Review Article

Macronutrients in Adolescence

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Abstract

Nutrition in adolescence has critical importance for future health and problems may cause important chronic diseases. A balanced diet is a nutrition way whose %50, %30 and %20 of the total calorie are consisted of carbohydrate, fat and proteins; respectively; and also includes vitamins and minerals. Inadequate nutrition means consuming essential nutrients below the sufficient level; whereas imbalanced nutrition means altered ratio of consumed nutrients. Energy requirement differs among genders. Growth rates and other developmental properties of girls differ from boys after 11-12 years old. Required intake of lipid, carbohydrate, and protein differ according to the need of energy. Generally, girls need more energy in their early puberty period (11-14 years) whereas boys need more energy in their middle puberty period (15-18 years). Protein requirement in adolescents is related to growth type than age. Daily protein intake requirement for adolescents according to the World Health Organization are 0.8 g/kg/day for girls and 1.0 g/kg/day for boys with the necessity of consuming nutrients with high protein quality such as egg and milk. Fat and fatty acids are required for normal growth and development. Thirty percent of the daily energy must be obtained from fat and it must be composed of %7-10 of saturated fatty acids, %7-8 of polyunsaturated fatty acids, %10-15 of single unsaturated fatty acids.

Key Words: Adolescence; carbohydrate; fat; protein; nutrition

Introduction

For considering individuals healthy; they must have physical structure in accordance with their age and gender, must be capable of performing any kind of metabolic, physiologic and physical functions and spiritually must feel themselves happy (B. Buyukgebiz, 2013)

Nutrition is a conscious activity performed for adequate, balanced and proper intake of nutritional elements in accordance with the requirements of the body for being healthy and well during a lifetime started from foetal development to the infanthood, childhood, adolescence, adulthood and finally geriatric period (Aykut, 2011; Karakoyun & Yagcı, 2013).

Adequate and balanced nutrition is consuming every nutritional element adequately and utilizing them properly for growth, renewal and functioning of the body (Baysal, 2009; Demirezen E, 2005; Spark, 1998; Suren & Soysal, 2002).

Carbohydrate, proteins and fat are three components of macronutrients that provide calories or energy. A balanced diet is a nutrition way whose %50, %30 and %20 of the total calorie are consisted of carbohydrate, fat and proteins; respectively; and also includes vitamins and minerals.

Adequate and balanced nutrition allows physical growth, mental development, performance increasing, and productivity, sustaining life and preserving health (Demirezen E, 2005; Spark, 1998; Suren & Soysal, 2002). Inadequate nutrition means consuming essential nutrients below the sufficient level; whereas imbalanced nutrition means altered ratio of consumed nutrients.

Imbalanced nutrition is usually seen as intake more than requirement and resulted with obesity (T. C. Ministry of Health Public Health Agency of Basic Health Services General Directorate of Publications, 2013; WHO, 2004)

Malnutrition is a disequilibrium between energy and nutrients required for growing, sustaining life and unique functions (Irmak, Kesici, & Kahraman, 2011; WHO, 2004). Scientific studies has revealed that around 50 type of nutrients are required for human life; and insufficiency, excess or lack of these nutrients may cause health problems, growth and developmental delay (Baysal, 2010; Gunoz, 2003; Oktar & Sanlıer, 1999; Tarim, 2006; Yucecan & Nursal, 2008).

Therefore, nutrition in adolescence is quite important because important anthropometric changes; physical, biochemical; mental and social rapid growth, development and maturation occur along with much more increased nutrient requirement compared with other stages of life (Aykut, 2011; Baysal, 2009; B. Buyukgebiz, 2013; Tarim, 2006; Yucecan & Nursal, 2008).

Inadequate nutrition in adolescent cause nutritional growth retardation ("stunting"-"stunted-growth") also called as chronic nutrition failure or linear growth retardation and nutritional short stature (Oktar & Sanlıer, 1999). Sudden or prolonged nutrition in this period may impair effects of growth hormone and IGF-1 hormone; therefore growth hormone cannot utilize its effect (Gunoz, 2003).

In addition, inadequate nutrition also negatively affects sexual development, delays the onset of puberty, slows maturation period (Baysal, 2009; B. Buyukgebiz, 2013; Yigit, 2009), prevents reaching optimal bone mineral density and prevents reaching estimated length (Karakoyun & Yagci, 2013; Yigit, 2009).

Most practical and easy way of identifying whether adolescent feeds adequate and balanced or not is anthropometric measurements and changing body composition of adolescent must be closely monitored (Baysal, 2010; Sencer, 1991; Tarim, 2006; Yucecan & Nursal, 2008). In adolescence, %50 of body weight and %15-20 of body length are gained (B. Buyukgebiz, 2013; Karakoyun & Yagcı, 2013).

During anthropometric changes, adolescent girls gain both muscle and fat tissues and total muscle mass reach two-thirds of adolescent boys. In addition, subcutaneous tissues of girls increase by %23 whereas subcutaneous tissues of boys decrease by %12 (Baysal, 2010; Rudolph, Kamei, Overby, & Yurdakok, 2003). For proper changes during this period, nutrition requirements of adolescents must be met in terms of age, gender, body mass, sexual development stage and physical activity level (Baysal, 2009; B. Buyukgebiz, 2013; Tarim, 2006; Yucecan & Nursal, 2008).

Although data obtained as body weight compared with length and length compared with age allow us to obtain information about nutrition level; it must be noted that genes also affect physical growth. In some studies, it was shown that nutrition changes body structure of children and they are correlated (Guler, Gonener, Altay, & Gonener, 2009; Pekcan, 2008).

Individuals, especially children can be interpreted for whether they are adequately fed and balanced according to their physical appearances and behaviours (Baysal, 2010). In nutrition deficiencies, conditions such as disfigured body; distended abdomen, various wounds in skin, frequent headache complaints, decrease in appetite, fatigue, pacifism and unwillingness may occur; also duration of focus may be shortened, perception may be impaired, learning difficulties and behavioural disorders may be experienced.

All these factors may cause increasing discontinuation to the school and may decrease school success (Oktar & Sanlıer, 1999). Inappropriate habits acquired due to lifestyle, pressure of coevals, school program, wrong information about body, feeling of independence, ignorance; and skipping meals, starting a diet, consuming foods lack of nutritional value also put many young people into nutritional risks (Oktar & Sanlıer, 1999; Yigit, 2009).

Chosen nutrition type may cause problems like obesity, leanness, low body weight, shortness and low height (Demir, 2008; Karakoyun & Yagcı, 2013; WHO, 2004).

Nutrition in adolescence has critical importance for further health problems which individuals may experience in future; and may provide basis for important chronic diseases in future (Erkan, 2011; Karakoyun & Yarcii, 2013; T. C. Ministry of Health Public Health Agency of Basic Health Services General Directorate of Publications, 2013; Tarim, 2006).

Insufficient nutrition may cause malnutrition, delayed puberty and nutritional growth retardation whereas imbalanced nutrition may provide basis for diseases occurred in adulthood with chance of mortality such as obesity,

metabolic syndrome, type II diabetes, fatty liver, atherosclerosis, obstructive sleep apnoea syndrome (Applegate, Ozpınar, 2011; Baysal, 2009; B. Buyukgebiz, 2013; Gokçay & Garipagaoglu, 2002; Irmak et al., 2011; Merdol, 2006). In a report of WHO in 2000; it was stated that obesity, body weight below normal level, iron insufficiency, hypertension, smoking, alcohol consumption and high cholesterol level are among 10 risky situations affecting public health negatively in worldwide.

Chronic health problems suffered by children in school age and young people related with nutrition in Turkey are chronic malnutrition, iron deficiency anaemia, iodine deficiency diseases, other vitamin and mineral deficiencies, tooth decays, eating disorders and obesity (Applegate, Ozpınar, 2011; B. Buyukgebiz, 2013; Gokcay & Garipagaoglu, 2002).

Physical appearance is important for adolescent individuals and body weight/body image may cause happiness or unhappiness. In this period; boys are interested in their physical development whereas girls are more interested in their body weights (Dogan, 2006).

In adolescence boys generally tend to over eat and girls develop a nutrient deficit diet for keeping a fit body shape. In addition, it also revealed that adolescents are on a inadequate and imbalanced diet. They are generally on a diet rich in saturated fat and salt; and eat very few fruits, vegetables, milk and milk products (B. Buyukgebiz, 2013).

Especially in both developed and developing countries; when considering the association between diseases consisting most of the adulthood mortality and nutrition; it can be concluded that reduction on the future mortality is only possible with healthy nutrition in all adolescent age groups (B. Buyukgebiz, 2013; Guler et al., 2009).

In a study performed in Istanbul in 510 adolescents aged between 12-13 years, it was found that %15.3; %10.6 and %1.6 of the adolescents were thin, overweight and obese; respectively (Guler et al., 2009).

Therefore, we suggest that habits acquired in adolescent or even childhood can change prevalence and course of the adulthood diseases. Nowadays, chronic diseases due to diet stand as the main reason of %60 of the deaths and %46 of the diseases (Yucecan & Nursal, 2008).

Energy requirement

Adolescent individuals require additional energy for maintaining growth and activities (Baysal, 2010; B. Buyukgebiz, 2013; Erkan, 2011). Energy requirement differs among genders. Growth rates and other developmental properties of girls differ from boys after 11-12 years old. Required intake of lipid, carbohydrate, and protein differ according to the need of energy.

Generally, girls need more energy in their early puberty period (11-14 years) whereas boys need more energy in their middle puberty period (15-18 years) (Aykut, 2011; Kurucu, 1997). In the light of these properties of adolescence, energy requirement is 1800-2500 calories in girls and 2500-3500 calories in boys (B. Buyukgebiz, 2013; Kuzgun, 2002). For evaluating whether all adolescents receive adequate energy or not; the easiest and most appropriate way is monitoring growth and development (A. Buyukgebiz, 2006; Erkan, 2011; Tarim, 2006).

Inappropriate energy intake may cause obesity, malnutrition, delayed puberty, nutritional growth retardation and insufficient intake of many nutrients; especially iron (Aykut, 2011). Insufficient energy intake may be related with strict diet, low socio-economic status or chronic diseases (Erkan, 2011).

Considering principles of healthy nutrition, it is recommended that increased energy requirement in adolescents may be met from cereals (bread, pasta, rice etc.), dry legumes, fruits and vegetables rather than fat and sugar (Aykut, 2011).

Proteins

Protein requirement in adolescents is related to growth type than age. Daily protein intake requirement for adolescents according to the World Health Organization are 0.8 g/kg/day for girls and 1.0 g/kg/day for boys with the necessity of consuming nutrients with high protein quality such as egg and milk (Aykut, 2011; Baysal, 2009).

In the period between 4 years and adulthood 18-19% of the total body weight is consists of proteins (Karakoyun & Yagci, 2013).

Protein requirement during adolescence significantly increases due to increases in muscle mass, need for erythrocyte and myoglobulin, and hormonal changes (Karabudak, 2008; Tarim, 2006).

Amount of protein required for growth is higher in girls during 11-14 years and in boys during 15-18 years (Erkan, 2008, 2011). When adequate protein intake is not acquired, retardation of linear growth and sexual maturation; and reduction in fat-free body mass may occur (Erkan, 2008).

Insufficient energy intakes in nutrition cause growth-development retardation due to consumption of proteins for energy (Karabudak, 2008). In conditions with insufficient energy intake and increased vegetative protein consumption; protein requirement is increased (Aykut, 2011).

Thirty percent or more protein loss from protein storage may cause reductions in muscle mass, immune functions and organ functions; and if reaches to advanced stage it may even cause death (Baysal, 2009). Therefore, a nutrition plan as %12-15 of the daily required energy intake that meets from proteins must be the goal (Karabudak, 2008).

Proteins are acquired from both vegetables and animals. Quality of protein acquired from animal source is higher than quality of protein acquired form vegetative sources. Quantity of protein is also important as its quality (Baysal, 2009, 2010; Erkan, 2008; Karabudak, 2008).

Half of the daily consumed protein must be met from animal sources whereas other half must be met from vegetative sources. About 70-80% of the proteins from animal source must be fat-free milk and other dairy products whereas remaining must be from meat, fish and egg.

Vegetative sources rich in protein are dry legumes, soy bean and oil seeds (Erkan, 2008). Cereal products also contribute vegetative proteins (Baltaci, Ersoy, Karaagaoglu, Derman, & Kanbur, 2008; Karakoyun & Yagcı, 2013; Koksal, 2008). Amount of protein is low because large amount of fresh vegetables and fruit consists of water (Karakoyun & Yagcı, 2013).

Carbohydrates

Fifty to sixty percent of the daily energy intake must be met from carbohydrates. Therefore complex carbohydrates and fibrous food must be in balance (Erkan, 2011; Tarim, 2006). Basic carbohydrates such as sugar (≤%10 of the daily energy) must be reduced whereas consumption of dry legumes (chickpea, lentil, dry bean etc.), whole grain products and wheat which include complex carbohydrates must be increased. Carbohydrates are mostly present in vegetative nutrients. Carbohydrate consists of 60-90% of the cereals, 10-20% of the fruits, 18-20% of the potato and 10% of the other vegetables (Karakoyun & Yagci, 2013). In addition, sweetening agents such as sucrose and fructose must not exceed %10-25 of the total calorie (Erkan, 2011; T. C. Ministry of Health Public Health Agency of Basic Health Services General Directorate of Publications, 2013).

However, adolescents usually consume less complex carbohydrates and fibres; and more basic sugars (Kurucu, 1997; Tarim, 2006).

Among nutrients including carbohydrate; whole grain products, un-purified cereals, vegetables and fruits must be chosen. These nutrients with complex carbohydrates prevent sudden increases in blood glucose and reduce risk of chronic diseases such as obesity, diabetes, heart, cardiovascular diseases and colon cancer due to fibre included. In addition, these nutrients also provide other nutrients such as protein, vitamin, mineral and water as well as carbohydrates (Karabudak, 2008; Karakoyun & Yarcii, 2013; Tarim, 2006).

Fats

Fat and fatty acids are required for normal growth and development (Erkan, 2011). Some fatty acids which cannot be produced by body are present in compound of lipids and they are required for growth, heart and skin health (Baysal, 2009, 2010).

Thirty percent of the daily energy must be obtained from fat and it must be composed of %7-10 of saturated fatty acids, %7-8 of polyunsaturated fatty acids, %10-15 of single unsaturated fatty acids (Applegate, Ozpinar, 2011). In addition, daily cholesterol consumption must be lower than 300 mg and intake of trans fatty acids must be restricted (Buyukgebiz, 2013; USDHHS, n.d.).

However; total energy of typical adolescent diet consists of %36 of fat and %13 of saturated fat (Tarim, 2006). Lipids are most concentrated energy source and if it is carelessly limited; it may cause insufficient energy intake. An adolescent who needs 2200 calories/day must consume 73 g/day of lipids whereas an adolescent who needs 2800 calories/day must consume 93 g/day of lipids (Erkan, 2011).

Consuming insufficient fat may cause utilization of proteins as energy source, reduced absorption of fat-soluble vitamins (vitamins A, D, E and K) and negatively affected growth and development in children (Baltaci et al., 2008).

Low consumption of red meat and egg with the aim of limiting lipid and cholesterol consumption may cause insufficient intake of iron and zinc which are richly present in these nutrients (Tarim, 2006). Fat-free meat, chicken meat, fish, dairy products with low fat which include less lipid and saturated fat must be included in the daily nutrition plans (Aykut, 2011)

Conclusion

Adolescence is a period where a balanced diet is critical. Nutritional deficiencies or unhealthy eating behaviours may cause significant morbidities. Future life of adolescents is highly dependent on healthy nutrition in that period. A team involving parents, teachers and medical personnel must be organised to promote a healthy generation. Also environmental conditions including family, school must be taken into consideration. The subject requires a public policy that involves the government and civil public organizations.

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