2021 menunjukkan bahwa pangan strategis menjadi lingkup tugas dan fungsi Badan Pangan Nasional (BPN). Ketersediaan pangan yang cukup secara jumlah maupun mutunya, aman,

beragam dan bergizi baik zat gizi makro dan zat gizi mikro agar mencapai ketahanan pangan.

Ketahanan pangan merupakan salah satu isu prioritas di berbagai negara. Ketahanan pangan meliputi berbagai pilar yaitu ketersediaan, keterjangkauan, konsumsi pangan dan stabilitas dari ketiganya (Ashby *et al*. 2016). Ketersediaan pangan menjadi salah satu aspek yang penting untuk memenuhi kebutuhan dan konsumsi pangan bagi rumah tangga, masyarakat, ataupun perseorangan secara berkelanjutan.

Tantangan dalam meningkatkan ketahanan pangan terutama pada aspek ketersediaan produksi pangan meliputi: pertumbuhan luas panen terbatas dikarenakan adanya kompetisi pemanfaatan lahan, pertumbuhan produktivitas yang kurang baik dikarenakan rendahnya inovasi dan penggunaan teknologi yang canggih, pemanasan global berperan dalam perubahan periode musim hujan dan kemarau sehingga dapat mempengaruhi ketersediaan pangan. Pemanasan global juga berpengaruh terhadap penurunan produksi dan produktivitas karena siklus air yang tidak menentu akibat dari perubahan pola hujan (Balitkabi, 2017). Selain itu, tantangan dalam ketersediaan pangan adalah jumlah kehilangan pangan (*food loss*) dan pemborosan pangan (*food waste*) cukup tinggi (Suryana, 2014).

Di sepanjang rantai pangan dapat memungkinkan terjadinya *food loss* dan *waste* (FAO, 2011). Mengurangi *food loss* dan *waste* merupakan bagian dari SDGs tujuan ke 12 yaitu konsumsi dan produksi yang berkelanjutan dengan salah satu targetnya untuk mengurangi menjadi setengah *food loss* dan *waste* pada sepanjang rantai pangan dari produksi hingga konsumsi (BPS, 2016).

Berdasarkan data *The Economist Intelligence Unit* (EIU) tahun 2017, Indonesia merupakan negara yang menduduki peringkat kedua tertinggi dengan *food loss* dan *waste* sebesar 300 kg/orang/

tahun. Salah satu provinsi di Indonesia yaitu Provinsi Jawa Barat berperan penting dalam menopang pemenuhan kebutuhan pangan nasional (Widjojo, 2012). Jawa Barat merupakan sentra beras yang menjadi pemasok terbesar dalam memenuhi kebutuhan di Jabodetabek (BKP, 2020). Berdasarkan data dari Kementerian Pertanian Republik Indonesia, Provinsi Jawa Barat dari tahun 2014-2017 mengalami peningkatan produksi beras dan menjadi provinsi kedua terbesar untuk produksi beras. Namun, Produksi beras Provinsi Jawa Barat pada tahun 2018 mengalami penurunan sehingga peringkatnya tergeser menjadi nomer tiga. Oleh karena itu, peneliti tertarik untuk menghitung jumlah, kerugian gizi serta ekonomi dari *food loss* dan *waste* pangan strategis untuk mendukung ketahanan pangan di Jawa Barat.

METODE

Desain penelitian yang digunakan adalah analisis diskriptif kuantitatif dengan mengolah data sekunder tahun 2018. Data penelitian ini meliputi data produksi pangan strategis dan jumlah penduduk bersumber dari dokumen publikasi BPS yaitu Provinsi Jawa Barat dalam angka tahun 2019. Harga pangan bersumber dari harga konsumen pedesaan Provinsi Jawa Barat 2018 yang dipublikasi BPS. Konversi produksi bersumber dari dokumen publikasi BKP yaitu panduan penyusunan neraca bahan makanan 2019. Data bagian dapat dimakan (BDD) bersumber dari tabel komposisi pangan 2017 yang dipublikasi oleh Kementrian Kesehatan.

Data yang diperoleh akan diolah menggunakan beberapa metode perhitungan dengan program *software microsoft excel 2017* dan Neraca Bahan Makanan (NBM) dalam Aplikasi Analisis Ketersediaan Pangan Wilayah yang dikembangkan oleh MWA *Training and Consulting*. Metode perhitungan perkiraan *food loss* dan *waste*

Tabel 1. Persentase kehilangan pangan Asia Selatan dan Tenggara (FAO, 2011)

Bahan pangan	Produksi	Penanganan dan penyimpanan pasca panen	Pemrosesan dan pengemasan	Distribusi	Konsumsi
Padi-padian	6%	7%	3,5%	2%	3%
Buah/biji berminyak	7%	12%	8%	2%	1%
Buah dan sayur	15%	9%	25%	10%	7%
Daging	5,1%	0,3%	5%	7%	4%

Tabel 2. Perhitungan *food loss* dan *waste* pada NBM

Tahapan	Keterangan
Food loss produksi (A)	*food loss* pada tahapan produksi dapat dihitung dengan rumus : A = [% *production loss*/ (1- % *production loss*)] x B
Produksi (B)	total produksi pangan suatu daerah
Import (C)	bahan makanan yang didatangkan dari luar daerah
Perubahan stok (D)	selisih antara stok akhir tahun dengan stok awal tahun
Eksport (E)	bahan makanan yang dikeluarkan dari suatu daerah
Food loss penanganan dan penyimpanan pasca panen (F)	*Food loss* yang terjadi pada tahap penanganan dan penyimpanan pasca panen yang dihitung dengan rumus : F = % *post harvest handling and storage loss* x B
Ketersediaan pangan (G)	Total ketersediaan pangan suatu daerah dapat dihitung dengan rumus : G = B + C – D – E – F
Pakan (H)	bahan makanan yang dipergunakan untuk makanan ternak
Bibit (I)	bahan makanan yang dipergunakan untuk keperluan reproduksi.
Industri pangan (J)	bahan makanan yang akan diproses untuk pengolahan lebih lanjut kemudian hasilnya akan dimanfaatkan untuk dalam bentuk lain oleh manusia
Industri non pangan (K)	bahan makanan yang akan diproses untuk pengolahan lebih lanjut kemudian hasilnya akan dimanfaatkan untuk kebutuhan industri selain manusia, seperti untuk pakan ternak/ikan.
Penggunaan lain (L)	bahan makanan yang diperuntukkan dalam memenuhi kebutuhan pengungsi, turis, asrama atau sekolah dan industry non pangan namun data penggunaannya tidak tersedia
Bahan makanan (M)	bahan makanan yang tersedia untuk dikonsumsi yang kemudian didistribusikan ke pasar dan konsumen yang dihitung dengan rumus : M = G – (H + I + J + K + L)
Food loss pemrosesan dan pengemasan (N)	*Food loss* pada tahap pemrosesan dan pengemasan dapat dihitung dengan rumus : N = % *processing and packaging loss* x M
Ditribusi (O)	Total pasokan pangan yang tersedia pada tahapan distribusi dan pemasaran yang dihitung dengan rumus : O = M – N
Food waste distribusi (P)	*Food waste* pada tahap distribusi dapat dihitung dengan rumus : P = % *distribution and market waste* x O
Konsumsi (Q)	Total pasokan pangan yang tersedia pada tahapan konsumsi yang didapatkan melalui perhitungan: Q = O – P
Food waste konsumsi (R)	*Food waste* pada tahap konsumsi dapat dihitung dengan rumus : R = % *consumption waste* x Q

menggunakan estimasi persentase kehilangan berdasarkan kelompok pangan menurut *Food and Agriculture Organization* 2011 (Tabel 1).

Pangan dalam penelitian ini yaitu beras dan jagung termasuk dalam estimasi kelompok pangan padi-padian; kedelai termasuk dalam estimasi kelompok pangan buah/biji berminyak; bawang merah, cabai besar, cabai rawit, bawang putih termasuk dalam estimasi kelompok pangan buah dan sayur; serta untuk bahan pangan daging sapi dan ayam termasuk dalam estimasi kelompok pangan daging. Proses perhitungan estimasi jumlah *food loss* dan *waste* pada setiap tahapan rantai pangan yaitu produksi, penanganan dan penyimpanan pasca panen, pemrosesan dan pengemasan, distribusi serta konsumsi dijelaskan pada Tabel 2 (FAO, 2011; Bappenas, 2021).

Setiap makanan mengandung zat gizi makro dan zat gizi mikro. Penelitian ini juga akan menghitung *food loss* dan *waste* berdasarkan beberapa zat gizi yaitu energi, protein dan lemak. Berikut formula perhitungannya:

$$FE = FLW \times E \times BDD/10000$$

Keterangan :
FE = *Food loss* dan *waste* dalam energi atau protein atau lemak
FLW = Jumlah *food loss* dan *waste*
E = Kandungan energi atau protein atau lemak per 100 gr BDD pangan
BDD = berat bahan yang dapat dimakan

Food loss dan *waste* juga menyebabkan dampak di bidang ekonomi. Kerugian nilai ekonomi dari *food loss* dan *waste* sangat dipengaruhi oleh jumlah dari *food loss* dan *waste* dan harga pangannya (Kariyasa dan Suryana, 2012). Berikut kerugian formula kerugian ekonomi *food loss* dan *waste*:

$$KE = FLW \times Hp$$

Keterangan :
KE = Kerugian ekonomi
FLW = Jumlah *food loss* dan *waste*
Hp = Harga pangan

HASIL DAN PEMBAHASAN

Food Loss dan *Waste*

Menurut Undang-undang No.18 Tahun 2012, Ketahanan pangan dapat diartikan kondisi ketersediaan pangan yang mencukupi untuk seluruh masyarakat baik secara jumlah ataupun mutunya agar dapat hidup dengan produktif, aktif serta sehat secara berkelanjutan. Ketersediaan pangan yang utama didapatkan dari jumlah produksi pangan. Keberhasilan produksi dipengaruhi oleh berbagai faktor seperti lahan tanam, karakteristik tanaman, biologis dan lingkungan (Mopera, 2016). Salah satu tantangan dalam mewujudkan ketahanan pangan adalah tingginya jumlah *food loss* dan *waste*.

Food loss atau kehilangan pangan biasanya terjadi dari tahapan proses produksi, pengelolaan dan penyimpanan saat pasca panen, hingga tahapan pemprosesan dan pengemasan (FAO, 2011). Pada tahun 2018, jumlah total *food loss* pangan strategis pada tahap produksi di Jawa Barat sebesar 643,29 ribu ton atau setara dengan 13,21 kg/kapita. *Food loss* diakibatkan karena adanya kerusakan dan atau terjatuh selama proses panen (seperti pemetikan buah) dan pemilihan hasilnya setelah dipanen (FAO, 2011).

Selanjutnya, *food loss* pada tahap penanganan dan penyimpangan pasca panen meliputi kehilangan akibat terjatuh selama penanganan, penyimpanan dan transportasi antar petani dan distribusi. *Food loss* tahap penanganan dan penyimpangan pasca panen pangan strategis di Jawa Barat tahun 2018 sebanyak 581,52 ribu ton. *Food loss* komoditas beras terbesar pada tahap penanganan dan penyimpangan pasca panen mencapai 428,1 ribu ton.

Food loss tahap pemrosesan dan pengemasan meliputi kehilangan dapat terjadi ketika tanaman disortir agar sesuai standar dalam pemrosesan atau terjatuh selama pengemasan. Jumlah *food loss* tahap pemrosesan dan pengemasan pangan strategis di Jawa Barat sebesar 388,03 ribu ton.

Food waste atau pemborosan pangan biasanya terjadi pada tahapan rantai pangan distribusi hingga konsumsi (FAO, 2011). Tahapan distribusi adalah kegiatan untuk menjembatani atau menyalurkan pangan dari produsen ke konsumen ataupun usaha lain yang berkaitan dengan barang dan jasa hingga sampai kepada konsumen (Andriyanto dan Yanuar, 2020). Jumlah *food waste* pada tahap distribusi pangan strategis di Jawa Barat mencapai 202,22 ribu ton.

Tahapan terakhir dari system pangan yaitu konsumsi. Pada tahapan konsumsi ini jumlah

Tabel 3.   Perkiraan *food loss* dan *waste* pada setiap rantai pangan di Jawa Barat tahun 2018

Komoditas Pangan	Produksi (ribu ton)	Pasca Panen (ribu ton)	Pemrosesan (ribu ton)	Distribusi (ribu ton)	Konsumsi (ribu ton)
Beras	390,36	428,10	198,73	109,58	161,09
Jagung	91,22	87,04	35,65	19,66	28,90
Kedelai	11,57	18,45	10,46	2,41	1,18
Bawang Merah	29,61	9,75	24,58	7,37	4,65
Bawang Putih	0,23	0,08	0,21	0,06	0,04
Cabai Besar	48,36	24,66	61,90	18,57	11,70
Cabai Rawit	23,19	11,83	29,69	8,91	5,61
Daging Sapi	3,72	0,16	2,58	3,43	1,83
Daging Ayam	45,03	1,46	24,23	32,22	17,12
Total	643,29	581,52	388,03	202,22	232,11

food waste lebih banyak pada negara yang maju dibandingkan dengan negara berkembang (FAO, 2011). Di Jawa Barat, *food waste* pada tahapan konsumsi hingga 232,11 ribu ton. Terdapat beberapa hal yang menyebabkan *food waste* dapat meningkat yaitu persoalan pola pikir. Pola pikir dalam mewujudkan ketahanan pangan melalui peningkatan ketersediaan pangan yang berfokus hanya pada bagian hulu yaitu peningkatan produksi melalui perluasan lahan pertanian ataupun peningkatan produktivitas. Sedangkan pada bagian hilir terutama mengupayakan penurunan timbulan *food waste* masih belum difokuskan (Kariyasa dan Djauhari, 2013).

Food loss dan *waste* berpengaruh terhadap ketahanan pangan, ekonomi dan lingkungan (Rezaei dan Liu, 2017). Jumlah *food loss* dan *waste* yang tinggi maka akan secara langsung menurunkan salah satu pilar ketahanan pangan yaitu ketersediaan. Ketersediaan pangan yang tidak memenuhi kebutuhan dapat menyebabkan terjadi kerawaan pangan (Nafees et al., 2021).

Di Jawa Barat pada tahun 2018, perkiraan jumlah total *food loss* dan *waste* pangan strategis sebesar 2,04 juta ton atau 22,3 % dari total produksi pangan strategis Jawa Barat yaitu 9,18 juta ton. Adapun jumlah *food loss* sebesar 1,61 juta ton dan *food waste* sebesar 0,43 juta ton. Proporsi *food loss* dan *waste* terbesar adalah beras dengan jumlah 1,28 juta ton. Beras merupakan makanan pokok untuk sebagian besar masyarakat Indonesia sehingga jumlah *food loss* dan *waste*

Tabel 4. Perkiraan *food loss* dan *waste* di Jawa Barat tahun 2018

Komoditas Pangan	*Food loss* (ribu ton)	*Food waste* (ribu ton)	*Food loss* dan *Waste* (ribu ton)
Beras	1.017,2	270,7	1.287,9
Jagung	213,9	48,6	262,5
Kedelai	40,5	3,6	44,1
Bawang Merah	63,9	12,0	76,0
Bawang Putih	0,5	0,1	0,6
Cabai Besar	134,9	30,3	165,2
Cabai Rawit	64,7	14,5	79,2
Daging Sapi	6,5	5,3	11,7
Daging Ayam	70,7	49,3	120,1
Total	1.612,8	434,3	2.047,2

Tabel 5. Tambahan ketersediaan pangan melalui pengurangan *food loss* dan *waste* di Jawa Barat tahun 2018

Komoditas pangan	Pengurangan *food loss* dan *waste* 50%	
	Ribu ton	**Kg/kapita**
Beras	643,93	13,23
Jagung	131,23	2,70
Kedelai	22,03	0,45
Bawang Merah	37,98	0,78
Bawang Putih	0,32	0,01
Cabai Besar	82,60	1,70
Cabai Rawit	39,61	0,81
Daging Sapi	5,86	0,12
Daging Ayam	60,03	1,23
Total	1.023,58	21,03

Keterangan: jumlah penduduk Jawa Barat tahun 2018 sebesar 48,6 juta jiwa

beras yang besar dapat mempengaruhi ketahanan pangan nasional.

Berdasarkan perhitungan dalam penelitian ini, jumlah *food loss* lebih besar dibandingkan dengan jumlah *food waste*. Hal ini dikarenakan pada negara berkembang termasuk Indonesia masih terbatasnya infrastuktur dan teknologi untuk menunjang peningkatan produksi dan pencegahan *food loss* di tingkat petani (Kariyasa dan Suryana, 2012).

Teknologi pertanian digital merupakan salah satu solusi untuk mencegah dan mengurangi terjadinya *food loss* dan *waste*. Teknologi pertanian digital merupakan system yang komplek untuk memberikan informasi mengenai pertanian (Benyam, 2021). Program digitalisasi pertanian yang ada di Indonesia seperti Kartu Tani. Kartu Tani digunakan untuk akses permodalan bagi petani dan alokasi subsidi pupuk sebagai salah satu ujung tombak strategi ketahanan pangan. (Abiwodo, 2021).

Bila pemborosan pangan bisa dikurangi sebesar 50 persen maka diperkirakan ada tambahan ketersediaan pangan dari beras untuk penduduk di Jawa Barat sebesar 643,93 ribu ton per tahun atau setara dengan 13,23 kg per kapita. Selain itu, ketersediaan pangan dari jagung, kedelai, bawang merah, bawang putih, cabai rawit, cabai besar, daging sapi, daging ayam juga meningkat berkisar 0,32 – 131,23 ribu ton per tahun atau setara dengan 0,01 – 2,7 kg per kapita.

Kerugian Kandungan Gizi *Food Loss* dan *Waste*

Ketahanan pangan merupakan salah satu cara untuk mengakhiri kelaparan, meningkatkan status gizi serta mencapai pertanian berkelanjutan yang menjadi tujuan kedua dari SDGs (Riski et al., 2019). Berdasarkan data Riskesdas pada tahun 2018, masalah gizi di Jawa Barat yaitu balita stunting mencapai 31,1%. Prevalensi balita stunting di Jawa Barat lebih tinggi dibandingkan rata-rata prevalensi Indonesia yaitu 30,8% .

Faktor penyebab langsung masalah gizi yaitu rendahnya jumlah dan mutu konsumsi makanan erat kaitannya dengan ketersedian makanan. *Food loss* dan *waste* sangat mempengaruhi dalam aspek ketersedian pangan baik secara jumlah maupun mutu. *Food loss* dan *waste* memiliki dampak negatif dari beberapa bidang salah satunya yaitu pangan dan gizi. Semakin banyak jumlah *food loss* dan *waste* maka semakin banyak juga kandungan gizi yang terbuang dari makanan tersebut (Rohaedi *et al.* 2014; FAO 2019).

Tabel 6 menunjukkan perkiraan kerugian beberapa zat gizi dari *food loss* dan *waste* pangan strategis di Jawa Barat tahun 2018 pada energi sebesar 335,61 kkal/kapita/hari atau setara dengan 15,98% dari kebutuhan harian energi yaitu 2100 kkal/hari. Kerugian ini masih lebih rendah jika dibandingkan dengan kerugian energi dari *food loss* dan *waste* di Indonesia dari 11 komoditas pangan yaitu 618-989 kkal/kapita/hari (Bappenas 2021). Selain itu, kerugian protein dari *food loss* dan *waste* yaitu 9,38 gram/hari hal ini mencakup

16,45 % dari angka kecukupan protein. Sedangkan kerugian lemak sebesar 3,98 gram/hari meliputi 5,94 % dari AKG lemak harian yaitu 67 gram/hari. Ketahanan pangan dan gizi membutuhkan zat gizi yang cukup dari hasil produksi pangan sepanjang tahun (Coles *et al*. 2016).

Kerugian Ekonomi dari *Food loss* dan *Waste*

Kerugian ekonomi terkait *food loss* dan *waste* jumlahnya mencapai sekitar 1 triliun USD setiap tahunnya (FAO, 2014). *Food loss* dan *waste* selaras dengan kebijakan pemerintah yang tertuang pada Rencana Pembangunan Jangka Menengah (RPJMN) 2020-2024 yaitu memperkuat ketahanan ekonomi untuk pertumbuhan yang berkualitas melalui pengelolaan sumber daya ekonomi yang mencakup pemenuhan kebutuhan pertanian dan pangan serta pembangunan rendah karbon.

Berdasarkan Tabel 7 menunjukkan kehilangan nilai ekonomi akibat *food loss* dan *waste* di Jawa Barat pada tahun 2018 mencapai 32,89 triliun rupiah. Kerugian *food loss* dan *waste* per kapita sebesar 675,75 ribu rupiah atau setara dengan 2,3% dari produk domestik regional bruto (PDRB) per kapita Jawa Barat. PDRB memiliki pengaruh terhadap ketahanan pangan (Biantoro dan Purnomo 2017). Hasil kajian food loss dan waste yang dilakukan *World Resources Institute* (WRI) bersama dengan Bappenas menunjukkan bahwa di Indonesia timbulan food loss dan waste menyebabkan kerugian ekonomi sebesar Rp

Tabel 6. Perkiraan total kerugian energi, lemak dan protein dari *food loss* dan *waste* di Jawa Barat tahun 2018

Komoditas Pangan	Energi (kkal/hari)	Protein (g/hari)	Lemak (g/hari)
Beras	258,74	6,09	1,23
Jagung	46,72	1,25	0,93
Kedelai	7,21	0,76	0,32
Bawang Merah	1,20	0,04	0,01
Bawang Putih	0,02	0,00	0,00
Cabai Besar	1,78	0,05	0,01
Cabai Rawit	2,84	0,11	0,06
Daging Sapi	1,03	0,10	0,07
Daging Ayam	16,07	0,98	1,35
Total	**335,61**	**9,38**	**3,98**

Table 7. Perkiraan total kerugian ekonomi dari *food loss* dan *waste* di Jawa Barat tahun 2018

Komoditas Pangan	Harga Pangan Per Kilo (Rp)	Kerugian *food loss* dan *waste* (Rp Triliun)	Kerugian *food loss* dan *waste* per kapita (Rp Ribu)
Beras	10.908	14,05	288,55
Jagung	6.689	1,76	36,06
Kedelai	11.779	0,52	10,66
Bawang Merah	24.612	1,87	38,40
Bawang Putih	27.368	0,02	0,36
Cabai Besar	38.678	6,39	131,24
Cabai Rawit	33.148	2,63	53,94
Daging Sapi	113.772	1,33	27,37
Daging Ayam	36.083	4,33	88,98
Total		**32,89**	**675,57**

213 triliun/tahun sampai 551 triliun/tahun atau setara dengan 4% sampai 5% persen dari produk domestik bruto (PDB) Indonesia per tahun. Nilai kehilangan ekonomi dari *food loss* dan *waste* di Indonesia paling besar sebesar Rp 88 triliun sampai Rp 155 triliun per tahun pada komoditas padi-padian (Bappenas, 2021).

KESIMPULAN DAN SARAN

Jumlah *food loss* dan *waste* di Jawa Barat pada tahun 2018 mencapai 22,3% atau hampir seperempat dari jumlah produksi. *Food loss* dan *waste* memiliki kerugian terhadap beberapa bidang seperti kerugian zat gizi pada energi 15,98%, protein 16,45%, serta lemak 5,94% dari kebutuhan harian masing-masing zat gizi. Selain itu, *food loss* dan *waste* memiliki kerugian nilai ekonomi mencapai 32,89 triliun rupiah. Pengurangan *food loss* dan *waste* dapat berpengaruh terhadap peningkatan ketersediaan yang akan mendukung ketahanan pangan di Jawa Barat.

Keterbatasan dalam penelitian ini yaitu tidak termasuk *food loss* dan *waste* pada proses prapanen, ekspor dan impor pangan. Pangan yang dihitung dalam penelitian ini hanya pangan stategis dan hanya menghitung beberapa zat gizi. Oleh karena itu, pada penelitian selanjutnya diperlukan perhitungan komoditas pangan serta zat gizi yang lainnya.

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HUBUNGAN ANTARA RIWAYAT PEMBERIAN MP-ASI DAN KECUKUPAN PROTEIN DENGAN KEJADIAN *STUNTING* PADA BALITA DI WILAYAH KERJA PUSKESMAS BANTARAN KABUPATEN PROBOLINGGO

Associations of Complementary Feeding Practice History and Protein Adequacy Level with Childhood Stunting in the Working Area of Puskesmas Bantaran in Probolinggo Regency

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ABSTRAK

Stunting sering dihubungkan dengan waktu pemberian MP-ASI terlalu dini dan asupan protein tidak adekuat. Tujuan dari penelitian ini adalah untuk menganalisis hubungan antara praktik pemberian MP-ASI dan tingkat kecukupan protein dengan kejadian *stunting* pada balita di wilayah kerja Puskesmas Bantaran Kabupaten Probolinggo, Jawa Timur. Jenis penelitian yaitu observasional analitik dengan desain *case control* secara retrospektif. Sampel penelitian sebesar 22 balita kelompok kasus (stunting) dan 22 balita kelompok kontrol (tidak stunting) yang memenuhi kriteria inklusi, kemudian diambil secara simple random sampling. Sampel merupakan balita desa lokus *stunting* di wilayah kerja Puskesmas Bantaran, Kabupaten Probolinggo dengan responden yaitu ibu balita. Instrumen pengumpulan data meliputi kuesioner berisi karakteristik ibu balita dan balita, SQ-FFQ untuk menilai kecukupan protein, dan microtise untuk mengukur tinggi badan. Analisis menggunakan uji *Chi Square* dan uji *Spearman*. Hasil penelitian menunjukkan bahwa balita *stunting* mendapatkan MP-ASI tidak tepat (81,8%) dan memiliki tingkat kecukupan protein defisit (81,8%). Balita tidak mengalami *stunting* mendapatkan praktik MP-ASI tepat (63,6%) dan tingkat kecukupan protein kategori cukup (59,1%). Terdapat hubungan antara praktik pemberian MP-ASI (p=0,002, OR 7,87) dan tingkat kecukupan protein (p=0,005, OR 6,5) dengan kejadian *stunting* pada balita. Kesimpulan dari penelitian ini adalah balita dengan praktik pemberian MP-ASI yang tidak tepat berisiko 7,87 kali mengalami *stunting* dan balita dengan tingkat kecukupan protein defisit berisiko 6,5 kali mengalami *stunting*. Maka sebaiknya ibu dapat meningkatkan jumlah asupan protein dan pemberian MP-ASI yang tepat.

Kata kunci: balita, kecukupan protein, Riwayat Pemberian Makanan Pendamping ASI (MP-ASI), stunting

ABSTRACT

Stunting is often associated with too early complementary feeding time and inadequate protein intake. The purpose of this study was to analyze the relationship between the practice of complementary feeding and the level of protein adequacy with the incidence of stunting in toddlers in the working area of Puskesmas Bantaran Probolinggo regency, East Java. Research used observational analytic with retrospective case control design. The sample were 22 stunted group and 22 non-stunted control group who met the inclusion criteria, and taken by simple random sampling. The sample was a stunting locus village toddler in the working area of Puskesmas Bantaran, Probolinggo Regency with mother as respondents. Data collection instruments included questionnaires of characteristic, SQ-FFQ to assess protein adequacy, and microtoise to measure height. Analysis using Chi-Square and Spearman test. The results showed that stunted toddlers get inappropriate complementary feeding (81.8%) and deficit of protein intake (81.8%). Non-stunted toddlers get the right complementary feeding practices (63.6%) and adequate protein intake (59.1%). There is a relationship between the practice of complementary feeding (p=0.002, OR=7.87) and the level of protein adequacy (p=0.005, OR=6.5) with the incidence of stunting in toddlers. The conclusion of this study is that toddlers with improper complementary feeding practices are 7.87 times higher risk of stunting and toddlers with adequate levels of protein deficit are 6.5 times higher risk of stunting. Mothers should be able to increase the amount of protein intake and proper complementary feeding.

Keywords: toddlers, protein adequacy level, complementary feeding practice history, stunting

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https://doi.org/10.204736/mgi.v17i3.310–319

PENDAHULUAN

Stunting adalah gangguan pertumbuhan dan perkembangan yang terjadi pada anak akibat gizi buruk, infeksi berulang dan stimulasi psikososial yang rendah (WHO, 2022), ditandai dengan TB/U kurang dari -2SD (pendek) dan kurang dari -3SD (sangat pendek) (Kemenkes RI, 2020).

Prevalensi balita *stunting* secara global di tahun 2020 sebesar 22% (WHO, 2022). Menurut data Riset Kesehatan Dasar (Riskesdas) prevalensi balita pendek di Indonesia tahun 2013 sebesar 37,2% dan tahun 2018 prevalensi *stunting* sebesar 30,8% (Riskesdas, 2013; Riskesdas, 2018). Berdasarkan data SSGBI tahun 2021 sebesar 24,4% balita mengalami *stunting* dan menurut SSGI tahun 2021 angka *stunting* di Jawa Timur sebesar 23,5% (Kemenkes, 2021). Meskipun prevalensi *stunting* di Indonesia berhasil diturunkan, tetapi *stunting* tetap menjadi permasalahan serius karena prevalensi masalah tersebut masih di atas 20% (WHO, 2022).

Angka prevalensi *stunting* di Kabupaten Probolinggo tahun 2018 sebesar 39,9%. Berdasarkan data Dinas Kesehatan Kabupaten Probolinggo dan Puskesmas Bantaran, wilayah kerja Puskesmas Bantaran memiliki prevalensi *stunting* yang cukup tinggi. Puskesmas Bantaran memiliki dua desa yang menjadi lokus *stunting* yaitu Desa Gunung Tugel dan Desa Karang Anyar. Masing-masing desa tersebut memiliki prevalensi balita *stunting* sebesar 57,9% dan 48,8% (Puskesmas Bantaran, 2019).

Pemberian makanan pendamping ASI atau MP-ASI memiliki keterkaitan dengan terjadinya *stunting* (Wandini, dkk., 2021). Pemberian MP-ASI yang tidak adekuat dan terlalu dini adalah salah satu faktor penyebab terjadinya masalah gizi *stunting*. Usia pemberian MP-ASI balita di wilayah kerja Puskesmas Maron Kabupaten Probolinggo lebih dari dan kurang dari 6 bulan tidak sesuai dengan usia pertama kali diberi MP-ASI yaitu 6 bulan (Hanum, 2019). Hal tersebut tidak sesuai dengan usia pemberian MP-ASI. Menurut WHO (2010), MP-ASI diberikan tepat usia 6 bulan.

Frekuensi pemberian MP-ASI yang benar dan sesuai dengan perkembangan dan pertumbuhan anak dapat mengurangi angka terjadinya stunting. Frekuensi pemberian MP-ASI tidak sesuai standar berhubungan signifikan dengan kejadian *stunting*

(Virginia, 2019). Penelitian lain juga menyatakan bahwa terdapat hubungan yang signifikan antara frekuensi pemberian MP-ASI dengan status gizi anak (Rizal dkk., 2013).

Berdasarkan penelitian Hanum (2019), usia pemberian MP-ASI berkaitan dengan kejadian *stunting*. Usia pemberian MP-ASI yang tepat sesuai dengan usia memiliki peluang 1,6 kali tidak *stunting* dibandingkan balita yang diberi MP-ASI yang tidak tepat. Pemberian MP-ASI pada usia yang terlalu dini dapat meningkatkan risiko terjadinya *stunting* pada balita. Pemberian MP-ASI yang terlalu dini (usia 4 bulan) berkaitan dengan peningkatan gangguan gastrointestinal yang mengakibatkan gangguan pertumbuhan, defisiensi zat gizi mikro, dan rentan terkena penyakit menular pada masa dua tahun pertama kehidupan (Kuchenbecker et al ., 2015)

Asupan zat gizi makro dan mikro yang tidak adekuat dapat mengganggu proses tumbuh kembang balita dan mengakibatkan *stunting*. Salah satu zat gizi makro yang berperan penting dalam pencegahan *stunting* adalah protein. Protein bertindak dalam proses pertumbuhan dan pemeliharaan jaringan tubuh serta menggantikan sel-sel yang rusak. Apabila asupan protein tidak adekuat saat periode pertumbuhan balita, maka proses tumbuh kembang balita dapat terlambat dan masalah gizi *stunting* dapat timbul. Tingkat kecukupan zat gizi protein memiliki hubungan dengan kejadian *stunting* (Azmy, dkk., 2018; Wulandari, dkk., 2020). Apabila asupan protein kurang, maka lebih berisiko mengalami *stunting*.

Berdasarkan data Riskesdas (2013), angka *stunting* paling tinggi pada usia 24–36 bulan yaitu sebesar 42,0%. Hal tersebut terjadi karena balita dengan usia 24–36 bulan lebih banyak membutuhkan energi dan zat gizi dibandingkan usia lainnya. Hal tersebut digunakan untuk respon adanya peningkatan metabolic akibat pertumbuhan (Barasi, 2009; Almatsier, 2011; Chaudhury, 2013). Energi dan zat gizi tersebut didapatkan dari Makanan Pendamping ASI (MP-ASI).

Tujuan penelitian ini adalah untuk menganalisis hubungan antara riwayat pemberian MP-ASI dan kecukupan protein dengan kejadiaan *stunting* pada balita di wilayah kerja Puskesmas Bantaran.

METODE

Penelitian menggunakan metode observasional dengan disain *case control* secara retrospektif. Data diperoleh melalui wawancara, pengukuran antropometri, dan data sekunder yang berasal dari Puskesmas Bantaran dan Dinas Kesehatan Kabupaten Probolinggo. Penelitian ini dilakukan pada bulan September 2020 hingga Agustus 2021 di wilayah kerja Puskesmas Bantaran yang berada di desa lokus *stunting* yaitu Desa Gunung Tugel dan Desa Karang Anyar, Kecamatan Bantaran, Kabupaten Probolinggo, Jawa Timur. Populasi penelitian ini adalah balita sebanyak 575 yang tersebar di dua desa lokus *stunting*.

Populasi meliputi kelompok kasus dan kelompok kontrol. Populasi terdiri dari 154 balita dengan usia 24-36 bulan yang mengalami *stunting* dengan nilai Z-*Score* TB/U <-2SD atau <-3SD. Usia tersebut dipilih karena dinilai lebih efektif untuk menghindari bias saat pengambilan data riwayat pemberian MP-ASI Kelompok kontrol terdiri dari 421 balita berusia 24-36 bulan yang tidak *stunting* dengan nilai Z-*Score* TB/U -2SD hingga 2SD.

Besar sampel minimal menggunakan rumus *case control* dari Lemeshow, *et al.* (1990) dengan tingkat kemaknaan 95% (Zα=1,96) dan kekuatan 80% (Zβ=0,84), OR=6,54. Besar sampel minimal yaitu sebanyak 19 balita kemudian dilakukan penambahan 15% pada masing-masing kelompok. Diperoleh total sampel pada kelompok kasus sebesar 22 balita dan kelompok kontrol 22 balita.

Pengambilan sampel secara *simple random sampling* dengn desain *case control* secara retrospektif. Kriteria inklusi yang ditetapkan adalah balita tidak dalam keadaan sakit, membutuhkan perawatan medis seperti gizi buruk, diare, dan penyakit infeksi lainnya, balita tidak mengalami cacat fisik maupun mental, balita memiliki Kartu Menuju Sehat (KMS), dan memiliki wali ibu kandung atau pengasuh balita bersedia mengikuti penelitian. Kriteria eksklusi adalah ibu yang tidak tinggal menetap di wilayah penelitian dan balita yang rewel dan tidak bersedia diukur tinggi badannya.

Data yang didapatkan meliputi data primer dan data sekunder pendukung. Data primer didapatkan melalui kuesioner untuk mengetahui karakteristik ibu balita meliputi usia ibu saat hamil yang kategorikan menjadi kelompok berisiko (<20 tahun dan >35 tahun) dan tidak berisiko (20-35 tahun). Data balita meliputi usia balita berdasarkan hasil wawancara melalui kuesioner serta divalidasi dengan menggunakan data tanggal lahir melalui buku KMS. Data sekunder yang didapatkan dari Puskesmas Bantaran untuk mengetahui berat dan panjang badan lahir bayi, jumlah balita seluruhnya, dan persentase balita *stunting* yang berada di dua desa lokus *stunting*. Untuk mengetahui kelompok *stunting* atau tidak dilakukan pengukuran tinggi badan secara langsung menggunakan alat *microtoise* merek GEA dengan ketelitian 1 mm.

Pengelompokan status gizi berdasarkan TB/U menggunakan klasifikasi WHO tahun 2005 yaitu *stunting* jika Z-*Score* <-3SD - <-2SD dan normal/ non *stunting* -2SD - 2SD. Untuk tingkat kecukupan protein, digunakan *Semi Quantitative-Food Frequency Questionnaire* (SQ-FFQ) lalu dibandingkan dengan AKG. Kecukupan protein dikategorikan menjadi defisit (≤89% nilai AKG) dan cukup (90 – 119% nilai AKG) (WNPG, 2012). Untuk mengetahui riwayat pemberian MP-ASI menggunakan kuesioner 6 pertanyaan sesuai dengan riwayat pemberian MP-ASI, jumlah skor maksimal yaitu 15 tepat jika skor 15 dan tidak tepat skor <15 (Cahyani, 2019). Kriteria MP-ASI tidak tepat apabila usia pemberian MP-ASI terlalu dini <6 bulan, frekuensi <3 kali dan jumlah pemberian MP-ASI kurang dari kebutuhan usia balita. Untuk melihat pengetahuan gizi ibu menggunakan kuesioner dikategorikan kurang (<60% jawaban benar), sedang (60-80% jawaban benar), dan baik (>80% jawaban benar).

Analisis data penelitian adalah menggunakan uji *Chi Square*, uji Kolerasi *Spearman*, dan uji regresi logistic. Analisis uji *Chi Square* untuk mengetahui p-*value* dan uji regresi logistic untuk mengetahui *odd ratio* dengan tingkat kepercayaan 95% (α =0,05). Uji Korelasi *Spearman* untuk mengetahui hubungan antara variabel praktik pemberian MP-ASI dan tingkat kecukupan protein.

Komisi Etik Penelitian Kesehatan (KEPK) Fakultas Kedokteran Gigi Universitas Airlangga telah menyetujui penelitian ini dengan nomor sertifikat etik yaitu 261/HRECC.FODM/V/2021.

HASIL DAN PEMBAHASAN

Karakteristik Balita

Usia balita pada penelitian ini meliputi kelompok kasus dan kelompok kontrol yang dibatasi antara 24–36 bulan. Rata-rata usia balita kelompok kasus 30,7±4 bulan dan kelompok kontrol 29,36±4,70 bulan.

Balita pada kelompok kasus didominasi laki-laki (54,5%) dan kelompok kontrol, baik laki-laki maupun perempuan sama (50%) (Tabel 1). Angka kejadian *stunting* pada penelitian ini lebih tinggi pada balita laki-laki (54,5%) dibandingkan perempuan (45,5%). Berdasarkan data Riskesdas (2018), kejadian balita *stunting* pada laki-laki lebih tinggi daripada perempuan. Pada laki-laki sebanyak 19,6% dan perempuan sebanyak 18,9%. Kejadian *stunting* pada balita di Bangladesh meningkat pada jenis kelamin laki-laki (50,99%) dibandingkan perempuan (49,01%) (Mistry et al ., 2018). Berbedaan kejadian *stunting* antara laki-laki dan perempuan terjadi karena adanya standar perhitungan TB/U yang dikategorikan berdasarkan jenis kelamin dan disesuaikan dengan antropometri penilaian status gizi anak (Adani, dkk., 2017).

Berdasarkan tabel distribusi diatas balita kelompok *stuting* dan tidak *stunting* paling banyak berat badan lahir dengan kategori normal (90% dan 95,5%). Sementara itu, balita dengan panjang badan lahir dengan kategori normal pada kelompok

stunting dan tidak *stunting* adalah sebesar 77,3% dan 86,4%.

Karakteristik Orang Tua

Karakteristik orang tua meliputi usia ibu saat hamil, pendidikan ibu, pengetahuan gizi ibu, dan pekerjaan orang tua. Usia ibu saat hamil pada balita kelompok kasus dan kontrol sebagian besar terdapat pada kategori tidak berisiko sebanyak 54,5% dan 86,4% (Tabel 2).

Usia kehamilan 20–35 tahun merupakan usia kehamilan yang baik. Hal ini dikarenakan usia

Tabel 2. Distribusi Frekuensi Karakteristik Orangtua Balita

Karakteristik Orang Tua	Stunting		Tidak Stunting	
	n	%	n	%
Usia Ibu saat Hamil				
Berisiko	10	45,5	3	13,6
Tidak Berisiko	12	54,5	19	86,4
Pendidikan Ibu				
Pendidikan Rendah	20	90,9	10	45,5
Pendidikan Menengahs	2	9,1	12	54,5
Pendidikan Tinggi	0	0	0	0
Pengetahuan Ibu				
Kurang	13	59	9	40,9
Sedang	8	36,4	11	50
Baik	1	4,6	2	9,1
Pekerjaan Orang Tua				
Pekerjaan Ayah				
Petani/ buruh tani	15	68,2	9	40,9
Peternak	1	4,5	0	0
Pedagang	1	4,5	3	13,6
PNS	0	0	1	4,5
Pegawai Swasta	4	18,2	5	22,7
Wiraswasta	1	4,5	4	18,2
Pekerjaan Ibu				
IRT	15	68,2	18	81,8
Petani/buruh tani	6	27,3	2	9,1
Wiraswasta	1	4,5	2	9,1

Tabel 1. Distribusi Frekuensi Karakteristik Balita di Desa Lokus *Stunting*.

Karakteristik Balita	Stunting		Tidak Stunting	
	n	%	n	%
Jenis Kelamin				
Laki	12	54,5	11	50
Perempuan	10	45,5	11	50
Berat Badan Lahir				
BBLR (<2,5 Kg)	2	9,1	1	4,5
Normal (≥2,5 Kg)	20	90,9	21	95,5
Panjang Badan Lahir				
Pendek (<48 cm)	5	22,7	3	13,6
Normal (≥48 cm)	17	77,3	19	86,4

kehamilan <20 tahun memiliki risiko melahirkan anak dengan berat badan lahir rendah lebih besar dan berakibat *stunting* (Destarina, 2018; Nurhidayati et al ., 2020). Ibu hamil yang berusia >35 tahun memiliki risiko lebih besar yang dapat menyebabkan komplikasi kehamilan, gangguan pertumbuhan janin serta beresiko berat badan bayi lahir rendah (Takziah, 2013).

Pendidikan ibu pada kelompok kasus sebagian besar berpendidikan rendah (90,9%) dan pengetahuan gizi kurang (59%) sementara kelompok kontrol sebagian besar berpendidikan menengah (54,5%) dan pengetahuan gizi sedang (50%) serta baik (9%) (Tabel 2). Sebagian besar tingkat pendidikan dan pengetahuan ibu pada kelompok balita *stunting*, yaitu pendidikan rendah (tamat SD maupun tidak tamat SD) dan pengetahuan kurang. Sementara ibu pada kelompok balita tidak *stunting* yaitu pendidikan menengah (tamat SMA) dan pengetahuan gizi sedang serta baik. Sejalan dengan penelitian Javid *et al.* (2020), ibu dengan pendidikan rendah dengan anak mengalami *stunting* (55,2%) lebih tinggi dibandingkan dengan ibu yang memiliki pendidikan menengah (28,5%). Pengetahuan gizi ibu dengan balita *stunting* yang kurang (45,87%) lebih tinggi dibandingkan pengetahuan gizi sedang (41%) serta baik (18%) (Yunitasari et al ., 2021). Hal tersebut berkaitan dengan praktik pemberian makanan pendamping ASI.

Pengetahuan ibu tentang gizi adalah faktor yang paling berpengaruh terhadap kejadian *stunting* karena pengetahuan ibu mengenai gizi sangat diperlukan balita selama proses perkembangan dan pertumbuhan, sehingga anak dapat tumbuh optimal dan terhindar dari *stunting* (Sulistyawati, 2018). Berdasarkan penelitian Uliyanti dkk. (2017),

variabel pengetahuan gizi ibu lebih berpengaruh terhadap kejadian *stunting* sebesar 9,61% dari variabel Perilaku Hidup Bersih dan Sehat (PHBS). Pengetahuan gizi mempengaruhi kejadian *stunting* secara langsung sebesar 0,210 dan tidak langsung sebesar 0,10 sehingga didapatkan total sebesar 0,310. Artinya, setiap peningkatan pengetahuan gizi ibu sebesar satu unit, maka variabel status gizi akan meningkat sebesar 0,31 satuan. Ibu berpengetahuan gizi kurang mempengaruhi praktek pemberian MP-ASI yang tidak tepat pada balita yang dapat menimbulkan masalah gizi seperti *stunting*.

Karakteristik orang tua balita lain meliputi pekerjaan ayah dan ibu. Mayoritas pekerjaan ayah pada balita *stunting* adalah petani/ buruh tani sebesar 68,2%. Sementara itu, pekerjaan ibu pada balita kelompok kasus dan kontrol sebagian besar tidak bekerja sebesar 68,2% dan 81,8% (Tabel 2).

Status Gizi (TB/U)

Status gizi balita menurut Z-*Score* TB/U didapatkan dari hasil pengukuran tinggi badan secara langsung, balita kelompok kasus memiliki rata-rata nilai Z-*Score* -2,57±0,34 dan balita kelompok kontrol memiliki rata-rata nilai Z-*Score* -0,74±0,77. Status gizi menurut Z-*Score* TB/U pada balita di Desa Lokus *Stunting* sebagian besar pada balita kelompok kasus memiliki status gizi pendek (81,8%) dan status gizi sangat pendek (18,2%).

Hubungan Antara Riwayat Pemberian MP-ASI dengan Kejadian *Stunting* Pada Balita

Hasil penelitian menunjukkan bahwa sebagian besar balita pada dua *locus stunting* memiliki praktik MP-ASI yang tidak tepat sebanyak 81,8%,

Tabel 3. Hubungan MP-ASI dan Tingkat Kecukupan Protein dengan Kejadian Stunting di Desa Lokus Stunting

Variabel	Stunting		Tidak *Stunting*		p-*value*	OR (95% CI)
	n	%	n	%		
Riwayat Pemberian Pemberian MP-ASI						
Tidak Tepat	18	81,8	8	36,4	0,002	7,87
Tepat	4	18,2	14	63,6		(1,96-31,57)
Kecukupan Protein						
Defisit	18	81,8	9	40,9	0,005	6,5
Cukup	4	18,2	13	59,1		(1,64-25,76)

315   Amalia et al. Media Gizi Indonesia (National Nutrition Journal). 2022.17(3): 310–319

https://doi.org/10.204736/mgi.v17i3.310–319

yaitu usia pemberian yang telalu dini (kurang dari 6 bulan), frekuensi pemberian MP-ASI kurang dari 3 kali sehari serta jumlah yang kurang dari kebutuhan pada usia balita.

Berdasarkan penelitian di Mozambique menyatakan bahwa rata-rata usia praktik pemberian MP-ASI pada balita kelompok normal 7,6±2.3 bulan sedangkan balita kelompok gizi *stunting* 5.3±2,3 bulan (P<0,001). Artinya, usia bayi pada praktik pemberian MP-ASI pertama kali berkaitan dengan risiko kejadian *stunting* (Cruz et al., 2017). Hal ini terjadi karena usia pemberian MP-ASI yang terlalu dini akan membuat gangguan pencernaan dan lebih rentan terhadap penyakit infeksi meliputi diare, risiko alergi, gangguan pertumbuhan dan perkembangan bayi (Ariani, 2008; Shofiyah, 2020). Oleh karena itu, praktik pemberian makanan pendamping ASI yang tepat diberikan pada bayi tepat berusia 6 bulan dan tetap memberikan ASI eksklusif (Fewtrell *et al.*, 2017).

Frekuensi dan jumlah pemberian MP-ASI balita dapat mempengaruhi kejadian *stunting* karena frekuensi dan jumlah MP-ASI tidak tepat dapat menyebaban kekurangan zat gizi yang dibutuhkan balita serta dapat mengakibatkan timbulnya penyakit infeksi dan proses pertumbuhan tulang dapat terganggu (Nai *et al.*, 2014; Nurkomala, 2018). WHO merekomendasikan bahwa bayi berusia 6–8 bulan diberi MP-ASI sebanyak 2–3 kali sehari dan meningkat menjadi 3–4 kali sehari antara usia 9–11 bulan dan 12-24 bulan. Makanan selingan diberikan sebanyak 1–2 kali/hari untuk bayi berusia 12–21 bulan (WHO, 2022).

Hasil uji *chi-square* menunjukkan hubungan antara praktik pemberian MP-ASI dengan kejadian *stunting* menggunakan nilai p<α (0,05) yaitu 0,002 dengan nilai OR 7,87 artinya, bahwa terdapat hubungan yang signifikan antara praktik pemberian MP-ASI dengan kejadian *stunting* pada balita. Praktik pemberian MP-ASI yang tidak tepat berisiko 7,87 kali mengalami *stunting*.

Hubungan Antara Kecukupan Protein dengan Kejadian *Stunting* Pada Balita

Balita pada kelompok *stunting* memiliki tingkat kecukupan protein defisit sebanyak 81,8% dan kelompok tidak *stunting* memiliki tingkat kecukupan protein normal sebanyak 59,1% (Tabel 3).

Hasil uji menggunakan *chi-square* menunjukkan nilai p< α (0,05) yaitu 0,005 dengan nilai OR 6,5, artinya, terdapat hubungan yang kuat antara tingkat kecukupan protein dengan kejadian *stunting* pada balita di Desa Gunung Tugel dan Karang Anyar. Tingkat kecukupan protein yang defisit berisiko 6,5 kali menyebabkan *stunting*.

Protein adalah salah satu zat gizi makro yang diperlukan oleh balita dalam proses pertumbuhan. Protein berperan dalam pembentukan jaringan baru serta perkembangan tubuh. Kekurangan asupan zat gizi protein dapat mengakibatkan kekurangan energi kronis, yang akan mempengaruhi pertumbuhan secara linier dalam jangka waktu lama (Nanda, 2016; Verawati, dkk., 2021).

Sebagian besar kelompok *stunting* memiliki tingkat kecukupan protein yang defisit yaitu 81,8% dan tidak *stunting* memiliki tingkat kecukupan protein yang normal yaitu 59,1%. Sejalan dengan penelitian lain yang menyebutkan bahwa balita *stunting* memiliki asupan protein rendah dibandingkan dengan anak tidak *stunting*. Asupan protein balita yang rendah lebih berisiko 5,16 kali mengalami *stunting* dibandingkan dengan balita asupan protein cukup (Satriani, dkk., 2019). Tingkat kecukupan protein dipengaruhi oleh praktik pemberian MP-ASI pada balita.

Rata-rata asupan protein balita *stunting* 16,87±2,54gram dan tidak *stunting* 19,62±2,27gram. Kedua kelompok tersebut masih mengkonsumsi daging olahan seperti sosis. Hasil penelitian lain juga menunjukkan bahwa pemberian makanan cepat saji seperti makanan olahan berupa sosis, nugget dan bakso yang dapat mempengaruhi pertumbuhan dan perkembangan yang dapat mempengaruhi status gizi balita seperti *stunting* (Nurlaeli, 2019).

Berdasarkan data Survei Kesehatan Keluarga di negara Nepal tahun 1996-2016 sesuai dengan Survei Demografi Kesehatan Nepal pada subjek balita, menunjukkan bahwa praktik pemberian MP-ASI dengan konsumsi makanan protein hewani berupa telur, daging, dan susu memiliki hubungan signifikan dengan penurunan angka *stunting*. Selain itu, hasil penelitian lain menunjukkan adanya keterkaitan antara asupan makanan protein hewani dengan peningkatan TB/U pada balita (p= 0,013)

(Hanley-Cook *et al.*, 2020). Konsumsi protein seperti daging sapi, ikan, sereal, dan umbi-umbian, serta susu yang rendah sering ditemukan pada balita yang mengalami *stunting* daripada tidak *stunting*. Konsumsi protein sangat dibutuhkan pada usia balita terutama balita *stunting*. Konsumsi makanan yang tinggi protein seperti susu, kacang-kacangan, dan daging berpotensi dapat menurunkan risiko *stunting* (Esfarjani *et al.*, 2013; Angeles-Agdeppa *et al.*, 2020).

Hasil penelitian Siringoringo et al. (2020), menunjukkan bahwa kejadian *stunting* berisiko 6,495 kali lebih besar pada balita dengan asupan protein rendah. Penambahan konsumsi protein hewani sebesar 1 g pada usia balita berkaitan dengan adanya peningkatan TB/U sebesar 0,02 cm per bulan (p= 0,021). Dalam penelitian Kaimila, *et al.* (2019), menunjukkan bahwa asupan protein sebesar 1 g dari protein hewani berkaitan dengan peningkatan TB/U sebesar 0,02 cm (p= 0,048). Konsumsi protein hewani yang kurang dari 2 porsi sehari atau setara dengan 1 potong daging dan segelas susu berhubungan dengan kejadian *stunting* (Rusyantia, 2018).

Penelitian ini memiliki keterbatasan, yaitu hanya meneliti di dua desa yang merupakan lokus *stunting*, tidak meneliti status ekonomi masyarakat, tidak terdapat jenis protein yang dikonsumsi balita *stunting* dan tidak *stunting*, tidak meneliti status infeksi yang dapat memengaruhi keterjadian stunting, dan asupan lain seperti lemak dan karbohidrat yang berperan terhadap kontribusi energi sebagai pencegah kekurangan energi kronis.

KESIMPULAN DAN SARAN

Hasil penelitian ini menunjukkan bahwa praktik pemberian MP-ASI dan tingkat kecukupan protein berhubungan dengan masalah *stunting* pada balita di wilayah kerja Puskesmas Bantaran Kabupaten Probolinggo. Praktik pemberian makanan pendamping ASI yang tidak tepat berkaitan dengan risiko 7,87 kali lipat mengalami *stunting*. Selain itu, balita dengan tingkat asupan protein defisit berisiko 6,5 kali mengalami *stunting*. Ketidaktepatan praktik pemberian MP-ASI menyebabkan balita lebih berisiko mengalami *stunting*. Selain itu, semakin defisit tingkat asupan

zat gizi protein menyebabkan balita lebih berisiko mengalami *stunting*.

Ibu balita *stunting* sebaiknya mampu meningkatkan asupan protein hewani anak dengan cara modifikasi bahan makanan protein hewani menjadi bentuk dan rasa yang lebih disukai anak sehingga anak lebih tertarik dan tidak bosan dengan lauk yang diberikan. Sejak pemberian makanan pendamping ASI usia 6 bulan, makanan sumber protein hewani yang beragam penting untuk diperkenalkan pada balita.

Pemberian edukasi mengenai praktik pemberian MP-ASI yang tepat sesuai tahapan usia balita dari pihak Puskesmas Bantaran sebagai upaya untuk meningkatkan pengetahuan ibu dalam pemberian MP-ASI.

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PENGARUH INTERVENSI BERAS TINGGI BESI TERHADAP VO₂MAX SANTRIWATI PONDOK PESANTREN AL-FALAK BOGOR

Effect of High-iron Rice Intervention on VO₂max of Female Students of
Al-Falak Bogor Islamic Boarding School

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ABSTRAK

Remaja putri berisiko mengalami defisiensi besi yang diketahui dapat berdampak negatif terhadap kebugaran. Beras tinggi besi telah dikembangkan melalui biofortifikasi namun masih belum banyak bukti terkait manfaatnya terhadap perbaikan VO₂max sebagai suatu indikator kebugaran fisik. Penelitian ini bertujuan untuk mengetahui dampak pemberian beras tinggi besi terhadap nilai VO₂max. Sebanyak 18 santriwati pondok pesantren Al-Falak di Bogor yang berusia 12–18 tahun dilibatkan dalam penelitian eksperimen semu ini berdasarkan kriteria yang ditetapkan. Beras tinggi besi yang mengandung 50,4 ppm besi disediakan 3 kali sehari selama 4 minggu. Tes lari bolak-balik 20 m dilakukan untuk mendapatkan nilai VO₂max. Data lainnya seperti asupan makanan, Indeks Massa Tubuh menurut umur, hemoglobin, dan ferritin serum juga dikaji. Uji-t berpasangan dan Wilcoxon Ranks dilakukan untuk menganalisis perbedaan nilai data sebelum dan sesudah intervensi. Hampir seluruh asupan zat gizi mengalami penurunan yang signifikan (p<0,05) setelah intervensi, kecuali asupan besi. Konsentrasi hemoglobin juga menjadi lebih rendah secara signifikan, sementara ferritin serum tidak berubah secara nyata. Meskipun begitu, VO₂max meningkat secara signifikan setelah intervensi. Kesimpulannya, terdapat peningkatan kebugaran setelah intervensi beras tinggi besi selama 4 minggu pada santriwati.

Kata kunci: beras tinggi besi, kebugaran, santriwati, VO₂max

ABSTRACT

Female adolescents are at risk of iron deficiency which is known can negatively affect fitness. High-iron rice has been developed through biofortification but there is still lack of evidence regarding its benefit in improving VO₂max as a physical fitness indicator. This study aimed to determine impact of high-iron rice intervention towards VO₂max value. A total of 18 female students from Al-Falak Bogor Islamic boarding school aged 12–18 years were selected purposively in this quasi-experimental study. High-iron rice contained 50.4 ppm iron provided thrice daily for 4 weeks. A 20 m shuttle run test was conducted to obtain VO₂max value. Other data such as food intake, BMI for age, hemoglobin, and serum ferritin were also evaluated. Paired t-test or Wilcoxon Ranks test was performed to analyze difference in data value before and after the intervention. Most nutrient intakes experienced a significant decline (p<0.05) after the intervention, except for iron intake. Hemoglobin concentration also became lower significantly, whereas serum ferritin did not alter significantly. Nevertheless, VO₂max improved significantly after the intervention. To summarize, there was an increase in fitness after high-iron rice intervention for 4 weeks in female students.

Keywords: *female student, fitness, high-iron rice, VO₂max*

PENDAHULUAN

Defisiensi besi merupakan penyebab utama anemia, dimana secara global masih dialami pada usia remaja (WHO, 2015; WHO, 2021). Periode remaja membutuhkan besi lebih banyak untuk menunjang peningkatan pertumbuhan dan ukuran tubuh (Edelstein, 2015; Mahan & Raymond, 2017). Menurut data Riskesdas Indonesia tahun 2018, prevalensi anemia untuk kelompok umur 15–24 tahun adalah sebesar 32%, menduduki tingkat sedang sebagai masalah kesehatan masyarakat (Kemenkes RI, 2018). Sementara itu, penelitian di

Indonesia terkait Anemia Defisiensi Besi (ADB) yang dapat diindikasikan dengan ferritin serum dan hemoglobin pada remaja masih sedikit.

Remaja putri lebih rentan mengalami ADB dibandingkan remaja putra dikarenakan kehilangan zat besi melalui menstruasi (Lopez *et al.*, 2016). Selain faktor jenis kelamin, penelitian menyebutkan bahwa anak yang menempuh pendidikan di sekolah asrama lebih berisiko mengalami anemia (Chen *et al.*, 2018; Nicholaus *et al.*, 2020). Beberapa faktor yang berkontribusi terhadap kejadian anemia di sekolah asrama diantaranya penyediaan menu makanan yang kurang seimbang dan kebiasaan melewatkan waktu makan (Purwandari, 2018; Chen *et al.*, 2018; Ekayanti *et al.*, 2020; Nicholaus *et al.*, 2020).

Defisiensi besi dapat menghambat pengangkutan oksigen oleh hemoglobin ke seluruh tubuh yang selanjutnya secara fungsional menganggu kebugaran tubuh (Myhre *et al.*, 2016). Kombinasi defisiensi besi dan rendahnya kebugaran dapat mencegah pencapaian potensi akademik murid yang optimal (Scott *et al.*, 2017).

Salah satu komponen kebugaran fisik yaitu kebugaran aerobik atau kardiorespirasi dapat diukur menggunakan nilai VO_2max. VO_2max adalah volume oksigen maksimal yang dapat digunakan dan didistribusikan ke otot ketika melakukan aktivitas fisik (Huldani, 2020).

Biofortifikasi merupakan salah satu strategi yang mudah dilaksanakan, hemat biaya, dan berkelanjutan untuk mengatasi masalah defisiensi zat mikro (Lockyer *et al.*, 2018). Biofortifikasi adalah pemuliaan tanaman untuk meningkatkan nilai gizinya, terutama mineral dan vitamin selama pertumbuhan tanaman (Tako, 2018). Biofortifikasi beras di Indonesia mulai dikembangkan dengan pendekatan pemuliaan molekular, menghasilkan beras yang tahan besi (Fe) dan disebut dengan beras BionutriFe. Beras tersebut mengandung 50,4 ppm besi atau dapat mencapai 5 kali lipat beras unggul lokal di Jawa Barat (Syahfitri *et al.*, 2018).

Hingga penelitian ini dilakukan, hanya terdapat satu penelitian yang mengamati tentang efek dari biofortifikasi beras yaitu penelitian pada wanita Filipina dan hasilnya menunjukkan peningkatan yang signifikan pada ferritin serum, dengan respon lebih besar pada wanita yang

defisiensi tanpa anemia (Haas *et al.*, 2005). Pengaruh biofortifikasi besi pada tanaman pokok lainnya yakni polong biofortifikasi besi yang dapat meningkatkan hemoglobin dan ferritin serum pada wanita di Rwandan dan millet mutiara yang dapat meningkatkan ferritin serum pada anak – anak sekolah di India (Finkelstein *et al.*, 2015; Haas *et al.*, 2016). Berdasarkan meta-analisis oleh Finkelstein *et al.* (2017), biofortifikasi besi pada tanaman pokok dapat memperbaiki status besi (Finkelstein *et al.*, 2017).

Terdapat hubungan signifikan antara status besi terhadap jumlah konsumsi oksigen maksimal (Wang *et al.*, 2009; De Moura *et al.*, 2014). Penelitian menunjukkan bahwa pemberian tambahan zat besi dapat meningkatkan VO_2max baik pada wanita yang anemia dan defisiensi besi tanpa anemia (DellaValle & Haas, 2014; Pasricha *et al.*, 2014).

Namun demikian, bukti-bukti manfaat beras biofortifikasi besi terhadap kebugaran yang dinilai dengan VO_2max masih terbatas, terutama di Indonesia. Penelitian terkait biofortifikasi besi terhadap kebugaran diperlukan untuk memperkuat manfaat dari pangan biofortifikasi besi, terutama diperuntukkan bagi populasi remaja putri yang menempuh pendidikan di pondok pesantren. Oleh karena itu, penelitian ini dilakukan untuk mengetahui pengaruh intervensi beras tinggi besi terhadap kebugaran fisik santriwati pondok pesantren Al-Falak di Bogor.

METODE

Penelitian ini merupakan bagian dari penelitian payung dan dirancang sebagai penelitian eksperimen semu dengan satu kelompok *pretest-posttest*. Tempat penelitian yang dipilih adalah pondok pesantren Al-Falak di Kabupaten Bogor, Jawa Barat.

Sejumlah 44 santriwati pondok pesantren Al-Falak Bogor yang datanya lengkap dan dipilih pada penelitian induk (utama) merupakan populasi sampel bagi penelitian ini. Kemudian secara *purposive*, subjek dipilih berdasarkan kriteria inklusi sebagai berikut: berusia 12-18 tahun, tinggal di pondok selama penelitian berlangsung, sehat, tidak aktif secara fisik (olahraga <2 kali/ minggu), dan tidak obes. Subjek yang melakukan
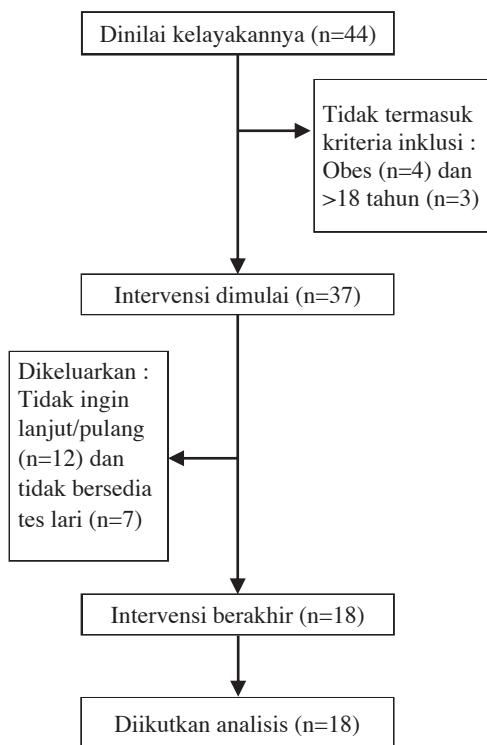
Gambar 1. Alur Subjek Penelitian.

donor darah, mengalami perdarahan hebat, dan mengonsumsi suplemen atau obat-obatan yang memengaruhi perdarahan dieksklusi dari penelitian ini. Perhitungan sampel menggunakan rumus Elashoff dan Lemeshow dengan power 90% dan tingkat signifikansi 5% (Ahrens & Pigeot, 2016). Pada akhir penelitian diperoleh 18 remaja putri yang sesuai dengan kriteria dan dipilih sebagai subjek penelitian.

Sekitar 12 karung yang berisi beras tinggi besi dikirim sekali ke pondok pesantren Al-Falak di awal penelitian, lalu diterima oleh petugas dapur dan dimasak setiap hari untuk intervensi selama 26 hari. Frekuensi pemberian nasi BionutriFe adalah sebanyak 3 kali sehari dengan porsi estimasi sebanyak 150 g untuk sekali makan. Beras BionutriFe mengandung 50,4 ppm dan 1,51 mg zat besi per 100 g nasi BionutriFe (BB Biogen, 2021). Pada minggu kedua intervensi dilakukan pemantauan asupan makanan dengan *food recall* 24 jam di dua hari berbeda (hari sekolah dan hari Minggu) serta menanyakan status kepulangan santriwati.

Beberapa data variabel dikumpulkan dari data sekunder yang berasal dari penelitian utama. Data sekunder tesebut meliputi karakteristik subjek seperti nama, usia, kelas, jumlah uang saku, dan tingkat aktivitas fisik, serta data lainnya seperti Indeks Massa Tubuh (IMT), hemoglobin, ferritin serum, dan asupan makanan. Data nilai VO_2max di awal penelitian atau sebelum intervensi juga didapatkan dari penelitian utama, namun nilai VO_2max di akhir penelitian didapatkan dengan pengukuran langsung setelah intervensi.

Data karakteristik subjek dikumpulkan berdasarkan pengisian kuesioner pada awal penelitian. Asupan makanan ditanyakan kepada subjek menggunakan *food recall* 2x24 jam (hari libur dan hari sekolah) untuk mendapatkan rata-rata harian dari asupan energi, karbohidrat, protein, lemak, besi, kalsium, folat, vitamin B12, vitamin A, dan vitamin C. Pengukuran antropometri seperti berat badan dan tinggi badan menggunakan timbangan berat badan dengan ketelitian 0,1 kg dan *microtoise* dengan ketelitian 0,1 cm. Pengukuran tersebut dilakukan untuk menghitung IMT. Data aktivitas fisik dari pengisian formulir dihitung berdasarkan WHO/FAO/UNU (WHO *et al.*, 2004). Pengambilan darah dilakukan oleh tenaga medis dan setelahnya dianalisa di laboratorium untuk mendapatkan kadar hemoglobin dan serum ferritin.

Untuk menilai kebugaran, dilakukan tes *beep* yang merupakan tes lari bolak-balik sepanjang 20 m. Pelari diberhentikan jika menyerah atau sebanyak 2 kali gagal mencapai titik yang ditentukan saat bip berbunyi. Jumlah level dan balikan yang dicapai setelah lari dicatat pada formulir dan digunakan untuk menentukan VO_2max dengan menggunakan rumus Matsuzaka (Matsuzaka *et al.*, 2004). Rumus Matsuzaka dapat memprediksi nilai VO_2max pada remaja dengan r = 0,65-0,90 (Menezes Júnior *et al.*, 2019). Nilai VO_2max, asupan makanan, IMT/U, dan status besi diukur pada dua waktu yaitu sekitar 1 bulan sebelum pemberian beras tinggi besi dimulai dan setelah pemberian beras yaitu pada minggu akhir intervensi.

Pengolahan dan analisis data menggunakan perangkat lunak NutriSurvey 2007, Microsoft Office Excel 2007, WHO AnthroPlus, dan IBM SPSS Statistics 21. Uji normalitas data yang digunakan adalah Shapiro-Wilk, sementara uji beda yang dipilih adalah *Paired t-test* atau uji *Wilcoxon Signed Ranks*. Segala perlakuan dan

runtutan kegiatan telah diketahui dan disetujui oleh Komisi Etik Penelitian yang Melibatkan Subjek Manusia dari Institut Pertanian Bogor dengan Nomor: 335/IT3.KEPMSM-IPB/SK2021.

HASIL DAN PEMBAHASAN

Karakteristik santriwati pada awal penelitian disajikan pada tabel 1. Rata-rata santriwati yang berpartisipasi dalam penelitian ini merupakan remaja awal (14 tahun), dan duduk di bangku madrasah tsanawiyah kelas 8. Tingkat kebugaran beragam antar umur. Seiring bertambahnya umur, maka nilai konsumsi oksigen maksimal meningkat pada remaja putri (Armstrong and Welsman, 2019).

Sebagian besar santriwati memiliki uang saku harian kurang dari Rp.10.000. Santriwati dapat secara mandiri memilih dan membeli makanan utama atau selingan dari luar pondok dengan uang saku yang didapatkan dari orang tua. Akses terhadap makanan bergizi merupakan salah satu faktor yang berkaitan dengan keadaan ekonomi (Lord et al., 2015). Keadaan ekonomi telah diteliti

Tabel 1. Karakteristik Awal Subjek

Karakteristik atau Intervensi	Jumlah[1] (n=18)
Umur (tahun)	
12–13	4 (22,2)
14–15	8 (44,4)
16–18	6 (33,3)
Kelas	
Kelas VII	4 (22,2)
Kelas VIII	6 (33,3)
Kelas IX	2 (11,1)
Kelas X	1 (5,6)
Kelas XI	3 (16,7)
Kelas XII	2 (11,1)
Jumlah uang saku (harian)	
< Rp10.000,00	11 (61,1)
≥ Rp10.000,00	7 (38,9)
Tingkat aktivitas fisik	1,3 ± 0,1
Overweight[2]	4 (22,2)
Anemia[3]	5 (27,8)
Defisiensi besi[4]	10 (55,6)
Anemia defisiensi besi	5 (27,8)

[1]Nilai adalah rata-rata ± standard deviasi atau n (%). [2]IMT/U >+1 sampai ≤+2 SD. [3]Hemoglobin <12g/dL. [4]Ferritin serum <15 µg/L.

berhubungan dengan kebugaran remaja (Bai et al., 2016; Wolfe et al., 2019).

Tingkat aktivitas fisik santriwati tergolong sedentari. Sebagian besar waktu dihabiskan oleh santriwati dengan melakukan aktivitas ringan dan melibatkan duduk dalam waktu berjam-jam seperti beribadah, mengaji, menghafal, dan belajar. Sementara itu, di hari Minggu terkadang santriwati melakukan senam pagi. Remaja yang memiliki tingkat aktivitas sedentari memiliki tingkat kebugaran yang lebih rendah dibandingkan remaja yang aktif (Mateo-Orcajada et al., 2022). Di sisi lain, sebanyak 22,22% santriwati dalam kondisi kelebihan berat badan (overweight). Konsumsi makanan tinggi energi yang tidak diimbangi dengan pengeluaran energi melalui aktivitas fisik dapat berisiko terjadinya kelebihan berat badan (Das et al., 2017). Kelebihan berat badan dapat meningkatkan risiko anemia dan menurunkan kebugaran (Mchiza et al., 2018).

Sekitar separuh dari total subjek mengalami defisiensi besi (55,56%) dan setengah dari proporsi tersebut tidak hanya mengalami defisiensi besi namun juga anemia (27,78%). Dibandingkan dengan hasil penelitian pada santriwati Sunda oleh Rahfiludin et al. (2021), prevalensi anemia defisiensi besi pada penelitian ini 5,5% lebih tinggi (Rahfiludin et al., 2021). Hal ini mungkin disebabkan karena jumlah subjek dalam penelitian ini lebih sedikit.

Defisiensi besi dapat disebabkan karena kurangnya asupan zat besi (Huang et al., 2020). Asupan zat besi santriwati tergolong defisit pada awal penelitian. Defisit asupan zat besi juga teramati pada penelitian santriwati di pondok pesantren Tasikmalaya (Rahfiludin et al., 2021). Lingkungan pertemanan dapat memengaruhi pola konsumsi remaja ke arah negatif (Ragelienė & Grønhøj, 2020). Salah satunya yaitu mengarah pada konsumsi makanan yang tinggi energi namun kurang zat gizi mikro. Selain itu, kurangnya asupan zat besi juga dapat dipengaruhi oleh penyediaan menu makanan dari sekolah yang kurang seimbang seperti rendahnya penyediaan produk hewani, sayur-sayuran, dan buah-buahan (Chen et al., 2018; Nicholaus et al., 2020).

Median konsumsi nasi BionutriFe oleh santriwati adalah 407 g/hari dengan kandungan zat besi sebanyak 6,15 mg/hari. Berdasarkan jumlah

Tabel 2. Asupan Zat Gizi Harian, Status Gizi, Status Besi, dan Kebugaran

Hasil	Sebelum Intervensi[1]	Setelah Intervensi[1]	p
Asupan gizi/hari			
Energi (kkal)	2.156,6 ± 764,4	1.579,7 ± 374,5	0,001*
Karbohidrat (g)	260,4 ± 88,7	189,2 ± 50,9	0,001*
Protein (g)	57,4 ± 21,4	45,6 ± 12,2	0,017*
Lemak (g)	96,4 ± 40,7	70,1 ± 17,1	0,008*
Besi (mg)	6,7 ± 2,9	9,7 ± 1,9	0,000*
Kalsium (mg)	271,1 (140, 422)	82,2 (61, 103)	0,001*
Asam folat (μg)	163,9 ± 86,1	78,1 ± 45,9	0,001*
Vitamin B12 (μg)	2,7 (1, 3)	2,7 (2, 3)	0,420
Vitamin A (μg)	325,5 ± 168,1	203,8 ± 144,4	0,008*
Vitamin C (mg)	5,0 (3, 10)	5,4 (2, 8)	0,528
IMT/U (skor Z)	0,6 ± 0,8	0,6 ± 0,7	0,058
Kadar hemoglobin (g/dL)	12,3 ± 1,1	11,9 ± 1,2	0,012*
Kadar ferritin serum (μg/L)	9,9 (7, 22)	10,9 (7, 31)	0,094
VO$_2$max (ml/kg/menit)	36,1 (35, 41)	36,4 (34, 39)	0,018*

[1]Nilai disajikan dalam bentuk rata-rata ± standard deviasi atau median (jangkauan interkuartil). *Berbeda signifikan ($p < 0,05$) dengan Paired t-test atau Wilcoxon Signed Ranks Test.

asupan zat besi tersebut, nasi BionutriFe telah menyumbang 76,9% angka kebutuhan besi bagi kelompok remaja putri berusia 12 tahun (AKG besi = 8 mg) dan 41% AKG besi bagi remaja yang berusia 13-18 tahun (AKG besi = 15 mg). Dengan demikian, konsumsi zat besi santriwati yang berusia 12 tahun menjadi tergolong cukup karena di atas 70% AKG.

Pada tabel 2, ditampilkan bahwa mayoritas zat gizi setelah intervensi berubah menjadi lebih rendah ($p<0,05$) dibandingkan sebelum intervensi, kecuali pada besi, kobalamin (vitamin B12), dan asam askorbat (vitamin C). Peningkatan secara signifikan terjadi hanya pada asupan zat besi setelah konsumsi nasi BionutriFe ($p = 0,000$).

Penurunan asupan beberapa zat gizi disebabkan oleh penurunan konsumsi terutama konsumsi jajanan. Intervensi beras tinggi besi berlangsung saat periode ujian akademik. Ujian sekolah dapat menyebabkan stress dan membatasi waktu untuk makan sehingga mengganggu pola makan santriwati (Michels et al., 2019).

Status besi yang diamati pada penelitian ini yakni hemoglobin dan ferritin serum. Hasil intervensi pada kedua biomarker besi tersebut disajikan pada tabel 2. Terdapat penurunan hemoglobin setelah pemberian beras tinggi

Fe ($p = 0,012$) dari kategori normal menjadi anemia tingkat ringan. Penurunan hemoglobin dimungkinkan karena penurunan jumlah konsumsi selama intervensi. Apalagi protein, asam folat, dan vitamin A yang penting untuk membantu penyerapan zat besi, produksi sel darah merah, dan sintesis hemoglobin mengalami penurunan jumlah konsumsi dalam penelitian ini (Green and Datta Mitra, 2017; Wiseman et al., 2017; Gupta, 2019). Faktor lain di luar intervensi yang tidak diteliti juga secara tidak langsung mungkin berkontribusi terhadap penurunan nilai hemoglobin seperti stress karena penelitian ini berlangsung ketika pandemi Covid-19 dan ujian akademik (Subbalakshmi dan Sunandha, 2017; Kim et al., 2019).

Berdasarkan penelitian sebelumnya, VO$_2$max dapat dibatasi oleh kadar hemoglobin yang rendah karena peran pentingnya dalam mengangkut oksigen (DiPietro et al., 2021). Meskipun demikian, penelitian lain tidak menemukan hubungan antara konsentrasi hemoglobin dengan VO$_2$max, terutama pada anak perempuan (Gligoroska et al., 2020). Lebih jauh lagi, penelitian sebelumnya menunjukkan adanya hubungan antara konsumsi oksigen puncak dengan total massa hemoglobin dan bukan konsentrasi hemoglobin (Otto et al., 2017).

Di sisi lain, status besi lainnya yakni ferritin serum mengalami peningkatan namun tidak signifikan. Meskipun menemukan peningkatan ferritin yang tidak signifikan, penelitian lain membuktikan adanya hubungan yang positif antara perubahan simpanan besi tubuh dengan perubahan asupan zat besi (Alaunyte *et al.*, 2015). Dengan demikian, peningkatan ferritin serum pada penelitian ini dapat disebabkan oleh peningkatan rata-rata asupan zat besi akibat pemberian beras tinggi besi sehingga meningkatkan simpanan besi tubuh, namun masih belum cukup menghasilkan perubahan yang signifikan karena jangka waktu pengamatan yang pendek. Ferritin penting dalam penyediaan besi untuk enzim-enzim yang terlibat pada metabolisme otot dan secara tidak langsung berkaitan dengan penggunaan oksigen oleh otot (DellaValle, 2011; Gaffney-Stomberg and McClung, 2012). Penelitian terdahulu menemukan adanya hubungan antara nilai VO_2max dengan keadaan defisiensi besi yang ditandai dengan ferritin serum pada anak sekolah usia 11-14 tahun (Wang *et al.*, 2009).

Kebugaran remaja putri dapat diukur dengan menggunakan volume konsumsi oksigen maksimal atau VO_2max. Tabel 2 menunjukkan bahwa santriwati memiliki kebugaran yang tergolong baik di awal penelitian dan setelah berlangsungnya pemberian beras intervensi. Nilai median VO_2max mengalami sedikit peningkatan yang bermakna setelah pemberian beras tinggi zat besi ($p = 0,018$).

Median VO_2max setelah intervensi menggambarkan kebugaran yang baik dengan nilai 36,35 ml/kg/menit. Menurut suatu meta-analisis, nilai dalam rentang 34,6 hingga 39,5 ml/kg/menit dikaitkan dengan risiko penyakit kardiovaskuler yang rendah pada anak-anak dan remaja (Ruiz *et al.*, 2016). Asupan zat besi merupakan salah satu prediktor yang baik terhadap nilai VO_2max (Debnath *et al.* 2019). Peningkatan ketersediaan zat besi pada jaringan-jaringan seperti pada ferritin, dapat meningkatkan pemanfaatan oksigen oleh jaringan (Houston *et al.*, 2018).

Sejauh ini, penelitian ini merupakan penelitian pertama di Indonesia yang menunjukkan adanya peningkatan median VO_2max setelah 4 minggu pemberian beras biofortifikasi besi pada remaja putri. Penelitian sejenis yang meneliti efek biofortifikasi beras terhadap VO_2max sangat jarang terutama pada remaja yang bukan atlet. Berbeda dengan hasil penelitian ini, penelitian di Rwandan dengan desain acak terkontrol pada 136 wanita usia reproduktif, menunjukkan bahwa tidak ada peningkatan VO_2max setelah konsumsi polong hasil biofortifikasi besi melainkan dapat menghambat penurunan VO_2max pada wanita yang mengalami peningkatan serum ferritin setidaknya 15% setelah intervensi (Luna, 2015). Perbedaan hasil tersebut dapat dijelaskan karena pada penelitian Rwandan terjadi peningkatan berat badan dan IMT setelah mengonsumsi polong tinggi besi sementara dalam penelitian ini menunjukkan tidak ada perubahan IMT/U. Peningkatan berat badan akibat massa lemak tubuh berkorelasi negatif dengan kebugaran (Marcos-Pardo *et al.*, 2020). Meskipun begitu, hasil penelitian lainnya dengan jenis intervensi berbeda yaitu melalui suplementasi oral, mendukung hasil penelitian ini dalam membuktikan manfaat tambahan zat besi terhadap konsumsi oksigen maksimal (Pasricha *et al.*, 2014).

Peningkatan nilai VO_2max dalam penelitian sebelumnya telah dikaitkan dengan status besi seperti peningkatan kapasitas pengangkutan oksigen melalui kadar hemoglobin serta perbaikan fungsi mitokondria dan pertumbuhan otot yang bergantung dengan ketersediaan zat besi dari simpanan tubuh (Pasricha *et al.*, 2014; Pompano, 2018). Penelitian lain juga menemukan adanya hubungan positif antara asupan karbohidrat dan protein dengan VO_2max (Pahlavani *et al.*, 2017; Baranauskas *et al.*, 2020; Król *et al.*, 2020; Alwatchi Alhayek, 2021).

Di antara faktor-faktor yang diteliti dapat mempengaruhi nilai kebugaran seperti IMT, asupan zat gizi, kadar hemoglobin, dan ferritin, hanya asupan zat besi yang menunjukkan hasil yang sejalan dengan peningkatan kebugaran. Peningkatan VO_2max pada penelitian ini mungkin berkaitan dengan sintesis mioglobin yang tidak dapat diamati dengan biomarker besi yang dipilih dalam penelitian ini. Tidak hanya hemoglobin, besi juga bertanggung jawab untuk pembentukan mioglobin sebagai protein penerima oksigen di otot (Domínguez *et al.*, 2018; Houston *et al.*, 2018). Ketersediaan besi dalam tubuh yang meningkat membantu pembentukan mioglobin untuk

selanjutnya memperbanyak oksigen yang diterima dan digunakan oleh otot yang aktif sehingga meningkatkan konsumsi oksigen.

Pelaksanaan intervensi beras tinggi besi dilakukan ketika berlangsungnya pandemi Covid-19, ujian sekolah, dan berdekatan dengan bulan Ramadhan. Oleh sebab itu, banyak santriwati yang mengundurkan diri atau tidak dapat berpartisipasi lengkap di tengah intervensi karena sakit dan durasi penelitian berkurang menjadi 26 hari. Selain itu, tes lari tidak dapat dilaksanakan pada akhir intervensi karena acara penyambutan bulan Ramadhan, sehingga dilakukan 4 hari lebih awal. Keterbatasan lainnya adalah penelitian ini hanya mengamati konsentrasi ferritin serum dan hemoglobin untuk menunjukkan status besi dalam tubuh. Selain itu, penelitian ini tidak menggunakan kelompok kontrol, yang memungkinkan adanya peubah lainnya yang dapat mempengaruhi nilai VO$_2$max seperti umur.

SIMPULAN DAN SARAN

Terdapat peningkatan kebugaran santriwati setelah intervensi beras tinggi besi selama 4 minggu namun tidak dengan perbaikan status besi. Disarankan untuk melakukan penelitian selanjutnya dengan menambah kelompok kontrol, memperpanjang durasi penelitian, dan menambah biomarker zat besi lain yang terkait dengan kebugaran seperti *soluble transferrin receptor* dan *transferrin saturation*. Selain itu, perhatian terhadap asupan makanan selama masa ujian sekolah dengan memberikan edukasi gizi diperlukan untuk memperoleh manfaat yang optimal dari beras tinggi besi.

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HUBUNGAN PERSEPSI PASIEN TERHADAP RASA MAKANAN DAN VARIASI MENU DENGAN DAYA TERIMA PASIEN COVID-19

The Correlation between, Patients' Perception of Food Taste and Menu Variation with The Covid-19 Patients' Food Acceptance

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ABSTRAK

Daya terima merupakan kesanggupan pasien dalam menghabiskan makanan yang disajikan, dalam penelitian ini menggunakan sisa makanan. Pasien Covid-19 perlu memperhatikan asupan makan agar dapat mengoptimalkan imunitas tubuh. Hal ini bertujuan untuk membantu proses kesembuhan berjalan secara maksimal. Perlu diperhatikan hal-hal yang mempengaruhi sisa makanan yaitu persepsi pasien terhadapat rasa makanan dan variasi menu. Penelitian ini dilakukan untuk menganalisis hubungan persepsi pasien terhadap rasa makanan dan variasi menu dengan sisa makanan pada pasien Covid-19. Penelitian ini menggunakan desain *cross-sectional* dan pemilihan sampel dilakukan dengan teknik *accidental sampling* hingga terpilih 148 responden. Pengolahan data dilakukan dengan menggunakan uji korelasi *pearson*. Sebagian besar responden berjenis kelamin laki-laki (60,8%), berusia 15-39 tahun (63,5%), dan memiliki lama rawat inap ≤7 hari (58,1%). Sebagian besar responden mengaku bahwa rasa makanan tergolong baik dan sangat baik (90,5%), demikian juga dengan variasi menu tergolong baik dan sangat baik (89,2%), dengan rata-rata sisa makanan responden ialah 10,4%. Hasil uji statistik menunjukkan bahwa terdapat hubungan rasa makanan (*Pvalue* = 0,000) dan variasi menu *Pvalue* = 0,005) dengan sisa makanan pasien Covid-19. Dapat disimpulkan, terdapat hubungan yang signifikan antara rasa makanan dan variasi menu dengan sisa makanan pasien Covid-19. Meskipun sudah memenuhi standar sisa makanan rumah sakit, tetapi tetap diperhatikan hal-hal terkait rasa makanan dan variasi menu supaya dapat mempertahankan sisa makanan dibawah standar yang ditetapkan.

Kata kunci: Covid-19, kesehatan masyarakat, daya terima, variasi menu, persepsi pasien

ABSTRACT

Food acceptance is patient's ability to spend food served, while in this study measured using food waste. In Covid-19 patients, it is necessary to pay attention of their food intake in order to optimize body's immune system. Improved immune system could help faster healing process. Thus, observing factors that affects food waste such as patients' perception and menu variation are needed. This study was conducted to analyze correlation between patient perceptions of food taste and menu variations with food waste in patients at the Covid-19 Indrapura Field Hospital. This study used a cross-sectional design. Sample was selected using the accidental sampling technique, 148 respondents were selected. Data was analyzed by using Pearson correlation test. Most of respondents were male (60.8%), aged 15-39 years (63.5%), and had a length of stay of 7 days (58.1%). Most of the respondents admitted that food taste was good and very good (90.5%), as well as menu variations were classified as good and very good (89.2%), with average food waste of respondents was 10.4%. Statistical test show that there was a correlation between food taste (p value = 0.000) and menu variations (p value = 0.005) with food waste Covid-19 patients. It is concluded that there is a significant correlation between food taste and menu variations with the food waste among Covid-19 patients. Though it meets hospital food waste standards, it is still important to pay attention to the things related to food taste and menu variations to keep the food waste below minimum standards.

Keywords: *Covid-19, public health and well-being, food taste, menu variations, patients' perception*

PENDAHULUAN

Pelayanan Gizi Rumah Sakit (PGRS) adalah pelayanan gizi yang disediakan oleh rumah sakit berdasarkan kondisi tubuh pasien. Kondisi gizi pasien dengan proses penyembuhan penyakit saling memengaruhi. Oleh karena itu, penting untuk memperhatikan kondisi gizi pasien supaya pasien terpenuhi kebutuhan gizinya (Kemenkes RI, 2013).

Salah satu upaya dalam memenuhi gizi pasien yaitu dengan penyelenggaraan makanan (Kemenkes RI, 2013). Oleh karena itu, dalam hal ini makanan diharapkan dapat diterima dengan baik oleh pasien. Perlu diperhatikan pula makanan yang dihidangkan dapat terjaga kualitasnya, maka dapat dievaluasi dengan melihat daya terima pasien.

Daya terima merupakan kesanggupan pasien dalam menghabiskan makanan yang disajikan (Kurniah, 2010). Secara umum daya terima makanan dapat diketahui dengan melihat sisa makanan dan jawaban dari pertanyaan yang memiliki hubungan dengan makanan yang dikonsumsi (Nur C, 2014). Sisa makanan merupakan indikator sederhana yang dapat dijadikan bahan evaluasi terkait keberhasilan pelayanan gizi rumah sakit (Ronitawati, *et al*, 2021).

Penelitian terdahulu dengan sasaran pasien Covid-19 didapatkan bahwa sebagian besar memiliki sisa makanan, didapatkan hasil 72% pasien memiliki sisa makanan (Setianto, B *et al.*, 2021). Pada penelitian tersebut tidak dipaparkan terkait rata-rata sisa makanan pasien, sehingga tidak dapat dibandingkan dengan Standar Pedoman Gizi Rumah Sakit yang menyebutkan sisa makanan rumah sakit tidak melebihi 20% (Kemenkes RI, 2013).

Terdapat beberapa faktor yang mempengaruhi adanya sisa makanan. Terbagi menjadi faktor internal dan eksternal. Faktor internal meliputi usia, jenis kelamin, jenis penyakit, lama perawatan, nafsu makan, kebiasaan makan, motivasi pasien untuk sembuh. Sedangkan untuk faktor eksternal ialah petugas distribusi makanan, jadwal makan, suasana lingkungan, makanan dari luar rumah sakit, dan mutu makanan (Umami, 2017; Moehyi, 2014).

Salah satu yang dapat memperbaiki kondisi pasien Covid-19 yaitu asupan makan pasien. Hal ini bertujuan untuk mengoptimalkan imunitas tubuh (Kemenkes RI, 2020). Asupan makan dapat diperhatikan dengan memperhatikan sisa makanan pasien. Terdapat beberapa hal yang dapat memengaruhi sisa makanan pada penelitian yaitu rasa makanan dan variasi menu. Oleh karena itu, perlu diperhatikan pula terkait rasa makanan dan variasi menu atau keberagaman makanan yang diberikan kepada pasien. Rasa makanan merupakan kombinasi rasa yang diciptakan dari bahan pangan yang diolah dan merupakan faktor utama yang menentukan kualitas suatu makanan. Sedangkan variasi menu dapat berpengaruh pada tingkat kebosanan pasien sehingga untuk meminimalisir masalah kebosanan pasien dapat digunakan siklus menu (Umami, 2017).

Penelitian dengan variabel rasa makanan, variasi menu, dan sisa makanan dengan sasaran pasien Covid-19 masih belum banyak dilakukan dan dipublikasikan. Namun, mengingat pentingnya pengaruh rasa makanan, variasi menu, dan sisa makanan pada pasien Covid-19. Oleh karena itu, diperlukan penelitian untuk menganalisis hubungan rasa makanan, variasi menu, dan sisa makanan pada pasien Covid-19.

METODE

Penelitian ini dilaksanakan di Rumah Sakit Lapangan Covid-19 Indrapura Surabaya dari Desember 2020 hingga Januari 2021 melalui kuesioner dan data Rumah Sakit. Penelitian merupakan penelitian data sekunder yang didapatkan dari Rumah Sakit Lapangan Covid-19 Indrapura Surabaya yang dalam penelitian tersebut menggunakan desain penelitian observasional analitik yaitu desain penelitian *cross-sectional*. Adapun variabel independen dalam penelitian ini adalah persepsi pasien terkait rasa makanan dan variasi menu. Variabel dependen dalam penelitian ini adalah sisa makanan pasien Covid-19. Data karakteristik pasien (jenis kelamin dan usia) serta lama rawat inap berasal dari *medical record*. Selain itu, terdapat kuesioner berisi beberapa pertanyaan yang diberikan kepada pasien untuk mengetahui kepuasan makan (rasa makanan, variasi menu, dan sisa makanan). Pada kuesioner ini diberikan pilihan kurang, cukup, baik, dan sangat baik untuk variabel rasa makanan dan variasi menu,

sedangkan pilihan tidak termakan, sisa 75%, sisa 50%, sisa 25%, dan habis semua untuk variabel sisa makanan. Kuesioner bersifat subjektif yang digunakan untuk melihat kepuasan makan pasien. Analisis data yang digunakan adalah uji korelasi *pearson* menggunakan SPSS 25.0.

Sampel dalam penelitian ini adalah pasien rawat inap Rumah Sakit Lapangan Covid-19 Indrapura Surabaya. Penentuan besar sampel dalam penelitian ini menggunakan teknik *accidental sampling*, yaitu metode penentuan sampel dengan mengambil responden yang kebetulan bertemu dan memenuhi syarat penelitian. Kriteria inklusi penelitian adalah sebagai berikut:

Pasien rawat inap Rumah Sakit Lapangan Covid-19 Indrapura Surabaya yang bersedia mengisi kuesioner kepuasan makan yang diberikan pihak rumah sakit

Pasien yang tidak mengalami gejala anosmia; pasien yang mengalami anosmia akan mengeluhkan kehilangan indra perasa, sehingga tidak dapat menikmati makanan. Hal ini terjadi karena kemampuan membedakan rasa bukan tergantung pada reseptor rasa yang ada pada lidah melainkan pada penciuman (Fried, 2021).

Sampel dalam penelitian ini akan dipilih berdasarkan kriteria inklusi yang ditetapkan oleh peneliti sehingga didapatkan 148 sampel. Penelitian ini telah disetujui oleh Komisi Etik Penelitian Kesehatan Fakultas Kedokteran Gigi Universitas Airlangga (KEPK FKG UNAIR) pada 10 Juni 2022 dengan nomor 305/HRECC.FODM/VI/2022.

HASIL DAN PEMBAHASAN

Berikut adalah paparan hasil penelitian yang telah dilaksanakan. Berdasarkan hasil Tabel 1, Sebagian besar responden berjenis kelamin laki-laki (60,8%), berusia 15-39 tahun (63,5%), dan memiliki lama rawat inap ≤7 hari (58,1%).

Menurut AKG (Angka Kecukupan Gizi) (2019) kebutuhan zat gizi manusia akan semakin berkurang seiring bertambahnya usia, contohnya pada laki-laki dewasa kelompok usia yaitu 30-49 tahun memiliki kebutuhan energi 2550 kkal, kemudian pada kelompok usia 50-64 tahun memiliki kebutuhan energi 2150 kkal, dan kebutuhan energi menurun lagi pada kelompok

usia 65-80 tahun yaitu menjadi 1800 kkal. Namun, pada masa tertentu seperti pada masa bayi dan remaja terdapat peningkatan kebutuhan zat gizi, contohnya pada masa remaja laki-laki kelompok usia 13-15 tahun memiliki kebutuhan energi yaitu 2400 kkal, kemudian kebutuhan energi pada remaja meningkat pada kelompok usia 16-18 tahun yaitu 2650 kkal.

Pada penelitian ini usia dikelompokkan menjadi dua kelompok yaitu 15-39 tahun dan 40-90 tahun. Penelitian lain menyatakan bahwa pada pasien usia 40-90 tahun, asupan makanan yang diterima adalah 0,4 kali lebih kecil dibandingkan dengan pasien yang berusia 15-39 tahun (Almatsier, 2012). Indera penciuman dan perasa seseorang akan melemah seiring bertambahnya usia. Hal ini juga akan mempengaruhi sisa makanan dan rendahnya asupan makan pasien (Berman, 2003).

Terdapat pula perbedaan kebutuhan zat gizi pada perempuan dan laki-laki. Berdasarkan Angka Kecukupan Gizi (AKG), perempuan memiliki kebutuhan nutrisi lebih rendah dibanding dengan laki-laki. Hal ini mengakibatkan sisa makanan pada perempuan berisiko lebih banyak dibandingkan pada laki-laki.

Data lama rawat inap pasien didapatkan dari selisih tanggal hari keluar dan masuk rumah sakit (Kementrian Kesehatan RI, 2018). Berdasarkan wawancara dengan pihak rumah sakit, pasien diperbolehkan pulang apabila kondisi sudah optimal dan mencapai target yang ditentukan. Pada pasien Covid-19 target yang ditentukan ialah jika pasien sudah mendapat hasil PCR (*Polymerase Chain Reaction*) negatif dan tidak ada penyakit

Tabel 1. Karakteristik Responden

Karakteristik Responden	n	%
Jenis Kelamin		
Laki-laki	90	60,8
Perempuan	58	39,2
Usia		
15–39 tahun	94	63,5
40–90 tahun	54	36,5
Lama Rawat Inap		
≤7 hari	86	58,1
>7 hari	62	41,9
Total	148	100

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https://doi.org/10.204736/mgi.v17i3.330–336

penyerta lainnya yang memerlukan perawatan khusus.

Terdapat faktor yang mempengaruhi lama rawat inap yaitu komplikasi, perawatan oleh tenaga medis, usia, jenis penyakit dan tingkat keparahan (Amrita & Badgal, 2015). Penelitian lain juga menunjukkan bahwa komplikasi (*diagnose* ganda) adalah hal yang dapat mempengaruhi lama rawat inap pasien (Arefian et al., 2019). Hal ini sejalan dengan penelitian lainnya yang menunjukkan bahwa rata-rata lama rawat inap pasien dengan diagnosa diabetes melitus yang mengalami hipertensi, neuropati, stroke, dan penyakit jantung koroner memiliki lama rawat inap lebih lama dibandingkan dengan yang tidak mengalami komplikasi (Salim, Lubis, dan Sugeng, 2019).

Berdasarkan kuesioner yang diisi oleh responden, sebagian besar responden dalam penelitian ini merasa bahwa rasa makanan sudah baik (46,6%). Adapun yang paling rendah yaitu yang memilih kategori kurang baik (2%). Sedangkan terkait variasi menu, hasil menunjukkan bahwa mayoritas responden mengisi variasi menu sangat baik (51,4%). Adapun yang paling rendah yaitu yang memilih kategori kurang baik (0%). Sedangkan terkait sisa makanan mayoritas responden menghabiskan makanan (68,9%). Hal ini dipengaruhi oleh Sebagian besar responden berjenis kelamin laki-laki yang memiliki kebutuhan kalori lebih banyak dibanding perempuan (AKG, 2019). Sebagian besar responden berusia 15-39 tahun yang memiliki asupan makan lebih banyak dibanding usia 40-90 tahun (Almatsier, 2012). Rasa Makanan, variasi menu, dan sisa makanan (kepuasan makan berdasarkan persepsi pasien) dapat dilihat lebih jelas pada Tabel 2.

Rasa makanan dan variasi menu termasuk dalam faktor eksternal yang dapat mempengaruhi sisa makanan pada pasien (Moehyi, 2014). Namun juga perlu diperhatikan dalam hal keberagaman menu. Maka dilakukan penyusunan menu menurut jenis hidangan pola menu, master menu, kombinasi warna, dan konsistensi bentuk serta variasi pada makanan yang dihidangkan (Bakri, *et al*, 2013).

Berdasarkan wawancara pada petugas gizi Rumah sakit Lapangan Covid-19 Indrapura Surabaya, terdapat 3 makanan utama dan 2 makanan ringan setiap harinya. Makanan selingan akan didistribusikan pada jam makan siang dan

Tabel 2. Kepuasan Makan berdasarkan Persepsi Pasien

Variabel	n	%
Rasa Makanan		
Kurang	3	2
Cukup	11	7,4
Baik	69	46,6
Sangat baik	65	43,9
Variasi Menu		
Kurang	0	0
Cukup	16	10,8
Baik	56	37,8
Sangat baik	76	51,4
Sisa Makanan		
Tidak termakan dan Sisa 75%	3	2
Sisa 50%	10	6,8
Sisa 25%	33	22,3
Habis semua	102	68,9
Total	148	100

malam. Kalori yang diberikan per hari yaitu 2800 kkal. Sedangkan untuk siklus menu Rumah Sakit Lapangan Covid-19 Indrapura Surabaya menerapkan siklus menu 10 hari.

Penelitian lain menyebutkan rata-rata sisa makanan yaitu 14,79% (Wirasamadi, 2015). Terdapat pula penelitian terkait sisa makanan dengan rata-rata 17,14% (Handayani, A, 2021), sedangkan indikator standar sisa makanan pasien menurut Pedoman Gizi Rumah Sakit (PGRS) ialah < 20% (Bakri, *et al*, 2013). Berdasarkan kuesioner kepuasan makan, rata-rata sisa makanan pasien yaitu 10,4%. Maka rata-rata sisa makanan pada pasien Covid-19 sudah memenuhi standar yang tersedia.

Hasil analisis pada tabel 3 menunjukkan bahwa terdapat hubungan yang signifikan antara rasa makanan dengan sisa makanan responden (*p value* = 0,000). Artinya semakin baik penilaian responden terhadap rasa makanan akan semakin sedikit sisa makanan. Pada penelitian ini, mayoritas pasien merasa bahwa rasa makanan dinilai baik dan sangat baik (90,5%). Penelitian ini sejalan dengan penelitian yang pernah dilakukan sebelumnya yang menyatakan bahwa terdapat hubungan antara cita rasa makanan rumah sakit dengan dan terima pasien (Lumbantoruan,dkk, 2018). Hal ini terjadi dikarenakan rasa makanan merupakan salah satu faktor adanya sisa makanan

Tabel 3. Hubungan Rasa Makanan dengan Sisa Makanan Responden

Rasa Makanan	Sisa Makanan										p value*
	Tidak termakan dan Sisa 75%		Sisa 50%		Sisa 25%		Habis semua		Total		
	n	%	n	%	n	%	n	%	n	%	
Kurang	0	0	1	0,7	1	0,7	1	0,7	3	2	
Cukup	1	0,7	4	2,7	3	2	3	2	11	7,4	
Baik	2	1,4	4	2,7	22	14,9	41	27,7	69	46,6	0,000
Sangat baik	0	0	1	0,7	1	0,7	57	38,5	65	43,9	
Total	3	2	10	6,8	33	22,3	102	68,9	148	100	

*) Signifikan apabila nilai *p value* < 0,05

Tabel 4. Hubungan Variasi Menu dengan Sisa Makanan Responden

Variabel	Sisa Makanan										p value
	Tidak termakan dan Sisa 75%		Sisa 50%		Sisa 25%		Habis semua		Total		
	n	%	n	%	n	%	n	%	n	%	
Variasi Menu											
Kurang	0	0	0	0	0	0	0	0	0	0	
Cukup	1	0,7	3	2	4	2,7	8	5,4	16	10,8	
Baik	2	1,4	5	3,4	11	7,4	38	25,7	56	37,8	0,005
Sangat baik	0	0	2	1,4	18	12,2	56	37,8	76	51,4	
Total	3	2	10	6,8	33	22,3	102	68,9	148	100	

*) Signifikan apabila nilai *p value* < 0,05

pada responden. (Agustina, Lilis dan Primadona, Suzanna, 2018). Bahkan pada penelitian lainnya disebutkan bahwa rasa makanan menjadi faktor utama dalam menentukan cita rasa makanan (Rimporok *et al.,* 2019). Rasa makanan rumah sakit meliputi aroma, bumbu, kematangan, dan tekstur makanan (Agustina, Lilis dan Primadona, Suzanna, 2018). Namun dikarenakan pada penelitian ini berdasarkan penilaian sensorik masing-masing responden. Sehingga faktor kesukaan dan kebiasaan makan sebelum masuk rumah sakit juga dapat berpengaruh terhadap penilaian responden (Ariyanti *et al.,* 2019).

Hasil analisis pada tabel 4 menunjukkan bahwa terdapat hubungan yang signifikan antara variasi menu dengan sisa makanan responden (*p value* = 0,005). Artinya, semakin bervariasi menu makanan rumah sakit semakin sedikit sisa makanan. Pada penelitian ini mayoritas pasien merasa bahwa variasi menu dinilai baik dan sangat baik (89,2%). Hal ini sejalan dengan penelitian lain yang menyebutkan bahwa terdapat

hubungan yang signifikan antara variasi menu dengan sisa makanan (Arawinda, 2021). Pada penelitian tersebut juga dikatakan bahwa hal ini bisa terjadi karena salah satu faktor eksternal dari sisa makanan yaitu variasi menu (Arawinda, 2021). Semakin sedikit atau kurang beragam variasi suatu menu, maka semakin mudah pasien untuk mengalami kebosanan (Umami, 2017). Maka, perlu diperhatikan terkait siklus menu, sehingga dapat mengurangi rasa bosan terhadap variasi menu yang dihidangkan.

Pada penelitian ini untuk variasi menu sudah beragam. Dikatakan sudah bervariasi karena Rumah Sakit Lapangan Covid-19 Indrapura Surabaya sudah menerapkan siklus menu 10 hari. Siklus menu 10 hari adalah sikus menu yang baik, dikarenakan tidak mudah untuk dihafal dan memiliki jangka waktu yang lama untuk pengulangannya. Meskipun siklus menu 10 hari juga memiliki kekurangan yaitu tidak mudah dalam pembuatan siklus menu tersebut (Bakri B *et al.,*2018).

KESIMPULAN DAN SARAN

Persepsi terhadap rasa makanan dan variasi menu menunjukkan bahwa terdapat hubungan yang signifikan dengan sisa makanan pasien Covid-19. Maka perlu diperhatikan terkait hal-hal yang mempengaruhi rasa makanan seperti Selain itu, perlu dipertahankan terkait siklus menu yang sudah baik. Melalui variasi menu yang beragam, diharapkan dapat mengurangi sisa makanan pada pasien Covid-19 dan dapat mempercepat kesembuhan pasien Covid-19.

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AUTHOR INDEX

SUBJECT INDEX

Media Gizi Indonesia
(National Nutrition Journal)

I. GENERAL GUIDELINES

Papers submitted to the editorial are self-generated papers, scientific, contain contemporary issues and unpublished. To avoid duplication, the editor does not accept papers that are also sent to other journals at the same time for publication.

Each author should attach:

*   A brief *Curriculum Vitae* (CV) of corresponding author on separate sheet, containing full name and title of author, address, home and institution phone number, formal education, publication and / or research of the last 5 years (optional)
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*   English proofread of the manuscript

II. FORMAT MANUSCRIPT WRITING

Manuscript should be typed using MS Word program, 1.5 space on A4 paper size with the left should be 4 cm length, while right, top, and bottom margin should be 3 cm length. The font used should be Times New Roman, sizing 16 pt for the title, 10 pt for author's name, 9 pt for author's identity, 11 pt for abstract and main content, and 9 pt for tables and figures. Specifically, for tables, single spaced should be used. The contents of the paper are made in two columns. The length of article should not below 10 pages and should not exceed 15 pages, send both in print-out and softcopy. Authors should also follow the manuscript preparation guidelines.

III. WRITING SYSTEM

Title in English
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Abstract in English (include keywords)
Introduction
Methods
Results and Discussion
Conclusion and Suggestion
References

<u>Annotation</u>
a. Title and Author's Identity
Title is written as clear, concise, informative, and understandable as possible. The maximum length of the title consists of 20 words. The author's name and identity (affiliation, city), are included

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Abstracts are written in English in Bahasa Indonesia and in Times New Roman 11 pt, single-spaced. Abstracts consist of no more than 250 words length, written in 1 (one) paragraph. Keywords are written below the abstract, consist of 3-5 specific words that are consistently used in the manuscript. Avoid using quotations and the use of abbreviations in writing abstracts.

Abstracts contain brief information regarding the background of the study, objectives of the study, brief summary of the methods (research design, subject selection, methods of data analysis), results, and discussion (use the most specific data in answering the objectives of the study, along with the signification results of statistical test, if any), conclusion as well as the significance/urgency of obtained conclusion..

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The core section of a manuscript consists of subtitles: introduction, methods, results and discussions, and conclusion and suggestions.

Introduction

The introduction part comprises the background of the study, research intention, research questions, previous studies and the objectives of the study.

Methods

The methods section consists of the steps completed by the author in doing the research, elaborated completely, yet concisely, begins from research design (including the sampling methods, if any), samples, materials, & tools used, working methods, techniques of data collection, and data analysis.
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Results of the study provide clear and concise results that are in line with the objectives of the study. The results can be complemented with tables and figures to help explaining the results.

- Number and title of a table are placed above the table and are written in bold. Table numbering is done in sequence. The lines used in table are only in table head and bottom (without column lines) with single space. Further explanations regarding the data on the table, the explanation can be written below the table.
- Number and label of figures are placed below figures and are written in bold. Figures numbering is done in sequence.
- Sources of reference are placed below tables/figures for tables and figures cited from other references (other than research results).

Discussions explains research results, concisely, and clearly. Using relevant arguments to the research topic and answering the research questions. Employ references (other research results or theories) to support the explanation of research. If there is abbreviation, use the standardized

abbreviations. The use of abbreviations must be preceded by the extensions first. Foreign terms are written in *Italics*. Numbers written in the beginning of a sentence are written in a word.

Conclusion

Conclusion elucidates important matters discussed in the result and analysis briefly, concisely, clearly, and answers research questions. Conclusion can be completed with suggestions (if necessary).

Acknowledgement (if necessary)

Acknowledgement given to person/institution who have important roles in conducting a research (for example, funders) and/or writing scientific manuscripts and includes explanations whether the research is part of a series of research in thesis/dissertation.

References

Writing references refers to the APA Referencing Guide 6th edition. [*Publication Manual of the American Psychological Association*. (6th ed.). (2010). Washington, D.C.: American Psychological Association]. References are arranged systematically and sorted alphabetically according to author's name. Generally, writing references is as follows:

Author, A.A., Author, B.B, & Author, C.C. (year of publication). *Title of publication: sub title*. (Edition [if not the first edition]). City of publication: Publisher.

A minimum of 80% of the literature used comes from 'up to date' sources (published no more than 10 years before scientific papers submitted to MGI). Unpublished sources, such as manuscripts or personal communication cannot be used as references for the writing.

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EXAMPLES OF REFERENCES WRITING

a. **References from books**
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El-Gilany, A. H., & Elkhawaga, G. (2012). Socioeconomic determinants of eating pattern of adolescent students in Mansoura, Egypt. *The Pan African Medical Journal*, 13, 22. https://doi.org/10.4314/pamj.v13i1.

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Diana, R. (2014). *Pengaruh pemanfaatan pekarangan dan penyuluhan terhadap konsumsi sayur dan asupan gizi rumah tangga dan balita*. Institut Pertanian Bogor.

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h. **Web page (if referenced are a few pages on the same web page, use the homepage page)**
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Example of tables:

Table 1. Characteristics of Patients in Malnutrition and Non-Malnutrition Groups

Karakteristik	Malnutrition (n=70)		Non-Malnutrition (n=233)		Total (n=303)	X^2	p value
	n	%	n	%			
Sex							
Male	38	54,3	117	52,5	155	0,070	0,790
Female	32	45,7	106	47,5	138		
Age							
<55 years old	48	68,6	151	67,7	199	0,890	0,180
≥55 years old	22	31,4	72	32,3	94		
Education							
Low	24	34,3	51	22,9	75	10,153	0,063
Middle	33	47,1	151	67,7	184		
High	13	18,6	21	9,4	33		

Table 2. Average of Nutrition Intake in Malnutrition and Non-Malnutrition Groups

| Nutrition Intake	Malnutrition (Mean ± SD)	Non-Malnutrition (Mean ± SD)	t	*p value*
Calories	1328,1± 215,3	1482,9± 327,4	2,04	0,032
Protein	43,2±13,1	48,7±17,3	2,47	0,010

Example of a figure:
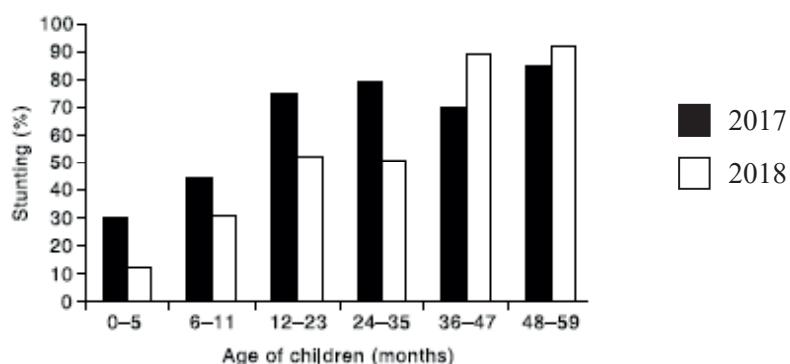
Figure 1. Changes in Stunting Prevalence (%) in Toddlers in Kalimantan

FORMULIR BERLANGGANAN

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