

# THE EFFECT OF HEALTH BELIEF MODEL-BASED INTERVENTIONS TO INCREASE DIET QUALITY OF ADOLESCENTS

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## ABSTRACT

*The adolescent dietary quality in Indonesia remains subpar, with a substantial proportion of  $\leq 95\%$  of adolescents not consuming enough or any fruits and vegetables. The main objective of this research was to evaluate the impact of nutrition education programs based on the Health Belief Model (HBM) and conventional methods on the knowledge, attitudes, and eating habits of adolescents, with the ultimate goal of promoting healthy dietary practices. This study was a quasi-experimental study with a non-randomized control group pre and post-test design to 78 adolescents 13-15 years who met the inclusion criteria at the Bogor Regency Junior High School. Diet quality data was collected using 2x24 hours of food recall. The knowledge, attitude, and health belief model questionnaires that had been collected through questionnaires were then analyzed using SPSS version 25.0 using the Wilcoxon and paired t-test. There was no change in the quality diet in the health belief model and control groups with  $p$ -value  $> 0.05$ . However, there was an increase in knowledge and attitude in both groups with a  $p$ -value  $< 0.05$ . Only three constructs that improved were vulnerability, seriousness and self-efficacy with  $p$ -value  $< 0.05$ . Perceived benefits, barriers and action cues did not increase with  $p$ -value  $> 0.05$ . Health belief model nutrition education methods can improve knowledge and attitude, but not give a change in behavior. Health belief model nutrition education method can improve knowledge and attitudes, but not changes in eating behavior. Further health belief model-based nutrition education programs are needed to increase motivation and willingness to act.*

**Keywords:** Health Belief Model, Diet Quality, Nutrition Education Intervention, Adolescents

## INTRODUCTION

The nutritional problems among adolescents in Indonesia are overnutrition and undernutrition caused by frequent consumption of snacks and sweet drinks only and not consuming enough fruit and vegetables (Arnelia 2015). The percentage of adolescents who consume less than 5 portions of fruits (95%), sweet foods consumption (45%), sweet drinks (59%), and salty foods (31%) (Balitbangkes 2018). Based on previous research conducted in Bogor, it was found that the quality of adolescent diet was still bad (60.5%) (Devie 2020). The diet quality of adolescents aged 12-19 years in West Java Province is also still bad (44.4%). (Agustina *et al.* 2020).

A poor quality diet happens because adolescents do not have a proper knowledge and self-awareness to consume a balanced nutritious food (Notoatmodjo 2010). Therefore, nutrition

education intervention programs are needed to make changes in eating behavior. In Indonesia, many nutrition education interventions have been conducted to improve adolescents' knowledge, attitudes, and behavior toward balanced nutrition (Irnani, 2017). However, there still existed unsuccessful nutritional education programs that only increased the knowledge and attitude but not yet arrive to change the behavior. Previous research that provides nutrition education to adolescents in Jakarta can increase knowledge but not consumption of vegetables and fruits (Seki 2019). The unchanging behavior is rooted in a lack of awareness, seriousness, and trust in balanced nutritious food without knowing the benefits and problems when not consuming balanced nutritious food, and insufficient time allocation for having nutritional education, also an unsupportive environment (Fathi *et al.* 2017). Therefore, it

is urgent to create a learning model to increase the confidence of an individual to change his/her behavior and one example is a Health Belief Model (HBM).

HBM is a theoretical model for assessing individuals whether the person is able to do a follow up behavioral changes based on belief, so the next changing in behavior can be carried out further (Glanz *et al.* 2008). HBM has six main constructs for assessing an individual: (a) perceived susceptibility, (b) perceived severity, (c) perceived barriers, (d) perceived benefits, (e) self-efficacy or a person's belief to make behavioral changes, also (f) cues to action, or action that will be taken next to start making changes into healthy eating behavior (Becker 1974). The purpose of this study was to analyze the effect of nutrition education interventions based on the Health Belief Model (HBM) changes in eating behavior and improve the quality of adolescent diets in Bogor Regency.

## METHODS

### Study Design

The design of this research was a Quasi-Experimental Study with a non-randomized control group in pre and post-test design. This research was conducted from May 2023 to June 2023 on adolescents at Dramaga 2 Public Junior High School (*SMP Negeri 2 Dramaga*) and Ciomas 1 Public Junior High School (*SMP Negeri 1 Ciomas*) in Bogor Regency. This research was carried out in two separate classes, with each class comprising 84 students. By employing the Lameshow formula (1997), the total number of respondents was calculated and resulted in 78 individuals. The participants were subsequently divided into two groups: the intervention group, comprising 39 individuals, and the control group, comprising an additional 39 individuals. This research has been approved by the Research Ethics Commission of Bogor Agricultural Institute with approval number of 876/IT3.KEPMSM-IPB/SK/2023.

### Subject's selection

The total respondents in this study were 78 respondents with inclusion criteria for sample study were 13–15 years adolescents who were in grade VIII, in healthy condition and willing

to take part in the research from the beginning until completion. Meanwhile, exclusion criteria for sample study were ill student or those absent at least once during the intervention activity.

### Research Procedures

First procedure of this research was preparing powerpoint media, videos, leaflets, also questionnaires of knowledge, attitudes, practices and a questionnaire of HBM, and then carrying out validity and reliability tests. Second procedure was collecting data on respondents' food consumption. Third procedure was implementing 4 meetings intervention program in one month, each lasting for 1.5 hours. Both intervention and control groups were given intervention using the same media, but the control group was not given the material of six construct of HBM. Every week the material provided for the research groups was different. In the first and fourth weeks, the baseline and end line data on knowledge, attitude and practice belonged to control group and the HBM questionnaire in the intervention group were collected. Questionnaires of pretest and post-test on knowledge will be given each week during the intervention program.

The topic and material of nutrition education intervention were differentiated for each week according to the balanced nutrition guidelines and IGS3 60 components, the recommendation for amount and portions of food for adolescents, the importance of consuming nutritious food, also providing examples of a balanced nutritional menu. On topic for intervention group that used HBM method, there was additional material given about the 6 main constructs perception of susceptibility where respondents become vulnerable to experience nutritional problems due to unbalanced nutrition eating behavior when did not comply to the recommendations, perception of severity feeling towards serious problems that would arise when they did not change into a good eating behavior, perception of barriers that make it difficult to change eating behavior, perception of benefits when changing into healthy and nutritious eating behavior, the self-efficacy or motivation exists within respondents so they are willing and able to change their behavior, as well as cues to act where the respondents have a way that can be done next so they can carry out recommendations for

consuming appropriate and nutritionally balanced foods.

### Data Collection Method

Data of diet quality was collected by food recall method 2 x 24 hours in weekends and weekdays, The results of this 2x24 hour food recall will be converted into portions using the Food Exchange List II in the Balanced Nutrition guidelines (Kemenkes RI, 2014). After calculating the serving sizes, the items were sorted and assessed based on a three-tier scoring system: 0.5, and 10. This evaluation was conducted across six food categories: carbohydrates, plant-based protein, animal protein, fruits, vegetables, and dairy (excluding nutrients and non-communicable diseases) (Kusumawati 2019). After determining the overall score by adding up the values of the six food components, the next step is to classify them into categories: very good ( $\geq 85$ ), quite good (70-84), moderate (55-69), less (40-54), and bad ( $\leq 40$ ) (Amrin *et al.* 2014).

The questionnaire of knowledge consists of 15 multiple choice questions. The maximum score in respondents' knowledge is 100 and divided into three categories: (a) good category with score  $> 80$ , (b) moderate category with score of 60-80, and (c) poor category with score of  $< 60$  (Khomsan, 2022). Whereas the questionnaire of attitude consists of 10 statements by using 4 Points Likert scale answers; strongly agree, agree, disagree, and strongly disagree which will be classified in to good category if the score is  $> 75$  %, or adequate category if the score is 56% - 75 % or poor category if the score is  $< 56$  %. The last one is the questionnaire of eating behavior, consists of 10 questions which must be answered correctly and accordingly to what the respondent experiences, then classified as good when the score is  $> 75$  %, or adequate when the score is 56-75 %, or poor when the score is  $< 56$  % (Khomsan 2000).

The HBM questionnaire consists of 30 statements where each perception has five statements with 5 points Likert scale answers (strongly agree, agree, disagree and strongly disagree). The questionnaire underwent initial evaluation for reliability and validity, resulting in a Cronbach's Alpha value of 0.701, which exceeded the minimum acceptable threshold of

0.316 according to the table of critical values for Cronbach's Alpha. Then, it will be classified into good category when the score is 76 % - 100 %, or moderate category if the score is 60 % - 75 %, or low category if the score is  $< 60$  % (Hupnau 2019). Assessment for the respondents' nutritional status was measured by anthropometry data based on body mass index indicator to respondents' age (BMI/U or BMI to Age). Height measurement was taken by a stature meter with maximum measurement of 200 cm and accuracy of 0.1 cm whereas weight measurement was taken by a digital scale with a maximum measurement of 150 kg and an accuracy of 0.1 kg. After series of these measurements completed then the data were classified according to BMI/U.

## RESULTS AND DISCUSSIONS

### Characteristics of Respondents

Respondents of this study predominantly were female adolescents as stated by percentage of 53.8 % in HBM group and 53.8 % in the control group. Age of most respondents were 14 years old (82.1 % in the HBM group and 79.5 % in the control group). Majority respondents are always given moderate pocket money ranging from IDR 11,000 – 29,000/day (74.4%), whereas some respondents have a lot pocket money/high category  $> IDR 30,000$  (17.9%) and the rest of respondents have low category pocket money  $< IDR 11,000$  (7.7 %). Most respondents allocate their pocket money to buy food/drinks/snacks in the canteen during break times. Most respondents came from Sundanese tribe, where in the HBM group was 71.8 % and in control group was 79.5 %. Most adolescents in both groups have a normal nutritional status.

### Description of Adolescents' Diet Quality

Quality of respondents' diet is a result which able to indicate individual food consumption or food intake whether he/she conforms to the food consumption recommendation or not. Quality of individual's diet will be considered as good when it meets the adolescent's nutritional needs. To assess whether individual food consumption meets or does not meet recommendations, an evaluation is necessary to measure the quality of food consumption, such as using Indeks Gizi Seimbang (IGS).

**Table 1.** Distribution of Respondents' Characteristics

Variable	Intervention (n=39)		Control (n=39)		Total		P value
	n	(%)	n	(%)	n	(%)	
<b>Gender</b>							
Male	17	43.6	18	46.2	35	44.9	0.821
Female	22	56.4	21	53.8	43	55.1	
<b>Age</b>							
13 years	3	7.7	6	15.4	9	11.5	0.198
14 years	32	82.1	31	79.5	63	80.8	
15 years	4	10.3	2	5.1	6	7.7	
<b>Nutrition Status</b>							
Under nutr.	11	28.2	10	25.6	21	26.9	0.093
Normal	25	64.1	16	41	41	52.6	
Over nutrition	2	5.1	12	30.8	14	17.9	
Obesity	1	2.6	1	2.6	2	2.6	
<b>Pocket Money</b>							
Low	3	7.7	4	10.3	7	9	0.222
Moderate	29	74.4	32	82.1	61	78.2	
High	7	17.9	3	7.7	10	12.8	
<b>Tribe</b>							
Sundanese	28	71.8	31	79.5	59	75.6	0.572
Javanese	8	20.5	4	10.3	12	15.4	
Batavians	1	2.6	0	0	1	1.3	
Malay	1	2.6	0	0	1	1.3	
Aceh	1	2.6	0	0	1	1.3	
Minang	0	0	1	2.6	1	1.3	
Batak	0	0	2	5.1	2	2.6	
Arab	0	0	1	2.6	1	1.3	

Based on the results of the difference test using the Wilcoxon test, the diet quality score in the HBM group and the conventional group found that there was no significant difference ( $p > 0.05$ ) between the scores before and after the nutrition education intervention. Where before the intervention, in both groups, most respondents were in the poor diet quality category (97.4%), while after the intervention, the respondents' diet quality remained in the poor category (94.9%). This result is consistent with Khoeriah's research (2017), which found that both male and female adolescents have poor food consumption quality (70.1%). Similarly, Rahmawati's (2015) study on diet quality using IGS3-60 revealed that the majority of adolescents aged 13-18, regardless of gender, have poor diet quality (76.7%).

During adolescence, it's important to consume balanced and nutritious food to support growth and prevent future nutritional problems. Developing a habit of consuming balanced and nutritious food is necessary to improve the quality of the diet

(Amalia *et al.* 2023). To ensure a high-quality diet, it is important to have a sufficient variety of food components that contribute to a balanced and nutritious diet. This includes adequate intake of vegetables, fruits, grains, fiber, protein, and iron (Dieny *et al.*, 2021). (Dieny *et al.* 2021). Eating a balanced diet is crucial for nutritional status. Food consumption reflects both nutrient adequacy and variety. The average food consumption of adolescents in Indonesia varies, but it does not meet the daily intake needs, which should include a variety from each food group (meat/poultry/fish/eggs, milk/nuts, grain products, fruits, and vegetables) (Azzahra *et al.* 2023)

### **The Difference of Knowledge, Attitude and Behaviour of Adolescents in Before and After Intervention Program**

Majority respondents of HBM group before intervention had sufficient knowledge (59%), then after the intervention there was a change in knowledge into good category (89.5%). The

**Table 2.** Categories Diet Quality of Adolescents Before and After Intervention Program

Food	Kelompok HBM		Kelompok Konvensional		Total	P Value
	n	%	n	%		
<b>Sebelum</b>						
Buruk ( $\leq 40$ )	37	94.9	39	100	97.4	0.942
Kurang (40-55)	2	5.1	0	0	2.6	
<b>Sesudah</b>						
Buruk	38	97.4	36	92.3	94.9	0.062
Kurang	1	2.6	3	7.7	5.1	

attitude of most respondents in HBM group before intervention were in the fair category (48.7%), then after intervention was increased into good category (94.9%). The behaviour before intervention in HBM group was also in fair category (51.3 %), and after intervention there was increase score into the good category (53.8%). It proves that after treated with intervention by employing HBM, this method was able to increase respondents' knowledge, attitude and practice at  $p < 0.05$ . Someone who has good knowledge tends to feel more susceptible to nutritional problems so that later strategies or ways to reduce the risk will emerge (Noorbakhsh *et al.* 2017).

According to research of Naghashpour *et al.* (2014), HBM method is able to increase the adolescents' knowledge and attitude about consuming type of foods that contains calcium. HBM method also can be used to understand behaviour related to health since HBM has 6 important constructs (perceptions of susceptibility, severity, benefits, obstacles, self-efficacy and cues to action) to make it able to influence adolescents knowledge and attitudes (Salem, 2018). In line with this theory, Keshani (2019) also found that nutrition education by HBM method through collaborative learning was able to increase adolescents' knowledge and attitudes towards dietary behaviour.

An increase also occurred in control group, in which before intervention, most respondents' knowledge was classified in moderate category (87.2 %) and after intervention there was an increase in respondents' knowledge into good category (94.9%). The respondents' attitude before intervention was 71.8 % and after intervention

**Table 3.** Result of Knowledge, Attitude and Behaviour of Respondents

Variable	HBM (n=39)	Control (n=39)	p value
	Mean $\pm$ SD	Mean $\pm$ SD	
<b>Knowledge</b>			
Pretest	64.71 $\pm$ 11.6	69.80 $\pm$ 7.14	0.034* <sup>b</sup>
Posttest	89.25 $\pm$ 7.42	91.81 $\pm$ 5.27	0.133
p value <sup>a</sup>	0.000*	0.000*	
<b>Attitude</b>			
Pretest	71.67 $\pm$ 9.39	79.81 $\pm$ 10.30	0.001* <sup>b</sup>
Posttest	84.55 $\pm$ 7.76	84.36 $\pm$ 7.92	0.851
p value <sup>a</sup>	0.000*	0.010*	
<b>Practice</b>			
Pretest	60 $\pm$ 11.21	73.33 $\pm$ 10.70	0.000* <sup>a</sup>
Posttest	75.64 $\pm$ 8.38	78.71 $\pm$ 6.90	0.721
p value <sup>a</sup>	0.000*	0.003*	

also increased into good category (87.2%). The respondents' behaviour before intervention was in 53.8% and after the intervention was in the good category (74.4%). In the conventional method, there was also an increase in adolescents' knowledge, attitude and practice regarding diet quality ( $p < 0.05$ ).

It confirmed that conventional nutrition education method also able to increase the adolescents' knowledge, attitude and practice regarding consuming balanced nutritious food and complying the suggested recommendations. According to Sofianita (2021), conventional nutrition education is still effective in increasing respondents' knowledge and attitude. Conventional nutrition education such as lectures also able in providing better understanding in a discussion or in answer questions session together with friends or teachers (Insani 2019).

### Effectiveness of Health Belief Model Nutrition Education towards Diet Quality

The nutrition education through Health Belief Model (HBM) method has 6 constructs which there are only 3 perceptions are believed by respondents to change behaviour: the perception of susceptibility, perception of severity and self-efficacy.

The respondents' perception of susceptibility in before and after intervention was classified as moderate category (64.1 %) whereas the respondents' perception of severity after intervention was increased to good category (59 %). The respondents' self-efficacy after intervention also in a good category (74.4%). Although three constructs (perception of susceptibility, perception of severity and self-efficacy) were found in good category, different results occurred in perception of benefits, barriers and cues to action, where in before and after intervention, the perception of benefit still in moderate category (64.1%). Perception of barriers after intervention was also in the moderate category (89.7%) and cues to action was in the moderate category (53.8%).

The result of this study showed a significant change found in perception of susceptibility, severity and self-efficacy ( $p < 0.05$ ). The same study was conducted on students in Qom City, Iran, who felt that they were vulnerable to nutritional problems if they consumed unhealthy snacks too often (Fathi *et al.* 2017).

When someone considers him or herself vulnerable, he/she tends to seek further information about his/her health. However, when the respondent lose motivation to seek information related to nutrition that able to change his/her eating pattern, there will be decline and diversion into other preventions which according to the person is more susceptible to occur at this time (Tzeng dan Ho 2022). When one's self-efficiency or self-confidence increases, one tends to be able to make behavioral changes, one starts to maintain weight and starts a healthy diet (Saghafi-Asl *et al.* 2020).

In contrast, there were no significant changes in perceived benefit, perceived barrier and cues to action ( $p > 0.05$ ). Lack of perception of the benefits of students' eating habits also occurred among students in Romania. Lower perceptions of the students' benefits of food habits are due to the lack of information obtained by changing their dietary habits (Dumitrescu, 2021). Although the respondents' knowledge significantly increased after given the intervention, it also found that there were still respondents who did not know and understand about benefit that would occur if they change their diet, some problems they will encounter and their lack of willingness to make changes into a nutritionally balanced diet. While still in young age, it can influence the perception of perceived obstacle to make adolescents feel safe of their bodies that still healthy so they will not experience more serious effect in their future time (Tavakoli *et al.* 2016)

### Changes in Diet Quality According to Food Components

Based on portion recommendation and amount of food consumption according to 2014 Balanced Nutrition Guidelines (PGS) for adolescents aged 13-15 years, the portion for male adolescents are  $\pm 650$  grams (61/2 portions) and portion for female adolescents are  $\pm 450$  grams (equivalent to 4 ½ portions) (Kemenkes RI, 2014)

The Balanced Nutrition Index (IGS) in this study evaluates the nutritional balance of adolescents' diets. The value obtained in the IGS food component is the sum of the food components. The results of dietary quality obtained in this study in the HBM group and the control group before and after the intervention did not show

**Table 4.** Difference in HBM Constructs in Before and After Intervention Program

Variable	Before	After	p value
	Mean $\pm$ SD	Mean $\pm$ SD	
Perception of Susceptibility	75.08 $\pm$ 6.11	81 $\pm$ 10	0.001*
Perception of Severity	73 $\pm$ 8.28	80.67 $\pm$ 7.26	0.000*
Perception of Benefit	79.1 $\pm$ 8.57	81.41 $\pm$ 9.38	0.114
Perception of Barrier	79.1 $\pm$ 8.57	81.41 $\pm$ 9.38	0.285
Self-Efficacy	72.69 $\pm$ 9.37	79.87 $\pm$ 3.88	0.000*
Cue to action	75.26 $\pm$ 6.06	77.82 $\pm$ 6.86	0.102

Differential Test of Wilcoxon before and after intervention  
 \*p value < 0.05

significant changes ( $p$  value  $> 0.05$ ). This also demonstrates that the quality of food consumption among adolescents in the HBM and conventional groups still needs to be higher or better than the recommendations of the Balanced Nutrition Index (IGS). Table 5 depicts the changes in diet quality based on food components in both groups before and after the intervention.

The results of diet quality in the HBM and control groups were based on food components that experienced an increase in only food sources of carbohydrates and animal protein. While the diet quality of other food groups did not improve, the t-test (Wilcoxon) results for the HBM group indicated that only carbohydrate foods and animal protein showed significant differences before and after the intervention, with  $p$  value  $< 0.05$ . On the other hand, food groups such as vegetable protein, vegetables, fruit, and milk did not show significant differences, with  $p$  value  $> 0.05$ .

**Table 5.** Difference in Diet Quality According to Food Components in Before and After Intervention Program

Variable	HBM (n=39)	<i>P</i> value <sup>a</sup>	Kontrol (n=39)	<i>P</i> value <sup>a</sup>
	Mean ± SD		Mean ± SD	
<b>Carbohydrate</b>				
Pretest	5.6±2.19	0.002*	6.96±2.05	0.001*
Posttest	7.8±3.81		8.46±2.6	
<b>Animal</b>				
Pretest	4.7±2.4	0.007*	4.5±1.8	0.008*
Posttest	6.9±3.71		7.1±2.2	
<b>Vege.pr</b>				
Pretest	1.8±2.3	0.166	1.56±1.7	0.289
Posttest	1.0±1.2		0.69±0.9	
<b>Vegetable</b>				
Pretest	0.84±0.5	0.111	0.62±0.65	0.685
Posttest	0.8±0.7		0.59±0.67	
<b>Fruit</b>				
Pretest	1.09±1.35	0.089	0.85±0.9	0.942
Posttest	0.67±1.0		0.83±1.1	
<b>Milk</b>				
Pretest	0.9±1.0	0.938	0.9±1.1	0.504
Posttest	0.86±1.36		0.79±0.8	
<b>Total</b>				

<sup>a</sup> Wilcoxon differential test in before and after intervention

<sup>b</sup> Score differential test between control and intervention groups

\*  $p$ -value  $< 0.05$

These results showed majority of adolescents have met the recommended portion size, especially in the carbohydrate food component. According to result of 2 x 24 hours recall, the carbohydrate food source for adolescents were vary such as rice, noodles, vermicelli, bread, potatoes and corn. However, most consumed carbohydrate food component was rice. Carbohydrate foods, one of which is rice, are an average energy contributor of 40-80% of Indonesians (Kementan RI 2021). Carbohydrate food sources are a source of energy nutrients that body needs most and becomes type of food easy to obtain since the price is affordable, so Indonesian selecting rice as their staple food (Almatsier 2009). The result of this research is in line with research of Dewi (2023) and Rahmawati (2015) that stated the type of most consumed food groups by adolescents is carbohydrate food.

Food groups that have met other food consumption recommendations in the HBM and control groups include animal-based dishes. This is consistent with previous research indicating that adolescent animal food consumption almost meets the recommended level of 75.5%, despite not reaching daily nutritional adequacy. Meanwhile, 88.9% of people still consume less milk, and 69.1% consume fewer vegetable side dishes than recommended (Dewi 2023). According to Rahmawati (2015), adolescents using IGS3-60 should consume the following recommended servings for one meal per day like carbohydrate food: 3-4 servings (100 grams per portion), animal side dishes: 2-4 servings (50 grams per portion), vegetables: 2-4 servings (50 grams per portion), fruits: 2-3 servings (50 grams per portion) and milk: 200ml per glass (liquid milk) or 20 grams (milk powder).

The adolescents period (13-15 years of age) is the most important period in supporting body growth (Rahmawati 2015). The animal protein component was consumed more often, but the vegetable protein component had a different result, where it became the lowest food component most consumed by adolescents. Although vegetable side dishes have lower protein quality when compared to animal side dishes, the vegetable foods contain a higher proportion of unsaturated fat than animal foods. Plant-based foods contain isoflavones, fiber, anti-oxidants and anti-cholesterol which can

prevent non-communicable diseases (Yang *et al.* 2020).

Other important food components such as vegetable side dishes, vegetables and fruits did not meet the recommended amount and portions of the balanced nutrition guidelines. Other similar research also stated that adolescents of Indonesia have low consumption of vegetable side dishes, vegetables and fruit (Dewi 2023; Al-Jawaldeh *et al.* 2020). According to 2014 Balanced Nutrition Guidelines (PGS), the recommended amount and portion of vegetable consumption is 300 grams (equivalent to 3 portions) and 400 grams of vegetables (equivalent to 4 portions). Low vegetables and fruits consumption in adolescents in the long term will result in nutritional deficiencies in vitamins, minerals, and fiber as well as an acid-base imbalance in the body and increase risk in causing non-communicable diseases such as diabetes, heart disease, hypertension, cancer, stroke and others (Qibtiyah *et al.* 2021)

One of many reasons for low consumption of vegetable side dishes, vegetables and fruits among adolescents in Indonesia is minimum understanding about functional foods (superfoods) among adolescents even though Indonesia has developed many types of functional food with high nutritional content. For example, processed foods most widely known as plant foods are tempeh and tofu. Although tofu and tempeh have high nutritional value, people only know tempeh and tofu as snack dishes (Tamam 2022).

This is in line with result research where majority adolescents are very lacking in consuming functional foods (super foods) namely tempeh and tofu. Although most adolescents have good knowledge, especially for types of balanced nutritious food, some adolescents also do not understand the benefit of consuming tempeh for the health and body growth. It also shows they do not have any future clues to start consuming balanced nutritious food. According to Amaliah (2019), adolescents in Indonesia have heard about functional food, but do not know that components in functional food can reduce serious illness in the future. Motivation of adolescents to consume functional food also still at minimum level. Adolescents stated they would start consuming functional foods when they have extra money or

if they had extra money, or if they experienced illness later in life.

According to research by Medeiros (2020), there are many influential factors contributed to the failure of nutrition education intervention in changing the eating behavior, such as external factors like schools that did not facilitate healthy canteen, lack of family support, and the very short duration of the intervention ( $\leq 1$  year). To make a behavior change takes longer time and requires continuous effort to maintain good eating behavior. According to Yuksel *et.al* (2020), nutritional intervention education must use a multicomponent system focused on the main learning content and permanent learning design for school and supported by training for teachers so that after intervention given not only increase the knowledge but also able to grow the skills and attitudes of the adolescents.

This study has some limitations. Firstly, it cannot assess the effectiveness of nutrition education interventions using the Health Belief Model (HBM) method and conventional methods on changes in diet quality because it only collected data on 6 HBM constructs from one group, specifically at SMP Negeri 2 Dramaga. Secondly, this study was only conducted for four weeks (four meetings during the provision of nutrition education interventions) because the school had limited time.

## CONCLUSION

Based on the study's findings, nutrition education interventions using the Health Belief Model method still failed to enhance the quality of adolescent diets. Although adolescents' knowledge and attitudes have improved, they still need to understand the benefits they will receive if they change their eating behavior. There is a need for a school nutrition education curriculum that should be implemented in school learning activities and further interventions on the consequences of good eating behavior in adolescents at risk of nutritional problems.

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