Amerta Nutrition
e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
Kamaruddin et al. | Amerta Nutrition Vol. 7 Issue 2SP (December 2023). 311-319

RESEARCH STUDY
English Version
OPEN ACCESS

Factors Influencing Nutritional Status in Overweight and Obese Adolescents

Faktor-Faktor Yang Mempengaruhi Status Gizi Pada Remaja Overweight dan Obese

Iriyani Kamaruddin[1]*, Lilik Kustiyah[2], Hadi Riyadi[2], Ruqayah Junus[3]

[1]Fakultas Kesehatan Masyarakat, Universitas Mulawarman, Samarinda, Indonesia
[2]Departemen Gizi, Fakultas Ekologi Manusia, Institut Pertanian Bogor, Bogor, Indonesia
[3]Jurusan Gizi, Politeknik Kesehatan Kementerian Kesehatan Manado, Indonesia

ARTICLE INFO

Received: *15-09-2023*
Accepted: *31-12-2023*
Published online: *31-12-2023*

Correspondent:
Iriyani Kamaruddin
iriyani@fkm.unmul.ac.id

DOI:
10.20473/amnt.v7i2SP.2023.311-319

Available online at:
https://e-journal.unair.ac.id/AMNT

Keywords:
Adolescents, Nutritional status, Overweight dan Obese

ABSTRACT

Background: One of the target groups at risk of becoming overweight and obese is teenagers. East Kalimantan is one of the largest provinces in Indonesia with a prevalence of overweight and obesity in children aged 13-15 years with a body massa indeks for age (BMI/A) indicator of 19.1% in 2018, where overweight was 12.0% and obesity was 7.1%.
Objectives: To analyze the factors that influence nutritional status in overweight and obese adolescents aged 11-15 years.
Methods: This study is a cross-sectional survey conducted at State Junior High Schools in Samarinda City from January to March 2021. The sample size was 290 students, determined using the Lemeshow and David formula, and selected through simple random sampling. Data collection includes the characteristics of the subject and their parents, measurement of body weight and height, food consumption, nutritional behavior, physical activity, and exercise habits using interviews using questionnaires. Data were analyzed using the Kruskal-Wallis test and Logistic Regression test.
Results: There are differences in the nutritional status of boys and girls (p=0.006), mother's education and occupation (p=0.007; p=0.007), father's and mother's nutritional status (p=0.001; p=0.014), exercise habits (p=0.009), protein adequacy level (p=0.000), and fat adequacy level (p=0.016).
Conclusions: Gender, occupation, education, nutritional status, eating habits, exercise habits, level of protein adequacy, and level of fat adequacy influence the occurrence of overweight and obesity in adolescents. It is necessary to increase sports activities which must be done at least 3-5 times a week for 30 minutes intensively and get used to consuming 3-4 portions of vegetables and fruit daily, as well as paying attention to appropriate meal portions.

INTRODUCTION

Adolescents are an especially high-risk group for overweight and obesity. According to the 2018 National Basic Health Research (Riskesdas), the prevalence of overweight and obesity among adolescents aged 13-15 years is 16%, with 11.2% classified as overweight and 4.8% classified as obese, shows an increase compared to the nutritional prevalence in this age group in 2013[5]. In 2018, the prevalence of overweight and obesity among adolescents aged 13-15 years in East Kalimantan, Indonesia, was 19.1%, with 12.0% classified as overweight and 7.1% classified as obese, as determined by the Body Mass Index for Age (BMI/A)[7].

Overweight and obesity in children and adolescents can lead to disruptions in glucose metabolism and degenerative diseases such as heart disease, blood vessel blockages, type 2 diabetes, and others[10]. Being overweight or obese can have negative social and psychological impacts on school-going adolescents or children. Adolescents facing obesity tend to experience low self-esteem, poor self-worth, difficulties in learning and school, which can subsequently lead to depression[11].

The factors effecting to overweight and obesity in adolescents include dietary patterns, fast food consumption, education levels, gender, genetic factors, physical activity, and socio-economic factors[12–15]. Race and family history are related to genetic factors. Individuals experiencing obesity are more likely to have a genetic predisposition. Unmodifiable risk factors for obesity include race and family history. People facing obesity are at a higher risk within certain ethnic groups. One example is the Tamil ethnic group in Sri Lanka[16] and African Americans[17]. Groups with parents experiencing obesity are found to have a higher prevalence of obesity[18].

How to cite: *Kamaruddin, I., Kustiyah, L., Riyadi, H., & Junus, R. (2023) Factors Influencing Nutritional Status in Overweight and Obese Adolescents: Faktor-Faktor Yang Mempengaruhi Status Gizi Pada Remaja Overweight dan Obese. Amerta Nutrition, 7(2SP), 311–319.*

Food consumption behavior is linked to the intake of macronutrients and micronutrients, habits involving fast food, snacks, vegetables, fruits, high-calorie and sweet foods, and soft drinks. Energy and macronutrient intake are directly proportional to obesity[19,20]. Obesity occurs due to the excessive storage of energy intake in the body. For every excess 3,500 Kcal, the body can only store around 500 grams of fat. Therefore, micronutrient consumption, especially fat-soluble vitamins (A, D, E, K), is inversely related to the occurrence of obesity, both in terms of body mass index (BMI) and waist circumference (WC)[21].

Individuals experiencing obesity have a higher amount of body fat compared to those who are not obese. Body fat serves as the primary storage site for fat-soluble vitamins in the body. The more body fat present, the fewer fat-soluble vitamins circulate in the blood[22]. Consuming large amounts of animal fat can pose a higher risk of obesity than consuming fiber-rich foods and grains[25]. Fats and oils contribute the most to energy intake compared to other nutrients. Obesity in urban adults is influenced by the consumption of oil exceeding 30 ml per day[24]. Obesity in adulthood is associated with micronutrient deficiencies. To prevent the accumulation of body fat, individuals can incorporate micronutrient-dense foods, such as vegetables and fruits, into a low-energy diet, as these foods contribute to energy metabolism. Consuming a higher quantity of low-energy fruits reduces risk of obesity[26].

Physical activity habits are linked to obesity. Improving both dietary habits and regular physical activity is crucial for increasing energy expenditure. A study conducted in West Africa (2019) found that physical activity is a protective factor for individuals with obesity, particularly those living on suburban areas[27]. On the other hand, a lack of physical activity contributes to obesity. Screening time, including habits like watching television, is one of the sedentary activities commonly observed in urban communities[23,28]. Watching television is a risk factor that can increase the occurrence of obesity, especially if done for more than 2 hours per day[29]. Lack of physical activity is a risk factor for obesity. Laziness means taking part in activities that involve minimal physical exertion. Watching TV is a sedentary activity linked to a lack of physical activity, and extending periods of television watching have been found to increase the possibility of obesity[30].

Socio-economic, educational, and nutritional knowledge factors can contribute to overweight and obesity in children. Children from high socio-economic status families have a lower rate of overweight, while children from younger families with lower educational levels are more likely to experience overweight[31], and Nutritional knowledge is linked to childhood obesity and overweight[32]. Based on the background provided, This study aims to determine the factors influencing the nutritional status of adolescents aged 11-15 who are overweight and obese.

METHODS

The study used a survey research design, specifically a cross-sectional study, conducted at a Public Junior High School in Samarinda City from January to March 2023. The sample size was determined using the Lemeshow and Davis formula. The number of potential dropouts, 20% was added, resulting in a total sample size of 290 participants. The participants were selected through simple random sampling.

Collected data were subject characteristics (age and gender), parental characteristics (education, occupation, income, and nutritional status), nutritional status (weight and height), nutritional behavior (knowledge, attitude, practice), and physical activity. Data collection involved structured questionnaire-based interviews and direct anthropometric measurements using a digital scale for weight and a microtoise for height.

The Kruskal-Wallis test compared groups when the data was not normally distributed. Logistic regression analysis was conducted using the Backwards logistic regression method. In logistic regression analysis, variables with p-values <0.25 during the Chi-Square test are considered.

RESULTS AND DISCUSSION

Respondent Characteristics

The characteristics of the subjects studied in this research include gender, age, weight, height, ethnicity, pocket money, pocket money utilization, and living arrangements with parents or guardians. The distribution of subjects based on individual characteristics and nutritional status can be seen in Table 1.

Table 1. Distribution of subjects based on individual characteristics and nutritional status

Characteristics	Normal (n=162)	*Overweight* (n=75)	*Obese* (n=53)	Total	*p-value*
	n (%)	n (%)	n (%)		
Gender					
Man	60 (37.0)	32 (42.7)	33 (62.3)	125 (43.1)	0.006*
Woman	102 (63.0)	43 (57.3)	20 (37.7)	165 (56.9)	
Age (years)**	12.52±1.17	13.28±0.98	12.38±0.68	12.69±110	
11 years old	36 (22.2)	0 (0.0)	4 (7.5)	40 (13.8)	
12 years old	49 (30.2)	20 (26.7)	27 (50.9)	96 (33.1)	0.000*
13 years old	43 (26.5)	22 (29.3)	20 (37.7)	85 (29.3)	
14 years	24 (14.8)	25 (33.3)	2 (3.8)	51 (17.6)	
15 years	10 (6.2)	8 (10.7)	0 (0.0)	18 (6.2)	
Body weight (kg)**	43.95±4.58	61.36±4.91	70.92±13.01	53.38±13.08	0.000*

How to cite: *Kamaruddin, I., Kustiyah, L., Riyadi, H., & Junus, R. (2023) Factors Influencing Nutritional Status in Overweight and Obese Adolescents: Faktor-Faktor Yang Mempengaruhi Status Gizi Pada Remaja Overweight dan Obese. Amerta Nutrition, 7(2SP), 311–319.*

Characteristics	Normal (n=162)	*Overweight* (n=75)	*Obese* (n=53)	Total	*p-value*
	n (%)	n (%)	n (%)		
Height (cm)**	148.73±7.69	159.26±6.17	157.10±7.73	152.98±8.77	0.000*
BMI/U **	0.41±0.25	1.51±0.27	2.55±0.49	1.08±0.89	0.000*

BMI/Age: Body Mass Index for Age; *p: Significant (p<0.05); **Mean±SD (Standard Deviation); Kruskal-Wallis test.

The study included 290 subjects, comprising normal weight individuals (55.9%), overweight individuals (25.9%), and obese individuals (18.3%). Most subjects were female (56.9%), with the remaining being male (43.1%). Male and female nutritional statuses tended to differ from one another. Compared to female children (37.7%), male children were more likely to have obesity (62.3%). In contrast, women were more likely than men (42.7%) to be obese (57.3%) when it came to overweight status (Table 15). The nutritional status of males and females differed significantly (p=0.006). According to data from the National Health and Nutrition Examination Survey, the prevalence of overweight and obesity has risen in males from 14% to 18% and in females from 13.8% to 16%. Males are more likely to experience obesity than females[33].

Family Characteristics

The analysis of family characteristics for the subjects is presented in Table 2. Generally, the education level of both parents, fathers and mothers, is mostly completed high school (44.8% and 45.9%, respectively). The majority of the fathers work (95.2%), typically in private employment, while most mothers do not work (68.3%), as household wife.

Table 2. Distribution of subjects based on family characteristics and nutritional status

Family Characteristics	Normal (n=162)	*Overweight* (n=75)	*obese* (n=53)	Total	p-value
	n (%)	n (%)	n (%)		
Father's education					
<High school	52 (32.1)	22 (29.3)	7 (2.4)	81 (27.9)	0.076
Senior High School	71 (43.8)	28 (37.3)	31 (58.5)	130 (44.8)	
>High school	39 (24.1)	25 (33.3)	15 (28.3)	79 (27.2)	
Mother's education					
<High school	61 (37.7)	21 (28.0)	6 (11.3)	88 (30.3)	0.007*
Senior High School	66 (40.7)	36 (48.0)	31 (58.5)	133 (45.9)	
>High school	35 (21.6)	18 (24.0)	16 (30.2)	69 (23.8)	
Father's occupation					
Work	152 (93.8)	74 (98.7)	50 (94.3)	276 (95.2)	0.962
Doesn't work	10 (6.2)	1 (1.3)	3 (5.7)	14 (4.8)	
Mother's job					
Work	41 (25.3)	26 (34.7)	25 (47.2)	92 (31.7)	0.007*
Doesn't work	121 (74.7)	49 (65.3)	28 (52.8)	198 (68.3)	
Father's nutritional status					
Normal	76 (46.9)	31 (41.3)	12 (22.6)	119 (41.0)	0.001*
Overweight	29 (17.9)	4 (5.3)	6 (11.3)	39 (13.4)	
Obese	57 (35.2)	40 (53.3)	35 (66.0)	132 (45.5)	
Maternal nutritional status					
Normal	54 (33.3)	21 (28.0)	10 (18.9)	85 (29.3)	0.014*
Overweight	34 (21.0)	13 (17.3)	6 (11.3)	53 (18.3)	
Obese	74 (45.7)	41 (54.7)	37 (69.8)	152 (52.4)	

*p: Significant (p<0,05); **Mean±SD (Standar Deviasi); Kruskal-Wallis Test

The nutritional status of parents is characterized by a high percentage of obesity (45.5% for fathers and 52.4% for mothers). Statistical analysis results show significant differences in nutritional status based on maternal education, maternal occupation, paternal nutritional status, and maternal nutritional status (p<0.05; p=0.007; p=0.007; p=0.001; p=0.014). Obese parents are more likely to have overweight or obese children compared to parents with normal weight. Obese parents have a significantly higher risk of obesity compared to those who are not obese[34].

Nutritional Behavior

Table 3 shows that level of category of nutritional knowledge is sufficient (93.2%), attitude is sufficient (57.2%), and practice is insufficient (87.9%). Regardless of nutritional status (normal weight, overweight, or obese), most study individuals have adequate nutrition knowledge and attitude but poor nutrition behaviours. The study found no significant differences in nutritional knowledge, attitude, and practice concerning the nutritional status of the subjects (p=0.503; p=0.621; p=0.882). Good nutritional knowledge is associated with healthier eating behaviors compared to those with less nutritional knowledge[35]. A study on adolescents at SMPN 2 Brebes (2014) found no significant difference in nutritional attitudes between obese and non-obese adolescents when choosing snacks[36]. A study

How to cite: *Kamaruddin, I., Kustiyah, L., Riyadi, H., & Junus, R. (2023) Factors Influencing Nutritional Status in Overweight and Obese Adolescents: Faktor-Faktor Yang Mempengaruhi Status Gizi Pada Remaja Overweight dan Obese. Amerta Nutrition, 7(2SP), 311–319.*

conducted at SMA Yayasan Pendidikan Shafiyyatul Amaliyyah showed a significant influence of attitudes toward the eating patterns of female students[37]. This study found no differences, possibly due to various factors. Influencing factors include personal experiences, the influence of important others, and cultural influences[38]. It is important to note that having a positive attitude does not necessarily guarantee the development of good eating habit[39].

Table 3. Distribution of subjects based on nutritional behavior (knowledge, attitude, and practice) and nutritional status

Nutritional Behavior	Normal (n=162)	*Overweight* (n=75)	*Obese* (n=53)	Total	p-value
	n (%)	n (%)	n (%)		
Knowledge					
Insufficient	7 (4.3)	1 (1.3)	2 (3.8)	10 (3.4)	
Sufficient	147 (90.8)	72 (96.0)	51 (96.2)	270 (93.2)	0.503
Good	8 (4.9)	2 (2.7)	0 (0.0)	10 (3.4)	
Mean±SD	60.49±7.70	60.53±5.67	59.25±3.84	60.28±6.64	
Attitude					
Insufficient	31 (19.1)	15 (20.0)	9 (17.0)	55 (19.0)	
Sufficient	97 (59.9)	40 (53.3)	29 (54.7)	166 (57.2)	0.621
Good	34 (21.0)	20 (26.7)	15 (28.3)	69 (23.8)	
Mean±SD	60.37±12.70	61.33±13.68	62.26±13.39	60.97±13.06	
Practice					
Insufficient	141 (87.1)	67 (89.4)	47 (88.7)	255 (87.9)	
Sufficient	19 (11.7)	7 (9,3)	6 (11.3)	32 (11.1)	0.882
Good	2 (1.2)	1 (1.3)	0 (0.0)	3 (1.0)	
Mean±SD	53.70±9.74	53.33±9.49	52.83±7.99	53.45±9.35	

Mean±SD (Standar Deviasi); uji Kruskal-Wallis

Physical Activity

Insufficient physical activity is one of the factors contributing to the rise in overweight and obesity among children. Sedentary activity is one of the factors causing an increase in overweight and obesity status in adolescents. Sedentary activities include prolonged sitting, watching TV/movies, playing video games, etc. dll[40]. The distribution of subjects based on physical activity and nutritional status is presented in Table 4.

Table 4. Distribution of subjects based on physical activity and nutritional status

Physical Activity	Normal (n=162)	*Overweight* (n=75)	*Obese* (n=53)	Total	p-value
	n (%)	n (%)	n (%)		
Watching TV/movies/playing games/etc					
Yes	142 (87.7)	65 (86.7)	47 (88.7)	254 (87.6)	0.943
No	20 (12.3)	10 (13.3)	6 (11.3)	36 (12.4)	
Frequency of watching TV/movies/playing games/etc in a day					
Never	20 (12.3)	10 (13.3)	6 (11.3)	36 (12.4)	0.466
< 3 times	50 (30.9)	18 (24.0)	11 (20.8)	79 (27.3)	
≥3 times	92 (56.8)	47 (62.7)	36 (67.9)	175 (60.3)	

Table 4 in this study shows that the majority of subjects have a habit of watching TV/movies/playing games, etc. (87.6%), including subjects with normal nutrition (87.7%), overweight (86.7%), and obese (88.7%). The frequency of watching TV/movies/playing games per day is ≥3 times (60.3%). Environmental factors have a significant impact on the occurrence of overweight and obesity in adolescents. Children who usually have space to play with their friends become victims because they lack playing space. As a result, physical activities that should be done outdoors and energy expenditure are replaced by less active activities such as watching TV/movies/playing games/using gadgets. This leads adolescents to be less active and at risk of overweight and obesity. Meta-analysis results show that obese children are five times more likely to become obese in adulthood, and approximately 80% of obese adolescents remain obese in adulthood[41]. Lack of physical activity and sedentary behavior are significantly associated with obesity in children [42].

Food Intake

Overweight and obesity occur when food intake exceeds requirements. The distribution of subjects based on food intake, nutritional adequacy, and nutritional status is presented in Table 5. The results of this study show that the average energy intake is 2020.50±368.58 kcal, protein intake is 65.22±19.42 g, fat intake is 70.65±26.55 g, and carbohydrate intake is 262.59±68.91 g.

How to cite: *Kamaruddin, I., Kustiyah, L., Riyadi, H., & Junus, R. (2023) Factors Influencing Nutritional Status in Overweight and Obese Adolescents: Faktor-Faktor Yang Mempengaruhi Status Gizi Pada Remaja Overweight dan Obese. Amerta Nutrition, 7(2SP), 311–319.*

Table 5. Distribution of subjects based on energy and nutrient intake adequacy and nutritional status

Variable	Normal (n=162)	*Overweight* (n=75)	*Obese* (n=53)	Total	p-value
	Mean±SD	Mean±SD	Mean±SD		
Nutritional Intake					
Energy (kcal)	1920.94±330.42	2144.15±390.02	2149.83±361.32	2020.50±368.58	0.000
Protein (g)	66.92±20.63	73.85±19.85	72.64±22.08	65.22±19.42	0.000
Fat (g)	65.91±25.48	77.69±27.84	75.16±25.36	70.65±26.55	0.001
Carbohydrates (g)	252.71±65.36	276.69±73.39	272.86±69.28	262.59±68.91	0.015
Nutritional Adequacy Level					
Energy (%)	94.33±18.54	101.39±22.03	203.65±19.75	97.86±20.06	0.004
Protein (%)	101.71±30.80	112.57±37.88	129.69±41.98	109.63±36.39	0.000
Fat (%)	96.09±38.42	109.41±42.98	108.95±39.01	101.89±40.15	0.016
Carbohydrates (%)	81.98±23.17	88.90±25.52	88.71±23.72	85.00±24.06	0.052

Nutrient adequacy levels, including energy, protein, fat, and carbohydrates, indicate that the overall energy adequacy level for subjects is (97.86±20.06%), protein (109.63±36.39%), fat (101.89± 40.15%), and carbohydrates (85.00±24.06%). Overall, the energy and nutrient adequacy levels are still within the normal category based on the 2014 Dietary Reference Intakes. When looking at energy adequacy levels in obese individuals (203.65±19.75%), it is higher compared to overweight individuals (101.39±22.03%) and normal nutritional status (94.33±18.54%). A similar pattern is observed in protein adequacy levels in obese individuals (129.69±41.98%), which is higher than overweight individuals (112.57±37.88%) and normal nutritional status (101.71±30.80%), exceeding the Dietary Reference Intakes. This suggests that nutrient intake exceeding the dietary reference intake may increase overweight and obesity among adolescents. Therefore, it is essential to pay attention to portion sizes in their plate for each meal, which should consist of staple foods, side dishes, vegetables, and fruits, according to the nutritional needs of adolescents.

Factors Influencing Overweight and Obese Nutritional Status

The factors influencing overweight and obese nutritional status were analyzed using multivariate tests, including gender, mother's occupation, mother's education, mother's nutritional status, eating habits, exercise habits, protein adequacy level, and fat adequacy level. The multivariate analysis influencing overweight and obese status is presented in Table 6.

Table 6. Multivariate analysis influencing overweight and obese nutritional status

Variables	p	OR	95% CI
Gender	0.005	2.168	1.260-3.730
Mother's Job	0.047	1.782	1.009-3.150
Mother's Education	0.003	0.409	0.225-0.742
Mother's nutritional status	0.076	1.700	0.946-3.055
Eating habit	0.065	0.520	0.259-1.041
Exercise habits	0.029	1.916	1.070-3.432
Protein Adequacy Level	0.000	0.320	0.177-0.580
Adequate Fat Level	0.012	0.447	0.238-0.839

OR: Odds Ratio; 90%CI: Confidence Interval; Logistic Regression Test

Male adolescents have a significantly higher risk of overweight or obesity compared to female adolescents, with a risk factor of 2.168 (OR=2.168, 95% CI=1.260-3.730). This finding is consistent with the research conducted by Febriani and Sudarti[43], which suggests that males have a 2.25 times higher likelihood of experiencing overweight or obesity compared to girls. The prevalence of overweight or obese males exceeds that of overweight or obese females[44–49]. The obese males are at a higher risk of hypertension, diabetes, hyperlipidemia, and cancers (colorectal and prostate)[50,51]. The results of the study by Lubis et al[52], showed a significant relationship between gender and the occurrence of obesity (p=0.002; OR=5.2). This finding aligns with the research conducted by Puspitasari[3] which similarly found a correlation between gender and obesity prevalence. Kusteviani54's study found a significant association between gender and central obesity.

The occupation of a mother has a significant correlation with adolescents overweight or obesity (p=0.047). Working mothers are at risk of experiencing overweight or obesity, meaning that working mothers have a 1.782 times greater risk of overweight or obesity than non-working mothers (OR=1.782, 95% CI=1.009-3.150). Working mothers spend less time preparing meals and rely more on fast food or ready-to-eat meals, which are generally higher in fat and calories than non-working mothers[55–57]. Additionally, school-age children whose mothers work are more likely to rely on school meals than bringing lunch from home[58]. Children who eat snacks at school are more likely to experience obesity than those who bring food from home[59]. Working mothers spend

How to cite: *Kamaruddin, I., Kustiyah, L., Riyadi, H., & Junus, R. (2023) Factors Influencing Nutritional Status in Overweight and Obese Adolescents: Faktor-Faktor Yang Mempengaruhi Status Gizi Pada Remaja Overweight dan Obese. Amerta Nutrition, 7(2SP), 311–319.*

less time preparing meals at home than non-working mothers.

Adolescent overweight and obesity have a strong correlation to educational level (p=0.003). Mothers with higher education are more likely to be overweight or obese, with a 0.409 times greater risk of being overweight or obese than mothers with lower education (OR=0.409, 95% CI=0.225-0.742). Parents' education level, especially mothers, can directly influence children's eating habits because mothers are closer to their children and can provide the necessary food for their children without restricting what they eat. Parents significantly influence the food available at home, and they can set rules about what their children eat. Some studies show that mothers with lower education levels tend to feed their children unhealthy foods that can negatively impact their health status[60,61]. The results of Feng et al.'s research[62] found that children whose mothers have completed junior high school have a 2.170 times higher chance of experiencing overweight/obesity compared to children whose mothers have completed junior high school or below. Children with mothers who have completed college have a 2.146 times higher chance of experiencing overweight/obesity compared to children with lower levels of education (OR=2.146, 95% CI=1.293–3.560).

Mothers with obese nutritional status are at risk of experiencing overweight in adolescents. Specifically, the risk of overweight or obesity in adolescents is 1.700 times higher for mothers who are obese than those who are not obese (OR=1.700, 95% CI=0.946-3.055). The Body Mass Index (BMI) of mother has a significant impact on the BMI of children[63–65], in the research by Telisa et al[66], obese parents have a 3.9 times higher risk of being obese. A history of obesity in parents increases the risk of obesity in adolescents by 2.016 times, and there is a significant relationship between a history of obesity in parents and the occurrence of obesity in adolescents[67]. The weight status of parents, reported as an important predictor of overweight and obesity in children and adolescents remaja[68,69]. The correlation between genetics, the environment, and the prevalence of childhood obesity is evident in cases where both parents and children are overweight. Genetics increase the risk of overweight in adolescents who have obese parents or live in the same environment, and children often imitate their parents. Therefore, eating habits and lifestyle can influence a child's eating patterns, leading to obesity[34].

Eating habits are a significant factor in the development of overweight and obesity among adolescents. Most adolescents (75.2%) consume breakfast, while a smaller proportion (24.8%) are not. There is no significant association between the habit of having breakfast and the occurrence of overweight and obesity in adolescents (p=0.065). Skipping breakfast increases the likelihood of overweight and obesity in adolescents. Specifically, adolescents who skip breakfast have a 0.520 times higher risk of experiencing overweight or obesity compared to those who eat breakfast (OR=0.520, 95% CI=0.259-1.041). This finding is consistent with the research conducted by Nugroho and Hikmah[70] at SMP Negeri 18 Samarinda found that the average frequency of meals for adolescents is less than or equal to 3 times per day (86.2%) and only more than 3 times per day (32.7%).

Physical activity habits have a significant relationship with the occurrence of overweight and obesity in adolescents (p=0.029). The Physical activity habit is a risk factor for overweight or obesity, meaning that adolescents who do not exercise and only do so for 15 minutes each time they engage in physical activity have a 1.916 times greater risk of overweight or obesity compared to those who exercise (OR=1.916, 95% CI=1.070-3.432). Another study found that adolescents with light physical activity have a 5 times greater risk of obesity than adolescents with moderate physical activity71. The frequency of subjects exercising <3 times/week is 39.0%, with an average exercise duration of 15 minutes/day being 30.3%. Consistent with the research by Adiwinanto72, engaging in moderate to vigorous-intensity exercise three times a week for 40 minutes per session over 12 weeks in adolescents aged 12-14 can result in a weight loss of 2.5 kg.

The protein adequacy level is significantly related to overweight and obesity in adolescents (p=0.000). A high protein adequacy level poses a risk of overweight and obesity in adolescents. The imbalance between energy intake and expenditure leads to overweight or obesity. The risk of obesity is 4.69 times higher compared to those who are not *obese*[15]. If someone consumes an excess of protein, it can lead to overweight. The excess protein will be stored in the form of fat.

High levels of fat consumption increase the risk of overweight and obesity in adolescents. Adolescents with higher fat adequacy levels have a 0.447 times greater probability of experiencing overweight or obesity than those with sufficient fat adequacy levels (OR=0.447, 95% CI=0.238-0.839). The Dietary Guidelines or SDT 2014 classify the fat adequacy level as sufficient (90-120%). The research findings show that most subjects (82.8%) consume fried foods, including fried chicken, french fries, and other fried snacks. Fried foods tend to have higher amounts of fat and salt. Consuming fried foods more than 6 times per week increases the risk of being overweight by 3.1 times compared to consuming them only 2.5 times per week[73].

CONCLUSIONS

Factors influencing the occurrence of overweight and obesity in adolescents include gender, mother's occupation, mother's education, mother's nutritional status, eating habits, exercise habits, protein adequacy level, and fat adequacy level.

Several things to consider in addressing overweight or obesity in adolescents include increasing the habit of having breakfast, regulating snacking habits, reducing the consumption of fast food and soft drinks, increasing mandatory daily exercise activities (3-5 times/week) for 30 minutes intensively, reducing screen time for watching TV/movies and playing games to no more than 2 hours, monitoring weight regularly (preferably monthly), cultivating the habit of consuming vegetables and fruits (3-4 servings daily), reducing carbohydrate intake, and paying attention to portion sizes according to the nutritional needs of adolescents.

How to cite: *Kamaruddin, I., Kustiyah, L., Riyadi, H., & Junus, R. (2023) Factors Influencing Nutritional Status in Overweight and Obese Adolescents: Faktor-Faktor Yang Mempengaruhi Status Gizi Pada Remaja Overweight dan Obese. Amerta Nutrition, 7(2SP), 311–319.*

ACKNOWLEDGMENTS

The researchers express their gratitude to the Principal of the state junior high school of Samarinda, the teachers, enumerators, parents, and all students who participated in this research. Thanks also to the University of Mulawarman East Kalimantan for funding this research.

Conflict of Interest and Funding Disclosure

All authors declare no conflict of interest regarding this article. The University of Mulawarman East Kalimantan financially supported this research.

REFERENCES

1. Langley-Evans, S. C. & Moran, V. H. Childhood obesity: risk factors, prevention and management. *Matern. Child Nutr.* **10,** 453–455 (2014).
2. Ulilalbab, A., Anggraeni, E. & Lestari, I. A. *Obesitas Anak Usia Sekolah*. (CV Budi Utama, 2017).
3. Smith, K. B. & Smith, M. S. Obesity statistics. *Prim. Care Clin. Off. Pract.* **43,** 121–135 (2016).
4. Aini, S. N. Faktor risiko yang berhubungan dengan kejadian gizi lebih pada remaja di perkotaan. *Unnes J. Public Heal.* **2,** 1–5 (2013).
5. KEMENKES RI. *Laporan Nasional Riset Kesehatan Dasar 2018*. (2018).
6. KEMENKES RI. *Riset Kesehatan Dasar (RISKESDAS) 2013*. (2013).
7. KEMENKES RI. *Laporan Provinsi Kalimantan Timur Riset Kesehatan Dasar (RISKESDAS) 2018*. (2018).
8. Reilly, J. J. *et al.* Progression from childhood overweight to adolescent obesity in a large contemporary cohort. *Int. J. Pediatr. Obes.* **6,** e138–e143 (2011).
9. Llewellyn, A., Simmonds, M., Owen, C. G. & Woolacott, N. Childhood obesity as a predictor of morbidity in adulthood: a systematic review and meta-analysis. *Obes. Rev.* **17,** 56–67 (2016).
10. Sawello, M. A. & Malonda, N. S. Analisis aktivitas ringan sebagai faktor risiko terjadinya obesitas pada remaja di sekolah menengah pertama negeri 1 Manado. *J. Kesmas* **1,** 38–44 (2012).
11. Pujiastuti, E., Fadlyana, E. & Garna, H. Perbandingan masalah psikososial pada remaja obes dan gizi normal menggunakan pediatric symptom checklist (PSC)-17. *Sari Pediatr.* **15,** 201 (2013).
12. Damapolii, W., Mayulu, N. & Masi, G. Hubungan konsumsi fast food dengan kejadian obesitas pada anak SD di Kota Manado. *ejurnal keperawatan* **1,** 1–7 (2013).
13. Hadi, A. J. *et al.* Consumption pattern and nutrition conseling roles on obesity of integrated primary school students. *Unnes J. Public Heal.* **8,** 45–50 (2019).
14. Septiani, R. & Raharjo, B. B. Pola konsumsi fast food, aktivitas fisik dan faktor keturunan terhadap kejadian obesitas (studi skasus pada siswa SD Negeri 01 Tonjong Kecamatan Tonjong Kebupaten Brebes). *Public Heal. Perspect. J.* **2,** 262–269 (2017).
15. Kurdanti, W. *et al.* Faktor-faktor yang mempengaruhi kejadian obesitas pada remaja. *J. Gizi Klin. Indones.* **11,** 179 **(2015)**.
16. Somasundaram, N. *et al.* High prevalence of overweight/obesity in Urban Sri Lanka: findings from the colombo urban study. *J. Diabetes Res.* 2019, 1–9 (2019).
17. Grammer, L. C. *et al.* Obesity and asthma morbidity in a community-based adult cohort in a large urban area: the chicago initiative to raise asthma health equity (CHIRAH). *J. Asthma* **47,** 491–495 (2010).
18. Wang, H. *et al.* Epidemiology of general obesity, abdominal obesity and related risk factors in urban adults from 33 communities of northeast china: the CHPSNE study. *BMC Public Health* **12,** 967 (2012).
19. Mbochi, R. W., Kuria, E., Kimiywe, J., Ochola, S. & Steyn, N. P. Predictors of overweight and obesity in adult women in Nairobi Province, Kenya. *BMC Public Health* **12,** 823 (2012).
20. Vadera, B., Yadav, S., Yadav, B., Parmar, D. & Unadkat, S. Study on obesity and Influence of dietary factors on the weight status of an adult population in Jamnagar City of Gujarat: a cross-sectional analytical study. *Indian J. Community Med.* **35,** 482 (2010).
21. Zhang, Y. X., Wang, Z. X., Zhao, J. S. & Chu, Z. H. Prevalence of overweight and obesity among children and adolescents in shandong, China: urban-rural disparity. *J. Trop. Pediatr.* **62,** 293–300 (2016).
22. Shea, M. K. *et al.* Adulthood obesity is positively associated with adipose tissue concentrations of vitamin K and inversely associated with circulating indicators of vitamin K status in men and women. *J. Nutr.* **140,** 1029–1034 (2010).
23. Agrawal, P., Gupta, K., Mishra, V. & Agrawal, S. Effects of sedentary lifestyle and dietary habits on body mass index change among adult women in India: Findings from a follow-up study. *Ecol. Food Nutr.* **52,** 387–406 (2013).
24. Vora, D. & Shelke, P. Effects of health education tool on select epidemiological factors associated with adult obese urban slum women. *Indian J. Public Health* **61,** 254 (2017).
25. Denova-Gutiérrez, E. *et al.* Dietary patterns are associated with different indexes of adiposity and obesity in an Urban Mexican population. *J. Nutr.* **141,** 921–927 (2011).
26. de Oliveira, M. C., Sichieri, R. & Venturim Mozzer, R. A low-energy-dense diet adding fruit reduces weight and energy intake in women. *Appetite* **51,** 291–295 (2008).
27. Malik, S. K. *et al.* Prevalence of abdominal obesity and its correlates among adults in a peri-urban population of West Africa. *AIMS Public Heal.* **6,** 334–344 (2019).
28. Anuradha, R., Ravivarman, G. & Jain, T. The prevalence of overweight and obesity among women in an urban slum of Chennai. *J. Clin. Diagnostic Res.* **5,** 957–960 (2011).
29. Rosiek, A., Maciejewska, N., Leksowski, K., Rosiek-Kryszewska, A. & Leksowski, Ł. Effect of television

on obesity and excess of weight and consequences of health. *Int. J. Environ. Res. Public Heal.* **12,** 9408–9426 (2015).
30. Astiti, D., Hadi, H. & Julia, M. Pola menonton televisi sebagai faktor risiko obesitas pada anak di sekolah dasar Kota Yogyakarta dan Kabupaten Bantul. *J. Gizi dan Diet. Indones.* **1,** 110–119 (2013).
31. Olaya, B. *et al.* Country-level and individual correlates of overweight and obesity among primary school children: a cross-sectional study in seven European countries. *BMC Public Health* **15,** 475 (2015).
32. Shahsanai, A., Farajzadegan, Z., Hadi Sichani, Z., Heidari, K. & Omidi, R. Assessment of the relationship between nutritional knowledge and anthropometric indices in Isfahan children and adolescent. *Adv. Biomed. Res.* **7,** 110 (2018).
33. Dupuy, M., Godeau, E., Vignes, C. & Ahluwalia, N. Socio-demographic and lifestyle factors associated with overweight in a representative sample of 11-15 year olds in France: Results from the WHO-Collaborative health behaviour in school-aged children (HBSC) cross-sectional study. *BMC Public Health* **11,** 1–11 (2011).
34. Bahreynian, M. *et al.* Association between obesity and parental weight status in children and adolescents. *J. Clin. Res. Pediatr. Endocrinol.* **9,** 111–117 (2017).
35. Asakura, K., Todoriki, H. & Sasaki, S. Relationship between nutrition knowledge and dietary intake among primary school children in Japan: Combined effect of children's and their guardians' knowledge. *J. Epidemiol.* **27,** 483–491 (2017).
36. Sukma, D. C. & Margawati, A. Hubungan pengetahuan dan sikap dalam memilih makanan jajanan dengan obesitas pada remaja di SMP Negeri 2 Brebes. *J. Nutr. Coll.* **3,** 862–870 (2014).
37. Ramadani Pratiwi. The influence of predisposing, enabling and reinforcing factors on meal patterns of senior high students in Shafiyyatul Amaliyyah education foundation in Medan. *Thesis* (Universitas Sumatera Utara, 2011).
38. Azwar, S. *Sikap Manusia Teori dan Pengukurannya*. (Pustaka, 2010).
39. Susanto. *Metodologi Penelitian Sosial*. (UNS Press., 2006).
40. Tremblay, M. S. *et al.* Systematic review of sedentary behaviour and health indicators in school-aged children and youth. *Int. J. Behav. Nutr. Phys. Act.* **8,** 98 (2011).
41. Simmonds, M., Llewellyn, A., Owen, C. G. & Woolacott, N. Predicting adult obesity from childhood obesity: a systematic review and meta-analysis. *Obes. Rev.* **17,** 95–107 (2016).
42. Thyfault, J. P. & Booth, F. W. Lack of regular physical exercise or too much inactivity. *Curr. Opin. Clin. Nutr. Metab. Care* **14,** 374–378 (2011).
43. Febriani, D. & Sudarti, T. Fast food as drivers for overweight and obesity among urban school children at Jakarta, Indonesia. *J. Gizi dan Pangan* **14,** 99–106 (2019).
44. Hajian-Tilaki, K. O., Sajjadi, P. & Razavi, A. Prevalence of overweight and obesity and associated risk factors in urban primary-school children in Babol, Islamic Republic of Iran. *East. Mediterr. Heal. J.* **17,** 109–114 (2011).
45. Mushtaq, M. U. *et al.* Prevalence and socioeconomic correlates of overweight and obesity among Pakistani primary school children. *BMC Public Health* **11,** 724 (2011).
46. Song, Y., Wang, H.-J., Ma, J. & Wang, Z. Secular trends of obesity prevalence in urban Chinese children from 1985 to 2010: gender disparity. *PLoS One* **8,** e53069 (2013).
47. Santiago, S., Zazpe, I., Martí, A., Cuervo, M. & Martínez, J. A. Gender differences in lifestyle determinants of overweight prevalence in a sample of Southern European children. *Obes. Res. Clin. Pract.* **7,** e391–e400 (2013).
48. Ogden, J. *The Psychology of Eating: From Healthy to Disordered Behavior*. *Nutrition Bulletin* 35, (Wiley-Blackwell, 2010).
49. Cao, M. *et al.* Association between sleep duration and obesity is age- and gender-dependent in Chinese urban children aged 6–18 years: a cross-sectional study. *BMC Public Health* **15,** 1–10 (2015).
50. Marema, R. T. *Obesity in Men*. (2022).
51. Schmidt, M. *et al.* Obesity in young men, and individual and combined risks of type 2 diabetes, cardiovascular morbidity and death before 55 years of age: a Danish 33-year follow-up study. *BMJ Open* **3,** e002698 (2013).
52. Lubis, M. Y., Hermawan, D., Upik Febriani & Farich, A. Hubungan antara faktor keturunan, jenis kelamin dan tingkat sosial ekonomi orang tua dengan kejadian obesitas pada mahasiswa di Universitas Malahayati tahun 2020. *J. Hum. Care* **5,** 891–900 (2020).
53. Puspitasari, N. Kejadian obesitas sentral pada usia dewasa. *HIGEIA (Journal Public Heal. Res. Dev.* **2,** 249–259 (2018).
54. Kusteviani, F. Factors associated with abdominal obesity in the productive age in Surabaya. *J. Berk. Epidemiol.* **3,** 45 (2015).
55. Crepinsek, M. K. & Burstein, N. R. *Maternal employment and children's nutrition: Volume II, other nutrition-related outcomes*. *Economic Research Service* (2004).
56. Ziol-Guest, K. M., DeLeire, T. & Kalil, A. The allocation of food expenditure in married- And single-parent families. *J. Consum. Aff.* **40,** 347–371 (2006).
57. Cawley, J. & Liu, F. Maternal employment and childhood obesity: A search for mechanisms in time use data. *Econ. Hum. Biol.* **10,** 352–364 (2012).
58. Datar, A., Nicosia, N. & Shier, V. Maternal work and children's diet, activity, and obesity. *Soc. Sci. Med.* **107,** 196–204 (2014).
59. Schanzenbach, D. W. Do school lunches contribute to childhood obesity? *J. Hum. Resour.* **44,** 684–709 (2009).
60. van Ansem, W. J., Schrijvers, C. T., Rodenburg, G.

How to cite: *Kamaruddin, I., Kustiyah, L., Riyadi, H., & Junus, R. (2023) Factors Influencing Nutritional Status in Overweight and Obese Adolescents: Faktor-Faktor Yang Mempengaruhi Status Gizi Pada Remaja Overweight dan Obese. Amerta Nutrition, 7(2SP), 311–319.*

& van de Mheen, D. Maternal educational level and children's healthy eating behaviour: role of the home food environment (cross-sectional results from the INPACT study). *Int. J. Behav. Nutr. Phys. Act.* **11,** 1–12 (2014).

61. Saldiva, S. R. D. M. *et al.* The consumption of unhealthy foods by Brazilian children is influenced by their mother's educational level. *Nutr. J.* **13,** 33 (2014).
62. Feng, Y., Ding, L., Tang, X., Wang, Y. & Zhou, C. Association between maternal education and school-age children weight status: A study from the China Health Nutrition Survey, 2011. *Int. J. Environ. Res. Public Health* **16,** 1–11 (2019).
63. Hsu, P.-C., Hwang, F.-M., Chien, M.-I., Mui, W.-C. & Lai, J.-M. The impact of maternal influences on childhood obesity. *Sci. Rep.* **12,** 6258 (2022).
64. Donato, K. A. National health education programs to promote healthy eating and physical activity. *Nutr. Rev.* **64,** S65–S70 (2006).
65. Kerr, J. A. *et al.* Early-life exposures predicting onset and resolution of childhood overweight or obesity. *Arch. Dis. Child.* **102,** 915–922 (2017).
66. Telisa, I., Hartati, Y. & Haripamilu, A. D. Faktor risiko terjadinya obesitas pada remaja SMA. *Faletehan Heal. J.* **7,** 124–131 (2020).
67. Ali, R. & Nuryani, N. Sosial ekonomi, konsumsi fast food dan riwayat obesitas sebagai faktor risiko obesitas remaja. *Media Gizi Indones.* **13,** 123–132 (2018).
68. Shafaghi, K. *et al.* Parental body mass index is associated with adolescent overweight and obesity in Mashhad, Iran. *Asia Pac. J. Clin. Nutr.* **23,** 225–231 (2014).
69. Jiang, M. han, Yang, Y., Guo, X. fan & Sun, Y. xian. Association between child and adolescent obesity and parental weight status: A cross-sectional study from rural north China. *J. Int. Med. Res.* **41,** 1326–1332 (2013).
70. Nugroho, P. S. & Hikmah, A. U. R. Kebiasaan konsumsi junk food dan frekuensi makan terhadap obesitas. *J. Dunia Kesmas* **9**, 185–191 (2020).
71. Irdianty, M. S., Sudargo, T. & Hakimi, M. Aktivitas fisik dan konsumsi camilan pada remaja obesitas di pedesaan dan perkotaan Kabupaten Bantul. *J. Community Med. Public Heal.* **32,** 217–222 (2016).
72. Adiwinanto, W. Pengaruh intervensi olahraga di sekolah terhadap indeks massa tubuh dan tingkat kesegaran kardiorespirasi pada remaja obesitas [tesis]. (Semarang (ID): Universitas Diponegoro, 2008).
73. Kuriyan, R., Bhat, S., Thomas, T., Vaz, M. & Kurpad, A. V. Television viewing and sleep are associated with overweight among urban and semi-urban South Indian children. *Nutr. J.* **6,** 25 (2007).

How to cite: *Kamaruddin, I., Kustiyah, L., Riyadi, H., & Junus, R. (2023) Factors Influencing Nutritional Status in Overweight and Obese Adolescents: Faktor-Faktor Yang Mempengaruhi Status Gizi Pada Remaja Overweight dan Obese. Amerta Nutrition, 7(2SP), 311–319.*