

Obesity in Children

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ABSTRACT Obesity in Indonesia starts to become a problem, considering the tendency for the prevalence rate to get higher. Data on obesity in Indonesian children are very limited and criteria for nutritional status and obesity in children are yet to be defined. Although, unlike in adults, side effects of obesity in children rarely become a health problem, obesity in children has a tendency to develop into adult obesity which is difficult to manage. That is why early management is very important. Management of obesity in children includes effort to increase understanding of obesity problems, build up a motivation to improve the condition, limitation of energy intake, increasing energy uptake by physical exercise, and management of psychological disorders. For those reasons, a full support from all family members is needed. Growth and development monitoring need to be increased so an optimal growth and development is reached. [*Paediatr Indones* 1997;37:91-104]

Introduction

Obesity is a nutritional problem that causes high morbidity in industrial countries.¹ This condition is also a risk factor for cardiovascular diseases, gall bladder diseases, diabetes, gouty arthritis, and some others.² Since obesity in children can develop into adult obesity which is difficult to manage and cure, early management in children is essential.³

In Western countries, obesity can be easily found since early childhood. It is estimated that the prevalence rate of obesity is between 6-15% in children and between 20-30% in adults.^{4,5} Several studies show a strong relationship between obesity in childhood and in adulthood.⁶ Pisunyer⁵ reported that 50% of grown up women with severe obesity, more than 18% above ideal body weight, had a history of obese in

puberty. Other authors find that 30% of adult with obesity have a history of obesity in their prepubertal period. Broussard reported that 80% of obesity in childhood continued until they reached adulthood.⁷ On long-term follow-up study of Mosberg⁸ for 40 years of children with obesity, 47% were still obese in their adulthood.

In the third world, unlike in the developed countries, obesity has not yet been a major nutritional problem. In Indonesia, obesity can only be found on some children coming from well income family.⁹⁻¹² Obesity can occur in almost every age, but the majority of obesity cases occur in infants, children between 5-6 years old, and teenagers, especially girls.¹² The aim of this paper is to discuss in brief some aspects of obesity in children and the ways of handling the problem.

Definition

Obesity is a deposit of excessive fat beyond normal anthropometric range of a normal. In a normal child, the fat proportion to body weight is 15-20% for boys and 20-25% for girls.¹³ Obesity may be defined when fat proportion is more than 20% of ideal body weight.¹³⁻¹⁵ Using weight for height index, The Division of Nutrition, Department of Child Health calls a child to be obese if the value is above 120%. If the condition is accompanied with other complications, the symptoms are called *clinically obese* or *morbid obesity*.^{10,11} Based on the etiology, obesity can be classified into 2 groups, i.e., nutritional or simple obesity, and obesity related to other disease or congenital defect.

Assessment of Obesity

There are 2 ways to evaluate obesity, i.e., by clinical manifestations, and by anthropometric measurements. Medical way is used to assess nutritional status on every individual as a patient at home or in practice room. This includes interview, physical examination, and other examinations.¹⁰ According to anthropometry measurements, obesity can be determined by:^{4,17,18} (1) body weight for age, (2) body weight for body height, (3) subcutaneous fat measurement, and (4) other more complex methods, such as densitometry, hydrometry, and gamma ray-spectrometry.

In children there is a growth spurt with increased lean body mass, so a correlation is needed for body weight to age. The followings are indexes commonly used for defining obesity:^{4,5}

$$\text{Relative weight} = \frac{\text{Actual weight} \times 100}{50\text{th centile weight for height / age}}$$

Weight / height ratio	=	$\frac{\text{Weight}}{\text{Height}}$
Shukla index	=	$\frac{\text{Actual weight} \times 50\text{th centile height}}{\text{Actual height} \times 50\text{th centile weight}}$
Quetelets (body mass) index)	=	$\frac{\text{Weight}}{\text{Height}^2}$
Rohrer index	=	$\frac{\text{Weight}}{\text{Height}^3}$
Ponderal index	=	$\frac{\text{Height}^3}{\text{Weight}}$

According to body mass index, Garrow divides obesity into 3 stages.⁵

Grade	III	:	$W/H^2 > 40$
	II	:	W/H^2 30 to 40
	I	:	W/H^2 25 to 29.9
	0	:	W/H^2 20 to 24.9

In The Division of Nutrition, Department of Child Health, Medical School, University of Indonesia, obesity is divided into 3 stages based on body weight/body weight.¹⁶

Mild	:	W/H 120 to 135 %
Moderate	:	W/H 135 to 150 %
Severe	:	$W/H > 150$ %

Subcutaneous fat measurement has been shown to have a good correlation with body fat. Usually, subcutaneous fat is measured at subscapular and triceps area and then they are averaged. If the value is more than P_{85} it is called obesity.^{1,15} One of the difficulty in measuring skinfold thickness is that there is no agreement on the best location that mirroring the exact body fat concentration value. It is easily mistaken if the clinician is not competent or the examination is not thorough.⁵

Prevalence

In USA it is estimated that the prevalence of obesity in children is between 3-25%.⁴ In the Indians, the prevalence is higher than the rate for United States.⁷ A child born to obese mother has a chance to become obese twice as much as a child who is born to a non-obese mother.⁶ In England, the prevalence is between 2-11%, depending on the age and gender. Similar findings have been reported from other European countries.⁴

In Australia, the prevalence ranges from 9 to 10%.

In developing countries such as Singapore, it is reported that the prevalence of obesity for 7-year old children is 2.17% and for 12-year old children is 10.10%. In Bangkok, Thailand, the prevalence of obesity in children between the age of 6-12 years old is 7.0%, and for those between 11-17 years old the prevalence is 9.3%. In The Philippines, there is a tendency of increasing of obesity, from 2.7% in 1987 to 3.4% in 1990.^{10,11} In our country obesity has not yet got much attention. This is caused by a low prevalence rate. However, in the last few years there has been increasing number of children from a high social-economic class who become obese and this condition should prompt our attention.⁹

Data collected from a survey of vitamin A in 15 provinces between 1987-1992 showed that the prevalence of obesity in pre-school children was between 1.05% and 0.94% for boys and 5.44% and 4.79% for girls. For the school age children between 6-12 years old, the prevalence of obesity in Jakarta is around 0-0.4% and has a tendency to increase. In Jakarta, among the teenagers between 12-18 years the prevalence rate of obesity is between 6.2% for the 12-13 year-old children and increase to 11.4% at the age of 17-18 years old. In general, obesity is found more frequently in girls than in boys.¹⁰

Obesity in children can be found in every age group but it is found more frequently in infants, children between 5-6 years old, and teenagers.¹² From 18 obese children who come to outpatient clinic of The Division of Nutrition, Department of Child Health, Medical School, University of Indonesia, 12 of them have a obesity problem at the age of 8-12 years, 2 children aged 6 to 7 years, and 4 children age less than 2 years old.⁹ There is a tendency of increased visit of patients with obesity in the last 10 years, from 5 patients in 1980 to 22 patients in 1988. The severity of obesity and the age of patients with obesity are increased.¹⁰

Etiology

Obesity is caused by excessive energy input, more than the body needs for metabolism.^{12,17,18} This excessive energy input can be caused by:

1. Excessive input, caused by:

- psychological or emotional disorder
- disorder of hypothalamus, hypophysis and other brain damages which can disturb the center of a satiety
- hyperinsulinism which decreases lypolisis and increases fat uptake and synthesis
- wrong way of feeding like giving baby feeding every time he cries or giving high calories food too early.
- genetic factor

2. Less energy consumption:

- decreased basal metabolism caused by prolonged bed rest in patients with chronic illness
- endocrinopathy, such as hypothyroidism, Cushing syndrome, Laurence-Moon-Biedel syndrome, Prader-Willi syndrome
- decreased of physical exercise

If this condition continues, for instance 500 Cal/day in one week, the body weight will increase 400-500 grams.¹²

Pathophysiology and Pathogenesis

To be able to explain the mechanism of obesity, there are many theories. Mayer⁹ differentiates the pathogenesis into 2 categories.

1. *Regulatory obesity*: Disorder primary based on central mechanism of regulating food intake. Disturbance to this central mechanism causes the excessive food intake.
2. *Metabolic obesity*: A condition caused by abnormalities in fat and carbohydrate metabolisms. There is an accumulation of tryglyceride in adipose tissue, caused by the imbalance of fat synthesis and lypolisis.^{4,9}

Sukatn¹⁹ stated factors influencing the pathophysiology of obesity is based on (1) The amount and size of fat cells, (2) CNS factors; (3) Psychological factors; (4) Metabolic factors; (5) Hormonal factors.

1. The number and size of fat cells

Fat cells or adipose cells are well distributed in the body. The cells grow by 2 ways, i.e., by increasing the cell size (hypertrophy) and by adding the number of cells (hyperplasia). Hyperplasia and hypertrophy can occur in childhood and the maximal size is reached at the beginning of adulthood. By that time there will be no more hyperplasia, but a certain hyperplasia can still develop. A child with obesity has more fat cells and the cell size is larger than in normal child.¹

Obesity develops at the beginning of adulthood is usually caused by hypertrophy instead of hyperplasia. And at the period of weight loss, the size is decreasing but the number of the cells is still the same.¹⁹

2. CNS factor

Appetite is controlled by sensory stimulus and neurotransmitter; these 2 factors cause the cerebral cortex to activate central autonomy in hypothalamus. Feeding center is located in ventrolateral part of hypothalamus and satiety center is located at the

ventromedial nuclei of hypothalamus.^{4,19} From feeding center, the impulse of higher center is sent to the cerebral cortex, which can be inhibited by stimulus from satiety center. If there is a disorder in feeding center, the result is low food intake. Lesion in satiety center in mice will make insulin concentration in blood rise and followed by excessive food intake and at the end, the result is obesity. Food uptake can be controlled by an alfa blocking agent, which can lessen the uptake by a beta blocking agent with a reverse reaction. The stimulation effect of amphetamine is caused by beta stimulation to the hypothalamus.

3. Psychological factor

It has been reported that there is a relationship between psychological factor to eating behavior. Under normal condition if a child is under pressure, the appetite will decrease. However, in obese people the appetite is increasing as a compensation for their problems.

4. Metabolic factor

Obese patients use their calories more efficiently. In an adult, for instance, if they are given more food, the excessive calories are changed into fat tissue and an obese state is developed. If an obese patient is being treated, only calories needed to maintain ideal body weight is given.¹⁹

5. Genetic factor

Tendency to become overweight in certain family has long been known. There is a correlation between a child weight to their parents'. Usually a child develops obesity if both parents are overweight. Monozygotic twins who are brought up separately will have similar body weight than a dizygotic twins who were brought up together. There is no relation between body weight of adopted child to their foster parents.

Obesity is often found in hereditary diseases, such as Prader-Willi syndrome as the result of hypogonadism, obesity, diabetic and mental retardation. In Laurence-Moon-Biedl syndrome there are retinitis pigmentosa, obesity, mental retardation, hypogonadism, hypogonadotropism, and polydactily. The etiology of both disorders is the disturbance of hypothalamus.

6. Hormonal factor

Although rare, sometimes obesity is caused by the hormonal imbalance such as Cushing syndrome, hyperactivity of adrenocortical, hypogonadism, and other hormonal disorders.

Clinical Manifestations

Obesity can occur at every age group, but mostly before 1 year old, between 5-6 years, and during adolescence.¹⁸ This is because at these periods the growth of fat cells are increasing, and as the results, the energy produced is readily changed into fat tissue.^{4,18} The face look unproportional, fluffy with head relatively smaller than the body. The chest with enlarge breast looks like a grown-up woman's breast. The stomach protruded like a pendulum. The external genital looks small because most of it hidden under the fat tissue around it. The upper arm and thigh are relatively bigger with small fingers. Genu valgum is often found.

On the skin fold, there are white or purplish linear marks (striae) and sometimes can be found eczema on the fold with a bad smell.^{4,10,12} Puberty can occur early, so that the final height usually lower than teenager of the same age. The development of external genital is usually normal in obese girls¹⁸ and their menarche usually occurs early.^{10,17}

The side effects of obesity in children are usually milder than those in adults, because in adults these are the risk factors of developing respiratory tract and cardiovascular diseases.^{1,4,10} However, in children with severe degree of obesity the clinical manifestations may often be accompanied with respiratory complaints, hypertension, dermatitis or eczema of the skin.

On laboratory examination there is an increase of trygliceride concentration. Cholesterol concentration or low density lipoprotein increases while the high density lipoprotein decreases. Other findings are related to the complications of the obesity. On radiological examination, bone age survey shows that the bone age is relatively older, besides orthopedic problems caused by the complication of obesity.^{4,18}

Complications

There are 2 major complications in obese children. First, the effect of obesity to the health in childhood, and secondly long-term complications, i.e., obesity in adulthood and diseases related to the condition.

1. Problems in childhood

a. Social and emotional problems

Obesity is a major problem that may cause a child to withdraw from their society. Obese adolescents may have a of wrong perception on obesity and may cause depression. Obese adolescents, similar to obese women, sometimes blame themselves and become passive and may develop bulimia.

b. Respiratory diseases

Obese infants and children are prone to suffer from respiratory infection.²⁰ Complications related to this condition which are rare but quite fatal are hypoventilation of the alveolus or Pickwickian syndrome.²¹

c. Acanthosis nigricans

This condition is related to insulin resistance.⁴ Acanthosis nigricans develops in 50% of children with morbid obesity. In certain group of adolescent females, this is accompanied by hirsutism and hyperandrogenemia.²²

d. Orthopaedic problems

Children with severe obesity may suffer from the skeletal problems, mainly from slipped femoral epiphysis,²³ and tibia vara (Blount's disease).^{1,4} Although surgical intervention has been performed the effect to lose weight is often needed to avoid repeated operation.¹⁸

e. Diabetes

Most children with obesity have the clinical symptoms and signs of glucose intolerance.^{1,4} True diabetes, including insulin dependent type or adult type, rarely occurs in obese adult, although some adult diabetics are obese.

f. Morbid obesity

This condition rarely occurs in children. Often found in severe type obesity such as in Prader-Willi syndrome.

2. Long term effect

a. Persistent obesity

Obesity in children can persist until they reached adulthood.⁴ Of the obesity develops during adolescence, 80% will remain and only 20% becomes normal.^{1,24}

b. Cardiovascular disorder

There is a correlation between adult obesity with risk factors of developing cardiovascular disorders, adult type diabetes, hypertension, low HDL cholesterol and high LDL cholesterol concentration.⁵ A child who has an obesity problem has a higher risk of becoming hypertensive.^{25,26} A certain study reported that mayor risk factors for the adult are fat malabsorption, hypertension, and glucose intolerance.⁴

c. Gout and arthritis

The incidence of gout and arthritis is 1.5 x higher in obese than in normal children. Effort to lose weight will lessen the signs and symptoms of the gout and arthritis.¹⁴

d. Gall bladder diseases

Risk of developing gall bladder diseases is higher in obese patients. Women have higher incidence rate than men. This condition is related to the increased cholesterol concentration in the blood that can induced the forming of gall stone.⁵

e. Reproductive disorders

Deposit of fat excess in women can caused early puberty.²⁷ Obesity is also a risk factor for developing cancer in endometrium. With the increased concentration of estrogen, the risk of developing breast cancer in postmenstrual women is higher. But this has not been proven yet.^{5,14}

Prevention

To avoid becoming obese, there are promotive, preventive, curative and rehabilitative ways. In order to prevent obesity, a nutritional education and growth and development follow-up are very important. This need every support from the patient it self, family, school and home environment.^{10,28,29}

1. Nutritional education

This include information for infants and children to the mother or the patient. In individual or family level advise should be made according to the child health state and behavior, because there are variations of needs in every children.¹⁰

2. Growth and development monitoring

Routine growth and nutritional status monitoring by measuring weight and height is mandatory in order to detect as early as possible an underweight or overweight nutritional status, so that early intervention can be performed as needed. In certain cases other nutrient status have to be monitored too, because obesity doesn't mean that the requirement for other nutrient has been fulfilled.¹⁰ Being an neglected child in childhood is likely to become obese in adulthood as compensation for being unwanted. This has nothing to do with age, gender, or social economic status.³⁰

Management of Obesity in Children

Obesity in children is a complex interaction between genetic and environmental factors. A successful treatment depends on motivation, decreasing energy intake and increasing the energy uptake. Whatever way used, try or avoid disturbing the growth and development of the child.

The management of obesity is based on 2 aspects:

1. Management of the primary disease or disorders or of the complication
2. Nutritional way is used to improving nutritional status and decreasing the risk factors of obesity. Nutritional therapy is one of the important part of managing obesity in children. This is used by involving the child itself, parents or family, and school or home environment.

In infants and toddlers, parents or environment take an important role. In older children the role of the child itself is also as important as the role of the parents and environment. The role is needed to improve their motivation to treat obesity.¹⁰ This effort can be divided in 5 groups.^{10,31-33} (1) Giving information of obesity problems; (2) Developing motivation against obesity; (3) Decreasing energy intake; (4) Increasing physical activity; and (5) Managing psychological disorders.

1. Information on obesity problems

In giving information about this condition, it is important to take into consideration the patient's age, severity of the condition, duration of illness, complication that have already developed or still to be anticipated, and the danger of developing adult obesity. If the obesity occurs beyond pre-school age, the condition will be more difficult to handle.

2. Developing motivation against obesity

There are several ways to build motivation against obesity such as making the patient to appear more attractive, dressed more fashionable, feeling more healthy and fresh or wanting to get rewards from the parents. Disturbance to the health is not yet developed and this condition does not influence the child, unlike in adult. For an adult the feeling of worry of becoming hypertensive, diabetic or having heart attack is often present.

3. Regulation of energy intake

If the motivation has become strong the next step is to control food intake and nutritional education. This is not an easy task, because there are many factors involved. Therefore an analysis of eating behavior, amount and variation type of consumed daily food is needed. A good eating habit has to be built up. Try to avoid snacks between meals. A regular meal time has to be maintained, don't wait until the child feel too hungry. Stop eating when the amount of food to be consumed is enough not because the child feels satisfied. In infants and pre-school children, it is important to take notice at the amount of food or drinks consumed which has to be limited. Early weaning for babies under 4 months old is better avoided, for it is not necessary and the amount has to be limited for this can develop into obesity in early age.

Taking snacks while watching TV or while reading, excessive food storage at home or instant food are better avoided. It is better to provide food that takes time to prepare. Avoid high calories food and low fiber. It is advisable to eat high fiber food like fruits, and vegetables is better prepared without coconut milk, margarine or oil. Soft drinks such as cola, lemonade, sweetened tea are limited.

For years, there has been effort to make a good diet in order to control calories intake and decrease body weight. Diet can be divided into diet that based on reduced calorie intake and diet that does not based on reducing calorie intake. Every diet has to be chosen with caution, taking into consideration to child's appetite because this kind of diet has to be taken for a long period. The diet has to have adequate amount of nutrient except for the amount of calorie.

Type of diet:³¹⁻³⁴

- a. Diet without calory/zero diet (starvation diet)
- b. Half fasting diet (semi starvation diet)
- c. Low calories diet
 - low balanced calorie diet
 - low calorie high protein diet
 - low calorie ketogenic diet

In children the type of diet usually used in managing obesity is low calorie diet, for children are still growing and developing. Usually the diet contain 800-1000 calories, enough protein should be compatible to child age and has high biological value, adequate amount of vitamin and mineral.³¹⁻³⁴

Diet without calories is used for intractable obese patients, and only given under strict supervision of a doctor for hospitalized patients that need a through laboratory examination. The aim of reducing weight is considered a success if the weight for height reaching 120% or less. With restricted energy, it is also proven that serum lipid and apolipoprotein concentration is reduced. This can prevent atherosclerosis.³⁵

4. Increasing physical exercise

Taking routine exercise is advisable, in order to increase energy uptake. Avoid watching TV for along period of time because this doesn't use much energy. Outdoor recreation is another alternative but do not bring to much food or drinks. For older children and teenagers taking sport groups is better, because individual type of sports usually didn't take long. Modern live style nowadays has to be balanced with energy expenditure.^{36,37}

5. Managing psychological problems

Psychological factor usually influences eating habits or food intake. The influence is vice-versa. Eating could be a way to compensate the need to be satisfied, but gaining

extra weight doesn't improve the image, which again, turn to eat more. If necessary, consult a psychiatrist, for this psychological disorders is not easy to manage; psychotherapy may be needed.

Drugs and surgical procedure

Drugs that used to depress appetite or improved metabolism is inadvisable for children for its side effect which have bad effect on growth and development. Some radical operation is often used in adult such as jaw wiring, gastric ballooning, or intestinal bypass are also inadvisable for the children for the physical or psychological effects in the long run.^{4,29}

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