TRIPLE BURDEN OF MALNUTRITION IN ADOLESCENTS

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Abstract

Triple burden malnutrition (TBMN) is a global nutritional problem that is found around the world and is a health problem in every country. TBMN consists of overnutrition (overweight and obesity), underweight (stunting and wasting), and micronutrient deficiency. The prevalence of nutritional problems increases every year, especially over-nutrition problems in adolescents, namely overweight and obesity, besides there is an increase in malnutrition, wasting, and stunting. TBMB is caused by environmental factors, namely eating behavior, physical activity, and socioeconomic conditions. Therefore adolescents need to pay attention to a healthy lifestyle, namely diet, physical activity, and lifestyle to avoid nutrition and health problems, both over and undernutrition problems.

Keywords:

Overnutrisi, Undernutrisi, Adolescent

1. Introduction

Triple burden malnutrition (TBMN) is a global nutritional problem that is found worldwide and is a public health problem in every country, which is increasing every year, especially in adolescents. TBMN includes overnutrition (overweight and obesity), underweight (stunting and wasting), and micronutrient deficiency [1], [2]. Basic Health Research (Riskesdas) 2018 shows that obesity, obesity, diabetes, and stroke have increased. Besides, the increase in malnutrition, wasting, and stunting is still high.

The prevalence of nutritional problems around the world is increasing, especially nutritional problems, more than tripled since 1975, and 2016, more than 1.9 billion adults and 340 million children and adolescents aged 5-19 years are overweight and obese [3]. Riskesdas 2018 data shows that the prevalence of obesity and obesity is 16.0% of adolescents aged 13-15 years and 13.5% among adolescents aged 16-18 years. Meanwhile, the short and very short nutritional status indicates that 25.7% of adolescents are aged 13-15 years and 26.9% are adolescents aged 16-18 years. Besides, there were 8.7% of adolescents aged 13-15 years and 9.1% of adolescents aged 16-18 years with thin and very thin conditions [4].

Nutritional problems in adolescents are caused by various factors. Factors that contribute to nutritional problems include genetics, metabolism, and the environment. Environmental factors that affect nutritional problems such as eating behavior, physical activity, and socioeconomic conditions [5]. Overnutrition and undernutrition in children and adolescents greatly affect food quality and morbidity and excess energy intake [6]. Dietary intake is associated with obesity, obesity, and non-communicable diseases [7]. Metabolism in adolescents is related to diets, such as type 2 diabetes and metabolic syndrome [8].

Nutrition is more of an imbalance between energy intake and energy expenditure. High energy and protein intake will result in excess body weight [9], [10]. Carbohydrate intake can affect body weight only from simple carbohydrates. Fat intake above 30% tends to increase body weight resulting in overweight (overweight and obesity) [12]. The influence of modernization has brought a change in the diet from a traditional diet to a westernized diet, namely from home food to fast food such as; hot dogs, pizza, hamburgers, fried chicken, and french fries with high intake of energy, protein, fat, sugar, salt but low fiber content. So that it affects increasing body weight because of the unbalanced nutritional content. One in four adults who consume fast food are at risk of being overweight and obese [13]. Increased energy intake along with the passing of frequency snacking on cookies, chocolate candy, and foods associated with sweet taste is associated with overweight and obesity incidence [14].

Technological advances in transportation have stopped physical activities such as walking, cycling, and climbing stairs, resulting in motorized vehicles or cars. Several studies of 17 studies on physical activity found an interrelationship between physical activity and being overweight and of the 15 studies on behavior showed no evidence of a direct relationship with being overweight [15].

Based on the prevalence of nutritional problems which is increasing every year which will have an impact on degenerative diseases, anemia, growth, and development of adolescents.

2. Triple Burden Malnutrition (TBMN) Problem in Adolescents

A. Overnutrisi

Overnutrition consists of overweight (BMI> 25 kg / m2) and obesity (BMI ≥30 kg / m2) which is caused by continuous excessive intake of total energy and lack of physical activity. Overnutrition is a condition characterized by an increase in energy in the body, namely 110-120% of the total energy, increasing body weight of 10-20% of ideal body weight [16]. Excess energy will be stored in the body as fat leading to overweight and obesity [17].

Eating behavior greatly affects the occurrence of excess nutrition. The role of diet on obesity is very large, especially a diet high in calories that come from carbohydrates and fats. The energy input is greater than the energy required. Teenagers have the habit of consuming fast food, which is generally high in energy because 40-50% comes from fat. Another habit of teenagers is consuming snack foods that contain lots of sugar. The choice of snack foods is influenced by TV commercials and the increasing amount of food consumption causes an increase in energy intake [18]. The factors that influence energy intake are the availability of food, social, economic, and knowledge about nutrition which then make a person's behavior in food selection [19]. Energy is the result of the metabolism of carbohydrates, fats, and proteins. The amount of energy intake above the recommended nutritional adequacy rate can affect the occurrence of over nutrition. The energy needs of boys (2400 kcal) and women (2050 kcal) are different [20], wherein carrying out activities a woman only consumes less energy than men -men because men do more physical activity which requires relatively much energy. An adult woman spends an average of 1400 calories a day. An additional 600-800 calories can meet energy needs in a day. Whereas men use up to 1650 calories a day for just basic life processes, such as heart rate, breathing, digestion, and excretion, this is known as the basic metabolic rate of work and other daily activities consume at least 600 calories and around 2400 calories in work. includes strenuous hand labor [21].

Adolescent eating behavior towards diet has shifted from a traditional diet to a modern diet, namely the tendency to consume fast food. Fast food that is high in calories, fat, sugar, and sodium, but low in vitamin A, ascorbic acid, calcium, and fiber. This excessive calorie intake will result in being overweight [22]. Coca-cola and hamburgers are examples of high energy fast food. 1 liter of Coca-Cola produces 400 kcal, Hamburger Mc Donald 250 kcal, so fast food increases the positive energy balance [23] thereby increasing excess body weight. Eating behavior is influenced by appetite and satiety. The signal in the body to start and stop eating starts in the digestive tract. At the time of approaching the meal, the hormone ghrelin will be secreted, especially from the stomach which stimulates appetite. The hormone ghrelin causes stomach contractions which can lead to hunger. Hunger causes a person to consume food or drink to get rid of this discomfort. Some researchers have argued that one way to maintain or lose weight is to reduce ghrelin production [24]. The stomach not only stimulates hunger, but also a feeling of fullness. When the stomach is stretched due to the consumption of food or drink and reaches its maximum capacity, ghrelin secretion will decrease causing a sensation of fullness which will make a person stop eating. The decreased ghrelin secretion will increase the secretion of leptin from adipose tissue which signals satiety. Leptin is the main signal for energy storage. Leptin secretion causes an increase in the basal metabolic rate, an increase in energy expenditure, and a decrease in food intake. In obese patients, the sensitivity to the leptin response decreases so that stretching of the stomach to its maximum capacity does not cause a satiety response regulated by the hormone leptin [24].

Protein is needed by adolescents for the formation of antibodies, transporting nutrients, and as a source of energy when the body is unable to meet sufficient energy. Protein will produce 2 kcal of energy. Protein is a nutrient that must be fulfilled by the body. This is because protein is useful as a building block for body growth and replaces damaged tissues as a regulatory substance for the formation of hormones and enzymes as well as energy reserves [25]. Protein requirements depend on age, body size, and activity level. Protein needs in adulthood are 50-60 grams per day or around 11% of the total energy input. The protein adequacy rate (AKP) of adults according to the nitrogen balance study results was 0.75 g / kg / BW, derived from egg protein [19]. Some diet programs and nutritionists calculate protein intake based on the percentage of carbohydrates, namely 10-20% per day. Lack of protein can cause disruption in nutrient intake and transportation. Excess protein will undergo deaminase. Nitrogen is removed from the body and the remains of carbon bonds will be converted into fat and stored in the body [19]. Protein will be converted into energy if the energy reserves from carbohydrates and fats are not sufficient to meet calorie needs. Protein will provide 4 calories in 1 gram. Protein sufficiency will be fulfilled if energy sufficiency has been fulfilled because no matter how much protein will be burned into heat and energy if the energy reserves are still below the requirement. Protein intake correlates with weight gain with BMI measurement [10], [26]. High protein intake will cause excess body weight because usually high protein intake will be accompanied by high fat intake. The excess fat will be stored in the adipose tissue. Overweight is characterized by the addition or increase in the number of adipocyte cells in adipose tissue which is commonly called

hyperplasia and is indicated by an increase in the size of adipocyte cells in adipose tissue which is commonly called hypertrophy [27]. Accumulation of fat in the adipose tissue causes excess body weight. Besides, protein functions to form tissue in muscles. The large muscle skeleton in an individual will affect the weight of that individual.

Fat is an energy source that is most often used as an energy source other than carbohydrates. Energy comprises 30% of total body fat. Fat intake above 30% tends to increase body weight which affects overweight and obesity [12]. High fat intake will be a risk factor for the development of nutritional problems. Various epidemiological studies have shown a positive relationship between fat intake and body weight. In people with low physical activity, high insulin sensitivity is associated with weight gain. This condition indicates an increase in carbohydrate burning and a decrease in fat burning, hence both excess fat intake and low-fat burning lead to weight gain [28]. Research in the United States and Finland showed that the group with high fat intake had a greater risk of weight gain than the low-fat group with an OR of 1.7. Other studies have shown that increasing meat consumption increases the risk of being overweight by 1.46 times. This situation is caused because fatty foods have a greater energy density and are less filling and have a less thermogenetic effect than foods that are high in protein and carbohydrates [29]. Fatty foods also have a delicious taste so that it will increase appetite which eventually results in excessive consumption. When body fat reserves are low and carbohydrate intake is excessive, about 60-80% of excess energy from carbohydrates is stored in the form of body fat. Fat has an unlimited storage capacity. About 96% of fat is stored in fat tissue, excess fat intake does not coincide with an increase in fat oxidation. Some simple healthy eating patterns offered by Tsigos (2008) [30] are reducing calorie intake of food and beverages, reducing meal portions, avoiding snacks between meals, not delaying breakfast, and avoiding eating at night. Food plays an important role in the pathogenesis of excess body weight.

Excess carbohydrates in the body will be converted into fat so that it will increase body weight which triggers more nutrition, namely overweight and obesity. According to WHO recommendations, the recommended carbohydrate intake is 55-65% of total energy. Excessive carbohydrate intake without a balanced energy expenditure causes glucose to accumulate a lot and if this condition continues for a long time it will cause over nutrition, namely overweight and obesity [31].

Dietary fiber has many functions in the diet, one of which is to help regulate energy intake in the body and reduce the risk of obesity. Dietary fiber is part of carbohydrates which are classified as polysaccharides. In the human diet, dietary fiber is found in many vegetables, fruit, grain products, nuts. The benefits of consuming fiber are that it improves colon function which can inhibit the digestion and absorption of carbohydrates and fats and reduces the risk of various diseases. The recommended fiber intake for adults is 20-35 grams daily [32]. According to WHO, fiber intake is associated with weight regulation and obesity prevention. People who consume high fiber can excrete more bile acids, thereby releasing more fats and sterols. This means that fat intake can prevent the accumulation of fat and cholesterol so that it can prevent excess body weight which risks the development of overnutrition [33]. Besides, high-fiber foods can decrease insulin response thereby increasing satiety and decreasing hunger [34].

Lack of physical activity in adolescents can lead to over nutrition. Technological developments in the transportation sector have reduced walking activities so that dependence on motorized vehicles or cars and practical equipment has also led to reduced physical activity. Energy expenditure from daily work can no longer be expected because there has been a lot less work that is done manually. One data shows that children's physical activity tends to decrease. Children play more indoors than outdoors, for example playing computer games, watching television, and other electronic media rather than walking, cycling, or going up and down stairs [35]. Besides, the habit of watching television can reduce the body's metabolic rate [36]. Time spent watching television is directly related to the prevalence of obesity in adolescents. Adolescents who watch tv> 2 hours per day are associated with the incidence of obesity. Apart from lowering the level of physical activity, watching television is associated with unhealthy eating habits. The eating habit that develops is consuming more foods that are high in energy, protein, fat, sugar, salt, and low in fiber [37]. Children who spend a lot of time playing with electronics, from computers, television, to video games instead of playing outside. Adolescents aged 10-19 years who watched TV> 5 hours per day, were significantly more likely to experience more nutrition than adolescents who only watched TV 2 hours per day [38]. American research on children shows that 5 hours of TV viewing time per day has a 5.3 times greater risk of watching TV than children with 2 hours of viewing time per day [39]. The physical activity consists of activities during work, sleep, and leisure time (formal and non-formal activities). The amount of time you sleep is also associated with obesity. Less sleep time is at higher risk for obesity [40]. Types of activities that use a lot of muscles that require a lot of energy, for example walking, require more energy than sitting and typing because the number of muscles involved in walking is greater. The intensity of the activity also has a direct effect on energy use.

Running even though it involves the same number of muscles as walking requires more energy per unit of time because the steps are longer and the frequency is greater.

B. Undernutrisi

Malnutrition was defined as wasting, stunting, or deficiency of micronutrients namely anemia, zinc, and vitamin A [41]. Wasting and stunting represent different malnutrition problems [42] Wasting is low weight based on height associated with food intake that does not meet protein and energy requirements. Wasting in developing countries is caused due to food insecurity and infectious diseases [43].

Stunting is a nutritional problem due to long-term malnutrition that has an impact on linear growth characterized by height/age below standard deviation (<-2SD) [44]. Stunting shows low growth and is the effect of long-term insufficient macronutrients or micronutrients that contribute to morbidity and mortality from infectious diseases such as acute respiratory infections, diarrhea, measles, and malaria [45]. The incidence of stunting in children is due to micronutrient deficiency problems [46]. The deficiency of food intake of macro and micronutrients at the age of 0-24 months can affect the growth and development process known as the golden period. There are 7.8 million children in the world under the age of five who are stunted [47]. According to Riskesdas (2013) the prevalence of stunting in Indonesia nationally is 37.2% (consisting of 18% very short and 19.2% short) [48], an increase compared to 2010 (35.6%) [49] and 2007 (36.8%) [50]. Whereas in 2018 it was 20.8% [4], it decreased to 37.2% in 2013 [48].

According to WHO, children with growth disorders experience less food intake and suffer from infectious diseases. Children aged 12-60 months, in the body's metabolism there is an increase in energy needs and nutritional intake due to the growth process [51]. Several studies have shown that children's growth is stunted because the food intake is less than needed. The reason is poverty, the large number of family members, living in rural and suburban areas. Rural areas with long distances from food sources lead to the low accessibility of food at the household level [52]. Infectious disease has a significant association with the incidence of stunting [53]. Toddlers who have a history of infectious diseases are more likely to suffer from stunting, which is four times than of children who do not have a history of infectious diseases. The incidence of stunting is related to toddlers who suffer from infectious diseases, as well as poor health services and incomplete immunizations. Toddlers who often suffer from infections will have 8.84 times the risk of suffering from stunting. Meanwhile, toddlers with a history of poor health care and immunization were able to increase the risk of suffering from stunting 3,167 times more than toddlers with a history of good health services and complete immunization [54].

3. Efforts to Prevent Triple Burden Malnutrition

The dietary pattern of adolescents in Indonesia is still low, especially in foods that come from animal protein and vegetables [55] and only 5% of fruits and vegetables (5 servings per day) [4]. According to WHO, the consumption of vegetables and fruits for a healthy life should be 400 grams per day, consisting of 250 grams of vegetables or 2 ½ servings and 150 grams of fruit or 3 medium-sized ambon bananas. In Indonesia, teenagers are encouraged to consume 400-600 grams per person per day. About 2/3 of the recommended total consumption of vegetables and fruits is a portion of vegetables [56]. Animal protein, vegetables, and fruit are a group of foodstuffs that contain macro and micronutrients. Protein includes macronutrients that are needed in large quantities by the body. Meanwhile, vegetables and fruits contain small amounts of vitamins and minerals which are micronutrients required [57]. If the diet of adolescents in Indonesia does not meet their nutritional needs, there will be nutritional disorders.

Fast food that is widely sold on the roadside at affordable prices has the opportunity for adolescents to consume more fast food that is high in calorie content which can increase risk factors for overnutrition [58]. If more nutrition occurs, it will have an impact on survival, such as metabolic syndrome, diabetes mellitus, kidney, heart, liver, dyslipidemia, etc. [58]. Consuming 3-4 servings of fruits and vegetables a day can reduce risk factors for degenerative diseases or non-communicable diseases [56]. Micronutrient deficiency that often occurs is iron anemia which will have an impact on developmental delays and behavioral disorders [59]. Consuming protein sources (meat, chicken, eggs, fish, beef liver, milk), vitamins, and minerals (fruits and vegetables) can prevent nutritional problems [56].

Based on the 2013 Riskesdas, the prevalence of adolescents experiencing anemia due to iron deficiency increased from 37.1% [49] to 48.9% in 2018 [4]. Increasing the intake of animal protein, vegetables, and fruit in adolescents will reduce the risk of TBMN. By increasing the intake of children, especially adolescents will develop their potential [60].

4. Penutup

The prevalence of TBMN in adolescents is increasing every year. TBMN problems in adolescents occur due to changes in diet and physical activity as well as changes in lifestyle so that adolescents make more of their own choices. The choices made are often inaccurate so indirectly it causes nutritional problems, both overnutrition problems, and malnutrition problems. Adolescent eating behavior towards diet has changed to a modern diet, namely the tendency to consume fast food. Fast food contains high calories, fat, sugar, and sodium but low in vitamin A, ascorbic acid, calcium, and fiber, and other micro substances. Besides that, technological developments in the transportation sector have reduced the physical activity of adolescents so that dependence on motorized vehicles or cars and practical equipment has also led to reduced physical activity.

Conflict of Interest

No conflict of interest

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