

ANALYSIS OF HEALTHY EATING INDEX (HEI) IN ADOLESCENTS OVERWEIGHT IN PADANG CITY

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ABSTRACT

Overweight is an increasing nutritional problem in the world. The prevalence of overweight in adolescents in the Southeast Asian region in 2015 according to WHO was 13.35% and increased in 2016 to 14.0%, where the prevalence of overweight in Indonesian adolescents was above the Southeast Asian prevalence. Various health complaints are associated with overweight/obesity. Overweight can be prevented by implementing a healthy diet pattern based on the Healthy Eating Index (HEI). This study aims to determine how the description, of the average HEI score in adolescents and determine the relationship between the HEI and the overweight in adolescents. This study is a quantitative study using a cross-sectional design. The population in this study were high school adolescents in the working area of a community health center in Padang City using a questionnaire instrument and FFQ form. Selection of high school by multistage random sampling. The sample size was 300 respondents consisting of 60 respondents from 5 selected schools. Samples were selected randomly. Based on the research, it was found that overweight in adolescents in Padang City was (19.7%). The mean HEI score of adolescents is 57.0 (low). The mean HEI score in adolescents with normal nutritional status of 57.5 was higher than the mean HEI score in overweight adolescents of 55.5. There is no significant relationship between HEI and overweight nutritional status ($p=0.198$). It is expected that adolescents can apply healthy dietary patterns by paying attention to the 4 (four) components of the HEI namely variety, adequacy, moderation, and overall balance.

Keywords: Adolescent; Overweight; Healthy Eating Index; Diet Quality Index

INTRODUCTION

Being overweight is defined as a metabolic syndrome that starts with an imbalance between energy intake and energy expenditure in the body (Fallah-Fini *et al.*, 2014). Being overweight is a nutritional

problem that continues to increase in the world (Ma *et al.*, 2020). The prevalence of overweight adolescents in the Southeast Asian region in 2015 was 13.35% and increased in 2016 to 14.0%, where the prevalence of overweight in Indonesian

adolescents was above the Southeast Asian prevalence (World Health Organization, 2016). Based on the 2013 Riskesdas data, it is known that the prevalence of adolescents aged 13-15 years overweight and obese (IMT / U) is 10.8% (8.3% overweight and 2.5% obese), while adolescents aged 16-18 years is 7.3% (5.7% overweight and 1.6% obese). The trend of overweight nutritional status (IMT/U) in 2010-2013 among adolescents aged 16-18 years was 1.4% in 2010 and increased to 7.3% in 2013 (Riskesdas, 2013).

Various health complaints are associated with overweight/obesity (Furuncuoğlu, 2016; Sundari, Dewi and Ikhsan, 2016; Chua *et al.*, 2017), and there is a high mortality rate in overweight/obese adults. Research results show obesity is at risk for prediabetes incidence (Astuti, 2019). Overweight and obesity are progressive conditions caused by behavioral, environmental, hereditary, socioeconomic status, and cultural factors (Indriawati and Soraya, 2009; Sartika, 2011; Ali, Onibala and Bataha, 2017). Diet is an important lifestyle factor associated with body composition and may play an important role in the prevention of overweight and obesity (Tande, Magel and Strand, 2010).

The focus of recent dietary assessments has been on measuring from diverse and comprehensive perspectives (Feskanich, Rockett and Colditz, 2004; Kirkpatrick *et al.*, 2020). In the US, a measure of diet quality or the Healthy Eating Index (HEI) represents dietary conformity with the Dietary Guidelines for America (DGA), which is the basis of nutrition policy for the US government and the foundation of all federal nutrition guidelines. The US Department of Agriculture (USDA) food pattern translates the main recommendations of the DGA into specific, measurable recommendations of the types and amounts of foods that should be consumed at 12-calorie levels, with limits on

calories from solid fats and added sugars (Guenther *et al.*, 2013).

The HEI is used to assess the concordance of each food group with the key dietary quality recommendations set out in the DGA. With the release of the 2015-2020 DGA, the HEI has been updated to reflect current federal dietary advice through a collaboration between researchers at the National Cancer Institute (NCI) and the US Department of Agriculture (USDA) Centre for Nutrition Policy and Promotion (CNPP) (Reedy *et al.*, 2018; Phillips, 2021).

The 2015 HEI includes 13 food components. It consists of nine sufficiency components (which are recommended to be included in a healthy diet) namely amount of fruit, whole fruit, number of green vegetables and legumes, whole grains, dairy, total protein foods, seafood, vegetable protein, and fatty acids. The four moderation components (which should be consumed in moderation) include grains, sodium, added sugars, and saturated fats. Added sugars are a new component in the 2015 HEI (Reedy *et al.*, 2018).

The assessment of the quality of the adolescent diet index is guided by the Diet Quality Index International (DQI-I) illustrated by China and the United States with minor modifications. There are four main categories in the assessment: Dietary variety was evaluated in two ways: overall variety and protein source variety, to assess whether intake came from diverse sources both within and across food groups. The inclusion of at least one serving of food per day from each of the five food groups (meat/poultry/ fish/ eggs/ milk/ nuts/ seeds/ fruits/and vegetables) determines the maximum overall diversity score (Kim *et al.*, 2003).

Variation in protein sources i.e. meat, poultry, fish, dairy, pulses, and eggs were also evaluated as diets that have variety

within the same food groups, as well as overall variety, are believed to be superior to diets with monotonous sources. Each of these food groups also provides other important nutritional and non-nutritional components (e.g. essential fatty acids from the fish group and phytochemicals from the nuts group) (Kim *et al.*, 2003).

Intake of more than half the serving size per day is considered meaningful consumption. When intake came from 3 different protein sources per day, the highest score was awarded 5 points. When the number of different sources was reduced to 2, 1 and 0, respectively (Kim *et al.*, 2003).

Sufficiency, this category evaluates the intake of food elements that should be provided sufficiently to ensure a healthy diet, as a preventive measure against undernutrition. Scores for the eight components in the category are assigned based on the percentage of attainment of recommended intakes on a continuous scale that ranges from 0 points for 0% to 5 points for 100%, with a limit of 5 points. The recommended intake of fruits, vegetables, whole grains, and fiber depends on energy intake (Kim *et al.*, 2003).

Diets containing 2-4 servings of fruit and 3-5 servings of vegetables, depending on the level of energy intake were awarded the highest score of 5 points. Daily intakes of 6, 9, and 11 servings from the grain group and 20, 25, and 30 g of fiber for the three categories of energy intake, respectively, met the criteria for the highest scores for the grain and fiber components (Kim *et al.*, 2003). If the consumption of these vitamins and minerals does not meet the adequacy, the body will experience vitamin and mineral deficiencies that can lead to reduced immunity (Gustiara, 2013; Muthmainah *et al.*, 2019).

Protein intake is considered adequate when the proportion of total energy intake derived from protein is 10%. Intake levels

that determine the highest scores for iron, calcium, and vitamin C adequacy are derived from Dietary Reference Intakes (DRIs), which vary by age and gender (Kim *et al.*, 2003).

Moderation/ is to evaluate the intake of foods and nutrients that are associated with chronic diseases and that may require restriction. Certain levels of total fat, saturated fat, cholesterol, and sodium are necessary for the body to function normally, but when consumed in excess can lead to the onset of chronic diseases (Kim *et al.*, 2003).

The intake levels of these nutrients are categorized into three levels, according to the degree of effect on health. The Healthy Eating Index (HEI) is an effective tool for measuring the quality of adolescent food to prevent overweight and chronic diseases related to diet. Those in the lowest tier include intakes where a healthy person would show no evidence of harmful effects. Excess intake of those in the highest tier may be associated with the presence of chronic diseases. The intermediate level includes intakes between the lowest and highest levels. The lowest intake category was given the highest score of 6 points, the highest intake category the lowest score of 0, and the intermediate level a score of 3 points (Kim *et al.*, 2003).

Overall balance, the last category examines overall dietary balance in terms of proportionality of energy sources and fatty acid composition. Consistent findings in the literature emphasize the importance of balance between energy-producing macronutrients in terms of contribution to total energy intake (Kim *et al.*, 2003; Sobotka *et al.*, 2017).

For fatty acids, a similar set of recommendations is available. Increased intake of saturated fatty acids (SFAs) is a risk factor for several chronic diseases, especially cardiovascular disease, whereas increased

intake of PUFAs and monounsaturated fatty acids was found to protect against these conditions. However, excess intake of these same fats is undesirable, and maintaining a balance between the intake of these fatty acids is more important for a healthy diet (Kim *et al.*, 2003; Li *et al.*, 2022).

The purpose of this study was to determine how the description, the average Healthy Eating Index (HEI) score or the quality of the food index in adolescents with obesity in Padang City and to determine the relationship between the Healthy Eating Index (HEI) and the nutritional status of overweight in adolescents.

RESEARCH METHODS

This study is a quantitative study with a cross-sectional study design. The population was all high school students in the working area of Andalas community health center and Anak Air community health center. Selection of community health center working areas based on data on the highest and lowest prevalence of overweight in Padang City, using multistage random sampling for school selection. Five high schools in Padang were selected, namely SMA N 10, SMA Adabiah, SMA Kartika I-5, SMA N 7, and SMA N 8. 300 samples consisting of 60 samples from

each high school were randomly selected. Inclusion criteria include High school students from selected schools, living with parents, physically and mentally healthy, willing to be respondents (agreeing to informed consent). Data collection on nutritional status was carried out by taking anthropometric measurements of height and weight categorized based on Body Mass Index (BMI) according to age. BMI calculation is based on body weight (cm) divided by height (m²). The tools used are microtois and stepping scales. Data on the characteristics of respondents were obtained by interview using a questionnaire and data on HEI components were obtained using the Semi Quantitative Food Frequency (SQ FFQ) form (Lipoeto *et al.*, 2001). The variables in this study are HEI components consisting of variety, adequacy, moderation, and overall balance. Data were analyzed using the SPSS program.

RESULTS AND DISCUSSION

Univariate analysis describes how the characteristics of adolescents according to age, gender, and nutritional status are measured using Body Mass Index (BMI) by age. Characteristics of adolescents are as follows:

Table 1. Characteristics of Adolescents by Age, Gender, and Nutritional Status

Characteristics of Adolescents	Total	Percentage
Age		
≤16 Years	124	41,3
16-17 Years	145	48,3
>17 Years	31	10,3
Gender		
Male	126	42,0
Women	174	58,0
Nutritional Status		
Overweight	59	19,7
Normal	241	80,3

The results showed that the prevalence of overweight in adolescents in Padang City was (19.7%). Almost half of the adolescents (48.3%) were aged 16-17 years and had female gender (58.0%). This is in line with the 2007 Riskesdas data which found that the

prevalence of overweight and overweight in the age group ≥ 15 years in 2007 was 18.8%, increasing to 26.6% in 2013 and 31.0% in 2018 (Riskesdas, 2018). Overweight and obesity show an increasing trend from year to year.

Table 2. Components of Healthy Eating Index (HEI), Number and Percentage of Samples in Sub Categories of Components among Adolescents in Padang City

Component	Score	Assessment Criteria	Nutritional Status			
			Overweighth		Normal	
n			59		241	
			n	%	n	%
Variations	0-20 points					
Variety of whole food groups (meat/poultry/fish/eggs; dairy/nuts/grains/fruits/vegetables)	0-15 points	≥ 1 serving of each food group/day =15	0	0,0	0	0,0
		there is 1 food group not served/day =12	0	0,0	0	0,0
		there are 2 food groups not served/day = 9	0	0,0	9	3,7
		there are 3 food groups not served/day =6	47	79,7	204	84,6
		there are 4 food groups not served/day = 3	12	20,3	28	11,6
		None of the food groups served/day = 0	0	0,0	0	0,0
Variation within groups for protein sources (meat, poultry, fish, dairy, beans, eggs)	0-5 points	≥ 3 different sources/day =5	50	84,7	210	87,1
		2 different sources per/day =3	9	15,3	31	12,9
		From 1 source/day = 1	0	0,0	0	0,0
		None =0	0	0,0	0	0,0
Sufficiency	0-40 points					
Vegetable group	0-5 points	$\geq 3-5$ servings/day =5	1	1,7	49	20,3
		1-2 servings/day =3	23	39,0	57	23,7
		0 servings/day =0	35	59,3	135	56,0
Fruit group	0-5 points	$\geq 2-4$ servings/day =5	5	8,5	13	5,4
		1-2 servings/day =3	13	22,0	54	22,4
		0 servings/day =0	41	69,5	138	57,3
Grain group	0-5 points	$\geq 6-11$ servings/day =5	0	0,0	0	0,0
		1-4 servings/day = 3	59	100	241	100

(142-155)

Component	Score	Assessment Criteria	Nutritional Status			
			Overweig ht		Normal	
n			59		241	
			n	%	n	%
		0 servings/day =0	0	0,0	0	0,0
Fibre	0-5 points	≥20-30 g/day =5	1	1,7	1	0,4
		≥15<20 g/day =4	3	5,1	12	5,0
		≥10<15 g/day =3	21	35,6	59	24,5
		≥5<10 g/day =2	25	42,4	132	54,8
		≥1<5 g/day =1	8	13,6	36	14,9
		0 g/day =0	1	1,7	1	0,4
Protein	0-5 points	≥10% dari energi/day =5	0	0,0	0	0,0
		≥7,5% <10% of energy/day =4	0	0,0	2	0,8
		≥5% <7,5% of energy/day =3	27	45,8	98	40,7
		≥2,5% <5% of energy/day =2	32	54,2	141	58,5
		≥1% <2,5% of energy/day =1	0	0,0	0	0,0
		0% energy/day =0	0	0,0	0	0,0
Iron	0-5 points	≥100% AKG/ day =	58	98,3	224	92,9
		0% AKG/ day =0, (Male = 11 mg, Female = 15 mg)	1	1,7	17	7,1
Calcium	0-5 points	≥100% AKG/ day =5	25	42,4	77	32,0
		0% AKG/day =0, (Male = 1200 mg, Female=1200mg)	34	57,6	164	68,0
Vitamin C	0-5 points	≥100%AKG/ day =5	18	30,5	58	24,1
		0% AKG/ day =0, (Male = 90mg, Female=75mg)	41	69,5	183	75,9
Moderation	0-30 points					
Total Fat	0-6 points	≤20% of total energy/ day =6	59	100	241	100
		>20-30% of total energy/ day =3	0	0,0	0	0,0
		>30% of total energy/ day =0	0	0,0	0	0,0
Saturated fat	0-6 points	≤7% of total energy/ day =6	59	100	241	100
		>7-10% of total energy/ day =3	0	0,0	0	0,0
		>10% of total energy/ day =0	0	0,0	0	0,0
Cholesterol	0-6 points	≤300 mg/ day =6	18	30,5	137	56,8
		>300-400 mg/ day =3	15	25,4	59	24,5
		>400 mg/ day =0	26	44,1	45	18,7
Sodium		≤2400 mg/ day =6	59	100	240	99,6



(142-155)

Component	Score	Assessment Criteria	Nutritional Status			
			Overweig ht		Normal	
n			59		241	
			n	%	n	%
Empty calorie food	0-6	>2400-3400 mg/ day =3	0	0,0	1	0,4
	points	>3400 mg/day =0	0	0,0	0	0,0
	0-6	≤3% of total energy/ day =6	59	100	241	100
	points	>3-10% of total energy/ day =3, >10% of total energy/ day =0	0	0,0	0	0,0
			0	0,0	0	0,0
Overall, Balance	0-10					
	points					
Macronutrient ratio	0-6	55 ~ 65:10 ~ 15:15 ~ 25 = 6	0	0,0	4	1,7
(Carbohydrate: Protein:	points	52 ~ 68:9 ~ 16:13 ~ 27 = 4	0	0,0	10	4,1
Fat)		50 ~ 70:8 ~ 17:12 ~ 27 = 2	2	3,4	11	4,6
		If not = 0	57	96,6	216	89,6
Fatty acid ratio (PUFA:	0-4	P/S = 1 ~ 1.5 and M/S = 1 ~ 1.5 =	0	0,0	1	0,4
MUFA: SFA)	points	4				
		P/S = 0.8 ~ 1.7 and M/S = 0.8 ~ 1.7	0	0,0	240	99,6
		= 2				
		If not = 0	59	100	0	0,0

The results of the Healthy Eating Index (HEI) study, which is assessed based on 4 components, namely variety, adequacy, moderation (FAO and WHO, 1998), and overall balance where the variety component consists of 2, namely the variation of the food group as a whole point (0-15) and variation within the group for protein sources points (0-5). It was found that in overweight adolescents and adolescents of normal nutritional status for the category ≥ 1 serving of each food group/day (meat/poultry/fish/eggs; milk/nuts/grains/fruit/vegetables) and the category there is 1 food group not served / day, both get 0 points (0.0%). This means that in every meal served to adolescents, none of the food groups were served in full. For the category, there are 2 food groups not served / day, overweight

adolescents (0.0%) and adolescents of normal nutritional status (3.7%). There were 3 food groups not served/day, among overweight adolescents (79.7%) and normal nutritional status adolescents (84.6%). There were 4 food groups not served/day, among overweight adolescents (20.3%) and normal nutritional status adolescents (11.6%).

The within-group variation component for protein sources showed that for the category ≥ 3 different sources per day in overweight adolescents (84.7%) and in normal nutritional status adolescents (87.1%). The category of 2 different sources per day in overweight adolescents (15.3%) and in normal nutritional status adolescents (12.9%).

Furthermore, the adequacy component was assessed based on vegetable group (0-5)



points, fruit group (0-5) points, grain group (0-5) points, fiber (0-5) points, protein (0-5) points, iron (0-5) points, calcium (0-5) points, and vitamin C (0-5) points. Each group obtained results, for the vegetable group the category ≥ 3 -5 servings/day in overweight adolescents (1.7%) and in normal nutritional status adolescents (20.3%), 1-2 servings/day in overweight adolescents (39.0%) and normal nutritional status adolescents (23.7%), group 0 servings/day in overweight adolescents (59.3%) and in normal nutritional status adolescents (56.0%).

Fruit group ≥ 2 -4 servings/day in obese adolescents (8.5%) and in normal nutritional status adolescents (5.4%), 1-2 servings/day category in overweight adolescents (22.0%) and normal nutritional status adolescents (22.4%), 0 servings/day group in overweight adolescents (69.5%) and in normal nutritional status adolescents (57.3%). The grains group was in the 1-4 servings/day category in both overweight and normal nutritional status adolescents (100.0%). The highest percentage of the fibre group was in the category $\geq 5 < 10$ g/day in overweight adolescents (42.4%) and normal nutritional status adolescents (54.8%). The highest percentage of protein group was in the category $\geq 2.5\% < 5\%$ of energy/day in overweight adolescents (54.2%) and normal nutritional status adolescents (58.5%). The highest percentage of iron adequacy was in the $\geq 100\%$ AKG/day category among overweight adolescents (98.3%) and normal nutritional status adolescents (92.9%). The highest percentage of the calcium group was in the category of 0% RDA/day in overweight adolescents (57.6%) and normal nutritional status adolescents (68.0%). The vitamin C group had the highest percentage of 0% RDA/day among overweight adolescents (69.5%) and normal nutritional status adolescents (75.9%).

The moderation component (0-30 points) consists of total fat (0-6) points, saturated fat (0-6) points, cholesterol (0-6) points, sodium (0-6) points, and empty calorie foods (0-6) points. The total fat category $\leq 20\%$ of total energy/day for both overweight adolescents and normal nutritional status adolescents was the same (100.0%). Saturated fat category $\leq 7\%$ of total energy/day for both overweight adolescents and normal nutritional status adolescents (100.0%). The highest percentage of cholesterol group for overweight adolescents was in the > 400 mg/day category (44.1%) while adolescents with normal nutritional status had the highest percentage in the ≤ 300 mg/day category (56.8%). The highest percentage of sodium group was in the ≤ 2400 mg/day category in overweight adolescents (100.0%) and normal nutritional status adolescents (99.6%). The empty calorie food group had the highest percentage of $\leq 3\%$ of total energy/day in overweight adolescents and normal nutritional status adolescents (100.0%).

The overall balance component has a value of (0-10) points, consisting of a macronutrient ratio (Carbohydrate: Protein: Fat) of (0-6) points and a fatty acid ratio (PUFA: MUFA: SFA) of (0-4) points. The macronutrient ratio group (Carbohydrate: Protein: Fat) had the highest percentage in the category with a value of 0, which is the category outside the 3 categories (55 ~ 65:10 ~ 15:15 ~ 25, 52 ~ 68:9 ~ 16:13 ~ 27, 50 ~ 70:8 ~ 17:12 ~ 27) in overweight adolescents (96.6%) and normal nutritional status adolescents ((89.6%). The highest percentage of fatty acid ratio (PUFA: MUFA: SFA) in overweight adolescents was in the 0 category (100.0%) and normal nutritional status adolescents had the highest percentage in the P/S = 0.8 ~ 1.7 and M/S = 0.8 ~ 1.7 categories (99.6%).

Table 3. Mean Healthy Eating Index (HEI) Score

Component	Score	Mean \pm SD HEI Score
Variation	0-20 points	10,4 \pm 1,4
Variety of whole food groups (meat/poultry/fish/eggs; dairy/nuts/grains/fruits/vegetables)	0-15 points	5,7 \pm 1,2
Variation within groups for protein sources (meat, poultry, fish, dairy, beans, eggs)	0-5 points	4,7 \pm 0,7
Sufficiency	0-40 points	18,5 \pm 4,9
Vegetable group	0-5 points	1,6 \pm 2,0
Fruit group	0-5 points	1,6 \pm 2,0
Grain group	0-5 points	3,0 \pm 0,0
Fibre	0-5 points	2,2 \pm 0,8
Protein	0-5 points	2,4 \pm 0,5
Iron	0-5 points	4,7 \pm 1,2
Calcium	0-5 points	1,7 \pm 2,4
Vitamin C	0-5 points	1,3 \pm 2,2
Moderation	0-30 points	27,8 \pm 2,5
Total Fat	0-6 points	6,0 \pm 0,0
Saturated Fat	0-6 points	6,0 \pm 0,0
Cholesterol	0-6 points	3,8 \pm 2,5
Sodium	0-6 points	6,0 \pm 0,2
Empty calorie food	0-6 points	6,0 \pm 0,0
Overall, Balance	0-10 points	0,3 \pm 1,1
Macronutrient ratio (Carbohydrate: Protein: Fat)	0-6 points	0,3 \pm 1,0
Fatty acid ratio (PUFA: MUFA: SFA)	0-4 points	0,0 \pm 0,3

Based on the results of the study, the average Healthy Eating Index (HEI) score of adolescents was 57.0 (low). This is in line with research conducted by Alfiah, et al who found the Diet Quality Index (DQI) score in adolescent girls at SMP Ibnu Aqil Bogor was 55.9 (low). (Alifiah, Yusuf and Puspa, 2021) and research conducted by Briawan, et al who got the results of the quality of the adult diet of 53.8 (low) (Briawan, Heryanda and Sudikno, 2021).

The variety component shows that each variety of food groups (meat/ meat/ fish/ eggs; milk/ nuts/ grains/fruit/ vegetables) is consumed every day and the variety for protein sources shows how many protein sources are consumed in one day. The mean

variation score in this study was 10.4 out of a maximum score of 20.

Adequacy scores for each group of vegetables, fruit, grains, fibre, protein, iron, calcium, and vitamin C were compared to the 2019 Nutritional Adequacy Score. The lowest score was vitamin C adequacy of 1.3 and the highest score was iron adequacy of 4.7. Vitamin C deficiency is associated with iron intake and the incidence of iron deficiency anemia in adolescent girls. Vitamin C consumption can maximize the absorption of iron in the blood, in addition to being able to absorb iron from food needed as prevention of anemia (Hapsari, Hidayati and Zulaekah, 2023).



The vegetables and fruits group also received a low score of 1.6 out of a maximum score of 5. In line with Hapsari's research, which found that the average vegetable intake in adolescent girls was still relatively low, especially when compared to the average vegetable intake of ≥ 250 grams/day (Hapsari, Hidayati and Zulaekah, 2023).

The World Health Organization (WHO) and the Balanced Nutrition Guidelines generally recommend the consumption of vegetables and fruits for a healthy life of 400 g per person per day, consisting of 250 g of vegetables (equivalent to 2 ½ servings or 2 ½ cups of vegetables after cooking and draining) and 150 g of fruit, (equivalent to 3 medium banana ambon or 1 ½ pieces of medium papaya or 3 medium oranges) (Hermina & Prihatini, 2016).

Various studies have shown the benefits of consuming vegetables and fruits are very important for the human body. These benefits include a role in maintaining normal blood pressure, blood cholesterol, and blood sugar levels. Adequate consumption of vegetables and fruits can also reduce the risk of constipation and obesity. By consuming fiber, the consumption of fat and salt intake can be reduced, causing a decrease in blood pressure and subsequently preventing overweight (Sartika, 2011)

Lack of consumption of vegetables and fruits, which are sources of fiber, vitamins and minerals, can lead to overweight and the incidence of non-communicable diseases such as heart and blood vessel diseases, diabetes, colon cancer, hypertension and stroke. Adequate consumption of vegetables and fruits is one of the simple indicators of a

healthy diet with balanced nutrition (Hermina and Prihatini 2016).

Based on table 3. the moderation group is various types of fat and sodium consumed in a day. The maximum score in this study is 6 of each. The lowest score is cholesterol 3.8. The overall balance shows the macronutrient ratio (Carbohydrate: Protein: Fat) and fatty acid ratio (PUFA: MUFA: SFA) with a total score of 10 points. The total overall balance score in this study was 0.3. Consisting of macronutrient ratio score (Carbohydrate: Protein: Fat) is 0.3 and fatty acid ratio score (PUFA: MUFA: SFA) is 0.0. One of the weaknesses of this study is the limited data on trans fatty acids, whose intake is a risk factor for chronic diseases including type 2 diabetes (Salmerón *et al.*, 2001) and cardiovascular disease (Oomen *et al.*, 2001).

Based on the results of the analysis of the relationship between HEI and overweight nutritional status, it was found that there was no significant relationship between HEI and overweight nutritional status in adolescents ($p=0.198$), however, the Healthy Eating Index (HEI) score in adolescents with normal nutritional status was 57.5. This score is higher than that of overweight adolescents 55.5, a difference of 2 points. The results of this study are in line with research conducted by Guo *et al.*, finding that the HEI score in people with overweight 63.5 is lower than the HEI score in people with normal nutritional status 63.6, differing by 0.1 points (Guo *et al.*, 2004). Another study found that the average total HEI score of people with abdominal obesity was lower, at 64.7 compared to non-obese people at 65.1 (Tande, Magel and Strand, 2009).

Table 4. Mean Healthy Eating Index (HEI) Score by Nutritional Status

Component	Score	Mean \pm SD HEI Score	
		Overweight	Normal
Variation	0-20 points	10,1 \pm 1,4	10,5 \pm 1,4
Variety of whole food groups (meat/poultry/fish/eggs; dairy/nuts/grains/fruits/vegetables)	0-15 points	5,4 \pm 1,2	5,8 \pm 1,2
Variation within groups for protein sources (meat, poultry, fish, dairy, beans, eggs)	0-5 points	4,7 \pm 0,7	4,7 \pm 0,7
Sufficiency	0-40 points	18,7 \pm 4,1	18,5 \pm 5,1
Vegetable group	0-5 points	1,3 \pm 1,5	1,7 \pm 2,1
Fruit group	0-5 points	1,1 \pm 1,7	1,7 \pm 2,1
Grain group	0-5 points	3,0 \pm 0,0	3,0 \pm 0,0
Fibre	0-5 points	2,3 \pm 0,9	2,2 \pm 0,8
Protein	0-5 points	2,5 \pm 0,5	2,4 \pm 0,5
Iron	0-5 points	4,9 \pm 0,7	4,6 \pm 1,3
Calcium	0-5 points	2,1 \pm 2,5	1,6 \pm 2,4
Vitamin C	0-5 points	1,5 \pm 2,3	1,2 \pm 2,1
Moderation	0-30 points	26,6 \pm 2,6	28,1 \pm 2,4
Total Fat	0-6 points	6,0 \pm 0,0	6,0 \pm 0,0
Saturated Fat	0-6 points	6,0 \pm 0,0	6,0 \pm 0,0
Cholesterol	0-6 points	2,6 \pm 2,6	4,1 \pm 2,4
Sodium	0-6 points	6,0 \pm 0,0	6,0 \pm 0,2
Empty calorie food	0-6 points	6,0 \pm 0,0	6,0 \pm 0,0
Overall, Balance	0-10 points	0,1 \pm 0,4	0,4 \pm 1,2
Macronutrient ratio (Carbohydrate: Protein: Fat)	0-6 points	0,1 \pm 0,4	0,4 \pm 1,1
Fatty acid ratio (PUFA: MUFA: SFA)	0-4 points	0,0 \pm 0,0	0,0 \pm 0,3
P	0,198		

CONCLUSION

Based on the results of the study it can be concluded that overweight in adolescents in Padang City is (19.7%). The mean Healthy Eating Index (HEI) score of adolescents is 57.0 (low). The mean HEI score in adolescents with normal nutritional status of 57.5 is higher than the mean HEI score in overweight adolescents of 55.5. The score difference was 2 points. There is no significant relationship between Healthy Eating Index and overweight nutritional status (p=0.198).

The results of this study are expected to be information for adolescents, parents, and schools, so that adolescents can apply healthy dietary patterns by paying attention to the 4 (four) components of the Healthy Eating Index (HEI), namely variety, adequacy, moderation, and overall balance.

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