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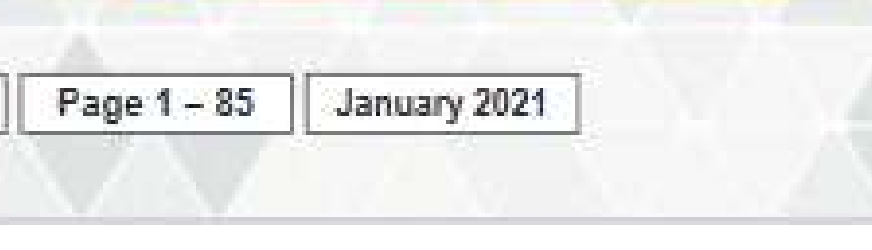

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THE EFFECTIVENESS OF NUTRITION EDUCATION THROUGH SOCIO-DRAMATIC METHOD TO VEGETABLE & FRUIT KNOWLEDGE AND CONSUMPTION IN 5-6 YEARS OLD CHILDREN

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ABSTRACT

Low consumption of vegetable and fruit in children was still commonly found. Appropriate and effective nutrition education methods are needed to increase knowledge and consumption of vegetable and fruit in children. This study aimed to know the effectiveness of nutrition education through socio-dramatic method of vegetable and fruit knowledge and consumption in children 5-6 years old. This study was a quasi-experiment with pre-test and post-test control group design. Research subjects were 36 Taman Putra Kindergarten children who were divided into treatment group who were given nutrition education with socio-dramatic method, and control group who were given nothing. The improvement of nutrition knowledge was assessed by pre-test and post-test with pictured form, while vegetable and fruit consumption were assessed by 3 Days Food Record instrument. A total of 15 subjects had low fruit vegetable knowledge, and more than 50% of subjects had less fiber intake, types of vegetable consumption <7 types, the amount of vegetable intake <250 grams, and fruit <150 grams. The provision of nutritional education through sociodrama method was effective in increasing knowledge of fruit vegetables in pre-school children ($p < 0.001$), as seen from the increase in average knowledge of treatment group compared to control group. But unfortunately, nutrition education through sociodrama method has not been able to significantly increase fruit vegetable consumption in terms of both quantity and type ($p > 0.05$).

Keywords: nutrition education, nutrition knowledge, socio-dramatic method, vegetable and fruit consumption in children

INTRODUCTION

The Ministry of Health of the Republic of Indonesia in 2009 divides children's age into under-five children (0-5 years old) and child (5-11 years old). Childhood is a period of optimal growth and development in a person's social, cognitive and emotional (Lucas & Feucht, 2008). Children have several developmental characteristics, one of which is social development. The typical development of preschool children is to like imitative, imaginative and dramatic games (Wong et al, 2018). Cognitive development in the preschool children will continue to develop language skills that tend to be egocentric.

Toddlers and preschoolers are prone to experiencing nutritional problems which will affect the child's growth and development. Malnutrition in children is associated with poor cognitive, mental and academic performance in school (Martins et al., 2011). Globally, about 45% of under-five mortality is caused by malnutrition. One aspect that affects individual health is eating behavior (Muckenhuber, et al, 2014). Knowledge of what to eat will certainly influence individual eating behavior. Nutritional knowledge is defined as an individual cognitive process related to information about food and nutrition and is related to the selection of healthy foods and the success of preventing a disease, so that knowledge is needed so that individuals can change their lifestyle in order to improve the health status (Barbosa et al., 2016).

The vegetable and fruit consumption survey conducted in Indonesia shows that the lowest vegetable consumption rate is in the under five children (Hermina & Prihatini, 2016). There are several factors that affect fruit vegetable intake including age, gender, diet quality, knowledge and food preferences (Bestari & Pramono, 2014).

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Physical environmental factors include the availability and accessibility of vegetables & fruit as well as social environmental factors such as socioeconomic status and support from parents, teachers and schools (Graziose & Ang, 2018). The school environment is a suitable place for health promotion interventions in school-age children (Nekitsing et al., 2018). Nutrition education in schools has a great opportunity to increase knowledge and become the basis for changing children's behavior (Desi et al., 2018). School age children tend to be active, play a lot and also ask questions. So that the chosen educational method is a method that allows children to participate and be actively involved in activities (Khairunnisya et al., 2017).

Sociodrama is a role-playing learning method to solve problems related to social phenomena. This game combines 2 elements, namely imitative and imaginative. Imitative, which is when children imitate someone's actions or words. Whereas imaginative when children use their imagination to create what is imitated (Smilansky, 1968). By applying the sociodrama method in nutrition education, children can easily absorb the messages or material being taught. This method encourages children to explore together, ask questions to each other, find answers and reflect on their everyday life (Mclennan, 2008).

The sociodrama method used in this study is to play roles collectively, including the introduction of vegetables through playing roles as buyers and sellers as well as introduction of fruit by means of the subjects being small chefs who process fruits into fruit salads. Research on the effect of nutrition education on vegetables and fruit using the sociodrama method has never been conducted before in Indonesia, so researchers are interested in applying it and analyzing its effect on changes in knowledge and behavior of fruit vegetable consumption in pre-school children.

METHODS

The study was used pre-posttest control group quasi experimental design. The study was divided into a control group and a treatment group which given a test before and after the intervention. The population was all students of Taman Putra Kindergarten, Semarang. The subjects as the unit of analysis were kindergarten children and the respondents were the subject's mother. The sample size used in this study was 18 for each group. The inclusion criteria were subjects aged 5-6 years and parents willing to take part in the study. The exclusion criteria were that the subjects moved or dropped out of school during the study and students did not participate in any of the research series. Each respondent or selected subject's parents provided informed consent as a sign that the subjects agreed to participate in the study. This study has received the approval of the Research Ethics Committee of the Faculty of Medicine, Diponegoro University / Dr Kariadi Semarang Hospital No. 350 / EC / KEPK / FK-UNDIP / VII / 2019.

The level of knowledge and consumption of fruit vegetables was the dependent variable. While the independent variable was the provision of fruit vegetable nutrition education using the sociodrama method which was carried out for 1 week.

Anthropometric measurements were carried out to determine the nutritional status of children. Body weight measured using the Gea Medical brand digital weight scale with an accuracy of 0.1 kg. Meanwhile, height was measured using the Gea Medical brand microtoise with an accuracy of 0.1 cm. The measurement results are then grouped based on the z-score of BMI / Age, i.e., very thin category if <-3 SD, thin -3 SD to <-2 SD, normal -2 SD to 1 SD, fat > 1 SD to 2 SD, and obesity > 2 SD (Ministry of Health, 2011). Changes in vegetable and fruit consumption were seen using the 3 Days Food Record instrument which was taken before the intervention and after the intervention which was then analyzed using the *Nutrisurvey* software. The 3 Days Food Record is filled in by the subject's parents who act as research respondents. The amount of fiber is categorized into mild deficit, moderate deficit, severe deficit, normal and more. Information about consumption habits and availability of fruit vegetables was obtained by using a questionnaire on habits and availability of fruit vegetables that was developed by the researcher and filled in by the students' parents. The number of vegetables and fruit consumption was categorized according to WHO recommendations; moderate vegetable

consumption (≥250 g) and less (<250 g), while the category of fruit is sufficient (≥150 g) and less (<150 g). Types of vegetables and fruit were categorized based on variations for 7 days; <7 types and ≥7 types. Changes in knowledge were seen using the pre-test and post-test in the form of questions about vegetables and fruit totaling 15 questions. The pre-test and post-test question models are adjusted to the abilities of children aged 5-6 years with 3 question models, those are choosing images, matching pictures with writing, and matching pictures with pictures (Kemendikbud RI, 2014, 2015). The nutritional knowledge scores were categorized into good knowledge (76-100%), sufficient knowledge (56-75%), and low knowledge (<55%) (Wawan, 2011).

The intervention in the treatment group was given sociodrama games about vegetables and fruit, while the control group was not given any intervention. If nutrition education in children is usually carried out by the lecture or storytelling method, in this sociodrama method, the children are invited to be actively involved in playing roles in which the education or information needed is tucked in. In this study, before the sociodrama game, the children were introduced to vegetables and fruit and their benefits using educational card instruments. Educational cards containing pictures of vegetables and fruits and their benefits. The sociodrama game was held for 1 day and consisted of 2 sessions. Each session lasts 1 hour. The first session was about vegetables, children were asked to play the roles of sellers and buyers of vegetables. The second session was about fruit, the children played the role of a chef and made fruit salads together.

The statistical test used in this study was the Paired T-Test and Wilcoxon test to analyze the effect of the intervention in each group, while the effect of the intervention on changes in the dependent variable between the treatment and control groups used the Mann Whitney U test and Independent T-Test. Data analysis was obtained using Statistical Package for the Social Sciences (SPSS) version 21.

RESULTS AND DISCUSSION

Based on the screening result, it was found that 48 children were divided into 2 classes. In the middle of the study, there were 12 children from both classes who dropped out because they did not follow the complete research course and there were problematic data. Then 18 children were taken from each group to become research subjects.

Table 1 shows the study subjects consisted of 44.4% boys and 55.6% girls in the control group and the treatment group. Respondents are parents or caregivers who know the subject's eating behavior every day. Most of the parents had a minimum college education and earned more than the Semarang minimum wage. Most of the subjects in the control group and 50% of the subjects in the treatment group had normal nutritional status. Before the intervention, 50% of subjects in the treatment group still have low nutrition knowledge (Table 2). Likewise, with the data on Likewise, with the data on vegetable and fruit consumption, 94.4% of the control group and 100% of the treatment group showed a severe deficit in the fiber intake. The types and amounts of fruit and vegetables consumed also do not meet the specified adequacy standards. Although there was no significant difference, there was an increase in the number of types of vegetables and fruit consumed. In the treatment

Table 1. Frequency Distribution of Subject Characteristics

Variable	Treatment		Control	
	n	%	n	%
Gender				
Boys	8	44.4	8	44.4
Girls	10	55.6	10	55.6
Father's occupation				
High school	2	11.1	1	5.6
College	16	88.9	17	94.4
Mother's occupation				
High school	1	5.6	2	11.1
College	17	94.4	16	88.9
Parents' income				
<Minimum wage*	2	11.1	0	0.0
≥ Minimum wage	16	88.9	18	100
Nutritional status (BMI/Age)				
Thin	1	5.6	2	11.1
Normal	14	77.8	9	50.0
Overweight	0	0.0	4	22.2
Obese	3	16.6	3	16.7

* Minimum wage of Semarang City year 2019 IDR 2.498.587,53

Table 2. Characteristics of Subjects Before Intervention

Variable	Control		Treatment	
	n	%	n	%
Nutrition knowledge				
Low (≤55%)	6	33.0	9	50.0
Sufficient (56-75%)	10	55.6	7	38.9
Good (76-100%)	2	11.1	2	11.1
Fiber intake (g)				
Severe deficit (<70%)	17	94.4	18	100
Moderate deficit (70-79%)	1	5.60	0	0.0
Type of vegetables*				
<7 types	17	94.4	18	100
≥7 types	1	5.6	0	0.0
Type of fruits*				
<7 types	18	100	18	100
≥7 types	0	0.0	0	0.0
Vegetable intake (g)				
Less (<250 g)	18	100	18	100
Moderate (≥250 g)	0	0.0	0	0.0
Fruit intake (g)				
Less (<150 g)	16	88.9	15	83.3
Sufficient (≥150 g)	2	11.1	3	16.7

*Types of vegetables and types of fruit eaten per week

Table 3. Changes of nutrition knowledge and consumption of fruit & vegetables before and after the intervention in the control group

Variable	Mean±SD		p
	Before intervention	After intervention	
Score of nutrition knowledge	9.44±1.7	10.28±1.4	0.207[a]
Fiber intake (g)	5.62±3.3	5.75±3.6	0.647 [a]
Type of vegetables/ week	3.72±1.6	3.61±1.7	0.782 [b]
Types of fiber/ week	2.11±1.6	1.83±1.5	0.296 [a]
Vegetable intake (g)	38.85±29.7	43.40±25.7	0.566 [b]
Fruit intake (g)	65.15±70.5	90.62±77.6	0.052 [b]

[a] Wilcoxon test [b] Paired T-Test

group, there was an increase of 44.4% of subjects who consumed ≥7 types of vegetables per week after the intervention.

Table 3 shows the increase in knowledge before and after intervention in the control group but not significant (p> 0.05). Whereas Table 4 in the treatment group, only the knowledge variable showed a significant difference (p<0.05) before and after the intervention.

Most of the parents at least having a college education. These data indicate that the education level of the subjects' parents in both groups are the same. This means that the acceptance of information by parents is also relatively homogeneous. Parents' income was mostly higher than minimum wage (88.9% in the control group and 100% in the treatment group). So, it can be said that the ability of parents to provide vegetables and fruit is relatively homogeneous. The nutritional status of the subjects varied with 50% of the control group and 77.8% of the treatment group having normal nutritional status.

At the beginning of the study, the knowledge scores, fiber consumption, types of vegetables & fruit, also consumption of fruits showed almost the same numbers between the two groups. It can be concluded that the condition of the subject before the intervention has the same characteristics. Prior to the intervention, some respondents (50%) in the treatment group still had low nutrition knowledge. Likewise, with the consumption of vegetables and fruit, 94.4% of the control group and 100% of the treatment group showed a severe deficit in the fiber intake. The types and amounts of fruit vegetables

Table 4. Difference of nutrition knowledge and consumption of fruit & vegetables before and after the intervention in the treatment group

Variable	Mean±SD		P
	Before intervention	After intervention	
Score of nutrition knowledge	8.72±1.9	12.94±2.6	<0.001 [a*]
Fiber intake (g)	5.69±2.7	5.92±3.1	0.758 [b]
Type of vegetables/ week	2.94±1.6	3.61±3.1	0.385 [a]
Types of fiber/ week	2.33 ±1.6	2.22 ±1.8	0.801[b]
Vegetable intake (g)	53.18±40.5	51.79 ±43.2	0.679 [a]
Fruit intake (g)	71.40 ±71.1	81.04 ±56.2	0.510 [a]

[a] Wilcoxon test [b] Paired T-Test; *Significant (p<0,05)

Table 5. Changes in the subject's nutrition knowledge and fruit vegetable consumption after the intervention

Variable	Mean±SD		p
	Control	Treatment	
Δ Nutrition knowledge (score)	0.83 ± 2.2	4.22 ± 2.5	**<0.001** [a*]
Δ Fiber intake (g)	0.13 ± 2.4	0.23 ± 3.1	0.914 [a]
Δ Type of vegetables/ week	-0.11 ± 1.7	0.67 ± 2.3	0.448 [b]
Δ Type of fiber/ week	-0.28 ± 1.3	-0.11±1.8	0.921 [b]
Δ Vegetable intake (g)	4.54 ± 32.9	-1.39 ± 37.3	0.616 [a]
Δ Fruit intake (g)	25.46 ± 51.6	0.67 ± 2.3	0.362 [a]

[a] Independent T Test [b] Mann Whitney Test; *Significant (p<0,05)

consumed also do not meet the specified adequacy standards. However, according to the subject's initial data before the intervention, the consumption of vegetables and fruit in the treatment group was better than the control group.

The recommendation for vegetables and fruit consumption according to the World Health Organization (WHO) in a day is at least 400 grams with details of 250 grams of vegetables (equivalent to 2 servings) and 150 grams of fruit (equivalent to 3 medium sized *Ambon* bananas or 1 medium piece of papaya). The recommendation to eat vegetables and fruit for Indonesians, especially toddlers and school children, is 300-400 grams, followed by a variety of food choices (Indah, 2018).

In Table 2, it is known that before the intervention, most of the subjects consumed vegetables and fruits less than 250 grams and 150 grams. Apart from that, the types consumed within one week are also only a few. In the control group only 1 person (5.6%) consumed ≥7 types of vegetables per week. While all subjects (100%) in the treatment group consumed <7 types of vegetables per week. Likewise, fruit consumption, all subjects consumed <7 types of fruit within a week. It can be said that most of the subjects did not consume a variety of vegetables and fruits.

Based on table 3 and table 4, the results of the nutrition knowledge score before intervention in the control group was 9.44 ± 1.7 and after the intervention was 10.28 ± 1.4. Despite the improvement, statistical tests using the Wilcoxon test showed no significant difference (p> 0.05) between knowledge before and after the intervention in the control group. This is because the control group was not given nutrition education. Whereas in the treatment group, the results before the intervention was 8.72 ± 1.9 and after the intervention was increased to 12.94 ± 2.6. Statistical tests using the Wilcoxon test showed that there was a significant difference (p <0.05) between the knowledge before and after the intervention in the treatment group. In addition, there was a significant difference in the mean change in knowledge between the control group and the treatment group (p <0.05), where the mean of the treatment group was 4.22 ± 2.49. This is in line with Ronasari's research which states that there is an effect of nutrition education on the knowledge of the importance of vegetables in preschool children (Putri & Maemunah, 2017).

Based on the knowledge score before the intervention, it was found that the lowest knowledge score was in the section on matching the benefits of vegetables and fruit. The knowledge score after the intervention in the control group did not change, while the treatment group had an increase. Most of the subjects were able to distinguish between vegetables and fruit, although it was still difficult to distinguish between each type of vegetable or fruit. Some subjects have difficulty in matching the text and pictures. This is because children aged 5-6 years are still in kindergarten A or small kindergarten, so they have not been taught to read and write.

Knowledge is defined as factual and interpretive information that leads to an understanding that is useful for making informed decisions or actions (Glanz, et al., 2002). Knowledge can increase if someone is given education. Interventions by providing education can increase a person's knowledge and behavior (Mahmood, et al., 2014). Knowledge can also be obtained from the learning process. Increased knowledge is influenced by several factors, one of which is the existence of learning methods or educational media. In the treatment group, the subjects were given education using the sociodrama learning method. This game combines 2 elements, namely imitative and imaginative. Imitative, which

is when children imitate someone's actions or words. Meanwhile, imaginative children use their imagination to create what they imitate (Smilansky, 1968). The elements in sociodrama games are also characteristic of children aged 5-6 years where the children are more receptive to the information provided. In addition, education through the senses of hearing and sight gives 35-55% higher results than just hearing, which is only 15% (Syah, 2017).

Sibagariang, et al. (2016) study showed that nutrition education using extension methods and guessing games is more effective than nutrition education through extension methods alone. Dyah's research (2016) concluded that there was a positive effect of the sociodrama learning method on the creativity of children's drawing work in group B students of Asih Sejati Kindergarten, Yogyakarta. In addition, the application of the sociodrama method in the subject of providing excellent service to class XI students of SMK in Semarang can also improve students' skills in providing assistance to customers.

Although research using the sociodrama learning method for children is still rare, the results of several studies show that there is a positive effect of the sociodrama method on increasing knowledge and changing the behavior of the subjects (Rosy, 2017). By the age of 3, children begin to develop a strong interest in roles and social relationships. That is why children begin to imitate and explore roles that are usually done by adults (Karpov, 2015). Rahardjo's research (2016) explains that sociodrama games have a positive influence on children's cognitive development such as problem solving, language development, skills, reading and writing skills, arithmetic, imagination and other developments. When playing sociodrama games, it is necessary to have adults explain different social roles to children so as to encourage behavioral development. Knowledge has a significant relationship with changes in a person's behavior, including one's own attitude. Knowledge is very important in shaping individual actions. Increased knowledge and understanding of behavior will increase the intention to implement such behaviors (Gusti, 2016; Mnguni, et al., 2015).

The results of fiber intake measurements in the treatment group before the intervention was 5.69 ± 2.7 and after the intervention was 5.92 ± 3.1. Although there was a slight increase, there was no significant difference found ($p > 0.05$). According to the Nutritional Adequacy Rate in Indonesia (AKG), children aged 4-6 years need 22 grams of fiber a day. Fiber itself is found in many vegetables and fruits. According to in-depth interviews conducted with the subject's parents, parents tend to provide fast food or junk food such as sausages, nuggets and others to children. Apart from being easier to serve, children also prefer these foods. Fast food is food that is high in calories and low in micronutrients such as vitamins, minerals, amino acids and fiber, so it is sufficient to contribute to the adequacy of the subject's fiber (Ashakiran & Deepthi, 2012).

Types of vegetables and number of fruit consumed also increased but not significant in the treatment group. Changing behavior from not liking to being willing to consume even liking vegetables and fruit requires a long educational process. Research on nutrition education using picture books conducted on children aged 2-4 years showed a change in fruit vegetable consumption after 4 weeks of education, but the results were not significant (Bestari & Pramono, 2014). The nutrition education that is given once is less able to maintain nutritional knowledge for one month so that it will affect behavior change (Irnani & Sinaga, 2018).

Based on the theory of behavior change, a person experiences new behavior changes through 3 stages, including the stage of changing knowledge (knowledge), followed by attitudes (affective) and finally practice (practice). At the knowledge stage, an individual will adopt a behavior if he knows the meaning and benefits of the behavior. After knowing the benefits of this behavior, someone will judge or act on the stimulus. At the practical stage, someone will practice or implement what they know and act on (Agustini, 2014). H.L. Blum in behavior theory says that there is a change in behavior due to changes in knowledge and attitudes, but the change process takes a long time with the interaction of various components of behavior (Bestari & Pramono, 2014). Meanwhile, the intervention conducted by researchers was only carried out for one week.

Even though there is a significant change in knowledge, this does not necessarily change the child's eating behavior. There are internal factors in children such as preferences for eating. Early in life, most babies and children prefer sweet and salty tastes. Sweet taste is a strong psychobiological stimulus for animal species including humans. Meanwhile, bitter tastes such as vegetables are often rejected when first exposed and can change when given repeated exposure. The innate tendency to refuse sour and bitter foods initially protects the individual from toxins, but it also causes a child to have a dislike for vegetables. Taste perception can vary between individuals depending on the variation of taste receptor genes (De Cosmi et al., 2018; Scaglioni, et al., 2011).

Judged from the measurement results after the intervention, although there was no significant difference, total types of vegetables and fruit had increased while the intake did not increase. This shows that the change in behavior experienced by children has reached the stage of increasing variation but not the amount. Apart from internal factors, there are several external factors that influence children's eating behavior. In children, the stages of receiving information to changing behavior cannot be done alone, but there are roles from parents, family environment, school, and also the media. The way for children to have preferences for food is by introducing these foods to children. When the family environment or parents do not provide and consume a variety of foods, then the opportunity for children to be exposed is smaller (Ansem, et al., 2015). This of course will affect the behavior and eating habits of children.

Apart from the factors of parents, teachers and the school environment also play a role in introducing variations in vegetables and fruits to children. If children are not accustomed to knowing the kinds of vegetables and fruits at school and the amounts that must be consumed, the children will also not get used to it. According to in-depth interviews, it was found that the habit of eating vegetables and fruit together at school is done once a month. Every day, the subject is recommended to bring snack to school. Snacks are usually high in calories and low in fiber.

Media exposure also has a major influence on children's eating behavior. Other studies have shown a significant relationship between media exposure and vegetable & fruit consumption behavior (Rachman, et al., 2017). One of the roles of the media that can influence the behavior of eating vegetables and fruit is advertising in electronic media. Unfortunately, there are very few advertisements regarding vegetables and fruit and the packaging is not attractive so that the message conveyed does not reach the children.

CONCLUSION

Nutrition education using the sociodrama method is effective in increasing nutritional knowledge, but it did not change vegetable and fruit intake in children aged 5-6 years. Further research is needed regarding the provision of nutrition education using the sociodrama method as a method of introducing vegetables and fruits to children with a more longer duration, more frequent, and involving the roles of parents at home and teachers at school.

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BREAKFAST HABITS AND NUTRIENT ADEQUACY LEVEL OF SNACKS IS CORRELATED WITH NUTRITION STATUS AMONG ADOLESCENT IN SMPN 1 TUBAN

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ABSTRACT

Adolescent often skip breakfast, so snacks are usually used as substitute for breakfast at school. Some snacks have unbalanced nutrient content. An imbalance in nutrient intake can affect nutritional status of adolescents. The purpose of this study was to analyze correlation between breakfast habits and nutrition adequacy level of snack with nutritional status of adolescents. The study design used in this study was cross sectional. The sampling technique was proportional random sampling with total sample of 77 students. Data on breakfast habits were obtained through questionnaires, while data on the adequacy level of snacks intake was obtained through 2x24 hours food recall. The correlation test used was spearman correlation. The results showed that there were correlation between breakfast habits, the adequacy level energy, protein, fat, and carbohydrate of snacks with nutritional status. Adolescent with poor breakfast habits and high adequacy of nutritional levels of snacks tend to have more obesity nutritional status.

Keywords: breakfast habits, nutrient adequacy level, nutritional statu, snack

INTRODUCTION

Adolescence is a period of biological, social and cognitive changes. (WHO, 2015). Adolescents undergo physical changes with varying duration. Nutritious intake is needed by adolescents to increase physical growth and body development. An unbalanced nutritional intake will lead to over or under nutritional status (Adriani, 2012).

Nutritional status in early adolescence must be considered in order to achieve optimal nutritional status to support adolescent growth in the future. Indicator in measuring nutritional status in 13-15 years age group use the results of anthropometric assessments of body weight and height, which are then displayed in body mass index according to age (BMI / U) (Balitbangkes, 2014). Based on the 2018 Basic Health Research data related to nutritional status in 13-15 years age group, it shows an increase in prevalence of overnutrition and obesity. Nationally, in 2013 over nutrition and obesity in 13-15 years age group showed prevalence of 10.8%. In 2018, over nutrition and obesity in 13-15 years age group increased to 16%. A similar increase also occurred in East Java Province, in 2013 over nutrition and obesity in 13-15 years age group showed prevalence of 11.9% and increased to 19.3% in 2018.

Good nutritional intake in adolescence is needed to replace malnutrition experienced during childhood and is needed to meet physical growth. (WHO, 2015). Adolescents are prone to change in behavior and lifestyle, especially changes in eating behavior. Irregular eating patterns are often carried out without paying attention to nutritional balance (Adriani, 2012). One of the causes of children being overweight is their habit of not eating breakfast which leads to an increase in frequency of consumption of snack foods that are high in calories, sugar and fat (Steiner, 2012). In addition, children who are accustomed to not having breakfast and not being balanced with intake increment will be at risk of malnutrition. The nutritional status of adolescents who usually eat breakfast are better than those who skip breakfast. Adolescents who have good breakfast consumption habits consume fewer calories in a day and are less likely to be obese (Rampersaud, 2005).

Adolescents are very difficult to find time to sit down to eat and prefer to skip meals or just snacking (Khan, 2009). Energy fulfillment of adolescents while at school are obtained by consuming snack food from stall, canteen, cafeteria, and snacks sold by mobile trader around school environment (BPOM, 2013). Street food is a form

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of food or drink that is served by street vendor for sale in public place and can be consumed directly by buyer. (Food and Agricultural Organization, 2009). School age children have a tendency to eat meal or snack according to what they want. Other factors that can affect include environment, pocket money, peers, and parents (More, 2014). Results of calculating calorie intake in adolescents show that 43% of calories are obtained only from sugar addition in snack foods (Khan, 2009). The more variety of snack foods sold by traders will encourage the habit of street food consumption for school children, especially during school break hours.

According to Basic Health Research 2013, the prevalence of obesity in 13-15 years age group in Tuban district exceeds provincial prevalence of 8.9% and national prevalence of 8.3%. State Junior High School 1 Tuban is one of school located in East Java. The location of school, which is right in the middle of the city, makes it easier for students to access street food sold by local traders. Based on the results of preliminary study conducted to determine children's snack consumption, it is known that 68.8% students prefer to buy snack on roadside, stall, and school canteen rather than bringing lunch from home, 65.2% of teenagers prefer to eat fried foods such as rolled omelettes, pentol and others, 55.1% of adolescents consume drinks with flavor additives more often, and 63.3% of adolescents do not read the nutritional content on packaging label when buying snack food. Based on the explanation of these identified problem that has been mentioned, researcher conducted a study on the relationship between breakfast habits and the level of nutritional adequacy of snack with nutritional status of adolescents at SMPN 1 Tuban.

METHOD

Study design used in this study was cross sectional. Population in this study were students of SMPN 1 Tuban with a total of 380 students. The chosen subjects were students of class VII and VIII of SMPN 1 Tuban. Based on Lemeshow formula, the subjects were 77 students (Lemeshow, 1997). Technique of taking the subjects in this study was used proportional random sampling until obtained total of class VII 38 students and class VIII 39 students. Students need to met inclusion criteria include not having verbal or speech impairment, not having dietary restrictions and not fasting during study.

Primary data were obtained through anthropometric assessments to determine adolescent nutritional status. Digital scales with an accuracy of 0.1 kg are used to measure body weight and a microtoise with an accuracy of 0.1 cm is used for measuring height. Primary data in this study were obtained through interviews with questionnaire on respondent characteristics (age, gender, pocket money for snacks) and parental characteristics (parental education, parental occupation, total parental income). Pocket money for respondent's snacks is categorized into 4 quartiles, which is K1, K2, K3, and K4. Parental education is categorized into primary level education (if have completed primary school / junior high school / equivalent), secondary level education (if have completed senior high school / equivalent) and high level education (if have completed diploma / university). Parent's income is classified into 4 quartiles, that is K1, K2, K3, and K4. Breakfast habits data were obtained through interviews with a questionnaire. Breakfast habits are grouped into two categories, that is good breakfast habits and poor breakfast habits. Respondents were entered category of good breakfast habits if they meet three criteria, namely breakfast every day (7x / week), breakfast before 09.00, and breakfast energy intake> 15% RDA (Soetardjo, 2011; Hardinsyah, 2012). If one of these three criteria cannot be met, respondent is categorized as having poor breakfast habit. The level of nutritional adequacy (energy, protein, fat, and carbohydrates) of snack food was obtained through a 2x24 hours food recall interview. The application used to convert the interview results is Nutrisurvey, after that the results are compared with nutritional adequacy rate (RDA). The level of adequacy is divided into three, that is low (<80% RDA), moderate (80% -100% RDA), and high (> 100% RDA). Determination of nutritional status in adolescents using BMI / Age indicator. The nutritional status of BMI / Age was categorized into severe undernutrition (<-3 SD), undernutrition (-3 SD to <2 SD), normal (-2 SD to 1 SD), obese (> 1 SD to 2 SD), and obesity (> 2 SD).

Test used to find the correlation between breakfast habits and level of nutritional adequacy of snacks with nutritional status was Spearman correlation test. Research ethics was obtained through approval from the Health Research Ethics Commission (KEPK) Faculty of Nursing Universitas Airlangga with Certificate Number 1357-KEPK.

RESULT AND DISCUSSION

Table 1 shows 46.8% of respondents were 13 years old. This age group is categorized aas early adolescent who is happy with new things, has the courage to face various risks, has broad interests and is not afraid of being wrong (Direktorat PLP, 2004).

The results of the study based on gender showed that 58.4% of respondents were female. At the age of 13-15 years, sex differences can affect the respondents nutritional intake needs. This is adjusted with differences in nutritional adequacy rates between men and women. Based on 2019 Indonesian RDA, the nutritional adequacy rate for men is greater if it is equalized to the nutritional adequacy level for women in the same age.

In terms of the amount of pocket money for snacks, more than half of respondents received pocket money for snacks that were in the range of Rp. 5,000 to Rp. 10,000. The amount of pocket money for snacks is one of the many indirect factors that have effect on nutritional status. The amount of pocket money affects the purchasing power of respondents towards various snack choices (Rosyidah, 2015).

Table 1. Respondent Characteristics

Respondent Characteristics	n	%
Age		
13 years	37	46.8
14 years	34	44.2
15 years	7	9.0
Sex		
Male	32	41.6
Female	45	58.4
Pocket Money for Snacks		
Rp. 5.000 - 10.000	44	57.1
> Rp. 10.000 - 15.000	23	29.9
> Rp. 15.000 - 20.000	8	10.4
> Rp. 20.000 - 25.000	2	2.6

Parent Characteristics

Based on Table 2, more than half of respondent's parents have education level in the middle category, that is 57.1%. Parents with a higher level of education have a high level of concern for the quality and nutritional content of served food, so that the nutritional needs of family can be fulfilled properly (Permaesih, 2005).

The largest respondent's total family income is included in the 2nd quartile category with an income range from Rp. 2,500,000 to less than Rp. 4,000,000. As much as 79.2% of respondents have an income level that has reached even higher when compared to the district minimum wage in Tuban for 2019 of Rp. 2,233,641.85. The amount of family income can influence family consumption patterns. Sufficient family income can increase the allocation of daily food purchases, so that needs can be fulfilled in terms of both quantity and quality.

Breakfast Habits

Table 3 shows that almost half of the respondents had breakfast in the category always (7x / week), that is 46.8%. The less frequent

Table 2. Parent Characteristics

Parent Characteristics	n	%
Father Education		
Primary Level	9	11.7
Secondary Level	44	57.1
High Level	24	31.2
Mother Education		
Primary Level	7	9.1
Secondary Level	44	57.1
High Level	26	33.8
Parents Total Income		
<Rp. 2.500.000	16	20.8
Rp. 2.500.000 - <Rp. 4.000.000	22	28.6
Rp. 4.000.000 - <Rp. 7.000.000	18	23.4
≥ Rp. 7.000.000	21	27.2
Income Level		
< UMK Tuban	16	20.8
≥ UMK Tuban	61	79.2

Table 3. Breakfast Habit Criteria

Criteria	n	%
Breakfast Habit Criteria		
Frequency		
Rarely (<3x/week)	31	40.2
Sometimes (4-6x/week)	10	13.0
Always (7x/week)	36	46.8
Breakfast Time		
< 09.00 am	36	46.8
≥ 09.00 am	41	53.2
Energy Intake		
<15% RDA	40	51.9
≥15% RDA	37	48.1
Breakfast Habit Category		
Good	27	35.1
Poor	50	64.9

breakfast, the greater the increase in nutritional status (Watanabe, 2014). This is in line with research of Kral et al (2011), frequency of breakfast if done regularly will not lead to excess food consumption at the next meal.

Breakfast is food consumption that is done before 09.00 am. based on the results of the study, 53.2% of respondents consumed breakfast at ≥ 09.00 am. This habit doesn't included into category of good breakfast habits. Breakfast time limits are required to collect data regarding breakfast consumption (Borton et al. 2005).

A healthy breakfast is recommended to meet around 15-30% of RDA. The results showed that more than half of respondents had energy intake <15% RDA, that is 51.9%. Foods that are consumed to replace the unmet energy adequacy usually have higher energy density, simple carbohydrates and have higher fats (Nurul, 2015; Kant, 2005).

In table 3, it is found that there are 64.9% respondents categorized as poor breakfast habits, this occurs due to the three criteria did not fulfilled. Respondents who have habit of having breakfast for 7 times / week do not all meet energy intake needs of more than 15% RDA. In addition, respondents whose breakfast intake was sufficient (> 15% RDA), not all ate breakfast before 09.00. Based on the results of in-depth interview, it was found that the reasons respondents missed breakfast because not lust or not hungry, fear of being late or late, not having time to cook, and fear of stomach pain. The usual solutions when skipping breakfast include buying snacks or packaged rice in the school canteen. In addition, respondents usually bring milk or bread from home.

Table 4. Adequacy Nutrients Level of Respondent's Snack

Nutrient Adequacy	n	%
Energy		
Low	28	36.4
Moderate	32	41.6
High	17	22.1
Protein		
Low	21	27.3
Moderate	19	24.7
High	37	48.1
Fat		
Low	16	20.8
Moderate	28	36.4
High	33	42.9
Carbohydrate		
Low	19	24.7
Moderate	26	33.8
High	32	41.6

Adequacy Nutrition Level of Snack

The nutritional adequacy level of snack is presented in Table 4, showing that 41.6% of respondents' energy sufficiency level is in the sufficient category. Nearly half of the respondents had excess protein adequacy level that is 48.1%. As much as 42.91% of respondents has high fat adequacy level. Carbohydrate adequacy level were high in 41.6% respondents. Snacks that contain high fat can contribute to increase the risk of overweight or obesity in children (Steiner, 2012). Excess consumption of street food can cause a decrease in appetite. Low and long-lasting appetite can affect nutritional status (Kelishadi, et al. 2017).

Variable Correlation

Based on Table 5, it can be seen the correlation between breakfast habits and nutritional status with a p-value of 0.000. The correlation value of this relationship is negative, which shows the opposite direction of the relationship, the is the less good the breakfast habit, the higher the nutritional status.

In this study, it was found that respondents with nutritional status were lean (2.6%), fat (14.4%) and obese (12.9%) were categorized as having poor breakfast habits.

Breakfast habit is one factor that can affect nutritional status of adolescents. Breakfast is very important to be eaten as a supply of fuel for nutritional needs in the morning. The habit of skipping breakfast can be a risk factor for health problems. The disadvantages of leaving breakfast include reducing cognitive function in children, reducing children's motivation and enthusiasm for activities, deficiency of macro and micro nutrient which can have a negative effect on physical, mental and health condition (Mhurchu, et al., 2010). The habit of leaving breakfast can be one of the causes for the body to experience nutritional deficiencies that cannot be replaced through other meal times (Rampersaud, 2005). Body lacks glucose as a result of skipping breakfast so that body breaks down energy supplies from fat tissue (Chitra, 2007). If this happens for a long time and continues to process it can result to malnutrition.

Based on Table 5, there is a correlation between level of energy adequacy (p = 0.000), protein (p = 0.001) fat (p = 0.000), and carbohydrates (p = 0.000) of snack with nutritional status. The correlation value of this relationship is positive, which shows the direction of an unidirectional relationship, that is the higher the level of energy, protein, fat and carbohydrates adequacy from snack food, the higher the nutritional status. In line with research that has been conducted, a correlation was found between fat content of snack and nutritional status (Dini, 2017; Nuryani, 2018). Snack intake is an alternative to fulfill nutrition for individuals who have limited main food consumption and have not met RDA (Syafitri, 2009). Consumption of snack foods that are high in fat and have a high energy density (such as chocolate, donuts, mini terang bulan, martabak, egg rolls, brains, cireng, etc.) causes children not to feel full quickly so it tends to increase the amount of consumption which ultimately has an impact on nutritional status (Jannah, 2017).

Tabel 5. Variable Correlation

Variable	Nutritional Status								Total		p-value	r
	Underweight		Normal		Overweight		Obese					
	n	%	n	%	n	%	n	%	n	%		
Breakfast Habits												
Good	0	0.0	27	35.1	0	0.0	0	0.0	27	35.1	0.000*	-0.390
Poor	2	2.6	27	35.1	11	14.3	10	13.0	50	64.9		
Adequacy Level Energy												
Low	2	2.6	17	22.0	1	1.3	0	0.0	20	25.9		
Moderate	0	0.0	36	46.8	10	13.0	0	0.0	46	59.8	0.000*	0.594
High	0	0.0	1	1.3	0	0.0	10	13.0	11	14.3		
Protein												
Low	2	2.6	33	42.9	5	6.5	0	0.0	40	52.0		
Moderate	0	0.0	19	24.6	6	7.8	0	0.0	25	32.4	0.001*	0.362
High	0	0.0	2	2.6	0	0.0	10	13.0	12	15.6		
Fat												
Low	2	2.6	17	22.1	0	0.0	0	0.0	19	24.7		
Moderate	0	0.0	34	44.1	11	14.3	0	0.0	45	58.4	0.000*	0.464
High	0	0.0	3	3.9	0	0.0	10	13.0	13	16.9		
Carbohydrate												
Low	2	2.6	24	31.2	3	3.9	0	0.0	29	37.7		
Moderate	0	0.0	30	38.9	8	10.4	2	2.6	40	51.9	0.000*	0.587
High	0	0.0	0	0.0	0	0.0	8	10.4	8	10.4		

Based on table 5, it is found 12.9% of respondents that have obese status, have poor breakfast habits, but the level of energy, protein and fat in their snacks included in excess category. This shows that respondents with obesity nutritional status consume excess snack food due to poor breakfast habits. In line with the findings of Mariza, et al. (2013), there is a correlation between breakfast habits and snack habits in children. The more often children skip breakfast, 1,5 times greater risk of children for taking snacks. In addition, it was found that there was a correlation between the habit of consuming street food and nutritional status. The habit of consuming street food has a seven-fold higher risk of experiencing an increase in nutritional status which leads to overnutrition and obesity.

CONCLUSION

Breakfast habit and nutritional adequacy level of snack were related to nutritional status. Respondents with poor breakfast habits and high adequate nutrition levels of snack were tend to have obese nutritional status. It is expected that respondents can improve the quality of their breakfast habits by fulfilling the nutritional intake of 15-30% of daily needs and consuming breakfast every day before 9 am. With the fulfillment of nutritional needs of breakfast, the intake of street food is reduced so that it can achieve optimal nutritional status.

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IRON INTAKE AMONG ADOLESCENT GIRLS BASED ON FAMILY SOCIO-ECONOMIC, FREQUENT HIGH-IRON FOODS CONSUMED AND KNOWLEDGE ABOUT ANEMIA IN PANDEGLANG DISTRICT

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ABSTRACT

Anemia is a condition with abnormalities in the red blood cells where lack of iron intake was postulated to be the main factor causing anemia. Research on iron intake, therefore, in adolescent girls is essential, specifically in high anemia prevalence area. This study aimed to examine the effect of family socio-economic factors, anemia comprehension, and ten-highest iron foods consumed on iron intake. Observational study with cross sectional design was performed, applying iron consumption as dependent variable and parents' education, employment, income and expenditure, along with ten-highest high-iron foods consumed and knowledge about anemia as independent variables. Iron intake was collected using 3 x 24-hours food recall, and ten-highest iron-rich foods consumed was obtained with 2 x food frequency questionnaire. Family socio-economic factors (education, employment, income and expenditure) and knowledge on anemia were assessed using standard questionnaire with closed-ended interview question. The study highlighted that the average iron intake was 8.11 ± 2.94 mg/day (ranging from 3.01 to 20.43 mg/day). Obtained data showed that the occupation of father played a role in the iron intake difference (6.20 ± 1.72 vs 8.40 ± 2.99 mg/day for formal and informal, $p < 0.05$). However, no differences were found between iron intake and education of fathers and mothers, maternal occupation, income, and expenses. Ten-highest iron-rich foods consumed did not significantly correlate to the amount of iron consumption ($p > 0.05$). Moreover, this study in adolescent girls found that there was a negative correlation between knowledge about anemia and iron intake ($r = -0.259$, $p < 0.05$). In conclusion, respondents consumed around 8 mg of iron, in average, lower than Recommended Dietary Allowance. Less amount of iron intake might be caused by scarce of high-iron sources consumption.

Keywords: iron intake, socio-economic, high-iron source, anemia knowledge

INTRODUCTION

Anemia is a condition with abnormalities in the blood chemistry such as decreased of hemoglobin level, hematocrit and red blood cells (Handelman & Levin, 2008; Johnson-Wimbley & Graham, 2011). Globally, almost 2.3 billion people suffered from anemia, of which were women and children, causing anemia as a serious health problem (United Nations Sub-Committee on Nutrition (ACC/SCN), 2000). Specifically, in Indonesia anemia prevalence was around 21% in 2013 for people with age more than 1 years old. However, anemia prevalence showed a higher prevalence in women compared to men (23.9% vs 18.4%, respectively) (Indonesian Ministry of Health, 2013). More specific to Banten province, anemia prevalence was recorded around 57% among reproductive women, showing a higher prevalence than national frequency (Prihatini, *et al.*, 2009). Correlating anemia to health, it would affect several outcomes in people, which are reducing productivity, increasing death risk of mother and children, delaying growth and development on children, as well as increasing risk of infection diseases when in moderate level (Lopez, et al., 2016). Low intake of iron sources is responsible for being the main factor causing anemia (Permaesih & Herman, 2005). Thus, research to study the effect of socio-economic factors, eating habit of iron-foods and knowledge about anemia on iron consumption in adolescent women, particularly, in higher prevalence district of anemia is necessary to be performed.

Anemia prevalence in girls was higher compared to boys, showing a number of 23,90% and 18.4%, respectively in 2013 (Indonesian Ministry of Health, 2013). More specific to adolescent girls, the prevalence was around

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57,1% for aged 10-18 years old and 39.5% for aged 19-45 years old in 2012 (Badan Penelitian dan Pengembangan Kesehatan RI, 2012). One of the main causing factor for anemia is low of iron intake (Permaesih & Herman, 2005). Literatures reported that the intake of iron in female adolescent was vary, consuming 18,3+30,43 mg/day (Kirana, 2011), 11,3 ± 1,75 mg/day (Cendani & Murbawani, 2011), and 10.4 ± 4.02 mg/day (Adhisti & Puruhita, 2011). However, the reported consumption were not sufficient when compared to recommendations of Ministry of Health of Indonesia, which instructs iron recommended dietary intake (RDI) for girls aged 13-18 years is 26 mg/day (Indonesia Health Ministry Policy number 75 year 2013). The lack of iron intake from the recommendation might be influenced by family socio-economic factors. The nutrient intake for iron was influenced by socio-economic family, such as education and parents' income (Bharati, et al., 2004; Bhargava, et al., 2001; Galobardes, et al., 2001; Hulshof, et al., 2003; Rahayu & Dieny, 2012).

In the Netherland, women with low socio-economic status showed a lower intake of iron (10.1 mg/day), contrasted to superior socio-economic status, 10.8 mg/day (Hulshof et al., 2003). Another study in India found that people with low socio-economic status consumed 20%-less of iron resources compared to higher socio-economic status (Bharati, et al., 2004). In addition, a smaller income also contributed to the selection of foods, which mainly comes from plants sources, effecting on anemia due to lower iron bioavailability (Collings, et al., 2013; Prihatini, et al., 2009; Tatala, et al., 1998). In vitro study to investigate the bioavailability of plant foods showed that legumes resulted around 25% iron (1.51 mg/100 g dry basis(db.)), vegetables 10.0% (5.6 mg/100 g db.), and if combined together in a menu, such as cereal with legume and vegetables, it corresponded to its bioavailability, ranging from 0.9% to 7.5% (0.31–1.17 mg/100 g db.) (Tatala et al., 1998). Thus, it is important to study the iron intake and possibly frequent high-iron sources ingested.

In addition to socio-economic factors and iron sources that influenced iron intake, knowledge about anemia also might be a determinant in this health problem. The understanding about anemia in people had been researched by many researchers, one of the studies found that around 40% of respondents had a good knowledge about anemia, another 40% showed a satisfactory result and the others (20%) achieved in less level (Soraya, 2013). Other studies also highlighted that knowledge about anemia with a good result was noted at 36.8% (Puspitaningrum & Fratika, 2014), 39.1% (Nora, 2012), and 38.8% (Prapitasari, 2013). Knowledge about anemia conveyed a significant influence to consume iron supplementation tablet in pregnant women (Nora, 2012; Puspitaningrum & Fratika, 2014). It highly motivates respondent to consume more iron to prevent anemia, which causes a side-effect to mother and fetus. However, the effect of knowledge about anemia on iron intake has not been fully studied in adolescent girls.

From all of the mentioned explanations, the effect of socio-economic and anemia knowledge on iron intake, generally had been studied. Thus, study focuses on iron intake in adolescent girls from districts with higher prevalence of anemia is very important. This study examined the effect of family socio-economic factors on iron intake in Pandeglang district, known for its high prevalence of anemia. Moreover, this study also explored the relation of knowledge about anemia to iron consumption. In addition, frequently high-iron sources consumed was investigated to study its correlation to iron intake.

METHODS

This observational research was commenced using a cross-sectional design. This research was performed in the last quarter of 2018. Respondent information (name, age, and sibling), nutritional status, parent's education, employment, and family income as well as food intake and knowledge about anemia were collected during the study. Independent variables in this study were parent's education, employment, income and expenditure, along with ten-highest high-iron foods consumed and anemia comprehension. While, the dependent variable was iron consumption. Prior to study, an ethical clearance from medicine faculty university of Indonesia was obtained with approval number 1028/UN2.F1/Etik/2018.

Two high schools in Pandeglang district were selected for this study, which were State Islamic Senior High School (MAN) 3 and State Senior High School (SMA) 17 Pandeglang. Purposive consecutive sampling was performed, selecting 65 adolescent girls from 125 girl students. All of the 65 respondents had been fitted the inclusion criteria, which were healthy, age between 15 and 18 years old, body mass index (BMI) for age score in between ±2 standard deviation (SD), and neither performing a special diet nor heavy exercises, doing sports not more than five hours a week of moderate exercise or two and a half hours of more intense activity (Piercy, et al., 2018). All respondents, then, signed the informed consent after receiving a full explanation regarding the study. In addition, parent's approval also obtained prior to the study. Due to exclusion criteria, which were resignation from the study, hospitalized, and absent during data collection. Only sixty-one respondents were used for statistical analysis because four respondents were absent during the sampling days.

Three days of 24-hours food recall, performed in non-consecutive days; two days on the weekday, and one day on the weekend (Sunday), to measure nutrients intake, including energy, carbohydrate, protein, fat, and iron, were executed. Nutrients intake was calculated using Nutrisurvey® with Indonesian foods databases. After that, it was compared to the RDI and multiplied with 100% to calculate the daily percentage of nutrients intake per day.

Food frequency questionnaire (FFQ) was applied for two times with 2 months differ, to measure the frequent of ten-highest iron sources consumed. To calculate the score, eight-scale of FFQ was used, which were never (0), 1x/month (1), 2-3x/month (2), 1-2x/week (3), 3-4x/week (4), 5-6x/week (5), 1x/day (6), and ≥1x/day (7). After that, food score was measured by multiplied the actual score of iron sources with iron content for each source then divided with the highest score (7). Ten-highest iron sources were selected. Finally, to divide into two parameters, we used mean if the data were normally distributed, or median if data were not normally distributed. Calculated score were categorized into not frequent if less than mean or median and frequent if the score was more than equal to mean or median.

Socio-economic data were obtained from direct interview with respondents, except family expenses which gained from respondent's parent by requesting respondents to ask their parent directly. Education was divided into greater than or equal 9 years and less than 9 years. Working status for father was distributed into formal and informal, where formal refers to working in government institutions and big companies with job security and paid monthly as well as paying taxes, meanwhile informal means self-employed workers, and workers who get paid at small business with no job security and pay no taxes (Bird & Manning, 2002; Perkins, et al., 2001). Mother working status was allocated into working and no working. Parent's income was calculated by adding mother income, if mother were gained money, to father income. Then, based on Pandeglang income per capita, it was categorized into <1.5 million Indonesian Rupiah and ≥1.5 million Indonesian Rupiah. Lastly, family spending was divided into two categories, which were <1.5 million Indonesian Rupiah and ≥1.5 million Indonesian Rupiah.

A standard questionnaire with some modification in this study was used (Soraya, 2013). Twenty questions were asked to measure the knowledge about anemia, which was the definition, type and caused of anemia as well as its effects on health. In this study, answer was scored as 1 if the answer was correct and 0 if incorrect. Knowledge about anemia, then, was scored according to mathematical formula, which was total score of right answers divided by total score (20) and multiplied with 100 (Soraya, 2013).

Descriptive analysis was performed for univariate data such as age, BMI/age z-score, iron intake, and % RDI. In addition, respondent's frequency was presented based on age, nutrition status, snacking habits, parents' education, occupation, income, and spending category. Due to iron intake data were not normally distributed, bivariate analysis between iron intake and parent's education, occupation, income, as well as spending was accomplished using Mann Whitney (Dahlan, 2011). In addition, Spearman rank test was used for analyzing the correlation between iron intake

and the ten-highest iron sources ingested as well as knowledge about anemia. P-values of <0.05 were considered significant. All results are presented as mean ± standard deviation (SD). Ethical clearance from Faculty of Medicine, Universitas Indonesia was obtained with approval number 1028/UN2. F1/Etik/2018.

RESULTS AND DISCUSSION

Sixty-one respondent was attended in all of data collection and analyzed for descriptive and bivariate analysis (mean age 15.77 ± 1.07 years old) and BMI/Age z-score -0.28 ± 0.84. Fortynine point two percent was aged from 13 to 15 years old and 50.8% was between 16 and 18 years old (Table 1). Nutrition status was divided into 2 categories, which were normal (58 respondents, 95.1%) and overweight (3 respondents, 4.9%). Education level was obtained; showing higher level of education (≥ 9 years) was 25 (41%) and 19 (31%) respondents, for father and mother respectively. Furthermore, it was found that 8 respondent's father (13.1%) working formal in the office, and 53 subject's father (86.9%) employing informal (Table 1).

Average energy intake was 1367.4 ± 243.1 kcal, whereas carbohydrate consumption was 196.7± 37.2 g. In addition, average protein intake was 42.5± 10.9 g and fat consumption was 46.4 ± 13.3 g (Table 2). Table 4 shows the percentage of recommended dietary allowance, which revealed for energy 64.3±11.4%, carbohydrate 67.4±12.8%, protein 66.9±18.3%, and fat 65.3±18.7%.

Study were focusing on iron intake, which is one of the main factors to prevent anemia (Permaesih & Herman, 2005). The result showed that average iron intake in this study was observed 8.11 ± 2.94 mg/day (ranging from 3.01 to 20.43 mg/day) (Table 2) and % iron RDI was pointed out 31.18 ± 11.32% (between 11.58 and 78.58 %) (Table 3). Previous study revealed a higher result, which were 18,3+30,43 mg/day (Kirana, 2011), 11.3 ± 1.75 mg/day (Cendani & Murbawani, 2011), and 10.4 ± 4.02 mg/day (Adhisti & Puruhita, 2011). This result might explain why Banten Province had a higher of anemia prevalence, which was more than 50% (Prihatini et al., 2009). Therefore, to support effort to lower prevalence of reproductive women, it requires a thorough and detail planning from Government to increase iron consumption, applying a supplementation such as iron tablet (Indonesian Ministry of Health, 2014b; World Health Organization, 2001) or exploiting the food diversity for iron sources (Indonesian Ministry of Health, 2014a; World Health Organization, 2001).

Food pattern provides a description regarding frequency, and variety of food consumed. Indonesian Ministry of Health (2014a) has issued policy for society to consume foods from diverse sources of animals and plants foods as iron resources. However, as seen in Table 5, when ten-highest high-iron foods consumed was divided into

Table 1. Respondent frequency based on the age, and nutritional status

Parameters	Categories	Frequency (n)	(%)
Age	13-15 years old	30	49.2
	16-18 years old	31	50.8
Nutritional status*	Normal	58	95.1
	Overweight	3	4.9
Parental Education			
Paternal education	< 9 years	36	59
	≥ 9 years	25	41
Maternal education	< 9 years	42	68.9
	≥ 9 years	19	31.1
Working Status			
Father	Formal	8	13.1
	Informal	53	86.9
Mother	Working	14	23
	Not working	47	77
Income/month	< 1.5 million IDR	21	34.4
	≥ 1.5 million IDR	40	65.6
Expenses/month	< 1.5 million IDR	32	52.5
	≥ 1.5 million IDR	29	47.7

Note *) : Nutritional status was categorized using children's anthropometry standards for BMI/age where normal is between – 2 SD and + 1 SD and overweight is ranging from +1 SD to + 2 SD (Indonesian Ministry of Health, 2020)

Table 2. Descriptive analysis of nutrient intake, calculated with 24 hour food recall

	Mean	SD	Minimum	Maximum
Calories (kcal)	1367.4	243.1	723.3	1887.7
Carbohydrate (g)	196.7	37.2	103.6	274.1
Protein (g)	42.5	10.9	21.5	86.3
Fat (g)	46.4	13.3	14.0	82.0
Iron (mg)	8.1	2.9	3.0	20.4

Table 3. Descriptive analysis of Indonesian recommended dietary allowance percentage

	Mean	SD	Minimum	Maximum
Calories	64.3	11.4	34.0	88.8
Carbohydrate	67.4	12.8	35.5	93.9
Protein	66.9	18.3	36.5	146.2
Fat	65.3	18.7	19.7	115.5
Iron	31.2	11.3	11.6	78.6

Table 4. Frequency of ten-highest high-iron foods consumed

Foods	Category	Frequency	(%)
Oncom	Frequent	9	14.7
	Infrequent	52	85.3
Chicken's Liver	Frequent	23	37.7
	Infrequent	38	62.3
Tempeh	Frequent	53	86.9
	Infrequent	8	13.1
Noodles	Frequent	32	52.5
	Infrequent	29	47.5
Long bean	Frequent	24	39.3
	Infrequent	37	60.7
Chicken Egg	Frequent	33	54.1
	Infrequent	28	45.9
Mung Bean	Frequent	29	47.5
	Infrequent	32	52.5
Tofu	Frequent	36	59.0
	Infrequent	25	41.0
Shrimp	Frequent	21	34.4
	Infrequent	40	65.6
Anchovy	Frequent	30	49.2
	Infrequent	31	50.8

frequent and infrequent (Table 4), tempeh and tofu was the two-most consumed foods by respondents, resulting 86.9% and 59%, respectively. Egg became the third eaten food, which was around 54.1% respondents. Furthermore, the last food that correspondent to more than 50% frequency was instant noodles. Except above mentioned foods were calculated less than 50%, which were *oncom*, chicken's liver, long bean, mung bean, shrimp and anchovy.

Looking at the data regarding ten-highest high-iron foods consumed, the two-most frequent iron consumed foods came from plants sources, which was tempeh and tofu. One study highlighted that there was a link between land ownership and house-hold food security (Tanziha & Herdiana, 2009). Therefore, because of living in rural region, plants sources, which are easy to access and free, become the most frequent consumed of iron foods to fulfill the iron requirement. This source was known to have lower bioavailability compared with animal foods (Tatala et al., 1998).

One of animal iron sources, which consumed more than 50%, was eggs. However, eggs only provide around 3 mg/100 g, which is not an adequate source of iron. This pattern, revealing a higher intake of plant sources with lower amount of iron, at the end, might contribute to anemia (Collings, et al., 2013; Prihatini, et al., 2009; Tatala, et al., 1998). The low consumption of animal iron food can be fully understood because the price is higher than other types of food. Therefore, food access to consume animal iron sources is also affected due to low power of purchasing (Bindon & Vitzthum, 2002).

Table 6 shows that parents education, both father and mother, did not influence iron consumption (8.41±3.54 vs 7.67 ±1.75, and 8.35 ± 3.22 vs 7.57 ± 2.19, respectively for < 9 years and ≥ 9 years, $p > 0{,}05$). There was a contradictory result between our finding and previous studies, which could establish a significant relation of parents education to iron intake (Basith, et al., 2017; Choi, et al., 2011; Farida, et al, 2014; Rahayu & Dieny, 2012). In a reviewed publication, it turns out that parents education might be a contributing factor to iron intake (Nguyen, et al., 2015), which noted that the higher education the higher prospect to have a better nutrition knowledge, resulting to present an improvement of nutrient intake quality and quantity. However, one study found similar results, which could not observe a difference between iron intake and parents education (Choi, et al., 2011).

Although almost adolescent girls in this study live with their parents, there is a phenomenon where they are more independent in choosing amount and kind of foods. For example, studies found that more than 50% adolescent girls did not have breakfast (Hermina, et al., 2009; Kalsum & Halim, 2016). In addition, adolescent girls tend to perform a poor food pattern habit, which showed by a study in Bukit Tinggi where 60% of adolescent girls practice that model (Santy, 2006).

Table 5. Coefficient correlation between iron intake and ten-highest iron sources consumed

Foods	Coefficients	p-value
Oncom	0.07	0.58
Chicken's Liver	-0.05	0.73
Tempeh	-0.04	0.76
Noodles	0.09	0.51
Long bean	0.08	0.55
Chicken Egg	-0.09	0.49
Mung Bean	0.05	0.72
Tofu	0.09	0.51
Shrimp	-0.15	0.25
Anchovy	0.02	0.89

Father's employment significantly affected iron intake, showing an consumption 8.40±2.99 mg/day and 6.20±1.72 mg/day for informal and formal working, respectively ($p < 0,05$) (Table 6). This result indicates that father's employment in informal sector allows beneficial part on choosing and determining iron intake. This research was conducted in rural areas where most of father's work was informal (87%). Therefore, in this study, it can be hypothesized that role of fathers for choosing the quantity, type and quality of foods for households will be greater due to having more available time to communicate and interact with mothers. However, in the society particularly in Indonesia, the role for choosing ingredients and foods typically is done by mothers, where they dominantly buy and cook for the whole family (Astuti, 2013; Putri & Kusbaryanto, 2012). Interestingly, working status for mother, whether they were working or not, did not influence iron intake 7.11 ± 1.18 mg/day and 8.41 ± 3.24 mg/day, respectively for working and not working mother ($p > 0,05$) (Table 6).

Table 6. Iron intake based on family socio-economic

Socio-economic parameters		Iron intake (mg/day)			p-value
		n	Mean	SD	
Education					
Father	< 9 years	36	8.41	3.54	0.730
	≥ 9 years	25	7.67	1.75	
Mother	< 9 years	42	8.35	3.22	0.640
	≥ 9 years	19	7.57	2.19	
Working status					
Father	Formal	8	6.20	1.72	0.033*
	Informal	53	8.40	2.99	
Mother	Working	14	7.11	1.18	0.123
	Not working	47	8.41	3.24	
Family income	< 1.5 million IDR	21	8.33	3.53	0.721
	≥ 1.5 million IDR	40	7.99	2.63	
Spending	< 1.5 million IDR	32	8.21	3.06	0.828
	≥ 1.5 million IDR	29	7.99	2.85	

* shows a significant difference ($p < 0.05$)

This research also obtained a result showing that there was no significant difference between iron intake, family salary and spending ($p > 0,05$) (Table 7). In our study, we could not find significant difference between salary income and iron intake. It is possibility due to the location of the study, which was in rural region, which mostly still have larger land for farming. In Lebak, a study found that there was a positive correlation between land ownership and house-hold food security (Tanziha & Herdiana, 2009). This implies that the more land they owned, the greater the chance of achieving household food security. In contrast, study by Rahayu dan Dieny (2012) found a relation of family income and expenditure to iron consumption in Tangerang Selatan city. The higher family income and spending for foods, the higher iron intake. Other studies in India and The Netherland also signified the effect of family income and spending on iron intake (Bharati, et al., 2004; Hulshof, et al., 2003). All of those factors contribute to family privilege to select nutrient

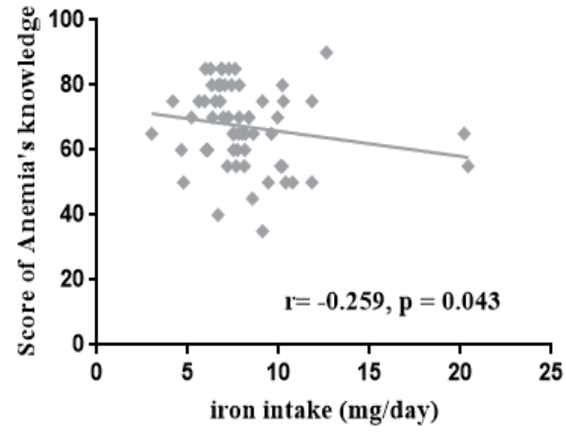

Figure 1. Correlation between score of knowledge about anemia and iron intake (mg/day)

intake specifically on quality and quantity (Nguyen et al., 2015; World Health Organization, 2001).

Our result showed that average score of knowledge about anemia was 67.3 ± 12.47. Anemia knowledge were measured gained information regarding anemia specifically definition, type and caused of anemia as well as its effects on health. Studies revealed that knowledge is significantly motivated pregnant mother to consume iron supplementation tablet (Nora, 2012; Puspitaningrum & Fratika, 2014). However, this study found that there was a negative correlation between iron intake and knowledge about anemia (r=-0.259, p=0.043). Explanation of what influencing factors on iron intake might be important. Since respondents were still adolescent, it is quite-obvious that the preference of foods for their daily meals is influenced by their parents, who are choosing and providing most of the consumed foods. In addition, there is a tendency where adolescent girls aim to have an ideal body image (Denich & Ifdil, 2015; Widianti & Candra, 2012), which causes them to perform a diet such as no breakfast (Hermina, et al., 2009; Kalsum & Halim, 2016; Saufika, et al., 2012). In addition, adolescent girls have irregular eating patterns (Jafar, 2012). Both reasons could contribute to reduce their nutritional intake, including macro and micro nutrients. Moreover, intervention by giving nutrition education to adolescent girls also did not affect to a better result on nutrient intake, including iron (Silalahi, et al., 2016).

CONCLUSION

Mean of iron intake in adolescent girls was around 8 mg/day or 31% of recommended dietary intake (RDI). This study found that socio-economic factor did not influence iron intake, except for employment status of father, which showed a higher intake when father works in informal sector compared to formal sector. Iron intake was negatively correlated with knowledge about anemia, showing a lower intake of iron for higher knowledge about anemia. Therefore, adolescent girls require to diverse the source of their iron daily intake, by choosing high-iron foods and animal sources of iron such as liver from chicken or cow, red meat, and other high sources of iron, as well as complying national program of iron supplementation, which might adequately supply iron needs.

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HOUSEHOLD FOOD INSECURITY IS ASSOCIATED WITH BINGE EATING DISORDER AMONG ADOLESCENT IN SEMAMPIR DISTRICT, SURABAYA, INDONESIA

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ABSTRACT

Teenage phase is a critical period of psychosocial development. Adolescent eating patterns are formed in this phase. Household food security is among factors which may influence eating pattern. Adolescent who are exposed to food insecure condition tend to experience stress, which one of the coping mechanisms is overeating and may develop binge eating disorder. The purpose of this study is to analyze association between household food security status and binge eating disorder in adolescent. This case control study involved 74 adolescents aged 16-18 years and their parents in Semampir District, Surabaya, Indonesia who were selected randomly using simple random sampling. Household food security was assessed by using the Household Food Insecurity Access Scale (HFIAS) and binge eating disorder is assessed by using Eating Disorder Diagnostic Scale (EDDS). The association between household food security and binge eating disorder was analyzed by Spearman's correlation test. There was an association between food security status (p = 0,001) and binge eating disorder. Further analysis showed that adolescents at risk of food insecurity were 5,625 times more likely to experience a binge eating disorder. This study recommends to increase food security through economic empowerment of housewives and socialization about coping strategy for both parent and adolescent.

Keywords: binge eating, eating disorder, food security, adolescent

INTRODUCTION

Binge Eating Disorder (BED) is an eating disorder characterized by consuming large amounts of food in a relatively short time accompanied by an inability to control the amount of food consumed and followed by feelings of guilt, shame and disgust (APA, 2013). Dietary disorders are a serious threat and represent a huge burden of health problems due to their potential long-term health problems. The effects of eating disorders vary, ranging from low body mass index, mental health disorders, changes in menstrual function, infertility, and complications during pregnancy such as low birth weight and gestational diabetes (O 'Brian et al., 2017).

Symptoms of eating disorders that consistently limit food can trigger to binge eating and overeating as much as 17% from long-term food insecurity (Becker et al., 2017). While food insecure occurs, adolescents feel worse because they have lower self-esteem (Popkin et al., 2016). Micali, et al. (2014) study showed that among food insecure adolescents, 29% had health problems, 26% had social interaction problems, 22% were hyperactive and 20% had problems with social groups. This is thought to occur due to a period of brain development which resulted in suboptimal nutrition and increased psychological stress. The peak of eating disorders is at the age of 15 to 19 years.

The Economist Intelligence Unit states in the 2018 Global Food Security Index that Indonesia is ranked 65th out of 113 countries, with a score of 54.8 from a maximum value of 100 (EIU, 2018). Food insecurity can lead to obesity because energy-dense foods are cheaper than nutrient-dense foods (Tester et al., 2016).

Food insecurity is closely related to poverty. One of the areas with the highest number of poor people in the Surabaya based on the aspects of work, food and housing is Semampir District as evidenced by 55% pre-prosperous family cards II [*Kartu Keluarga Pra-Sejahtera II*] (Belinda and Rahmawati, 2017; Normanda and Rahmawati, 2013). This statement is supported by Setijaningrum (2017) which states that 60.41% of the population in Semampir District are poor and Jayarni (2018) with 54.9% of households in

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Semampir District are in a food insecure condition accompanied by moderate hunger. This study aims to analyze the relationship between household food security and binge eating disorder among adolescents in Semampir District, Surabaya, Indonesia.

METHODS

This was an observational study used a case control design with a case group was adolescents with Binge Eating Disorder (BED) and a control group was adolescents without BED. The adolescent population is all active students in 10th and 11th grade, SMAN 8 Surabaya and Al Irsyad Private High School Surabaya. The inclusion criteria in this study were adolescents who lived in Semampir District at the time of data collection. Meanwhile, the exclusion criteria included students who were dieting, sick or suffering from certain diseases, and height or weight could not be measured.

Samples were taken using simple random sampling technique by first screening using the Eating Disorder Diagnostic Scale (EDDS) instrument. The sample sizes were 37 in each of case and control groups. Adolescents were randomly selected if they met the inclusion requirements and were willing to be interviewed. Then BED adolescents and parents became the sample case group and non-BED adolescents and parents became the control group sample. In this study, matching was not performed due to the limited number of case populations.

Household food security status was assessed using the Household Food Insecurity Access Scale (HFIAS) instrument. In addition, the variables studied were the characteristics of adolescents and adolescent families including age, gender, amount of pocket money, parent's occupation, family economic status and number of family members.

The inferential statistics used was Spearman correlation test to see the relationship between household food security and BED in adolescents and said to be related if $p < 0.05$.

Table 1. Age Descriptive Data

	Min	Max	Median
Case	15	17	16
Control	15	18	16

RESULTS AND DISCUSSION

Respondent Characteristics

Table 1 shows that the majority of adolescents in both groups (59.5% in BED adolescents and 56.8% in non-BED adolescents) were 16 years old. According to Brown (2013), this age is included in the middle adolescent phase from the ages of 15-17 years. Research by Allen et al. (2013) showed that 44% of adolescents experience eating disorders at the ages of 17 and 20.

The gender of respondents was mostly girls (86.5% in BED adolescents and 59.5% in non-BED adolescents). BED is more often seen as an eating disorder associated with girls, while boys are reluctant to admit that the BED phase is a problem (Lee-Winn et al., 2016). The distribution of the amount of allowance was mostly <IDR 10,000 (32.4% for BED adolescents and 67.6% for non-BED adolescents).

Most family heads work as laborers (27% for BED adolescents and 35.1% for non-BED adolescents). Heads of poor households in urban areas are closely related to low education and tend to work as laborers or employees or employees or others (BPS, 2015).

Teenage mothers were mostly unemployed (54.1% in BED adolescents and 48.6% in non-BED adolescents). Based on research conducted by Zulaiha (2018), working housewives have an influence on household food security. With the presence of family members who work, in this case a mother is expected to be able to help her husband meet the needs of the family, whether it is food, shelter, education or family support facilities. Therefore, by looking for additional income, housewives can help their husbands.

Household income for BED adolescents is mostly ≤Rp 3,000,000 with a total of 15 household (40.5%). While the household income of non-BED adolescents is mostly >Rp. 6,000,000 with a total of 12 household (32.4%). Food insecurity and family income are so closely related that poor families are 3 times more vulnerable to experiencing food insecurity than others (Nord

Table 2. Distribution of Respondent Characteristics

Variable	Case (n=37)		Control (n=37)		Total (N=74)		p-value
	n	%	n	%	N	%	
Age							
15	8	21.6	9	24.3	17	23.0	0.820
16	22	59.5	21	56.8	43	58.1	
17	7	18.9	6	16.2	13	17.6	
18	0	0	1	2.7	1	1.4	
Sex							
Boys	5	13.5	15	40.5	20	27.0	0.008
Girls	32	86.5	22	59.5	54	73.0	
Pocket money							
<Rp 10.000	12	32.4	25	67.6	37	50.0	0.052
Rp 10.000 - Rp 15.000	8	21.6	3	8.1	11	14.9	
Rp 15.000 - Rp 20.000	11	29.7	5	13.5	16	21.6	
> Rp 20.000	6	16.2	4	10.8	10	13.5	
Father's occupation							
Not working	7	18.9	1	2.7	8	10.8	0.359
Freelance	8	21.6	5	13.5	13	17.6	
Trader	5	13.5	10	27.0	15	20.3	
Labor	10	27.0	13	35.1	23	31.1	
Govt employee	3	8.1	1	2.7	4	5.4	
Army/Policeman	4	10.8	7	18.9	11	14.9	
Mother's occupation							
Not working	20	54.1	18	48.6	38	51.4	0.432
Freelance	4	10.8	4	10.8	8	10.8	
Trader	2	5.4	7	18.9	9	12.2	
Labor	6	16.2	1	2.7	7	9.5	
Govt employee	5	13.5	7	18.9	12	16.2	
Army/Policeman	0	0.0	0	0.0	0	0.0	
Household income							
≤Rp 3.000.000	15	40.5	11	29.7	26	35.1	0.009
>Rp3.000.000-≤Rp 5.000.000	12	32.4	5	13.5	17	23.0	
>Rp5.000.000-≤Rp6.000.000	5	13.5	9	24.3	14	18.9	
>Rp 6.000.0000	5	13.5	12	32.4	17	23.0	
Family number							
≤4	12	32.4	11	29.7	23	31.1	0.805
>4	25	67.6	26	70.3	51	69,.6	

Table 3. Results of Multivariate Analysis of Respondent Characteristics

Variable	Phase 1	Phase 2	Phase 3	Phase 4
Gender	5.77 (1.55-21.44)*	5.33 (1.42-19.8)*	5.52 (1.48-20.51)*	
Pocket money	4.43 (1.33-14.7)*		4.26 (1.27-14.14)*	4.02 (1.20-13.36)*
Household income	0.18 (0.05-0.58)*	0.19 (0.05-0.61)*		0.20 (0.05-0.63)*

*$p < 0.05$

and Hopwood, 2008). Sharp price increases for some basic commodities can cause food insecurity, especially in households with incomes near the poverty line, so government policies must help create jobs and stabilize prices (Yadegari et al., 2017).

The family member is mostly more than 4 (67.6% in BED adolescents and 70.3% in non-BED adolescents). Sharafkhani et al. (2010) revealed that food insecure household conditions were not related to the number of children. However, the presence of toddlers and elderly among family members can increase the risk of food insecurity. Financial support and nutrition education programs can reduce the risk of household food insecurity.

The variables included in the multivariate analysis were gender, amount of pocket money and household income. Parents' occupation, age and number of family members were not included in the analysis because they did not qualify the requirement to enter multivariate analysis. Table 3 shows that these three factors are not a confounding factor, because they meet the requirements with a p-value <0.05 and do not cause a change > 10% of the OR value.

The Relationship between Household Food Security and Binge Eating Disorder

Based on Table 4, the food security variables are categorized into two, i.e., food resistance and food insecurity. Food insecure households were 5.625 times more likely to experience BED than food resistant households (p = 0.001). In line with the findings of Bruening et al. (2012) and Becker et al., (2017), the prevalence of BED is higher in insecure conditions than individuals who are in food secure conditions. Due to uncertain food availability, physiological and psychological hunger can increase the likelihood of binge eating (West et al., 2019). Olson et al. (2007) also found a cycle of limitations and overeating in food insecure households, where when a family is able to get food, binge eating will occur. Meanwhile, when there is not enough food, parents will tend to limit the food consumed (Castner and Henke, 2011).

Eating disorders can occur in all individuals of all ages. In adolescents, the increased prevalence of BED can occur in early adolescence and late adolescence. Smink et al. (2014) study explained that BED occurs immediately after puberty, with a mean age of 14 years. While study of Stice et al. (2013) among female subjects revealed that BED occurred in late adolescence between 18 to 20 years of age. This is supported by the research of Brewerton et al. (2014) which also among female subjects who were divided into two categories; adolescents <18 years and adults ≥18 years, showing that BED in adults (70% experienced BED for the first time in adults, with mean age 27.7 years with an age range of 16.7 - 38.7 years) twice as common as adolescents (30% experienced BED for the first time during the transition from children to adolescents with a mean age of 13.9 years from the age range 11.1 – 16.7 years).

Mitchison et al. (2014) found that the prevalence of BED in respondents who were below the median value of household income was higher than those who were above the median household income. The existence of a food restriction pattern and binge eating are a cycle that is often experienced by many individuals with low income (Rasmusson et al., 2019). Adolescents from low socioeconomic origin with food insecurity and not having enough food tend to have similarities to dietary restriction behavior and are believed to encourage binge eating behavior. Also, low socioeconomic conditions allow adolescents to be more exposed to stressful environments (West et al., 2019).

Table 4. The Relationship between Household Food Security and Binge Eating Disorder

Variable	Case (n=37)		Control (n=37)		Total (N=37)		p-value	OR	95% CI	
	n	%	n	%	n	%			Lower	Upper
Food secure	10	27.0	25	67.6	35	47.3	0.001	5.625	2.069	15.292
Mildly food insecure	7	19.0	3	8.1	10	13.5				
Moderately food insecure	10	27.0	6	16.2	16	21.6				
Severely food insecure	10	27.0	3	8.1	13	17.6				

Food insecure households tended to be more associated with the incidence of BED. This research supports the theory that food insecurity can also have an impact on the risk of developing BED, which is conceptualized in a cycle of limitations and overeating, both when externally limited such as financial difficulties and internally such as limiting food to reduce body weight (Fairburn, 2013).

Adolescents in food insecure household have a higher rate of mental health problems (Salvo et al., 2016). The experience of not having adequate access to food often leads to feelings of anxiety, stress and depression, which in turn can lead to behaviors that increase the risk of obesity. These behaviors include binging or overeating when food is available or choosing energy-dense foods rich in sugar, salt and fat. These foods have physiological effects that can suppress stress in the short term (FAO, 2018).

Stress is a challenge to the natural homeostasis of an organism, so that at some point, the organism can react to stress by providing a physiological response to regain the balance lost due to the impact of these stressors. One of the disturbed homeostatic conditions is eating behavior (Yau and Potenza, 2013). Chronic stress is associated with BED because it affects biochemical pathways that negatively impact appetite and eating behavior (Sojcher et al., 2012). Stress can occur emotionally and physiologically. Emotionally includes interpersonal conflicts, loss of loved ones, dismissal, and so on. Meanwhile, physiologically includes lack of food, disease, and rehabilitation from narcotics (Fragkos and Farngos, 2013).

CONCLUSION

Household food insecurity is associated with binge eating disorder. Binge Eating Disorder adolescents are often found in food insecure households. Binge eating is a coping mechanism in dealing with stress in food insecure household conditions.

Increasing household food security needs to be done through increasing productivity by empowering the economy of housewives. Further research on a history of eating disorders is also necessary because binge eating can also be triggered by Anorexia Nervosa. In addition, it is necessary to increase adolescent knowledge about stress coping strategies in overcoming food insecurity conditions.

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SLEEP DURATION AND METABOLIC SYNDROME IN OBESE ADOLESCENTS

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ABSTRACT

Shorter sleep duration is a risk factor for obesity and metabolic syndrome. Previous studies conducted on different races showed inconsistent results. The purpose of this study was to analyze the differences in sleep duration in obese adolescents who suffer from metabolic syndrome compared with obese adolescents who do not suffer from metabolic syndrome. A cross sectional study was carried out on 59 obese adolescents who visited the Pediatric Nutrition and Metabolic Disease Clinic in Dr. Soetomo General Academic Hospital, Surabaya. Subjects were selected using total sampling techniques who met the inclusion and exclusion criteria in August-November 2018. Anthropometry (weight, height and waist circumference), blood pressure, and blood tests (HDL cholesterol levels, triglycerides, and fasting blood glucose levels) were held to determine obesity according to CDC 2000 and metabolic syndrome according to International Diabetes Federation. The difference in sleep duration in obese adolescents suffering from metabolic syndrome and without metabolic syndrome analyzed using Chi square test. A total of 27 subjects (45.8%) suffered from metabolic syndrome. Most obese adolescents (57,6%) have sufficient sleep duration (≥ 8 hours/day). There was no sleep duration differences in obese adolescents suffering and not suffering from metabolic syndrome (p> 0.05).

Keywords: Obesity, Sleep Duration, Metabolic Syndrome, Adolescents

INTRODUCTION

Obesity is a global health problem today in all ages. The incidence of obesity in adolescents is increasing and it causes metabolic syndrome. The incidence of obesity increases with the lack of sleep duration in adolescents (Seo & Shim, 2019).

Metabolic syndrome is a collection of metabolic disorders consisting of several criteria based on the International Diabetes Federation (2007) including waist circumference ≥ 90 percentiles for age and sex accompanied by 2 of the following criteria: (a) fasting triglyceride levels ≥ 150 mg / dL, (b) fasting HDL cholesterol levels <40 mg / dL, (c) systolic or diastolic blood pressure ≥ 90 percentile, and (d) fasting blood glucose levels ≥ 100 mg / dL (Zimmet, et al., 2007). Pro-inflammatory cytokines that are increased in obesity cause metabolic syndrome (Rochlani, et al., 2017). The prevalence of metabolic syndrome in obese adolescents is 5.5% in males and 3.3% in females (Seo & Shim, 2019).

The duration of sleep for each individual is different, according to age. The sleep duration of a child is different from that of adolescents and adults. Adolescents aged 14-17 years are recommended to have sleep duration of 8-10 hours/day. While sleep duration of 7-9 hours/day is recommended for adults. Sleep duration is a matter of concern today because it is related to health (Ju & Choi, 2013).

The decrease in sleep duration and quality is currently an endemic problem (Van Cauter, et al., 2008). Sleep duration that was too short or too long was associated with health complications. Studies suggest that waist circumference that is more than normal was associated with less and more sleep duration. Sleep duration> 10 hours/day was associated with waist circumference and abnormalities of fasting cholesterol, triglyceride, and blood glucose levels (Kim, et al., 2018). The risk of suffering from metabolic syndrome was greater in adolescents with less sleep duration (Hemati, et al., 2018).

The effect of sleep duration on health has been widely studied in adult subjects, such as the incidence of cardiovascular disease (Magee, et al., 2012). Insufficient sleep duration also increased mortality in cardiovascular disease, diabetes, hypertension, and obesity (Itani et al., 2017).

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Research on sleep duration with metabolic syndrome in obese adolescents is still limited. Previous studies on sleep duration have categorized different hours/days of sleep duration. Studies in adolescents have shown an association between sleep duration and metabolic syndrome (Hemati, et al., 2018), but other studies have shown no association (Sung, et al., 2011). This study aimed to analyze the differences in sleep duration between obese adolescents who suffer from metabolic syndrome or not.

METHODS

This cross sectional study was conducted on obese adolescents who visited the Children's Nutrition and Metabolic Disease Clinic Dr. Soetomo, Surabaya. Subjects aged 13-16 years were taken using a total sampling technique that met the inclusion and exclusion criteria. The inclusion criteria in this study included adolescents aged 13-16 years, able to understand Indonesian, and having parents who signed their readiness to participate in the study. Obese adolescents who suffer from secondary obesity, suffer from endocrine disorders, receive hormonal therapy, smoke, and consume alcohol were excluded in this study. A total of 59 obese adolescents visited the Children's Nutrition and Metabolic Disease Clinic Dr. Soetomo in August - November 2018 who met the inclusion and exclusion criteria were recruited into the study.

Obesity was classified based on CDC 2000. Subjects were obese if the BMI for Age (BMI/A) was above 95th percentile according to age and sex. Subjects suffer from metabolic syndrome if the criteria for metabolic syndrome were obtained according to the International Diabetes Federation (2007) including waist circumference ≥ 90 percentiles for age and gender accompanied by 2 of the following criteria: (a) fasting triglyceride levels ≥150 mg/dL, (b) cholesterol levels Fasting HDL <40 mg/dL, (c) systolic or diastolic blood pressure ≥90 percentile, and (d) fasting blood glucose levels ≥100 mg/dL (Zimmet et al., 2007).

Sleep duration data were obtained through direct interviews. Subjects were asked to report their sleep and waking hours every day for the past three days. Sleep duration is less if the sleep duration is <8 hours a day (Garaulet, et al., 2011a).

Physical examination of the subjects consisted of anthropometric measurements and blood pressure checks. Anthropometric measurements carried out on subjects included body weight, height and waist circumference. Measurement of body weight was carried out using a digital scale scale (Seca, Germany No ref. 224 1714009) with an accuracy of 0.1 kg. Height measurements are carried out using a stadiometer (Seca, Germany No ref. 224 1714009). Height is measured in cm with an accuracy of 0.1 cm. Waist circumference was measured to determine central obesity using metlin (OneMed, Indonesia) which has an accuracy of 0.1 cm from the midpoint between the apex of the superior iliac crest and the last rib at the end of expiration expressed in units of cm. Subjects suffered from central obesity if a waist circumference was ≥ 90 percentile according to age and sex.

Blood pressure checks were performed using a digital blood pressure measuring device (OneMed, Indonesia). Blood pressure checks were performed on the subject in a sitting position after the subject had rested for 10 minutes.

Blood sampling was conducted at 08.00-09.00 am after the subjects had fasted for 12 hours through the median cubital vein. Ten cc of blood was drawn. HDL cholesterol examination was carried out with the HDL-Cholesterol Kit, namely Cholestest® HDL (Sekisui Medical Co., Ltd., Japan) using the TMS Premium 24i tool. Triglyceride examination was carried out with Autosera S TG-N (Sekisui Medical Co., Ltd., Japan) using the TMS Premium 24i tool. Checking fasting blood glucose levels was carried out using glucose hexokinase reagent FS (DiaSys Diagnostic System, Germany) using the TMS Premium 24i tool.

Sleep duration in subjects was described as means and standard deviation. Differences in sleep duration among obese adolescents with or without metabolic syndrome was analyzed by Chi square test using SPSS version 21.0. The study was conducted after obtaining permission from the ethics committee at RSUD Dr. Soetomo, Surabaya (No. 0411/KEPK/VII/2018). Prior to the study, parents were explained about the study to obtain

informed consent. After the informed consent is signed, the research is carried out on the subject.

RESULT AND DISCUSSION

In this study, 59 subjects aged 13-16 years were found. A total of 45.8% had metabolic syndrome and 54.2% had no metabolic syndrome (Table 1). Most of the obese adolescents (96.6%) suffer from central obesity. A total of 22.1% of subjects had triglyceride levels ≥150 mg / dL. A total of 32.2% of subjects had HDL cholesterol levels <40 mg / dL. As many as 59.3% of subjects had systolic or diastolic blood pressure ≥90 percentile, and 3.4% of subjects had fasting blood glucose levels ≥ 100 mg / dL. Subjects suffering from obesity based on BMI/A above 95 percentile according to age and sex.

Metabolic syndrome criteria according to the International Diabetes Federation (2007) include waist circumference ≥90 percentile for age and sex accompanied by 2 of the following criteria: (a) fasting triglyceride levels ≥150 mg / dL, (b) fasting HDL cholesterol levels <40 mg / dL, (c) systolic or diastolic blood pressure ≥ 90th percentile, and (d) fasting blood glucose level ≥100 mg / dL (Zimmet, et al., 2007).

The sleep duration of obese adolescents with metabolic syndrome was almost the same as those of obese adolescents who did not suffer from metabolic syndrome (<8 hours/day). Most (57.6%) obese adolescents had adequate sleep duration, namely ≥8 hours/day.

Table 1. Characteristics of Research Subjects

Variable	Metabolic Syndrome		Non Metabolic Syndrome	
	n	%	n	%
Gender				
Male	20	33.9	12	20.3
Female	7	11.9	20	33.9
Metabolic Syndrome Criteria				
Waist circumference ≥90 percentile	27	45.8	30	50.8
Triglyceride ≥150 mg/dL	8	13.6	5	8.5
HDL <40 mg/dL	15	25.4	4	6.8
Systolic or diastolic ≥ 90 persentil	24	40.7	11	18.6
Fasting blood glucose ≥100 mg/dL	2	3.4	0	0

Table 2. Differences in Sleep Duration in Obesity Subjects

Sleep Duration	Metabolic Syndrome		Non Metabolic Syndrome		p
	n	%	n	%	
<8 hours/day	10	16.9	15	25.4	0.45
≥8 hours/day	17	28.8	17	28.8	

There was no difference in sleep duration between obese adolescents with metabolic syndrome and those without metabolic syndrome (p = 0.446). Less sleep duration interferes with appetite regulation and glucose metabolism thereby increasing the risk of obesity (Van Cauter et al., 2008). Increased ghrelin and decreased leptin occur in individuals who have less sleep duration, thus increasing hunger and associated with increased consumption of high-calorie foods (Spiegel et al., 2004). Chronic lack of sleep duration affects adiposity in children which is associated with metabolic risk (Cespedes et al., 2014).

Metabolic syndrome is associated with poor sleep duration. Adolescents who slept <8 hours / day performed longer sedentary activities, such as watching television and consuming less fruit and vegetables than adolescents who had sleep duration ≥ 8 hours a day (Garaulet et al., 2011a). In this study, there was no difference in sleep duration between obese adolescents with or without metabolic syndrome (Table 2). This was in accordance with previous studies in obese adolescents, which states that sleep duration was not related to metabolic syndrome (Sung et al., 2011; Lee & Park, 2014).

Another study stated that the relationship between metabolic syndrome and sleep duration depended on the dose or duration of sleep (Iftikhar et al., 2015). Ethnic differences in subjects can have different effects on sleep duration and metabolic syndrome. Previous studies explaining the relationship between sleep duration and metabolic syndrome were mostly carried out in adolescents in European countries (Garaulet, et al., 2011b). Studies in Korea explained that there was no difference in metabolic syndrome in adolescents based on sleep duration (Seo & Shim, 2019).

This study had several limitations. Sleep duration was assessed based on the subject's perception, so that recall bias could occur. This study did not assess the duration of sleep on the subjects' school days and weekends so that the total sleep duration in one week in the subjects could be different. Blood examination of the subjects was carried out once. Serial blood tests are required to reduce the influence of the circadian rhythm and the random fluctuations of increasing or decreasing levels of fat or blood glucose.

CONCLUSION

There was no difference in sleep duration between obese adolescents with metabolic syndrome compared with obese adolescents without metabolic syndrome. Assessment of sleep duration at the subjects' school days and weekends in obese adolescents is needed to assess the association between sleep duration and the risk of metabolic syndrome.

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ACADEMIC STRESS IS ASSOCIATED WITH EMOTIONAL EATING BEHAVIOR AMONG ADOLESCENT

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ABSTRACT

Academic stress is one of the sources of stress factor among adolescent. Stress condition will trigger cortisol reaction process which associated with unhealthy eating behavior. Emotional eating is an eating behavior in response to stimulation of negative emotion. This study aims to analyze the association between academic stress with emotional eating behavior among adolescent at SMAN 6 Surabaya. This study used a cross sectional design. Samples were obtained using Cluster Random Sampling techniques with total sample of 133 people. Data were collected using the Educational Stress Scale for Adolescent (ESSA), Dutch Eating Behavior Questionnaire (DEBQ) and Food Frequency Questionnaire (FFQ). Kolmogorov-Smirnov was used to determine the normality of data obtained. Association between variables was analyzed using Spearman correlation. The results showed that 47,4% students experienced moderate academic stress and 51,1% of students experienced emotional eating. There was significant association between academic stress with emotional eating behavior (p=0.003). Emotional eating behavior was positively correlated with consumption of fast food or canned food, sweet food or cakes, dairy products and sweet beverages.

Keywords: emotional eating behavior, adolescent, academic stress

INTRODUCTION

Adolescence is a critical period of biological, emotional and psychological development, as well as social. During this period a person becomes an independent individual, forms new relationships, develops social skills, and learns behaviors that will last for the rest of life. This period can also be one of the most challenging (WHO, 2018). Teenagers are often faced with emotional and behavioral problems including anxiety, depression, self-harm and eating disorders (Murdoch Children's Research Institute, 2015). There are four sources of emotional problems in adolescents, namely intrapersonal, interpersonal, academic, and environmental. Compared to other sources of stress, sources of academic stress are the most significant in adolescents. Perceived stress such as lower scores than expectations, fear or anxiety facing exams, high workload in class, and too many lessons (Akande, et al., 2014).

Senior High School is an important stage for students, because it begins to determine the subject area as desired. The results of learning, i.e., values, become a factor of consideration in being able to be in the desired subject area. This makes adolescents under pressure to get grades as expected. In addition, there is also a feeling of pressure because they face difficulties in understanding subjects that are definitely more difficult and have broader content to study than junior high school students (Subramani and Kadhiravan, 2017; Sripongwiwat, et al., 2018). Conditions in which students are unable to face academic demands and perceive existing demands as distractions are the definition of academic stress (Sayekti, 2017). Subramani and Kadhiravan's (2017) research shows the results of academic stress and mental health are significantly correlated with each other.

In short term, stress triggers a decrease in appetite. The hypothalamus in the brain will give a message to the adrenal glands to pump the epinephrine hormone which helps trigger the body's response to delay eating (Harvard, 2018). However, if the stress condition continues or persists, adrenals will increase cortisol in the bloodstream which can trigger an increase in appetite (Finch and Tomiyama, 2015). Stress conditions are also associated with emotional eating and unhealthy eating patterns (Tahir, 2016). In addition, emotional eating behavior is also related to stress factors that come from academic performance (Kim and Kye, 2017). Emotional

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eating behavior is eating behavior in response to negative emotional stimulation. This is done as an effort to coping with negative emotions, but will have a dangerous impact on physical, emotional and self-esteem (NEDA, 2004). The physical impact that can be seen is the change in body weight which can affect the nutritional status of adolescents.

Nutritional status is an indicator that can be used to assess a person's health status. Nutritional status can be determined using the Body Mass Index (BMI) through height and weight. Research done by Purwanti, et al. (2017) found that the higher the level of stress, the higher the BMI value. A high BMI value from the normal category indicates that someone is over nutrition or overweight. Stress that occurs among adolescents can lead to the development of obesity, which is a worldwide public health problem in adulthood (Tajik, et al., 2016). Therefore, this study aims to analyze the relationship between academic stress and emotional eating behavior in adolescents at SMAN 6 Surabaya.

METHOD

This was an observational study using a cross sectional design. The research was conducted at SMAN 6 Surabaya in February-April 2019. Samples were obtained through cluster random sampling technique as many as 133 students. The total population was 614 students who were students in grades 10 and 11 aged 15-17 years with 308 students coming from grade 10 and 306 students from class 11. The total number of clusters in the study was 17 clusters. Then from several clusters randomly selected to be the research subjects or representatives of the population (Fig. 1). The inclusion criteria are adolescents aged 15-17 years, active students who attend SMAN 6 Surabaya and the exclusion criteria are adolescents who are on a diet, use assistive devices such as wheelchairs, or who cannot stand up to have their weight and height measured, as well as those who are sick or suffering from certain diseases.

The independent variable in this study is academic stress, while the dependent variable is emotional eating behavior and frequency of food consumption. Anthropometric measurements were carried out with the *Elitech*® digital bathroom scale with an accuracy of 0.1 to measure body weight and a stadiometer to measure height. The anthropometric data obtained were then analyzed using WHO *AnthroPlus*®, in order to obtain a z-score value to determine BMI / Age (Body Mass Index based on Age) for adolescents. The z-score was categorized according to the BMI / Age cut off point for 5-18 years age group (Indonesia MoH, 2011). The Educational Stress Scale for Adolescent (ESSA) questionnaire was used to determine adolescent academic stress data. The questionnaire consisted of 16 question items using a 5-point Likert scale with answers to strongly disagree to strongly agree and classified into high (score> 58), moderate (score 51-58), and low (score <50) (Sun, et al., 2011). The Cronbach alpha for a total of 16 items on the ESSA scale was 0.81 which indicates good internal consistency.

Emotional eating behavior was measured using 13 question items, the Dutch Eating Behavior Questionnaire (DEBQ). DEBQ is a self-reported questionnaire that has strong psychometric properties. The use of DEBQ has been supported in clinical and nonclinical samples, from various weight categories (normal, overweight, and obese). Responses are given through a 5-point Likert scale with details of 1 (never), 2 (rarely), 3 (sometimes), 4 (often) and 5 (very often). The score is obtained from the total number of responses from each question item which is then categorized as emotional eating if ≥ median and not emotional eating if the score is <median (Strien, et al., 1986). This questionnaire has been used in research in Indonesia and tested for reliability and obtained a Cronbach alpha coefficient value of 0.846 (very high) (Khotibuddin, 2017). Consumption frequency data was obtained using the Food Frequency Questionnaire (FFQ) which was classified as frequent (≥3x / week to daily) and rarely (≤3x month). The list of food ingredients listed was the result of a focus group discussion (FGD) with 10 students and observations of the school canteen.

The data obtained was tested for normality using the Kolmogorov-Smirnov. Descriptive statistical analysis was used to provide an overview of the characteristics of respondents, while inferential statistical analysis was used to analyze the relationship between the independent and the

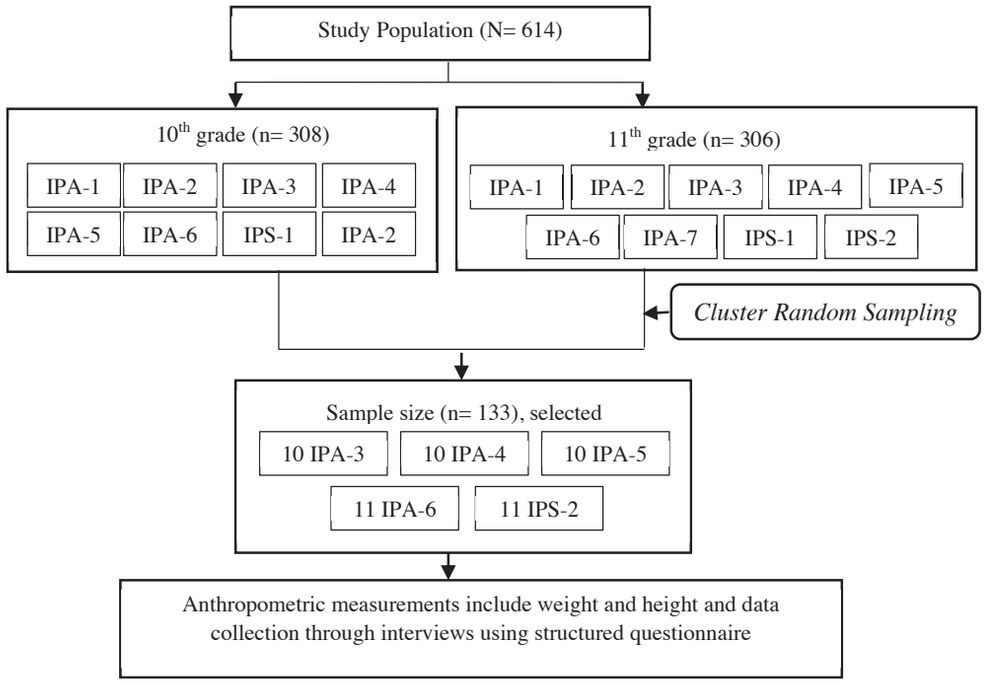

Figure 1. Sample selection flowchart

dependent variable using the Spearman correlation test with a significance value p <0.05; means that there is a relationship between variables. This research has obtained a certificate of research ethics from the Faculty of Nursing, Universitas Airlangga No. 1330-KEPK.

RESULT AND DISCUSSION

The results showed that 62.4% of respondents were girls. Respondents are students in grade 10 (58.6%) and grade 11 (41.4%) who are in the middle adolescence age range, between15-17 years (Brown, et al., 2013) with a maximum age of 16 years (57.9%). In adolescence, a person experiences emotional instability that is greater than that of adulthood (Bailen, et al., 2018).

Table 1. Respondents' characteristics

Variable	n	%
Gender		
Boys	50	37.6
Girls	83	62.4
Age (years old)		
15	15	11.3
16	77	57.9
17	41	30.8
Grade		
10th	78	58.6
11th	55	41.4
Nutritional status		
Very thin	2	1.5
Thin	7	5.3
Normal	96	72.2
Overweight	19	14.3
Obese	9	6.8

Based on the nutritional status category (BMI / A), most of the adolescents were having normal nutritional status (72.2%). Nineteen adolescents (14.3%) were overweight and 9 adolescents (6.8%) were obese. These results are greater than the national prevalence where there were of 9.5% adolescents with overweight and 4% with obesity, and higher than the prevalence in East Java, where 11.3% of adolescents ware overweight and 5.1% were obese (Indonesia MoH, 2018).

The results showed that most of the respondents' fathers were private employees (39.1%), while most of the respondents' mothers did not work (41.4%). The majority of the respondent's father and mother's last education was high school and equivalent. The economic status of the family can be measured by the income of the parents which is the sum of the income of the respondent's parents. Parents' income can determine the fulfillment of family needs, including determining the quality and quantity of food (Rachman, et al., 2017). It is known that

Table 2. Parents characteristics and socioeconomic status

Variable	n	%
Father's occupation		
Government employee	15	11.3
Private employee	52	39.1
Traders	33	24.8
Teacher/lecturer	6	4.5
Army/policeman	8	6.0
Physician	2	1.5
Etc.	17	12.8
Father's last education		
Elementary school	1	0.8
Junior high school	2	1.5
Senior high school	62	46.6
D1/D2/D3 (Diploma)	8	6.0
S1/D4 (Bachelor degree)	49	36.8
S2 (Master degree)	10	7.5
S3 (Doctoral degree)	1	8.0
Mother's occupation		
Not working	55	41.4
Government employee	5	3.8
Private employee	27	20.3
Traders	12	9.0
Teacher/lecturer	1	0.8
Army/policeman	1	0.8
Physician	2	1.5
Etc.	30	22.6
Mother's last education		
Elementary school	3	2.3
Junior high school	5	3.8
Senior high school	68	51.1
D1/D2/D3 (Diploma)	6	4.5
S1/D4 (Bachelor degree)	46	34.6
S2 (Master degree)	5	3.8
S3 (Doctoral degree)	0	0.0
Family socioeconomic status		
Quintile 1 (≤ IDR 3,510,000)	33	24.8
Quintile 2 (>IDR 3,510,000 - ≥ 5,000,000)	39	29.3
Quintile 3 (IDR > Rp. 5,000,000 - ≥ 9,210.,000)	28	21.1
Quintile 4 (IDR > Rp. 9,210,000)	33	24.8

29.3% of parents' income is in the range of IDR 3,510,000 - ≥ IDR 5,000,000 (Table 2).

Based on Table 3, it is known that almost half of the respondents experienced moderate academic stress, as much as 47.4% and it is known that 23.3% of adolescents experienced high levels of academic stress. This results in line with the research conducted at SMAN 10 Padang, West Sumatra which reported that 23% of students experienced high stress (Barseli, et al. 2018). According to Yussof (2010), factors such as too much material to be studied, difficulty in understanding subject matter, a lot of homework, exams, and tight school schedules are considered as pressure by high school students.

Table 3. Academic stress level

Stress level	n	%
High	31	23.3
Moderate	63	47.4
Low	39	29.3

Another study revealed that 31.6% of students were dissatisfied and as many as 40.6% of students were less confident about the academic scores that had been obtained. In addition, more than half (50.4%) of the adolescents agreed with the condition of feeling not good enough, when they failed to meet their own expectations and felt that there was too much work to be done at school. More than a quarter (27%) of students with high academic stress felt very dissatisfied or dissatisfied with school life, while only 10% of students with low academic stress felt very dissatisfied or dissatisfied with school life (Kim, et al., 2013).

30.8% of students in our study did not feel pressure in learning every day. There are other things that can be a factor of academic stress for students, such as feeling worried about not being able to find a place to continue their education to a higher level (Yussof, 2010). In this study also found that most students gave a neutral response if education and work in the future could provide academic pressure, but there were still 24.8% of students agreeing and 24.8% of students disagreeing with these conditions.

Hassan, et al. (2017) stated that the environment is the main factor that causes stress on students. The environment means the social environment such as teacher expectations, parental expectations, and peer pressure. It can also put students under pressure while they are in school stage. As many as 41.4% of adolescents felt that they had disappointed the teacher if their test or exam results were bad. As many as 53.4% of adolescents agreed with the condition that they felt they had disappointed their parents when the

Table 4. Distribution of Respondents' Answers Based on Educational Stress Scale Adolescents (ESSA) Questions

No	Question	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)
1	I am very dissatisfied with my academic grades	2.3	11.3	42.1	31.6	12.8
2	I feel that there is too much school work	1.5	6.0	26.3	34.6	31.6
3	I feel that there is too much homework	3.0	11.3	42.9	28.6	14.3
4	My future education and work put a lot of academic pressure on me	4.5	24.8	38.3	24.8	7.5
5	My parents cared too much about my academic grades which put pressure on me	15.0	31.6	33.1	15.8	4.5
6	I feel a lot of pressure in studying every day	10.5	30.8	36.8	16.5	5.3
7	I feel that there are too many tests or exams in school	2.3	14.3	45.9	28.6	9.0
8	Academic grades are very important to my future and can even define my entire life	5.3	21.1	32.3	26.3	15.0
9	I feel like I let my parents down when my test / exam results were bad	2.3	4.5	16.5	53.4	23.3
10	I feel like I've let my teacher down when my test / exam results weren't ideal	3.8	7.5	39.1	41.4	8.3
11	There was too much competition among classmates which gave me a lot of academic pressure	2.3	13.5	51.1	21.8	11.3
12	I always lacked confidence in my academic grades	6.0	11.3	32.3	40.6	9.8
13	It was very difficult for me to concentrate during lessons	4.5	26.3	42.9	20.3	6.0
14	I feel depressed when life doesn't live up to the standards that I want	3.0	22.6	37.6	27.1	9.8
15	When I fail to live up to my own expectations, I don't feel good enough	2.3	10.5	21.1	50.4	15.8
16	I usually can't sleep because I worry that I won't be able to meet the goals I set for myself	9.0	21.8	32.3	23.3	13.5

test or exam results were bad even though it was known that 31.8% of parents did not really care about the academic scores of the teenagers. Parents play an important role in adolescent development. There is a significant negative relationship between social support from parents and academic stress in adolescents at SMKN 11 Semarang. This means that the higher social support from parents, the lower the academic stress is, and vice versa (Ernawati and Rusmawati, 2015). The relationship between parents and adolescents is the strongest predictor of stress that occurs in adolescents. A good relationship between parents and adolescents can help adolescents cope with stress or problems experienced during this development stage (Yuin and Yacoob, 2018). When students get high pressure from their parents, students also show high levels of anxiety before exams or during exams.

Table 5. Respondents Emotional Eating Behavior

Emotional Eating Behavior	n	%
Not emotional eating	65	48.9
Emotional eating	68	51.1

The majority of parents criticized the children by comparing the child's recent performance with the best performance in the class. So that in friendship, there is a sense of competition among classmates (Deb, et al., 2015; Pratiksha and D'Souza, 2018).

Table 5 shows that 51.1% of students experience emotional eating. Some people use food not because of hunger, but in an attempt to influence their emotions by consuming food to achieve short-term satisfaction from negative feelings, improve mood and minimize uncomfortable feelings. (Kemp, et al., 2013; Ozier, et al., 2008).

Table 6. Distribution of Respondents' Answers Based on Emotional Eating Questions

No	Questions	Never (%)	Rarely (%)	Sometimes (%)	Often (%)	Very often (%)
1	Have the urge to eat when upset	25.6	26.3	29.3	12.8	6.0
2	Have the urge to eat when doing nothing	9.8	12.8	32.3	36.1	9.0
3	Have a desire to eat when feeling depressed or hopeless	30.1	35.3	21.8	9.0	3.8
4	Have a desire to eat when feeling lonely	24.8	23.3	30.1	17.3	4.5
5	Have the urge to eat when someone lets you down	49.6	30.1	12.8	6.0	1.5
6	Have the urge to eat when irritated	29.3	26.3	25.6	13.5	5.3
7	Have the urge to eat when something unpleasant happens	41.4	31.6	18.0	7.5	1.5
8	Have the desire to eat when anxious, worried or tense	43.6	21.8	12.0	11.3	11.3
9	Have the urge to eat when something is against or something is wrong	63.2	27.1	6.8	2.3	0.8
10	Have the urge to eat when scared	72.2	21.8	5.3	0.8	0.0
11	Have the urge to eat when disappointed	54.9	30.1	9.0	3.0	3.0
12	Have the desire to eat when you are emotionally angry	45.1	31.6	13.5	6.0	3.8
13	Have a desire to eat when bored or restless	18.8	19.5	30.8	24.8	6.0

As many as 36.1% of students often have the desire to eat when they are not doing anything and as many as 24.8% of students have the desire to eat when they feel bored or restless. In addition, it is known that 11.3% of students often and very often have the desire to eat when anxious, worried or tense. This shows that there were students who have a tendency to emotional eating. Teens tend to overeat or consume unhealthy foods to distract them during stressful conditions and consider it a habit (American Psychological Association, 2014). In addition, stress conditions during adolescence also affect eating preferences in adulthood (Handy, et al., 2016). If this condition continues, it will have an impact on health and nutrition, such as obesity.

The Spearman correlation analysis in Table 7 shows that there is a significant relationship between academic stress and emotional eating behavior ($p < 0.001$). As many as 64.5% of students with high academic stress also experienced emotional eating, while only 28.8% of students with low academic stress experienced emotional eating. Emotional eating behavior is known to have a significant relationship with stress that comes from academic performance factors (Kim and Kye 2017). The same thing was also found in Syarofi's research (2018) which states that there was a significant relationship between emotional eating behavior and the level of stress experienced by regular nutrition students in the fourth year, but only respondents with severe stress levels experience a tendency to behave emotional eating, while respondents with moderate and mild stress do not experience emotional eating. The results of Penaforte's (2016) study conducted on student, using a Three-Factor Eating Questionnaire, also showed a relationship between stress and emotional eating and uncontrolled eating. In addition, students with higher stress levels have higher scores for emotional eating habits.

Figure 2 shows a positive relationship pattern between academic stress and emotional eating behavior, which means that the higher the level of academic stress, the higher the emotional eating behavior. Higher levels of stress are related to eating behavior such as uncontrolled eating, emotional eating, seeking pleasure through food and using food as a reward (Jarvela-Reijonen, et al., 2016). In stressful conditions, cortisol reactivity occurs in response to stress, this is associated with eating behavior, especially consumption of high-

Table 7. Relationship between Academic Stress with Emotional Eating and Food Consumption Frequency

Variable	Academic stress			Total [n (%)]	p-value
	High [n (%)]	Moderate [n (%)]	Low [n (%)]		
***Emotional eating* behavior**					
Not emotional eating	11 (35.5%)	32 (50.8%)	28 (71.8%)	71 (53.4%)	**0.003***
Emotional eating	20 (64.5%)	31 (49.2%)	11 (28.2%)	62 (46.6%)	
Vegetables consumption					
Often	2 (6.5%)	8 (12.7%)	3 (7.7%)	13 (9.8%)	0.551
Rarely	29 (93.5%)	55 (87.3%)	34 (87.2%)	118 (88.7%)	
Never	0 (0.0%)	0 (0.0%)	2 (5.1%)	2 (1.5%)	
Fruits consumption					
Often	1 (3.2%)	5 (7.9%)	0 (0.0%)	6 (4.5%)	0.103
Rarely	30 (96.8%)	58 (92.1%)	37 (94.9%)	125 (94.0%)	
Never	0 (0.0%)	0 (0.0%)	2 (5.1%)	2 (1.5%)	
Fast food/canned food					
Often	2 (6.5%)	9 (14.3%)	4 (10.3%)	15 (11.3%)	0.702
Rarely	29 (93.5%)	54 (85.7%)	35 (89.7%)	118 (88.7%)	
Never	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Snack					
Often	1 (3.2%)	5 (7.9%)	2 (5.1%)	9 (6.0%)	0.815
Rarely	30 (96.8%)	58 (92.1%)	37 (94.9%)	125 (94.0%)	
Never	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Sugary food/cake					
Often	8 (25.8%)	17 (27.0%)	8 (20.5%)	33 (24.8%)	0.490
Rarely	23 (74.2%)	44 (69.8%)	30 (76.9%)	97 (72.9%)	
Never	0 (0.0%)	2 (3.2%)	1 (2.6%)	3 (2.3%)	
Milk and its products					
Often	7 (22.6%)	21 (33.3%)	9 (23.1%)	37 (27.8%)	0.736
Rarely	23 (74.2%)	37 (58.7%)	27 (69.2%)	87 (65.4%)	
Never	1 (3.2%)	5 (7.9%)	3 (7.7%)	9 (6.8%)	
Sweet drinks					
Often	2 (6.5%)	9 (14.3%)	6 (15.4%)	17 (12.8%)	0.469
Rarely	29 (93.5%)	50 (79.4%)	32 (82.1%)	111 (83.5%)	
Never	0 (0.0%)	4 (6.3%)	1 (2.6%)	5 (3.8%)	

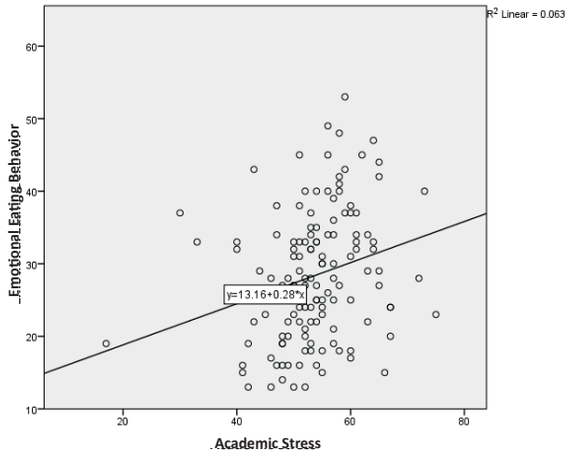

Figure 2. Scatterplot of academic stress and emotional eating behavior

calorie foods. Individuals with a high cortisol reactor to stress conditions, will consume more sweet and high fat foods. It can be said that high stress is associated with increased consumption of unhealthy foods (Cvetovac and Hamar, 2012; Scott and Johnstone, 2012).

In this study, it was found that more than a quarter (25.8%) of students who experienced high academic stress ate the sweet food or cake group frequently. Based on the scatterplot, there was a positive pattern between emotional eating behavior with fast food or cans, sweet foods or cakes, milk and its products and sweet drinks. Teens who experience emotional eating have a tendency to consume fast food or cans, sweet foods or cakes, milk and processed products and sweet drinks. Although the relationship with fast food is low. Nguyen, et al., (2007) study describes emotional eating was significantly associated with the frequency of salty high energy-dense, sweet high

energy-dense, and soda or soft drinks. Everyone has different coping strategy during stress. People with stress conditions tend to eat unhealthy foods, overeat, and some do not experience changes in consumption (Zellner, et al., 2006). However, research by Cvetovac and Hamar (2012) shows that there is a greater positive relationship between consuming more food when stressed as a coping effort than consuming unhealthy foods during stress, even though the results show a positive relationship.

Previous research done by Kim and Kye (2017) also found that adolescents with high stress categories consumed 1.727 times more snacks and the frequency of consuming sweet drinks increased 2.613 times compared to the low stress group. Snacks are usually high in calories and fat but low in fiber. Adolescents with greater stress levels are also associated with increased fat intake (Vidal, 2018).

Another study by Mikolajczyk, et al. (2009) showed that greater stress is associated with higher consumption of carbohydrate-dense foods, such as candy, cakes, snacks, fast food in young women, but not in boys. During adolescence, many adolescents feel that they will not be able to control themselves to consume healthy food when there is a lot of delicious food around them and unhealthy food both at school and / or when they are at home. Only a few adolescents feel able to eat healthy foods (Verstraeten, et al., 2014). According to Thiruselvakumar, et al. (2014), only 18% of adolescents can control themselves from consuming too much chocolate, candy, and snacks.

There are 4 sources of stress that occur in adolescents, those are intrapersonal, interpersonal, environmental and academic. However, this study has limitations, first is that the source of stress studied was only specific to the source of stress that comes from academics without examining other factors. In addition, this study also did not examine the respondent's daily intake, so it was not possible to know whether the stress variable would affect the respondent's daily intake.

CONCLUSION

The results showed a relationship between academic stress and emotional eating behavior among adolescents at SMAN 6 Surabaya. It is known that there are still students with high academic stress who have emotional eating behavior and there are students who have the desire to eat when anxious, worried or anxious. The higher the emotional eating score, the higher the tendency to consume fast food or canned food, sweet foods or cakes, milk and its processed products and sweet drinks, although it shows a low positive relationship. Students need to increase student self-efficacy to consume healthy foods in any condition, including stress through nutrition education programs. Further research is needed to collect data on the daily intake of respondents or other negative emotional coping strategy while experiencing academic stress.

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ASSOCIATION OF MACRONUTRIENT INTAKE WITH PERCENTAGE OF VISCERAL FAT IN INTERNATIONAL STUDENT AT UNIVERSITAS AIRLANGGA SURABAYA

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ABSTRACT

Diets are often associated with nutritional status of a person. Good nutritional status always accompany a good diet, if the intake of food is good, then it will give a good nutritional status as well. If energy intake exceeds output energy along with low physical activity, so it can lead to a build up of fat and increase the risk of overweight and obesity. The purpose of this research was to analyze the relationship between macronutrient intake with visceral fat on foreign students Universitas Airlangga in Surabaya. This study is observational, cross-sectional research design. The research sample was 65 students, where subjects was determined by purposive with inclusion criteria that had stayed at least 6 months in Indonesia, healthy, and not on a diet. The independent variable is the level of macro nutrient adequacy. The dependent variable is the visceral fat. Data were analyzed using chi-square test with a significance level of <0.05 and linear regression. Results showed that there was a significant relationship between energy sufficiency level ($p = 0.000$) and fat ($p = 0.018$) with percentage of visceral fat. Every 1% increase in level of energy sufficiency, respondent's percentage of visceral fat will increase by 3.589. Every additional 1% of level of fat sufficiency, percentage of visceral fat will increase by 1.712. The higher the intake of energy and fat, there will be an increase in visceral fat. The conclusion of this study is energy and fat intake can increase visceral fat. Increasing energy sufficiency and fat will increase visceral fat as well.

Keywords: macronutrients, visceral fat, foreign student

INTRODUCTION

In Indonesia, in 2016 the Ministry of Research, Technology and Higher Education issued 6,967 study permits for foreign students (Suwignjo, 2017). The interest of foreign students in studying in Indonesia is increasing. Foreign students who apply for higher education in Indonesia range from 100-500 application letters per week which are sent to the Ministry of Research, Technology and Higher Education (Suwignjo, 2017). In Surabaya, there are several universities that have programs for foreign students such as Petra Christian University, Surabaya University (UBAYA), Ten November Institute of Technology (ITS), and Universitas Airlangga (UNAIR).

Foreign students are students who come and move from their home country to another country, bringing the values, habits, beliefs, and behavior of their country of origin (Wijaya, 2013). For some people studying in another country is a challenge in itself. Following educational programs at tertiary institutions in other countries will provide opportunities to be able to learn languages, cultures and gain meaningful life experiences for students who do (Amanah, 2015).

Switching regions can lead to changes in diet and diet. These changes are adjusted to the environment or country in which they live. Based on the results of research in several countries, if the new migrant population maintained their diet, then a person had a lower risk of disease than the native population of that country (Tobias et al., 2012).

A person's diet can be influenced by cultural factors. Cultural differences can also lead to differences in eating patterns between individuals. Cultural factors influenced a person in behaving and fulfilling basic biological needs, including food needs (Sulistyoningsih, 2011).

Previous research has shown a decrease in the amount of intake by about ± 20% among foreign students in Surabaya. This occured due to differences in cultural environments that made

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it difficult for foreign students to adapt and the lack of access to food. Foreign students found it difficult to find local food, besides that foreign students often skip their meals, only 1-2 times a day (Levina and Muniroh, 2018).

A person's health condition is also determined by physical activity. If the energy consumed is excessive, it is not the same as the energy expended and added with less physical activity, it can cause weight gain, increasing the risk of obesity and obesity (Mahardikawati et al., 2008). Diet has a positive relationship with obesity status. This is in line with high body fat and visceral fat deposits (Putri et al., 2017).

Visceral fat is fat in the body that accumulates in the central part of the body and wraps around the internal organs of the body. Excess visceral fat is associated with the incidence of central obesity. Central obesity is associated with an increased risk of degenerative diseases (Sugianti et al., 2009). This research was conducted to identify the intake of macro nutrients through the adequacy level of intake with the percentage of visceral fat, for foreign students at Universitas Airlangga, in Surabaya.

METHODS

This research was conducted with a cross-sectional design with 65 respondents of foreign students studying at Universitas Airlangga, Surabaya. Respondents were selected using purposive sampling, with the inclusion criteria of foreign students who have lived in Indonesia for at least 6 months, were in good health and were not on a diet. Respondents who had met the inclusion criteria were contacted via email to ask about their willingness to be the respondent, their health status and diet. Email addresses were obtained from Airlangga Global Engagement (AGE) until the number of respondents was met.

The data were taken from May to June 2019. The method used when data collection was face-to-face interviews followed by measuring body visceral fat. Macro nutritional intake data were obtained from a 2x24 hour food recall questionnaire. The intake datas were analyzed using Nutrisurvey software to determine the amount of macro nutrient intake, then compared with the Nutritional Adequacy Rate (RDA). Adequacy of macro nutrients was said to be sufficient if it meets 80% -110% of the RDA (WNPG, 2004).

Data on the visceral fat percentage of foreign students were obtained through direct measurement using Bioimpedance Analysis (BIA) Omron HBF-375. Percentage of foreign students visceral fat compared with cut-off from Omron Healthcare. The percentage of visceral fat was categorized as normal if ≤9%, high if> 9% to ≤14%, and very high if> 14%. Data analysis used SPSS 21 software by performing a Chi-square test to analyze the relationship between macro nutrient intake and visceral fat. The significance value used <0.05. To find out how much influence the intake of macro nutrients has on the percentage of visceral fat, a linear regression test was carried out on the adequacy of energy and fat with the percentage of visceral fat. This research has received approval from the Faculty of Nursing Ethics Commission on May 7, 2019 with number 1387-KEPK.

RESULT AND DISCUSSION

Respondents Characteristic

Table 1 shows that most of the respondents (52.3%) were young adults (18-25 years). Age has a significant relationship with the incidence of central obesity (Nurrahmawati and Fatmaningrum, 2018). Most of the respondents (66.2%) are

Table 1. Distribution of Characteristics of Foreign Students of Airlangga University, Surabaya, 2019

Variable	n	(%)
Age		
18 – 25 years old	34	52.3
26 – 40 years old	31	47.7
Gender		
Male	24	37
Female	41	63
Education		
Strata 1	19	29.2
Strata 2	43	66.2
Strata 3	3	4.6
Continent Origin		
Asia	46	70.8
Africa	19	29.2

Table 2. Description of the total intake of foreign students at Airlangga University, Surabaya, 2019

Variable	Total
Energy intake (kcal)	
Mean ± SD	1781 ± 359
Minimum	1193
Maximum	2586
Protein intake (g)	
Mean ± SD	66.15 ± 16.33
Minimum	38.1
Maximum	102.7
Fat intake (g)	
Mean ± SD	69.7 ± 20.7
Minimum	28.05
Maximum	123.75
Carbohydrate intake (g)	
Mean ± SD	224.56 ± 51. 93
Minimum	121.95
Maximum	374

Table 3. Adequacy of Macro Nutrients for Foreign Students at Airlangga University, Surabaya, 2019

Variable	n	(%)
Energy Adequacy		
Inadequate (<80% RDA)	51	78.5
Sufficient (80-110% RDA)	12	18.5
Excessive (>110% RDA)	2	3.1
Protein Adequacy		
Inadequate (<80% RDA)	8	13.3
Sufficient (80-110% RDA)	18	27.7
Excessive (>110% RDA)	39	60
Fat Adequacy		
Inadequate (<80% RDA)	28	43.1
Sufficient (80-110% RDA)	14	21.5
Excessive (>110% RDA)	23	35.4
Carbohydrate Adequacy		
Inadequate (<80% RDA)	53	81.5
Sufficient (80-110% RDA)	11	16.9
Excessive (>110% RDA)	1	1.5

currently pursuing a Masters degree and the largest number of respondents are from postgraduate faculties. A person's education is very influential with the level of one's individual knowledge, so that it will increase awareness of healthy living habits (Rahajeng and Tuminah, 2009).

More female respondents (63%) than male respondents (27%). Female gender had a significant relationship with the incidence of central obesity. Women had a 1.7 times higher risk of experiencing central obesity than men (Puspitasari, 2018). Most of the respondents came from the Asian continent (70.8%), such as Myanmar, Malaysia, Yemen, Timor Leste, Palestine, Pakistan, Syria and Syria. In addition, there were respondents who came from the African continent, namely from Madagascar, Malagasy, Nigeria, Rwanda, Uganda, Zimbabwe, Tanzania, Ethiopia, and Kenya.

Intake and Adequacy of Respondents' Macro Nutrients

Table 2 shows that the average energy intake of foreign students was 1.781 kcal, protein was 66.15 g, fat was 69.7 g and carbohydrate was 224.56 g. Table 3, shows that most (78.5% and 81.5%) the level of energy and carbohydrate adequacy of foreign students was in the low category. As much as 43.1% had a less adequate level of fat and 60% had a more adequate level of protein

Table 4. Foreign Student Viseral Fat Level at Airlangga University Surabaya, 2019

Level	n	(%)
Normal	53	81.5
High	10	15.4
Very high	2	3.1

Visceral Fat Level

Table 4 shows more than 80% of foreign students had visceral fat in the normal category and less than 20% have abnormal levels. Central obesity can be seen based on the size of the waist circumference. High visceral fat affects waist circumference and can increase the risk of central obesity (Gadekar et al., 2018).

Relationship between Macro Nutrient Intake and Viseral Fat

The results of this study indicated that there was a significant relationship ($p < 0.05$) between energy and fat intake and the percentage of visceral fat among foreign students at Universitas Airlangga, Surabaya. The intake of protein and carbohydrates with visceral fat in foreign students

Table 5. Results of Chi-Square Test between Macro Nutrient Intake and Viseral Fat for Foreign Students at Universitas Airlangga, Surabaya, 2019

Nutrient	p-value
Energy	0.000
Protein	0.261
Fat	0.018
Carbohydrate	0.188

at Universitas Airlangga, Surabaya did not show a significant relationship (p> 0.05). Supported by the research of Nurrahmawati and Fatmaningrum (2018) where there was no significant relationship between carbohydrate and protein intake with the incidence of central obesity.

Based on the results of the linear regression test above, the regression function for energy adequacy was Y = 0.898 + 3.589X and for fat adequacy was Y = 2.038 + 1.712X. Each additional 1% level of energy sufficiency, the percentage of visceral fat of the respondent will increase by 3.589. For every 1% increase in the adequacy level of fat, the percentage of visceral fat will increase by 1.712. The higher the energy and fat intake, the increase in visceral fat will occur.

Another study conducted by Sholuhiyah (2018) showed a significant relationship between the level of energy adequacy and visceral fat (p = 0.037). High levels of energy sufficiency will be followed by high visceral fat. In contrast to Sofa's research (2018) where there was no significant relationship between visceral fat and food intake.

The size of the waist circumference can be affected by the level of visceral fat. The risk of experiencing central obesity can increase due to the higher percentage of visceral fat (Gadekar et., 2018).

Central obesity can occur when more energy in the form of food enters the body than the energy needed or used and will be stored in the form of fat. Excess fat will be accumulated in the abdominal adipose tissue in the form of triglycerides. High calorie intake, lifestyle modernization, and low physical activity are other factors that cause central obesity (Pahlevi, 2012).

Central obesity is associated with an increased risk of degenerative diseases (Sugianti et al., 2009). Degenerative diseases in question such as cardiovascular disease, dyslipidemia, diabetes mellitus II, hypertension, and insulin resistance.

CONCLUSION

Energy and fat intake were significantly associated with visceral glue. The higher the intake of energy and fat that is not used by the body, it will be stored and accumulated into fat and the higher the level of visceral fat. The intake of carbohydrates with protein was not significantly associated with visceral fat. The greater the energy intake and fat accumulated, the visceral fat will increase.

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CORRELATION BETWEEN PERCENTAGE OF BODY FAT WITH SPEED AND CARDIORESPIRATORY ENDURANCE AMONG FUTSAL ATHLETES IN SURABAYA

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ABSTRACT

Futsal is one of the sport that begin to be popular in Indonesia. Physical condition in futsal is an important aspect because it directly affects athlete performance especially for speed and cardiorespiratory. One of the factor that affect physical condition is percentage of body fat. The purpose of this study is to analyze the correlation between percent body fat with physical condition of futsal athletes in Surabaya**.** This study was an observational analytic study with cross sectional design. The population were sixty-eight peoples from members of Buana Mas FC, Garuda Emas FC, Nisrina FC and Surabaya Porprov team 2019. Fifty-four peoples were selected as subject of this study by proportional random sampling method. Data collection included questionnaires for respondent characteristics namely age, occupation, education, smoking history and sports activity, and then, measurement of subcutaneous fat thickness using skinfold calliper, and measuring speed and cardiorespiratory endurance using sprint 20m and yoyo test. Data analyze used Spearman correlation test. The result of this study showed most of respondent have normal percentage of body fat (59.3%). Respondents speed mostly classified as lacking (50.0%) and cardiorespiratory endurance respondents mostly classified as sufficient (59.3%). The results showed an positive correlation (p = 0.001; R=0.732) between percent body fat with speed, it was mean that the higher percentage of body fat, the slower sprint time. And there was negative correlation (p = 0.001; R=-0.639) between percentage of body fat and cardiorespiratory endurance, so the higher percentage of body fat, the lower cardiorespiratory endurance. This contradictory conclusion is due to increasing sprint time, the respondent speed will decrease while $V0_2$Max increase so the cardiorespiratory endurance will increase.

Keywords: body fat percentage, speed, cardiorespiratory endurance, futsal

INTRODUCTION

Since 2003, futsal has become a sport that has been starting to be in great demand in Indonesia. The sport of futsal began to be developed from Uruguay in 1930 (Bichescu, 2014). Indonesia's achievements at the Asian level are still not encouraging. The Indonesian Futsal National Team has played 14 times in the AFF championship but won the title only in 2010. In the last 5 years, namely 2013-2018, Indonesia's best achievement was only winning 3rd place in 2018. In 2016 and 2017 Indonesia failed in the preliminary round. One of the competitions held in Indonesia is the Indonesian Professional Futsal League which has been held since 2006 which brings together the best futsal teams from all over Indonesia. East Java participated in the competition from 2010-2018 but was only able to reach third place in 2017.

This declining performance in futsal can be improved by optimizing the physical condition of the players. In the category of achievement sports, physical condition is an important aspect because it directly impacts athletes' performance (Joshua, 2017). Physical conditions that are more dominant in futsal are speed and endurance of the heart and lungs. Speed plays a role in playing short passes, breakthrough passes and anticipating opponents in counterattacking with fast movements (Pradipta, 2017). Cardiac pulmonary endurance is the maximum capacity of the heart to breathe in oxygen or called VO2 max. The results showed that athletes who have a maximum VO2 of 80 mL / kg BW / minute can run 5000 m faster than athletes with a maximum VO2 of 40 mL / kg BW / minute (Levine, 2008). The higher the VO2 maximum, the better the cardiovascular endurance so that the performance will be better. In Saichudin (2014), respondents of futsal players had an average VO2 Max value of 44.27 ml /kg BW/minute, the highest result is 55.40 ml /kg BW/minute, and the lowest

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result is 38.50 ml/kg BW/minute (Abdillah, 2014). Based on the results of this study, it was found that most of the futsal players had low heart-lung endurance. Athletes who do not have a good VO2 Max will experience a decrease in stamina and ability and will make many fundamental mistakes that can be detrimental (Debbian, 2016).

The description above can conclude that physical condition is the basis for achieving achievement. If the tactics and techniques of the players are great but the physical condition is poor, the achievements will be different from those of players who have technical skills, good strategy and are supported by good physical condition. Futsal is a game that requires good physical condition. With the stability of the physical condition, the players will last a long time well during the 2x20 minute futsal game (Maryami, 2016).

Factors that can affect athlete's performance other than physical condition are the athlete's body composition (Setiowati, 2014). The composition of the human body consists of 60% percent fluid and 40% solids which can give shape to a person's body proportions consisting of muscle, bone, fat and other tissues (Corwin, 2009). Percent body fat is generally used to determine optimal body composition in athletes. The measurement of body fat percentage is done by measuring the thickness of the subcutaneous or subcutaneous fat. The mass of body fat is spread over the subcutaneous area more than 50%, around the internal organs there is 45% or what is commonly called visceral fat and the rest is scattered in the intramuscular tissue (Almatsier, 2011).

Body fat percentage is considered equally important for maximizing athlete potential. Several studies have found a negative correlation between body fat percentage and body performance, the higher the body fat percentage, the lower the performance. In Anwar (2016), it is known that there is a relationship between the percentage of body fat and the running speed of football players ($r = 0.59$; $p = 0.001$). The higher the body fat percentage, the longer the running time increases. In addition, there was a significant relationship between the percent of body fat and the heart-lung endurance of soccer players ($r = –0.4$; $p = 0.004$). The higher the body fat percentage, the lower the VO2Max value. The results of Sulaiman's (2011) research on national futsal players in Malaysia showed that the average percentage of body fat in futsal players was 18.33% with the highest yield of 36.95% and the lowest result of 10.82%. Based on these results, it was found that most futsal players had excess body fat percent. If the athlete's excess body fat percentage will affect the cardiovascular system, body composition, endurance of muscles, strength of muscles, and flexibility (Truter, 2010). If the athlete is unable to maintain body proportions and composition, the opportunity is to be overweight and even obese (Kreider, 2010).

From the interviews with researchers to several coaches from the futsal team, the athlete's body composition was not given too much attention because the coach only focused on training and playing strategies. Based on the explanation that has been mentioned, the researcher wanted to examine the body composition of futsal athletes and its relationship with the physical condition of the futsal athletes.

METHODS

This study employed a cross-sectional research design and was a quantitative research that was analytic observational. This research was conducted in two different places, namely the Nisrina Futsal Field and Gool Futsal Universitas 17 August 1945. The study was conducted in April-May 2019. The population in this study were members who were members of the Buana Mas FC team, Garuda Emas FC, at least 6 months. Nisrina FC and the Surabaya 2019 Porprov Team with a total of 68 athletes. The sample size was obtained using Lemeshow's (1997) calculation of 54 samples. The sampling technique used was proportional random sampling which then calculated the number of samples to be used for each team. From the calculation results obtained a sample of 14 athletes from Buana Mas FC, 10 athletes from the Surabaya 2019 Porprov Team and each of 15 athletes from Buana Mas FC and Nisrina FC. After obtaining the number of samples for each team, members of the team will be randomly selected according to the maximum number of samples and selected according to the inclusion criteria. The sample inclusion criteria are

members of the futsal team in Surabaya who have joined for at least 6 months, often participate in routine training at least 2 (two) times a week, are 18-25 years old, are not injured, are willing to be respondents and do a physical condition test.

Percentage of body fat was the independent variable and the dependent variable in the study, namely heart rate and lung endurance. The data collection technique in the study was filling out a general questionnaire for the characteristics of the respondents. Subject characteristics include age, occupation, education, smoking status or history and sports activity. Age was classified into early, middle and late adolescence, then the respondent's occupation was classified into civil servants, private employees, honorary, self-employed and students. The characteristics of education are classified into Elementary, Junior, Senior High School, or Vocational School and universities. Smoking history was categorized as yes every day, yes sometimes, no but used to every day, no but used to sometimes and never. For the characteristics of sports activities, there were futsal and other sports activities. Subcutaneous fat thickness was then measured on the triceps, biceps, supscapular, and suprailiacs. The measurement of the thickness of the subcutaneous fat of the subject was carried out by the researcher when the subject had not done physical exercise. Measurement of the thickness of the subcutaneous fat was carried out twice and the average value was taken. Measurements were made using the Qiorange digital skinfold caliper in millimeters. Then from the measurement results, calculations were made to determine body density and body fat percentage. The formula for calculating body density using the Durnin and Womersley (1974) formula is D = c + m (X4), where D is the density of the body, and X4 is the log of the total measurements of triceps, biceps, supscapular and suprailiac. Then from the results of the calculation of body density, the percentage of body fat was calculated using the Siri formula (1961), namely:

$$\%\,BF = \left(\frac{4.95}{D} \times 4.50\right) \times 100$$

The results of the calculation of body fat percentage were then categorized based on Jeukendrup (2004) for the categories of soccer or futsal athletes to be less (<10%), normal (10-18%) and excess (> 18%).

The measurement of speed uses the sprint method or 20 meter run which was done by the respondent running as fast as possible at a distance of 20 meters. Measurements were taken 2 times and the best results were taken. Then the results will be categorized as less (> 3.44 seconds), sufficient (2.71-3.44 seconds) and good (<2.77 seconds) according to the cut-off from EA Sports BCSPL Fitness Testing (2012). Measurements with this method have tested the validity and got a value of 0.956 and the reliability test got a value of 0.924 (Fuziyono, 2013).

Meanwhile, the measurement of cardiac and pulmonary endurance used the yo-yo test method which was carried out by providing an area of 25 meters with details of 5 meters from cone A to B for resting and 20 meters from cone B to C to run according to the rhythm of the beep. The respondent would run to the rhythm until the respondent reached the maximum limit and could not run to the rhythm. Measurements were carried out once and then the results were categorized as very good, good, moderate, moderate, lacking and very poor. The measurement results were in the form of speed level and level from the shuttle which were then converted into VO2Max using the Yoyo Test Reference Table. This method has been tested for validity and reliability and obtained values of 0.968 and 0.996 (Akbar, 2015). The researchers and the coach of each team measured the heart and lung speed and endurance.

The data was tested for normality first using the Kolmogorov-Smirnov method. The results of this study were analyzed using descriptive analysis to provide an overview of the characteristics of the respondents. Then performed inferential statistical analysis using the Spearman correlation test to analyze the relationship between the independent variable and the dependent variable with a p-value less than the significance value ($p < 0.05$), which means that there is a relationship between variables. This study passed ethics and obtained a certificate of ethics testing from the Faculty of Public Health, Airlangga University with a code of ethics certificate 141-KEPK.

RESULT AND DISCUSSION

Characteristics of respondents in the study including age, gender, occupation, education, status or history of smoking and sports activities are presented in Table 1. Based on table 1.From 54 respondents, most of the respondents (72.2%) were classified as late adolescents aged 18- 21 years. Most of the students (81.5%) and were SMA / SMK students (98.1%). Respondents who were mostly classified as adolescents generally experience changes in the proportion of body composition with an increase in muscle mass due to the hormone testosterone which plays a role in protein synthesis. In addition, cardiac physiology changes to a greater extent in adolescents and results in increased cardiac output which can increase cardiovascular endurance (Arum, 2014). Age 17-21 years in men is the peak VO2Max. In another study, the speed and explosive power of the leg muscles when jumping on two big football teams continued to increase at the age of 16-17 years. Athletes less than 17 years of age have a lower percentage of body fat than adults (Joshua, 2017).

There were still 7.4% of athletes who smoke every day and 24.1% who smoke occasionally, both classified as active smokers. In smokers, the oxygen supply that enters the body will decrease because the hemoglobin that binds to carbon monoxide is more than oxygen, so that smokers who exercise usually quickly experience fatigue and gasp for breath to meet the oxygen needs needed by the body (Zuhdi, 2017). Someone who has a smoking habit, the maximum volume of oxygen will be lower than someone who does not smoke.

In table 2, it is found that the respondents did futsal activity 2-3 times a week and were classified as sufficient with a duration of 1-2 hours. Apart from futsal, the respondents also did other sports as shown in Figure 1. The respondents did sports with sufficient frequency, namely 2-3 times a week with a duration of more than two hours. Routine exercise can be done as a physical activity to increase the potential and abilities of athletes. Someone who did physical activity regularly, would increased cardiovascular efficiency and decreased resting heart rate will decrease when did maximum workload. This could make breathing more efficient when breathing slower so that more oxygen reaches the lungs and results in an increase in cardiovascular endurance (Permatasari, 2018).

Based on table 3, it is known that most of the respondents' body fat percentage was classified as normal, namely as much as 59.3%, while 37.0% of respondents had a body fat percentage that was classified as excess. In Joshua's (2019) research conducted on the Bintang Timur Surabaya futsal

Table 1. Distribution of Respondent Characteristics Based on Age, Occupation, Education and Smoking History

Characteristic	Total	Percent
	n	%
Age		
Late adolescent (18-21 y.o)	39	72.2
Early adult (22-25 y.o)	15	27.8
Occupancy		
Private employee	9	16.7
Self-employed	1	1.9
Students	44	81.5
Education		
Senior High/Vocational School	53	98.1
Universities	1	1.9
Smoking status		
Yes, everyday	4	7.4
Yes, sometimes	13	24.1
No, used everyday	1	1.9
No, used sometimes	5	9.3
Never	31	57.4

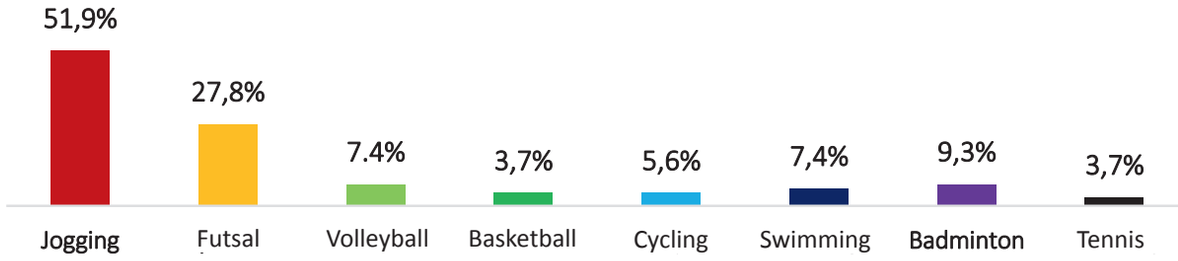

Figure 1. Distribution of Other Sports (Non-futsal) to Futsal Athletes in Surabaya in 2019

Table 2. Distribution of Respondent Characteristics Based on Sports Activities

Sport Activities	n	%
Futsal		
Frequency		
Sufficient (2-3x/week)	49	90.7
Often (>3x/week)	5	9.3
Duration		
20 minutes - < 1 hour	1	1.9
1 - ≤ 2 hours	53	98.1
Other Sport Activities		
Frequency		
Seldom (≤1x/week)	17	31.5
Sufficient (2-3x/week)	35	64.8
Often (>3x/week)	2	3.7
Duration		
<20 minutes	11	20.4
20 minutes - < 1 hour	4	7.2
1 - ≤ 2 hours	10	18.6
>2 hours	29	53.8

Table 3. Distribution of Body Fat Percentage, Heart Lung Speed and Endurance

Variable	Total	Percent
	n	%
Body Fat Percentage		
($\bar{x}$ =17.35±4.31 SD; min= 7.67; max= 27.27)		
Inadequate	2	3.7
Normal	32	59.3
Excessive	20	37.0
Speed		
($\bar{x}$ =3.35±0.29 SD; min= 2.44; max= 3.95)		
Inadequate	27	50.0
Normal	25	46.3
Excessive	2	3.7
Cardiovascular Endurance		
($\bar{x}$ =48.67±1.92 SD; min= 44.13; max= 52.53)		
Inadequate	5	9.3
Normal	17	31.5
Excessive	32	59.3

player, it was known that the average percent of respondents' body fat is proportional or normal (75%). Futsal athletes must have a body that is quite ideal as seen from the body fat percentage ranging from 10-18%. A balance of muscle mass and fat mass is needed by athletes to achieve the recommended proportion of body size and composition (Maulina, 2015). If an athlete's excess body fat percentage will affect the performance of the cardiovascular system, body composition, muscle endurance, muscle strength, and speed (Truter et al. 2010).

In table 3, the results of the measurement of the running speed of the respondents were mostly classified as less (50%). In Royana's research (2017), it was found that 50% of the UPGRIS futsal team players had a relatively low speed. Likewise in Anwar's research (2016) it was also found that the average respondent had a relatively low speed. In futsal, if the player's speed is high, the player will be able to find a gap quickly to provide a counter attack and kick the ball at the goal. Players can anticipate by returning to the defense area quickly so that they can thwart the gap in the opponent's attack in scoring goals (Pradipta et al, 2017).

In table 3, it is known that most of the respondents had sufficient heart-lung resistance, namely 59.3%. This is in line with research by Ulfa, et al. (2017), namely 71.4% of respondents who took futsal had moderate or moderate cardiovascular endurance. Cardiac pulmonary endurance is the maximum capacity of the heart to breathe in oxygen or called VO2 max. Respondents with low VO2Max will experience significant fatigue during training so that their mastery of the basic techniques learned during training or competition is not optimal.

Correlation of Body Fat Percentage with Heart Lung Speed and Endurance

Based on the results of the Spearman analysis test in Table 4, it is known that there was a correlation between the percentage of body fat and the respondent's speed ($p < 0.001$). In Figure 2, the direction of the correlation between the percentage of body fat (%) and velocity (seconds) was positive, namely R = 0.732. A positive correlation means that the higher the percentage of the respondent's body fat, the more the duration of running the respondent will be. The longer the duration of running required by the respondent, the less the respondent's speed will be. Respondents with a normal body fat percentage mostly had sufficient running speed (71.9%). Meanwhile, respondents who had an excess percentage of body fat had a relatively low running speed (100.0%). Then in Hyka's (2017) study, the results were also obtained, namely that there was a relationship

between body fat percentage and the speed of football players (p = 0.019). The results of this study were also supported by Anwar's (2016) study, where there was a relationship between body fat percentage and the speed of football players (r = 0.59; p = 0.001). In Anwar's research (2016) there was a positive correlation result, namely the higher the percentage of body fat of the respondent, the longer the duration of running is so that the respondent's speed tends to be less. In this study, if the percentage of body fat was higher, the duration of the speed would also be longer so that the speed category in running would be less. This can happen because a person's high or excessive body fat only plays a role in increasing body weight and body weight so that it is less profitable for the body. High fat stores cause the body's performance in moving and moving to decrease so that the body's acceleration in running will decrease when the fat in the body was high. Athletes with a low percentage of body fat perform better than athletes with a high percentage of body fat.

In table 4, it is found that between the percentage of body fat and cardiovascular endurance there is a significant relationship (p <0.001). All respondents with a normal percentage of body fat had sufficient heart-lung resistance. Meanwhile, respondents who had a lower percentage of body fat had less heart and lung resistance. This is supported by research by Anwar (2016), which shows that there was a significant relationship between the percent of body fat and the heart-lung endurance of soccer players (r = –0.4; p = 0.004). In Sharma's (2015) study, the percentage of body fat was related to cardiovascular endurance (r = -0.929; p = 0.046). In Gligoroska's (2015) study, there was a relationship between the percentage of body fat and cardiovascular endurance, even though the relationship is relatively weak (r = -0.08; p = 0.034).

The three studies above were also in line with this study, namely that there was a negative relationship between body fat percentage and cardiovascular endurance. Figure 3. shows the negative correlation coefficient (R), which is -0.639. This means that if the percentage of body fat increases, the heart and lung resistance tends to decrease, and vice versa. The lower the percent result of the respondent's body fat, the better the respondent's heart-lung endurance. Excess body fat will increase a person's body mass resulting in a decrease in movement speed. Excess body fat composition will result in faster fatigue. If the body fat composition is high, there will be an increase in body temperature, so that the body quickly

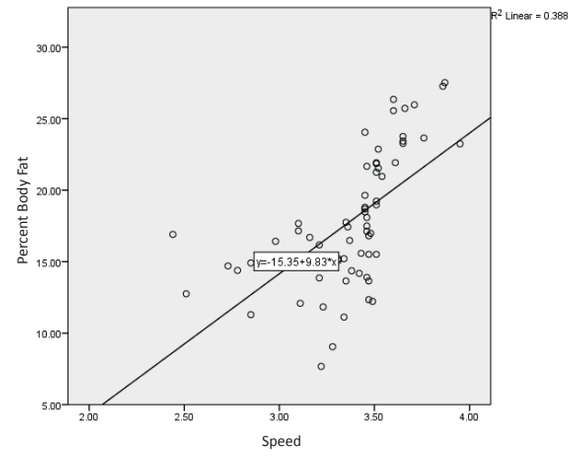

Figure 2. Scatterplot Percent Body Fat by Running Speed

Table 4. Correlation of Body Fat Percentage with Heart Lung Speed and Endurance

Variable	Body Fat Percentage			Total n (%)	p-value
	Inadequate	Normal	Excessive		
	n (%)	n (%)	n (%)		
Speed					
Inadequate	0 (0.0)	7 (21.9)	20 (100.0)	27 (50.0)	0.001*
Sufficient	2 (100.0)	23 (71.9)	0 (0.0)	25 (46.3)	
Good	0 (0.0)	2 (6.2)	0 (0.0)	2 (3.7)	
Daya Tahan Jantung Paru					
Inadequate	2 (100.0)	0 (0.0)	3 (15.0)	5 (9.3)	0.001*
Moderate	0 (0.0)	0 (0.0)	17 (85)	17 (31.5)	
Sufficient	0 (0.0)	32 (100.0)	0 (0.0)	32 (59.3)	

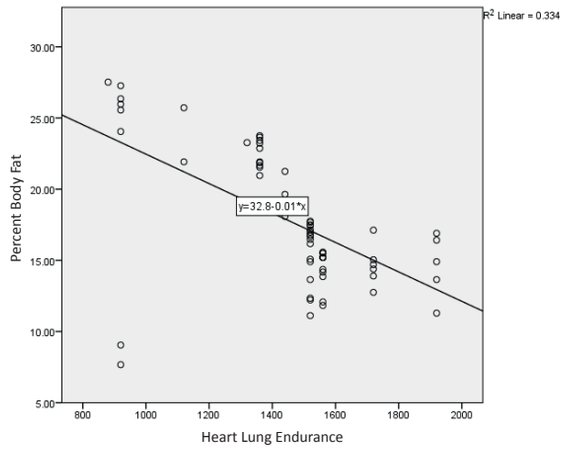

Figure 3. Percent Body Fat Scatterplot with Heart Lung Endurance

experiences fatigue and affects the endurance of an athlete's heart and lungs (Salamah, 2019).

Weight gain due to increased fat reserves will decrease your VO2 max during activity. Excess fat does not benefit the heart in extracting oxygen to the skeletal muscles so that the heart works harder. Large deposits of fat will not be efficient in energy use because they require more oxygen and aggravate one's physical activity (Syantika, 2013). In conditions of high percent body fat, cardiac output will decrease and consequently the amount of blood pumped decreases. This causes oxygen consumption to decrease in working muscles and results in decreased cardiovascular endurance (Manore, 2009).

Increasing body weight results in increased fat reserves in adipose cells and muscle glycogen (Murbawani, 2017). Decreasing body fat will improve the performance of sports athletes because of the improved physical condition. If the percentage of fat is high or increases, the muscle mass will decrease so that the muscles are not optimal in contracting and muscle performance is less effective and efficient (Putranto, 2015). Most of the respondents have sufficient heart and lung resistance due to the fact that the respondents' sports activities are classified as good so that the body is better trained and their physiological conditions improve.

CONCLUSION

The percentage of body fat with heart-lung speed and endurance in futsal athletes in Surabaya has a significant relationship. Most athletes have normal body fat percentage. Athletes who have a normal body fat percentage mostly have sufficient heart-lung speed and endurance. Increasing the percentage of body fat has a negative impact on physical conditions such as decreased running speed and cardiovascular endurance. A balanced diet and nutritional intake need to be applied to athletes so that there is no excess or deficiency of nutrient intake. Athletes also need to implement regular sports activities to improve their physical condition. This is done to keep the athlete's body fat percentage within the normal range.

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ACCEPTABILITY AND NUTRIENT CONTENT OF INSTANT DRINK MADE FROM YELLOW SWEET POTATO AND RED KIDNEY BEAN AS AN ALTERNATIVE SUPPLEMENTARY DRINK FOR PREGNANT WOMEN WITH CHRONIC ENERGY DEFICIENCY

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ABSTRACT

Providing supplementary food or drink for pregnant women with chronic energy deficiency (CED) is one form of specific interventions to increase the nutritional intake of pregnant women which is quite effective. Supplementary drink made from local food are very appropriate to be developed by considering its nutritional and sensory aspects. This study aimed to develop and to analyze instant powder drink made from yellow sweet potato and red kidney bean as an alternative supplementary drink for pregnant women with chronic energy deficiency (CED). This study used a completely randomized factorial design with two factors and two replications. The ratio between yellow sweet potato and red kidney beans as the first factor and the addition of maltodextrin as the second factor. Results showed that from 6 formulas, formula with ratio 3:1 of yellow sweet potato and red bean also the addition of 5% maltodextrin (F5) was chosen as the best formula. Based on acceptance test results, instant drink was accepted by pregnant women with percentage of acceptance 89.5% of overall sensory characteristics. Nutrient content analysis showed that instant drink contained 423 kcal of energy, 3.75% of water, 1.52% of ash, 14.28% of protein, 9.92% of fat, 70.53% of carbohydrates, 7.27% of dietary fiber, 14.4 mg of β-carotene, and 74.22% of protein digestibility. This product can be suggested as an alternative supplementary drink for CED pregnant women because it was acceptable by sensory and the nutrient content had fulfilled nutritional content requirements of supplementary food for CED pregnant women.

Keywords: pregnant women, red beans, chronic energy deficiency, instant drink, sweet potato

INTRODUCTION

Chronic energy deficiency (KEK) is a condition caused by malnutrition, especially energy and protein for a long time or chronic, characterized by mid upper arm circumference (MUAC) <23.5 cm. Based on the results of Indonesia Basic Health Research, the incidence of pregnant women experiencing chronic energy deficiency in 2013 was 24.2% and decreased in 2018 to 17.3% (Kemenkes RI, 2013; Kemenkes RI, 2018). Even though it has decreased, Indonesia still has moderate public health problems (10-19%), that is problem of pregnant women at risk of chronic energy deficiency (WHO, 2010).

Provision of additional food or drink for pregnant women is one form of specific intervention to increase the nutritional intake of pregnant women which is quite effective. Based on Pastuty, et al. (2018), giving additional food to pregnant women in chronic energy deficiency gives good results in increasing the arm circumference and mother's body weight.

According to the Indonesian Ministry of Health (2010), additional food or drinks for pregnant women should be acceptable in terms of form, taste, and easy consumption. One form of additional food or drinks that can be developed is in the form of instant beverage products. The selection of instant drinks as a form of additional food or drinks is based on several advantages, namely practicality, has good product quality and stability, low production costs, suitable for large-scale consumption and is easy in the distribution process so that it can be used as an alternative to additional drinks, especially for pregnant women (Susanti and Putri, 2014).

The making of instant drinks made from sweet potatoes and red beans is considered very appropriate because able to raise the potential of local food ingredients and has various nutritional contents. Almasyhuri (2009) showed that nutritious

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formula drinks based on local non-dairy foods had good acceptance. This local food-based formula drink also contain nutritional value that can meet the nutritional needs of pregnant women so that it can be used as an alternative to additional drinks that affordable to pregnant women.

Sweet potato is an alternative carbohydrate source to replace rice. In addition, there are other components contained in yellow sweet potatoes, including protein, fat, vitamins and minerals (Ginting, 2009). Red beans are a food source of protein which is widely consumed throughout the world, including Indonesia. Red beans are also a source of other nutrients such as fat, dietary fiber, carbohydrates and several important minerals, one of which is iron which is quite high. Red beans have been widely used as an ingredient to improve product quality and nutritional content in product development (Audu and Aremu, 2011). Maltodextrin is an ingredient that is often added to various food products. Based on Jittanit (2010), the reason for adding maltodextrin is because it can function in maintaining the physical and sensory properties of the product, protecting food components that are sensitive to surrounding conditions, and can increase solubility and viscosity, especially in beverage products. This study aims to analyze the acceptability and nutritional content of instant drinks from a combination of yellow sweet potato (*Ipomoea batatas* L.) And red beans (*Phaseolus vulgaris* L.) for chronic energy deficiency pregnant women (KEK).

METHOD

The design of this study was experimental study using a complete randomized design factorial with two factors, that is ratio between yellow sweet potato and kidney beans as first factor and addition of maltodextrin as second factor. Manufacture of instant drinks is carried out at Food Processing and Experiment Laboratory, IPB University. The drying process for instant drinks is carried out at IPB Seafast Center. Proximate analysis, protein digestibility, and β-carotene were carried out at Laboratory of Food Chemistry and Analysis, IPB University. The test of acceptance of beverage products was carried out at several posyandu in Bogor City and has received ethical approval from research ethics commission involving human subjects of the Bogor Agricultural University with number 128/IT3.KEPMSM-IPB/SK/2018. This research was conducted from October 2018 to June 2019.

Yellow yam and kidney beans are the main ingredients used in making instant powder drinks. The yellow yams used are jago varieties that have harvest age of about 4-4.5 months and the red beans used are local varieties or cultivars with harvest age of about 73 days after planting. Other ingredients used as supporting materials in the manufacture of instant powder drinks include soy protein isolate, red palm oil (RPO), egg white flour, sugar flour, honey, maltodextrin and water.

This research consists of two stages that is initial stage and advanced stage. The initial stage includes designing formula, making and drying the liquid. In the next stage, analysis was carried out through organoleptic tests to determine acceptability and analysis of nutritional content of the selected formula.

Formulation design is the first stage of research. Design of formula is adjusted by nutritional content that refers to the Technical Guidelines (Juknis) of Supplementary Foods for Pregnant Women (Ministry of Health, 2017) and SNI for special drinks for pregnant women (BSN RI, 2005). Six formula were made for beverage products with two treatment factors. Composition of ingredients and determination of treatment factors, that is the ratio of yellow sweet potatoes and red beans (factor A) and the addition of maltodextrin (factor B) were carried out by trial and error until six formulas were obtained that met nutritional content reference from Technical Guidelines and SNI for special additional drinks pregnant mother. Instant powder drink formulations are presented in Table 1.

The stages of making instant powder drink based on yellow sweet potato and red beans go through several main stages, that is preparing raw material, mixing, and drying. Preparation of raw materials, yellow sweet potato and red bean, was based on modifications made by Ruben, et al. (2016) and Ticoalu (2016). The final result of preparation stage is red bean and yellow sweet potato puree. At the mixing stage, puree of yellow

Table 1. Instant powder drink product formulation per 100 grams

Ingredients	Formula					
	F1	F2	F3	F4	F5	F6
Yellow sweet potato (g)	20	30	10	20	30	10
Red bean (g)	20	10	30	20	10	30
Red Palm Oil (RPO) (g)	10	10	10	10	10	10
Soy Protein Isolate (IPK) (g)	15	15	15	15	15	15
White egg flour (g)	8	8	8	8	8	8
Honey (g)	15	15	15	15	15	15
Sugar Powder (g)	15	15	15	15	15	15
Maltodextrin (g)	10	10	10	13	13	13
Water (ml)	250	250	250	250	250	250

Note:
F1: 1:1 ratio of yellow sweet potato and kidney beans without addition of maltodextrin;
F2: 3:1 ratio of yellow sweet potato and kidney beans without addition of maltodextrin;
F3: 1:3 ratio of yellow sweet potato and kidney beans without addition of maltodextrin;
F4: 1:1 ratio of yellow sweet potato and kidney beans with addition of 5% maltodextrin;
F5: 3:1 ratio of yellow sweet potato and kidney beans with addition of 5% maltodextrin;
F6: 1:3 ratio of yellow sweet potato and kidney beans with addition of 5% maltodextrin;

sweet potatoes and red beans is mixed using several other supporting ingredients, that is red palm oil, soy protein isolate, egg white flour, sugar flour, honey and water using blender. Drying stage uses drum dryer to get drink powder. The powder drink obtained is then packaged using aluminum foil 50 grams / serving.

The next stage was organoleptic hedonic test involving 30 semi-trained panelists, namely students of IPB Community Nutrition Department with the criteria of already received material abour sensory evaluation, participated in the organoleptic test and had a high sensitivity level to assess several organoleptic attributes. Panelists were asked to rate the product with the scale of 1 (very dislike) to 7 (very like) with the assessment attributes including color, aroma, taste, viscosity, mouthfeel, and product aftertaste. From six instant drink formulas, the best one will be selected for further product acceptance testing involving 100 combined pregnant women from normal pregnant women and chronic energy deficiency. The percentage of product acceptance is calculated based on the ratio of pregnant women, which gives a scale of 5 (slightly likes) to 7 (very likes).

The formula for instant powder drink selected based on the highest level of preference through the organoleptic hedonic test was also analyzed for its nutritional content to determine the contribution of nutrients to the RDA for pregnant women and energy contribution of protein. This is necessary to be able to meet the energy-protein balance in additional drinks for pregnant women in chronic energy deficiency. In addition, the nutritional content obtained is also compared with the requirements for the nutritional content of SNI for special drinks for pregnant women, technical instructions for additional food or drinks for pregnant women in chronic energy deficiency by the Ministry of Health, and 30 types of milk products for pregnant women.

The nutritional analysis of selected products includes analysis of the water content by oven method (AOAC, 2005), the ash content by gravimetric method (AOAC, 2005), the protein content by kjeldahl method (AOAC, 2005), the fat content by Soxhlet method (AOAC, 2005), the crude fiber content (AOAC, 2005), total carbohydrate content by difference method (AOAC, 2005), total dietary fiber content by enzymatic method (AOAC, 2005), β-carotene content (AOAC, 2000), and analysis of protein digestibility by in vitro method (Saunders, et al., 1973). Data processing was performed using Microsoft Excel 2010 and analyzed using SPSS version 17. Analysis of diversity used T-Test and Two-Way ANOVA difference test with Duncan advanced test ($p < 0.05$).

RESULT AND DISCUSSION

Hedonic Organoleptic Test

The results of ANOVA analysis on hedonic organoleptic test showed that the comparison of yellow sweet potatoes and red beans and the addition of maltodextrin was significantly different ($p < 0.05$) on panelist's preference in terms of color, viscosity, taste, mouthfeel, and aftertaste. The results of Duncan test showed that the level of preference in attributes of color, viscosity, taste, mouthfeel, aftertaste and overall was higher in F5 formula. This shows that the more the proportion of yellow sweet potatoes compared to red beans (3: 1) accompanied by the addition of 5% maltodextrin, the higher panelists' preference for the organoleptic attributes of the product.

In terms of color, the F5 formula has a bright yellow color. According to Yuliawaty and Susanto (2015), the addition of maltodextrin in beverage product with a slightly dark color will affect the degree of color brightness. Maltodextrin tends to give white color, so when it is mixed with yellow sweet potato and dark yellow kidney beans, it will give the product a bright color. The addition of yellow sweet potato causes the color of drink brighter because of beta-carotene content of yellow sweet potato. Therefore, the greater the proportion of yellow yam and the addition of maltodextrin in drink, the higher the color acceptance.

The larger proportion of yellow sweet potatoes in F5 formula also gives a strong intensity in terms of taste. This is in line with Nurhayati (2017) which states that drinks with a higher number of sweet potatoes have a distinctive sweet taste than sweet potatoes. Yellow yams have a high carbohydrate content which results in a sweet taste. The carbohydrates found in sweet potatoes will break down into simple molecules (simple sugars such as sucrose, maltose and glucose) due to the heating process so that the resulting taste will sweet (Saragih, 2017).

Panelists also preferred the viscosity level in formula F5 with a higher proportion of yellow sweet potato. This is thought to come from the amylopectin content in yellow sweet potatoes which is higher than amylose. Starch with high amylopectin content will increase viscosity of the drink, while high amylose content will cause the drink to become thinner (Mahmudatussadah, 2014).

The addition of maltodextrin also affects the mouthfeel of F5. According to Yousefi (2011), maltodextrin can affect the particle size of the resulting powder to become finer. The smaller particle size has an impact on the ability to rehydrate the powder, which is easier to dissolve, so it can give a soft taste and increase the solubility of drink. The maltodextrin solution has the characteristics of a soft flavor and smooth mouthfeel so it is suitable to be added in food products to increase the quality and level of preference.

Determination of the Selected Formula

The best formula is selected from the results of hedonic organoleptic test. The higest average score of panelist's preference based on overall organoleptic parameters was formula F5 compared to other formulas. The average value of panelist's preference in F5 formula is color (5.80 = like), aroma (5.50 = like), viscosity (5.30= rather like), taste (5.60 = like), mouthfeel (5.30 = rather like), aftertaste (5.10 = a little like), and overall (5.62

Table 2. Instant Drink Organoleptic Hedonic Test Result

Formula	Organoleptic Parameter						
	Color	Aroma	Viscosity	Taste	Mouthfeel	Aftertaste	Overall
F1	4.45^{a}	5.48^{a}	4.10^{ab}	5.15^{ab}	4.10^{a}	4.73^{ab}	4.75^{a}
F2	5.13^{bc}	5.37^{a}	4.83^{c}	5.35^{c}	4.88^{b}	$5.10b^{b}$	5.40^{b}
F3	4.83^{ab}	5.28^{a}	4.00^{a}	5.08^{ab}	4.33^{a}	4.78^{ab}	4.85^{a}
F4	5.40^{cd}	5.22^{a}	4.52^{bc}	5.18^{ab}	4.57^{ab}	4.90^{ab}	5.07^{ab}
F5	5.80^{d}	5.50^{a}	5.33^{d}	5.60^{c}	5.30^{c}	5.24^{c}	5.62^{c}
F6	5.43^{cd}	5.22^{a}	4.40^{abc}	4.75^{a}	4.40^{a}	4.63^{a}	4.85^{a}

Note : Different letters in the same column indicate significant differences ($p<0,05$).

= like). Thus, formula F5 was determined as the choosen formula because it has high average organoleptic value compared to other formula. Formula F5 is a formula with a higher proportion of yellow sweet potatoes than red beans (3: 1) accompanied by addition of 5% maltodextrin.

Acceptance of the Chosen Formula

Product acceptance test is carried out using the selected formula. The acceptance test of product involved 100 pregnant women, a combination of normal and chronic energy deficiency pregnant women as panelists. Panelist's preferences for the overall product were obtained based on the number of assessment scores given by panelists with the following percentages: 20% of the color score, 20% of the aroma score, 30% of the taste score, 10% of the viscosity score, 10% of the mouthfeel score, and 10 % of the aftertaste score. The percentage of product acceptance is calculated based on ratio of pregnant women who give a scale of (5) rather like, (6) like, and (7) very like.

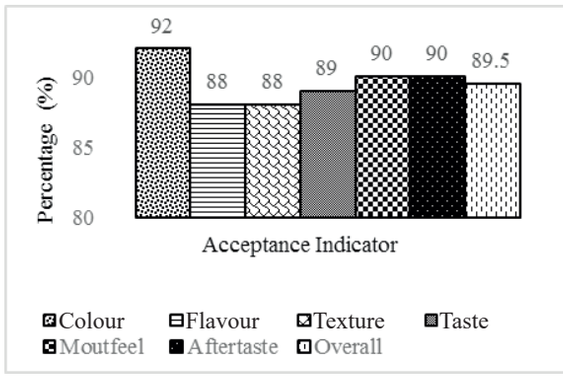

Figure 1. Percentage of acceptance of selected instant drink products by pregnant women

The results of analysis show that percentage of panelist's acceptance of instant powder drink products is 92% in taste attribute, 88% for aroma attribute, 88% for texture attribute, 89% for taste attribute, 90% for mouthfeel attribute, 90% for aftertaste attribute, and overall of 89.5%. These results indicate that beverage products given to 100 pregnant women can be well received because the percentage of overall acceptance that likes the product has been more than 50% (Setyaningsih, 2010).

Nutritional Content of the Selected Formula

Based on the analysis of nutrient content, the selected beverage formula has energy content of 423 kcal, water content of 3.75%, ash content of 1.52%, protein content of 14.28%, fat content of 9.92%, carbohydrates of 70.53%, total fiber of 7.27%, beta-carotene levels of 14.4 mg / 100 g, and protein digestibility of 74.22%. The nutrient content in selected formula has fulfilled the RDA contribution for snack food or drink, which ranges from 15-20%. The nutritional content in selected formula has also met the nutritional content requirements of additional foods or drinks for chronic energy deficiency pregnant women based on SNI for special drinks for pregnant women and

Table 3. Nutritional Content of the Selected Formula per 100 gram

Nutrient	Content	Ttechnical instructions for additional foods or drinks for chronic energy deficiency pregnant women. (Kemenkes 2017)	on SNI for special drinks for pregnant women (BSN 2005)	% RDA
Water (%)	3.75	–	Maks. 4	–
Ash (%)	1.52	–	Maks. 6	–
Protein (%)	14.28	Min. 6	18 – 25	18.79
Fat (%)	9.92	Min. 12	Min. 3.50	11.81
Carbohydrate (%)	70.53	–	Maks. 65	20.44
Energy (kcal)	423	Min. 270	Min. 370	17.05
Dietary Fiber (%)	7.27	Min. 5	–	20.77
β-carotene (mg)	14.40	–	–	–
Protein Digestibility (%)	74.22	–	–	–

technical instructions for additional foods or drinks specifically for chronic energy deficiency pregnant women.

The ash content value of instant powder drink products was 1.52%. This shows that in every 100 g of product there are 1.52 g of mineral elements. The value of ash content in instant drink products is still classified as normal because it does not exceed 6% ash content based on SNI for special drinks for pregnant women (BSN RI, 2005). The value of ash content in foodstuffs is able to reflect the quality of foodstuffs related to certain metal contaminants. The higher the ash content, the higher the level of metal contamination which can affect the safety and quality of food (Andarwulan, et al., 2011).

Instant drink products have protein content of 14.28%. During pregnancy, the fulfillment of protein requirements is needed to support increased protein synthesis which functions to maintain maternal tissue and fetal growth, especially in the third trimester. Provision of additional food (PMT) is needed as an effort to increase protein intake in pregnant women, especially those experiencing chronic energy deficiency (Kristiyanasari 2010). Therefore, provision of additional food generally has a fairly high protein content. The protein content in the product has met the technical guidelines for providing additional food or drink for chronic energy deficiency pregnant women, which is at least 6 g (Kemenkes RI, 2017). The protein content in instant drink products is quite high when compared to similar products for chronic energy deficiency pregnant women, which is nuts and milk formula drinks of 5.3-7 g / 100 g and additional food products from the government, that is 10.14 g / 100 g (Indonesian Ministry of Health, 2017; Utami, et al., 2017).

The analysis showed that protein content contributed 13.31% to the total energy of beverage products. According to WHO (2018), providing additional food or drink with balanced protein energy has protein less than 25% of total energy. For chronic energy deficiency pregnant women, protein has been shown to increase pregnancy weight and improve pregnancy outcome. A meta-analysis research conducted by Liberato, et al (2013) also states that balanced protein energy supplementation reaches 20% of energy, can increase fetal growth, birth weight (by 95-324 g) and height (by 4.6-6.1 mm), as well as reducing percentage of low birth weight (by 6%). Balanced protein energy supplementation during pregnancy that is less than 20% (12.3% protein) results in higher fetal growth compared to supplementation containing 22.4% protein. The percentage of energy from protein of 13.31% can provide benefits or have a positive impact on fetal development and growth.

Fat is one of the essential nutrients to be consumed during pregnancy because it can provide energy and help build many fetal organs and placenta (Okubo, et al., 2011). The fat content of instant drink products is 9.92%. These results do not meet the technical guidelines for providing additional food or drink for pregnant women with a minimum of 12 g (Indonesian Ministry of Health, 2017), but have met the requirements of SNI for pregnant women, which is a minimum of 3.50 g of fat content (BSN RI, 2005).). Based on Utami, et al. (2017), nuts and milk drink products for pregnant women also have a relatively low fat content, namely 1-3.8% each. The low fat content is due to the less homogeneous oil in the drink so that the oil tends to be less stable (a lot is wasted) during the drying process.

Carbohydrate content of instant drink products is 70.53%. Carbohydrate content in the product is thought to come from the contribution of yellow sweet potatoes and red beans which are used as raw material. Carbohydrates are the dominant nutrient in yellow sweet potatoes where per 100 g contains 88.32 g carbohydrates (Endrias, et al., 2016). Meanwhile, red beans contain 56.70 g of carbohydrates per 100 g (Chaudary and Sharma, 2013). The addition of other ingredients such as maltodextrin, sugar and honey also contributes to carbohydrate content of the product.

The need for energy during pregnancy is necessary for the growth of fetus in womb. Therefore, energy needed also increases to support fetal growth and development as well as maternal health (Syari, et al., 2015). Energy content of the yellow sweet potato and red bean powder drink products is 429 kcal. This value has met the requirements for energy content of beverage products or additional food for pregnant women in chronic energy deficiency, which is a minimum

of 270 kcal (Kemenkes RI, 2017). In addition, the energy content of this beverage product also meets the requirements for additional energy from additional food and drink including nutrient dense drinks, which is 400 kcal (Damajanti, 2015).

The results of the analysis showed total dietary fiber content in beverages were 7.27% or in 100 g of products contain 7.27 g of dietary fiber. Based on these results, yellow sweet potato and red bean powder drink products can be claimed as high food fiber products because it has total dietary fiber more than 6 g per 100 g, in accordance with the provisions of BPOM RI regarding claims and labels for processed food in Indonesia (BPOM RI, 2016). Yellow yams and red beans contribute to fiber content of products, which contain 3.59 grams of fiber in yellow sweet potatoes and red beans contain 4 grams of fiber (Endrias, et al. 2016; Chaudary and Sharma, 2013).

The result of β-carotene analysis of selected formula is 14400 mcg/100 g or equivalent to 1200 mcg RAE/100 g vitamin A. Based on BPOM RI, a food product can be claimed to be high or rich in vitamin A (β-carotene) if it meets at least 30% Nutrition Label Reference of vitamin A for pregnant women. To meet 30%, at least product contain 245 mcg RAE or equivalent to 2938 mcg/100 g β-carotene. This shows that the beverage product can fulfill the high β-carotene claim because it has met the requirement for 30% vitamin A based on Nutrition Label Reference. β-carotene is also known as provitamin A. β-carotene is converted into retinol (vitamin A) in the intestinal mucosa with the help of an enzyme derived from intestinal cell cytosol. In pregnancy, vitamin A is needed by second trimester pregnant women to maintain immunity, maintain healthy bones, teeth, skin and hair while for the fetus it is useful for nerves in the brain, forming cell membranes and vision (Preedy, 2012).

The protein digestibility of selected formula was 74.22%. According to Sediaoetama (1991), high protein digestibility in food products ranges from ≥80%. The low protein digestibility in drinks is caused by the type of protein used. Most of the types of protein used in the study were vegetable protein, except for egg white flour, which included animal protein. Vegetable protein that enters body is not completely digested. Vegetable protein is not digested completely because it is protected by protective cellulose and polysaccharides which cannot be digested by digestive enzymes, so that the digestibility of vegetable proteins is generally lower than animal sources (Diana, 2010).

Other factors that can affect protein digestibility include interaction of protein with polyphenols, phytates, carbohydrates, fats, and anti-nutritional substances (Duodu, et al., 2013). Heating process in beverage-making process is thought to affect the digestibility of the protein. Heating triggers protein denaturation. Excessive heating will cause the protein to lose its binding structure (protein folding) so that some molecules will separate with their insoluble sub-units. Furthermore, these molecules combine and form an aggregate. The results of protein aggregation limit access to peptide bonds for hydrolytic enzymes (proteases) so that protein digestibility decreases (Gulati, et al., 2017).

The selected formula contributed 17.05% of energy, 18.79% protein, 11.81% fat, 20.44% carbohydrates, and 20.77% total dietary fiber of nutritional adequacy rate for pregnant women. The nutritional value of selected drink products is able to meet the nutritional needs of pregnant women for a portion of a snack. The nutritional content of food at least meets 10-20% of daily nutritional needs for a snack (Almatsier, 2010). Based on this, instant drinks based on yellow sweet potatoes and red beans can be used as an alternative supplementary drink for pregnant women because they meet the nutritional needs of pregnant women in a day for drinks or snacks.

CONCLUSION

The chosen instant powder drink product was F5 with a ratio of 3: 1 yellow sweet potato and kidney beans along with 5% addition of maltodextrin. Based on overall organoleptic characteristics, 89.5% of pregnant women accepted the selected instant drink products. Selected instant beverage products have an energy content of 423 kcal, 3.75% water content, 1.52% ash content, 14.28% protein content, 9.92% fat content, 70.53% carbohydrate content, 7 g total food fiber, 27%, beta-carotene 14.4 mg/100 g, and protein digestibility of 74.22%. The nutritional content

of selected instant drink products has met the nutritional content requirements of additional food for chronic energy deficiency pregnant women, SNI for pregnant women, and the requirement for pregnant women to drink or snack.

For future research, beverage products can be added flavor variants to increase product acceptance by pregnant womoen. The addition of encapsulated MMN (Multi-Micro Nutrient) also needs to be added in the future to increase and prevent loss of mineral content of beverage products. In addition, it is necessary to do other processing methods to reduce the water content of these powdered beverage products such as using spray dryer method which is quite effective in reducing water content.

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THE CORRELATION BETWEEN ENERGY, CARBOHYDRATE, FAT AND PROTEIN CONSUMPTION LEVEL WITH DEMENSIA IN ELDERLY

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ABSTRACT

Increasing number of elderly population due to influence of increased life expectancy, has an impact on increasing various health problems that occur due to aging process, one of which is dementia. Dementia is influenced by various factors, one of which is the level of nutrient consumption. The purpose of this study was to examine the relationship between level of energy consumption, carbohydrate, fat and protein with dementia in elderly. The population was elderly (> 60 y.o) in Tulungagung Regency. This study was cross sectional study with sampling techniques were used cluster random sampling. Samples in this study was 165 person. Variable analysed used chi square test. There were relationship between age, energy and protein consumption level with dementia in elderly ($p < 0.05$). Elderly who have dementia majority are over 70 years old (60.5%). The majority of elderly with dementia have energy and protein consumption level in low category, that is 48.7% and 55.3%, respectively. The conclusion is that there were correlation between age, level of energy and protein consumption with the incidence of dementia in elderly.

Keywords: Energy, Carbohydrate, Fat, Protein Intake, Dementia, Elderly

INTRODUCTION

The increase in life expectancy has an impact on the evelation in the number of elderly people (elderly) around the world, including in Indonesia (Kemenkes RI, 2017). This has resulted in epidemiological changes in the health sector, one of which is due to dementia. Dementia is a collection of chronic symptoms caused by decreased brain function resulting in cognitive dysfunction which is characterized by deterioration in language, comprehension, numeracy, memory and social skills (Ide, 2008; Kaplan, 2010; Wysocki et al., 2012). It is estimated that more than 130 million people experience dementia between 2015 and 2050 worldwide (Prince, 2016). Meanwhile, in Indonesia the prevalence of dementia in the elderly is around 5% of the total elderly and this prevalence increases to 20% for those aged over 85 years (Anurogo & Usman, 2014)

The occurrence of dementia will have an impact on the disruption of daily activities and social relations between the elderly and the environment (Boustani & Richard, 2007). Dementia is even one of the causes of death, which is increasing every year (Connors et al., 2015). In addition, dementia also causes increased dependence of the elderly on productive age. The Indonsesian Statistical Center Organization report (2018) states that the dependence ratio of the elderly to productive age has increased to 14.49%.

Apart from being a result of the aging process, dementia is influenced by various factors including gender, age and nutrient intake (Richard et al., 2007). Women tend to be more at risk of developing dementia than men (Dunen, 2008). One of the causes is the decrease in estrogen levels in women which is directly proportional to age. The hormone estrogen in women functions to protect areas of the brain, especially in the memory and cognitive sections (Eberling, 2003; Eberling, 2004; Robertson, 2009; Genazzani, 2005; Mott & Pak, 2013).

As someone gets older, the risk of dementia will increase. After entering the age of 60 years, every 5 years of age, the risk of dementia will increase two fold. Paul et al., (2010) found that increasing age corresponds to a decrease in cognitive function.

Nutritional and dietary factors, such as nutrient intake, are modifiable causes of

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dementia (Alles et al., 2012). Decrease in taste and sensitivity to food taste can affect changes in food intake in the elderly, so that certain nutrients can increase or decrease (Kemenkes RI, 2011). Energy intake and macronutrients (carbohydrates, fats and proteins) affect cognitive function and the occurrence of dementia (Kaplan et al., 2001, Campbell & Campbell, 2006; Creavin et al., 2012). Consumption of energy, carbohydrates, fats and proteins in a certain amount can improve cognitive performance so that it can prevent dementia. Likewise, the opposite can reduce cognitive function which can lead to dementia (Purnakarya, 2009). Robert et al., (2012) reported that the elderly with a percentage of meeting energy needs of 63% from carbohydrates, 16% from protein and 25% from fat have a higher risk of developing dementia compared to elderly people whose energy needs are 41% from carbohydrates, 20% of protein and 37% from fat.

This research is necessary because research on the relationship between the level of energy, carbohydrate, fat and protein consumption with dementia is still limited and shows varying results. Most studies on dementia in the elderly are carried out in social institutions, whereas this study takes place at the community level with locations taken randomly, so that it can provide a better picture of the incidence of dementia and the factors that influence it globally. The purpose of this study was to examine the correlation between gender, age, level of energy, carbohydrate, fat and protein consumption with the incidence of dementia in the elderly in the Tulungagung district.

METHODS

This research is an analytic observational study with a cross sectional design that takes place in Tulungagung Regency, East Java Province from December 2019 to January 2020. The research location was chosen because Tulungagung Regency has an elderly prevalence (15.25%) above East Java Province (12.92%) (BPS, 2017). The dependency ratio of the elderly in Tulungagung Regency is 23.86%. This figure is above the national ratio (14.49%) and East Java Province (19.68%) (BPS, 2017). Information worthy of ethics was obtained from the Health Research Ethics Commission of Sebelas Maret University (No. 364 / UN27.06 / KEPK / EC / 2019).

The population in this study were people in Tulungagung District who were >60 years old. Subjects were taken based on the statement of Santoso (2011), if a study has more than 3 indicators, then the number of 100-150 subjects is considered sufficient, then added the lost of follow-up from the number of subjects is 10%, so that the total subject becomes 165 subjects. The technique of taking the subject is using the cluster random sampling technique. Public Health Center (PUSKESMAS) in the Tulungagung District area were randomly selected to be the research locations. Tulungagung district has 32 health centers. Ten health centers were taken randomly. From each Puskesmas, Integrated Health Posts (Posyandu) were selected randomly. Then, as much as 165 elderly according to the inclusion and exclusion criteria were chosen randomly. The interview and measurement process was carried out at the Posyandu by researchers, enumerators and mental health officers.

Subject selection was made based on inclusion and exclusion criteria. The inclusion criteria are elderly people who can carry out daily activities independently, actively carry out health checks, regularly participate in elderly exercise, are able to read, write, hear and see well. The exclusion criteria used were elderly people with a history of disease (heart problems, stroke, diabetes and head trauma) and living in nursing homes. Willingness to be a respondent in this study was proven by signing the consent form.

The consumption level data was obtained by interview using a questionnaire, consisting of a 1x24 hour food recall questionnaire, a Mini Mental State Exam / MMSE questionnaire, and a questionnaire on subject characteristics. The 1x24 hour food recall questionnaire interview used the food model tool. The results of the food recall interview were analyzed electronically to determine the level of energy, carbohydrate, fat and protein consumption. The level of consumption in this case is the intake of energy, carbohydrates, fat and protein of the respondent. The results of the calculation of the consumption level are compared with the Nutrition Adequacy Rate (RDA) for the elderly and multiplied by 100%, then classified

into more (intake ≥ 120% RDA), normal (intake 90% - 119% RDA) and less (intake <90% RDA).

Dementia data were obtained by interview using the Mini Mental State Exam / MMSE questionnaire and the results were categorized into normal (cognitive function results 24-30), mild dementia (cognitive function results 19-23), moderate dementia (cognitive function results 10-18) and dementia. weight (cognitive function result <9). Gender and age data were obtained through interviews using a questionnaire.

The study of the research results was analyzed descriptively by calculating the frequency distribution of the research results. In addition, a Chi Square test was performed to see the relationship between the independent and dependent variables. Statistical tests were performed using the IBM SPSS statistic 21 program.

RESULTS AND DISCUSSION

From table 1, it can be seen that the majority of respondents in this study were women (59.4%) and as many as 50.9% of respondents were 60-69 years old. Respondents' energy intake was in the normal category at 40.6%. As many as 44.2% of respondents had carbohydrate intake in the normal category. Meanwhile, most respondents had low levels of fat and protein intake, respectively 44.2% and 44.8%. Most of the respondents' dementia status was in the normal category (53.9%). Based on the results of this study, data on the prevalence of dementia in the elderly in the Tulungagung District was obtained by 46.1%.

The age range of respondents based on Table 2 weres 61 to 83 years old, with an average age of the respondents being 71 years old. The respondents' average energy intake was 1444.6 Kcal, while the average carbohydrate intake was 221.9 g. The average fat intake of the respondents was 39.6 g and the average protein intake was 50.2 grams. When compared with the RDA, the average adequacy of energy, carbohydrates, fat and protein of respondents was 86.18 ± 16.75%, 88.36 ± 20.11%, 80.62 ± 31.61% and respectively. 82.89 ± 21.64%. Daily intake of carbohydrates, fats and protein can affect cognitive function. Elderly (70-89 years) who consume 232 grams of carbohydrates per day, 78 grams of protein per day, and 61 grams of fat per day have normal cognitive function and do not experience dementia (Roberts et al., 2012).

Based on Table 3, most of the respondents who did not experience dementia were female respondents (64.0%). However, more than 50% of respondents who experienced moderate and

Tabel 1. Distribution of Gender, Age, Energy Intake, Carbohydrates, Fat, Protein and Dementia in the Elderly in Tulungagung District in 2020

Variable	Total	
	n	%
Gender		
Male	67	40.6
Female	98	59.4
Age		
60-69 y.o	84	50.9
70-79 y.o	50	30.3
≥ 80 y.o	31	18.8
Energy intake		
Excessive	36	21.8
Normal	67	40.6
Inadequate	62	37.6
Carbohydrate intake		
Excessive	33	20.0
Normal	73	44.2
Inadequate	59	35.8
Fat intake		
Excessive	39	23.6
Normal	53	32.1
Inadequate	73	44.2
Protein intake		
Excessive	30	18.2
Normal	61	37.0
Inadequate	74	44.8
Dementia		
Normal	89	53.9
Mild Dementia	28	17.0
Moderate Dementia	27	16.4
Severe Dementia	21	12.7

Tabel 2. Average Age, Energy, Carbohydrate, Fat and Protein Intake of the Elderly in Tulungagung Regency in 2020

Variable	Min	Maks	Mean
Age (years old)	61	83	71
Energy intake (Kcal)	745.1	1911.6	1444.6
Carbohydrate intake (g)	112.1	347.7	221.9
Fat intake (g)	6.1	75.3	39.6
Protein intake (g)	22.1	80.2	50.2

severe dementia were female respondents. The majority of people with dementia are women, namely 61% of the total dementia sufferers and the rest are men (Alzheimer's Disease International, 2015b). This condition occurs as a result of the influence of hormones, where the female hormone estrogen decreases which is proportional to age. Meanwhile, one of the functions of the hormone estrogen is to protect areas of the brain, especially in the memory and cognitive areas (Eberling, 2003; Eberling, 2004; Robertson, 2009; Genazzani, 2005; Mott & Pak, 2013; Pike, 2017). This is also due to differences in neurophysiological conditions and due to differences in lifestyles between men and women (Moser & Pike 2016; Pike, 2017). Lifestyle factors such as education, stress and physical activity affect the incidence of dementia in men and women (Zu et al., 2015). Research by Mulyani et al., (2017) shows that there are differences in physical activity in men and women related to the occurrence of dementia. This is inversely proportional to the results of this study, namely there is no relationship between gender and the incidence of dementia in the elderly (p = 0.024).

Age is related to the incidence of dementia in the elderly, where the risk of dementia will increase with increasing age (Gibbons et al., 2014). Most of the incidence of dementia occurs when someone is> 60 years old and about 32% occurs at the age above 85 years (Prince et al., 2016). Based on the results of the Chi-square test, it is known that there is a relationship between age and the incidence of dementia (p = 0.014). This condition is in accordance with the results of research by Paul et al., (2010) which found that increasing age is in line with a decrease in a person's cognitive function. Research in Austria has also shown a decline in mental and cognitive abilities associated with increasing age (Freidl et al., 1996).

Decrease in energy and nutrient needs occurs in line with increasing age (Fatmah, 2010). Energy, carbohydrate, fat and protein intake are associated with the incidence of dementia (Ortega, 1997; Kaplan et al., 2001; Robert et al., 2012; Dieng et al., 2018). Table 3 shows that elderly with

Tabel 3. Relationship of Subject Characteristics, Energy Intake, Carbohydrates, Fat and Protein with Dementia in the Elderly in Tulungagung Regency in 2020

Variable	Normal		Mild Demensia		Moderate Demensia		Severe Demensia		p- value
	n	%	n	%	n	%	n	%	
Gender									
Male	32	36.0	15	53.6	11	40.7	9	42.9	0.424
Female	57	64.0	13	46.4	16	59.3	12	57.1	
Age									
60-69 y.o	54	60.7	11	39.3	14	51.9	5	23.8	
70-79 y.o	23	25.8	13	46.4	6	22.2	8	38.1	0.014*
≥ 80 y.o	12	13.5	4	14.3	7	25.9	8	38.1	
Energy intake									
Excesive	18	20.2	8	28.6	6	22.2	4	19.0	
Normal	46	51.7	10	35.7	5	18.5	6	28.6	0.026*
Inadequate	25	28.1	10	35.7	16	59.3	11	52.4	
Carbohydrate intake									
Excesive	16	18.0	7	25.0	5	18.5	5	23.8	
Normal	49	55.1	11	39.3	8	29.6	5	23.8	0.620
Inadequate	24	27.0	10	35.7	14	51.9	11	52.4	
Fat intake									
Excesive	18	20.2	8	28.6	7	25.9	6	28.6	
Normal	34	38.2	7	25.0	7	25.9	5	23.8	0.735
Inadequate	37	41.6	13	46.4	13	48.1	10	47.6	
Protein intake									
Excesive	16	18.0	7	25.0	5	18.5	2	9.5	
Normal	41	46.1	11	39.3	5	18.5	4	19.0	0.018*
Inadequate	32	36.0	10	35.7	17	63.0	15	71.4	

*) statistically significant at $p<\alpha$, $\alpha=0.05$

moderate and severe dementia mostly have low energy intake, 53.9% and 52.4%, respectively. There was a relationship between energy intake and dementia in the elderly (p = 0.026), low energy intake increased the incidence of dementia in the elderly. This is different from the results of the study by Creavin et al. (2012) where high energy intake in the elderly was associated with an increased risk of cognitive dysfunction.

Meanwhile, the elderly who did not have dementia mostly had normal carbohydrate intake (55.1%). In contrast to respondents with moderate and severe dementia, where most of their carbohydrate intake was in the low category. There was no correlation between carbohydrate intake and the incidence of dementia (p = 0.62), meaning that high or low carbohydrate intake did not affect the incidence of dementia in the elderly. This is different from research by Roberts, et al. (2012) who found that a high percentage of carbohydrate intake in meeting the daily energy needs of the elderly can have an impact on the increased risk of cognitive decline. The higher the percentage of energy fulfillment from carbohydrates, the risk of dementia also increases (Roberts et al., 2012). Increased carbohydrate intake in the elderly is associated with increased consumption of foods with a high glycemic index. Glucose is the main source of energy needed for metabolic activities in the brain and administration of glucose can help improve cognitive performance (Bourre, 2006). However, excessive consumption of carbohydrates and simple sugars in old age can interfere with glucose metabolism and insulin performance (Witte et al., 2009; Malik et al., 2010; J et al., 2009). High insulin levels can interfere with a person's cognitive abilities (Stolk et al., 1997).

Respondents who did not experience dementia or those who have dementia, mostly have less fat intake. Fat intake was not associated with the incidence of dementia (p = 0.735), which means that the adequacy of fat consumption did not affect dementia in the elderly. High fat deposits in the human body can result in insulin resistance which affects cognitive performance (Perkeni, 2015; Stok et al., 1997). Research by Nagai et al. (2019) found that intake of high-fat foods can reduce cognitive function and hippocampal neurogenesis in mice. This suggests that consumption of fatty foods can adversely affect cognitive abilities and accelerate the onset of dementia.

Protein intake was associated with dementia (p = 0.018). Respondents with moderate and severe dementia, mostly were in low protein intake. Protein is a nutrient that functions in the formation of neurotransmitters in the brain and nerves (Schelenker & Long, 2007). It is estimated that 10-25% of the elderly did not consume protein as recommended and 5-9% of the elderly only consume protein around 0.66 g / kg body weight per day (Volpi et al., 2013). Low protein intake can be associated with a lack of fulfillment of essential amino acid intake needed for neurotransmitter synthesis (Roberts et al., 2012). The occurrence of dementia is related to abnormalities in a number of amino acids that function as neurotransmitters (Ravaglia et al., 2007). Research by Kaplan et al. (2001) reported that consumption of protein sources was significantly associated with improved memory.

CONCLUSION

There was a positive relationship between age and the incidence of dementia and there was a negative correlation between the level of energy and protein consumption with dementia in the elderly. The older people and the lower the level of energy and protein consumption, the higher the incidence of dementia in the elderly. Further research needs to be done to assess eating patterns using the SQ-FFQ and 2 x 24 hour food recall to determine the eating habits of the elderly associated with dementia.

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ACCEPTABILITY AND NUTRIENTS CONTENT (VITAMIN B12 AND FOLIC ACID) OF SUBTITUTED SNACK BAR WITH PURPLE SWEET POTATO (*IPOMOEA BATATAS* L.) ENRICHED WITH NUTRITIONAL YEAST AS HEALTHY VEGAN FOOD

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ABSTRACT

Vegan are group of people who have high risk of megaloblastic anaemia because of vitamin B12 and folic acid deficiency. Purple sweet potato (Ipomoea Batatas L.) and nutritional yeast are rich vitamin B12 and folic acid, therefore can be formulated into healthy food, such as snack bar for vegan. The purpose of this study is to determine the effect of purple sweet potato substitution and nutritional yeast addition on acceptability and availability of vitamin B12 and folic acid of snack bar. The type of research of formulation was true experimental design (Complete Randomize Design) with 1 formula control and 2 modified formula. This research was carried out for 3 months (December 2018-March 2019) in Nutrition Laboratory Universitas Airlangga. The panelists are 38 people who affiliated with vegan community Yayasan Buddha Maitreya Surabaya. Statistical analysis used Kruskall Wallis test and Mann Whitney test with 5% significance level. The results of organoleptic test showed that the most preferred formula by panelists was F2 with an average value of 3,6. There are differences in terms of smell characteristic (p=0.017) and taste characterictic (p=0.021). F2 have the highest content of vitamin B12 and folic acid, which are 1.58 mcg and 1,62 mcg, respectively, for 50 gram snack bar. The study showed that the best optimization (acceptability and nutrient content) in formula is F2 (substitution of 20% of purple sweet potato and addition 9 g of nutritional yeast). Therefore, snack bar with purple sweet potato substitution and nutritional yeast enrichment is feasible as an alternative healthy snack for vegan.

Keywords: folic acid, nutritional yeast, purple sweet potato (Ipomoea Batatas L.), snack bar, vegan, vitamin B12.

INTRODUCTION

Vegan is a community group that applies dietary pattern of not using or consuming products derived from animals, animal products, and its derivatives (Wirnitzer, 2018). Vegan diet were included as the risk factors for vitamin B12 deficiency (Pawlak et al., 2014). Deficiency of vitamin B12 when combined with folic acid deficiency will cause megaloblastic anemia (Almatsier, 2011). Efforts to overcome megaloblastic anemia are oriented towards preventing deficiencies of both nutrients. Supplementation of vitamin B12 and folic acid has been considered to be the best solution to prevent megaloblastic anemia in vegan society, but in reality it is considered ineffective. This is due to the tendency of the vegan community to adopt or orient towards non-supplement diet, known as clean eating (Cramer et al., 2017). Some vegan groups even apply raw vegan diet (Pawlak et al., 2014). Therefore, dietary supplementation cannot solve the problem of megaloblastic anemia in vegan society.

An effective solution to prevent megaloblastic anemia in vegan society due to deficiency of vitamin B12 and folic acid is through food formulation. Food formulation can be done by adding certain food ingredients to the food that is commonly consumed by vegan community and does not go against vegan diet. Nutritional yeast can be act as source of vitamin B12 and folic acid, and purple sweet potato (*Ipomoea Batatas* L.) as a source of fiber and folic acid.

Nutritional yeast is yeast derived from deactivated and dried from *Saccharomyces cereviciae* bacteria. The nutrient content of nutritional yeast includes carbohydrates, protein, fat, vitamins and minerals. Nutritional yeast also contains several nutrients that are not found in other vegetable sources, that is lysine and

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methionine and several vitamins (Jach & Serefko, 2018). Nutritional yeast has a taste similar to cheese, which is salty and savory. Because of its common taste, nutritional yeast can be accepted by all people, including vegetarian.

Nutritional yeast has been widely available in market with certain brands, one of which is Bob's Red Mill. 1 gram of nutritional yeast with Bob's Red Mill brand contains 1.17 mcg of vitamin B12 and 121.6 mcg of folic acid. Addition of 1 gram of nutritional yeast in food has met 48.8% vitamin B12 total requirement and 30.4% folic acid total requirement according to 2013 RDA. This content is sufficient for snack requirements with claims as sources of vitamin B12 and folic acid, which contain 15% of nutritional adequacy rate (BPOM, 2016).

Purple sweet potato as source of folic acid and fiber can affect the texture of food products, so that these foods are not easily damaged. According to Winarno (2004), fiber and water content in food dough determines texture of food product. In addition to a source of folic acid and fiber, purple sweet potato also contain vitamin, mineral and antioxidant (Restuono et al, 2013). Purple sweet potato contain the highest antioxidant compared to other type of sweet potato, including anthocyanin, phenolic acid (quinic acid and ferulic acid), and flavonoid (O-hexoside of quercetin, chrysoeriol) (Wang et al., 2018). According to Restuono (2017), purple sweet potato can be found throughout Indonesia, one of which is in Pacet District, Mojokerto Regency. Purple sweet potato is one of main commodity in Mojokerto. Purple sweet potato can be processed into flour before it is used in food formulation.

One food formulation alternative that target vegan community is snack bar. Snack bar are included in snack commonly consumed by vegan community. According to Saputro (2018) snack bar is ready-to-eat snack. In general, snack bar are made from ingredient that are rich in nutrients such as various type of nuts, fruit, and other. The main ingredient and other additional ingredient can be mixed using binder and formed into stick that can be cut to desired size.

Snack bar formula refers to commercial snack bar product that is soyjoy variants strawberry and pineapple flavors, with modification adapted to the principle of vegan food. The main ingredient for snack bar are soy flour, sugar, cacao butter, chia seeds, salt and vanilla, and additional ingredients consisted of raisins and pineapple. According to Guiotto and Nancy (2014), chia seed play a role in strengthening nutrition bar and bread structure. Cacao butter as a binder has unsaturated fatty acid up to 40% and has a better biocompatibility compared to semi-synthetic fats (Kim et al., 2005). Soybean flour can be substituted with purple sweet potato flour aiming to increase fiber and folic acid content, as well as adding nutritional yeast to provide value for vitamin B12 content and increase the value of folic acid.

This study aims to formulate food in groups of people who are more susceptible to megaloblastic anemia. Fibriafi (2018) conducted research on food formulation in an effort to prevent megaloblastic anemia in ovo-vegetarian community in Surabaya. Sources of vitamin B12 were used seaweed flour and eggs which are used as a composition in making brownies. In contrast to this study, the composition of eggs cannot be used because it is against vegan diet rule, so the sources of vitamin B12 that can be used in this study are more limited and have higher difficulty.

The problem of nutrient deficiency is the background of this study to analyze the acceptability and nutritional content of snack bars substituting purple sweet potato flour enriched with nutritional yeast. The output of this study is the best snack bar formula through formula optimization. In hope that the substitute snack bar for purple sweet potato flour enriched with nutritional yeast can be accepted and provide access to food sources of vitamin B12 as well as an alternative source of folic acid for vegan community.

METHOD

This research is a true experimental using complete randomized design. This study used 1 snack bar control formula (F0) and 2 snack bar formulas substituting purple sweet potato flour and adding nutritional yeast (F1 and F2). Control formula there were no substitutions and additions, while in modified formula, 10% (F1) and 20% (F2) purple sweet potato flour was given, and 6 g and 9

g nutritional yeast were added, respectively (Table 1). This research was conducted from December 2018 to March 2019.

The snack bar was made at Nutrition Laboratory, Universitas Airlangga. Organoleptic tests covering color, aroma, texture, and taste on consumer panelists were carried out in vegan community "Yayasan Budha Maitreya" at Jalan Dukuh Kupang Utara 1 No. 2-4, Putat Jaya, Kec. Sawahan, Surabaya. Test for content of vitamin B12 and folic acid was carried out in Nutrition Laboratory, Universitas Airlangga through absorbance reading method using spectrophotometer and *Lactobacillus leichmanii* ATCC 7830 test organism.

Research sample was snack bar substitution of purple sweet potato flour which was enriched with nutritional yeast using developed formula. Sample size presented to panelists was 10 g for each snack bar formula. A total of 38 consumer panelists assessed sample presented by filling out questionnaire using scale value of 1 to 5 on each of preference tests (color, aroma, texture, and taste). Assessment of preference test includes: 1 = very dislikes, 2 = dislikes, 3 = neutral, 4 = likes, and 5 = very likes.

The results of preference test are processed, analyzed, and interpreted to determine formula with the highest acceptance value. The differences of substitution of purple sweet potato flour and addition of nutritional yeast was known after Kruskal Wallis test $\alpha \leq 0.05$, while the differences in each formula were known after Mann Whitney test $\alpha \leq 0.05$. Formula with the highest acceptance value was tested for vitamin B12 and folic acid levels in Nutrition Laboratory. The ingredienta used in making snack bar substitution of purple sweet potato flour which are enriched with nutritional yeast include soy flour, purple sweet potato flour, nutritional yeast, cacao butter, sugar, chia seeds, salt and vanilla, pineapple and raisins. The formulation of snack bar substitution of purple sweet potato flour which is enriched with nutritional yeast is presented in Table 1.

The process of making snack bar consisted of preparation stage, processing stage, and packaging stage. In preparation stage, soybean flour and purple sweet potato flour are roasted until smells good and are filtered using sieve. This aimed to get the smallest and even flour particle. Next process is to soak chia seeds and raisins for 10 minute, and chop filling ingredients (pineapple and raisin).

Table 1. Purple sweet potato flour enriched with nutritional yeast Snack Bar Formulation

Ingredients (g)	Formula		
	F0	F1	F2
Soybean Flour	**150**	**135**	**120**
Purple Sweet Potato Flour	**0**	**15**	**30**
Nutritional yeast	**0**	**6**	**9**
Cacao butter	50	50	50
Sugar	50	50	50
Raisin	10	10	10
Pineapple	10	10	10
Chia seed	10	10	10
Vanilla	4	4	4
Salt	4	4	4
Total	**288**	**294**	**297**

Information
F0: soy flour = 150 g; purple sweet potato flour = 0 g; Nutritional yeast = 0 g
F1: soy flour = 135 g; purple sweet potato flour = 15 g; nutritional yeast = 6 g
F2: soy flour = 120 g; purple sweet potato flour = 30 g; Nutritional yeast = 9 g

The processing process is carried out by mixing all ingredients, except stuffing ingredients, into food processor until all ingredients are evenly mixed. The stuffing ingredients are mixed in the dough before it is printed on baking sheet. The dough is molded with a thickness of 1.5 cm and baked in oven at 150^{o}C for 75 minute. In the last 10 minute, snack bar was given nutritional yeast on top (as topping). The snack bar is removed from the oven and cooled to room temperature.

The packaging stage is carried out by packing the snack bar with aluminum foil and closed using hot press sealer. Next snack bar was given to the panelists for organoleptic testing. This research has been approved by the Health Research Ethics Commission, Faculty of Dentistry, Universitas Airlangga number 032/HRECC.FODM/II/2019.

RESULT AND DISSCUSION

Organoleptic test results by consumer panelists on color preference for snack bar are presented in Table 2. The highest color preference is F2. The color of control snack bar is brownish yellow, while modified snack bar is brown. Consumer

panelists like the three types of snack bar color. The average assessment of consumer panelists on the color of snack bar F0 and F1 has the same value, while the assessment of color preference on snack bar F2 has increased. This is in line with research on manufacture of black soybean sweet potato snack bars. In Avianty research (2013) in manufacture of black soybean sweet potato snack bar, panelist like control and modification snack bars and there is no significant differences.

The brownish color produced from control and modified snack bars is the result of mailard reaction between lysine found in soybean and reducing sugar. Lysine has 2 amine groups which react with reducing sugar to produce a dark or dark brown color (Dewi, 2006). The darker color of modified snack bar than control was the result of a combination of purple sweet potato flour and soybean flour.

Organoleptic test results by consumer panelists on the level of preference for the aroma of snack bar are presented in Table 3. The highest level of preference for aroma is F2. The aroma in control snack bar was dominated by aroma of soy flour, cacao butter, and vanilla, while modified snack bar was dominated by aroma of soy flour, cacao butter, purple sweet potato flour, and vanilla.

Purple sweet potato gives a distinctive aroma to the modified snack bar. The aroma increases panelist's preference to snack bar. There is no unpleasant aroma that has potential to cause panelists to dislike it. This is because lipoxygenase enzyme has been lost in roasting process. Heating process functions to deactivate the lipoxygenase enzyme in these two ingredients (Dewi, 2006).

Consumer panelists like the aroma of snack bar F2 the most with the highest average, after that followed by the average consumer assessment of snack bar F0, then snack bar F1. This is in line with Avianty (2013) on the manufacture of black soybean sweet potato snack bars, the aroma of snack bars with purple sweet potatoes increases panelist's preference for the aroma of snack bar.

The results of organoleptic test by consumer panelists on preference for snack bar texture are presented in Table 4. The highest level of texture preference is F2. The texture of modified and control snack bar is the same, which is slightly hard. Consumer panelists like the three types of snack bar texture. The average consumer panelist assessment of snack bar F0 texture has the lowest value, while the texture of snack bar F1 and F2 has the same value. This is in line with Avianty (2013) on the manufacture of black soybean sweet potato snack bars, which is the texture of purple sweet potato snack bar did not increase panelist's preference for the texture of snack bar.

In snack bar with purple sweet potato substitution which is enriched with nutritional

Table 2. Distribution of Panelist's Preference to Snack Bar Color

Code	Preference Scale										Total		Total Score	Mean
	1		2		3		4		5					
	n	%	n	%	n	%	n	%	n	%	n	%		
F0	0	0	3	7.9	24	63.2	6	15.8	5	13.2	38	100	127	3.34
F1	0	0	2	5.3	22	57.9	13	34.2	1	2.6	38	100	127	3.34
F2	0	0	2	5.3	19	50.0	14	36.8	3	7.9	38	100	132	3.47

Note : 1 = very dislike; 2 = dislike; 3 = neutral; 4 = like; 5 = very like.

Table 3. Distribution of Panelist's Preference to the Snack Bar Aroma

Code	Preference Scale										Total		Total Score	Mean
	1		2		3		4		5					
	n	%	n	%	n	%	n	%	n	%	n	%		
F0	0	0	4	10.5	17	44.7	14	36.8	3	7.9	38	100	130	3.42
F1	1	2.6	6	15.8	19	50.0	8	21.1	4	10.5	38	100	129	3.21
F2	0	0	3	7.9	9	23.7	21	55.3	5	13.2	38	100	135	3.74

Note : 1 = very dislike; 2 = dislike; 3 = neutral; 4 = like; 5 = very like.

Table 4. Distribution of Panelist's Preference to the Snack Bar Texture

Code	Preference Scale										Total		Total Score	Mean
	1		2		3		4		5					
	n	%	n	%	n	%	n	%	n	%	n	%		
F0	0	0	5	13.2	20	50.6	9	23.7	4	10.5	38	100	126	3.32
F1	0	0	4	10.5	15	39.5	14	36.8	5	13.2	38	100	134	3.53
F2	0	0	3	7.9	16	42.1	15	39.5	4	10.5	38	100	134	3.53

Note : 1 = very dislike; 2 = dislike; 3 = neutral; 4 = like; 5 = very like.

yeast, the texture is influenced by purple sweet potato, water, chia seeds, sugar, and cacao butter.

Sugar, chia seeds, and cacao butter act as binder for snack bar and make snack bar texture solid. Fiber from purple sweet potato flour and water mixed with chia seeds affects the structure of modified snack bar. According to Winarno (2004), fiber and water levels in food play a major role in influencing texture of food.

Organoleptic test results by consumer panelists on the level of taste preference for snack bars are presented in Table 5. The highest level of taste preference is F2. Each formula, both controlled and modified, is added with cacao butter, sugar and salt to enhance the taste of snack bar. The taste of control snack bar was dominated by savory taste of soybean flour, while modified snack bar was dominated by combination of savory flavors of soybean flour and sweet which was typical of purple sweet potato flour.

The taste of purple sweet potato gives a distinctive taste to modified snack bar, thereby increasing panelist's preference for the taste of modified snack bar. This is in line with Avianty (2013) on manufacture of black soybean sweet potato snack bars which also states that the use of purple sweet potatoes in snack bar increase panelist's preference for taste. The sweet taste of modified snack bar comes from sugar and natural sugars in purple sweet potatoes, which is maltose, sucrose, fructose and glucose (Anggita, 2008).

Each formula has a different amount of soy flour, purple sweet potato flour, and nutritional yeast, so it affects the characteristics of snack bar. The results of statistical analysis with Kruskal Wallis showed a significant difference ($p \leq 0.05$) in aroma and taste characteristic.

Through Mann-Whitney test, there is a significant difference in aroma characteristics of F1 snack bar with aroma of F2 snack bar, but there is no significant difference between aroma of snack bar F0 and aroma of modified snack bar formula. This also happen to taste characteristic of snack bar. There is a significant difference in taste characteristics of F1 snack bar and taste of F2 snack bar, but there is no significant difference between taste of F0 snack bar and modified snack bar formula.

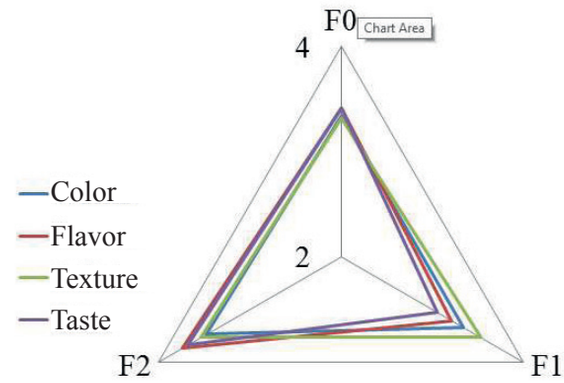

Figure 1. Overall Snack Bar Acceptance Assessment Diagram

Table 5. Distribution of Panelist's Preference to the Snack Bar Taste

Code	Preference Scale										Total		Total Score	Mean
	1		2		3		4		5					
	n	%	n	%	n	%	n	%	n	%	n	%		
F0	0	0	4	10.5	20	52.6	8	21.1	6	15.8	38	100	130	3.42
F1	1	2.6	12	31.6	12	31.6	10	26.3	3	7.9	38	100	122	3.05
F2	0	0	3	7.9	14	36.8	13	34.2	8	21.1	38	100	134	3.68

Note : 1 = very dislike; 2 = dislike; 3 = neutral; 4 = like; 5 = very like.

Table 6. The value of the content of vitamin B12 and folic acid in a snack bar in a serving dose of 50 grams

Nutrient	RDA*	Vitamin Sources Snack Rule	Nutrient per Serving	RDA Contribution (%)	Comercial Product Content **
Vitamin B12 (mcg)	2.4	15%	1.58	65.8%	unknown
Folic Acid (mcg)	400	15%	1.62	0.41%	80

Note: * The nutritional adequacy of men and women aged 10 to 60 years

** Product snack bar "Soyjoy" Strawberry flavor variant

The 10-20% substitution of ingredients resulted in significant differences in characteristic, especially purple sweet potato flour affected preference of panelists in snack bar. Snack bar F2 as the control formula has the highest assessment of all characteristics of preference test assessment. Another indicator to be an alternative snack source of vitamin B12 and folic acid is that it contains 15% of the nutritional adequacy rate. Nutritional values based on calculations and laboratory results are presented in Table 6.

Table 6 shows the results of calculation of vitamin B12 and folic acid value per 50 gram of snack bar. Vitamin B12 snack bar on DKBM calculation (1.8 mcg) shows a higher amount than laboratory results (1.58 mcg), while snack bar folic acid has a high range of differences between DKBM calculations and laboratory results. The results of folic acid calculation using DKBM (108.4 mcg) showed a higher amount than laboratory results (1.62 mcg). The amount of vitamin B12 snack bar substitution of purple sweet potato which is enriched with nutritional yeast has fulfilled the regulation of the Head of BPOM RI No. 13 of 2016, which fulfills 15% of total nutritional adequacy based on 2013 RDA. Snack bar's folic acid content has a low amount, so it does not meet minimum amount in the regulation.

The significant difference in folic acid content between the results of calculations based on DKBM and laboratory results was due to the use of terminology in calculations based on DKBM, which is purple sweet potato. The process of collecting purple sweet potatoes reduces content of folic acid to a minimum amount because folic acid is susceptible to damage in heat-dry process (Miftakhussolikhah et al., 2015). Heating process causes significant damage to folic acid A heating temperature of 120^{o}C for 22 minutes has reduced folic acid level by 80% (Qodriah, 2016), while vitamin B12 is relatively stable in hot, aerobic, and slightly acidic condition (Almatsier, 2011). The appropriate method for processing folic acid source material is by blanching at a temperature of 100^{o}C in less than 15 minute (Miftakhussolikhah et al., 2015).

Formula optimasi dihitung berdasarkan pembobotan daya terima (warna, aroma, tekstur, rasa, dan preferensi) dan nilai kandungan gizi (vitamin B12 dan asam folat). Formula optimasi dengan bobot tertinggi adalah F2, sesuai dengan tujuan formulasi makanan yaitu membuat produk makanan dengan daya terima yang layak dan nilai gizi yang cukup. *Snack bar* F2 merupakan formula dengan substitusi ubi ungu dan penambahan *nutritional yeast* yang tepat.

Optimization formula is calculated based on weighting of acceptability (color, aroma, texture, taste, and preference) and nutritional value (vitamin B12 and folic acid). The optimization formula with the highest weight is F2, in accordance with the purpose of food formulation, which make food product with adequate acceptance and sufficient nutritional value. Snack bar F2 is a formula with substitution of purple sweet potato and the right addition of nutritional yeast.

CONCLUSION

Substitution of purple sweet potato and addition of nutritional yeast had a significant effect on acceptability and nutritional content (vitamin B12 and folic acid) of snack bar. Based on results of optimization formula analysis, it was concluded that F2 snack bar had the best acceptance with the highest value of vitamin B12 and folic acid. F2 snack bar formula is suitable as an alternative healthy snack for the choice of vitamin B12 sources as a result of substituting purple sweet potato and adding nutritional yeast.

Purple sweet potato substitution snack bars and nutritional yeast additions can be a healthy

snack alternative for vegan community with the recommended serving size of 50 grams to meet the needs of 65.8% RDA for vitamin B12. In addition, to increase folic acid intake, vegan are advised to maintain consumption of green vegetables such as broccoli, kale, spinach, and others, as well as fruits to get enough folic acid intake.

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