

Nutritional Status and Its Associated Factors among Adolescents Residing in Different Countries: A Review

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ABSTRACT

Human development depends on good health state which is also essential for the wellbeing of people belonging to different age groups. Adolescence is a time of fast growth that is associated with increased nutritional needs. The base of the community's nutritional condition and the main point of action to end the intergenerational cycle of nutritional inadequacies is by improving the nutritional status of rural adolescents. This review will show the prevalence of under nutrition and over nutrition among adolescents by exploring different studies. Nutritional intake, nutritional deficiencies in adolescence age group in different regions of developed and developing countries are discussed. Nutritional knowledge among adolescents especially in developing countries are mentioned in this review.

Keywords: Adolescent, Nutritional status, Nutritional deficiencies, Under nutrition, Over nutrition, Nutritional intake

INTRODUCTION

From the time of conception to the moment of death, humans experience several growth and development stages. Each stage is marked by distinctive and particular traits. Adolescence refers to the developmental stage that is initiated by the onset of puberty and concluded by the acquisition of physical and emotional maturity^[1]. The nutritional status in this age group is very important for their growth and development.

Defining Adolescence

Between puberty and adulthood, adolescence is a period of physical and psychological development. The word comes from the Latin ‘adolescere’, which means ‘to mature’^[2,3]. Adolescence is a stage of development for people during which they undergo changes in their bodies, mind, emotions and social interactions^[4]. The largest age group on earth is made up of teenagers who are in a unique era of life known as the transitional period between childhood and adulthood. New knowledge is being produced as a result of longitudinal research conducted in both developed and developing nations as well as improved measures of teenage behaviour^[5].

The Stages of Adolescence

Adolescence which is often seen as the time between the ages of 11 and 19, is the stage of life when a person transitions from being a kid to an adult. Along with physical change and growth, adolescents also go through emotional, psychological, social and mental development. The stages of adolescence can be broadly distinguished as - Early adolescence (Between the ages of 11 and 13), middle adolescence (Roughly between the ages of 14 and 17) and late adolescence (Approximate age between 17 to 19 years)^[6]. Due to the processes of socialization, training and education, the rate of teenage changes varies among different cultures and societies. Important developmental milestones are reached during adolescence and it's crucial to comprehend teenagers' physical, cognitive, psychological, social-emotional, moral, educational and occupational growth as well as the changes that result from it. When we look at all these things, we can see that there are differences between boys and girls. Physical and sexual growth, social and economic independence, identity development, the development of adult relationships and roles and the capacity for abstract thought all contribute to this turbulent period's end^[1].

Table 1: Stages of Adolescent

Stages	Physical development	Cognitive development	Social-emotional development
Early Adolescence (11 – 13 years of age)	During puberty, body hair grows, sweating and oil	Increasing ability to think abstractly. Intellectual interests	Conflict with one's identity. Feel uncomfortable with

	production in the skin and hair increases, growth of the breasts and hips in girls' along with onset of menstrual cycle. Boys' testicles and penis expand and their voices get coarse.	increase yet remain mostly focused on the present.	one's appearance and self, realizing that parents are not perfect. Conflict with parents, influences by peer group, a desire for freedom Tendency. Want to be "childish" again, especially under stress.
Middle Adolescence (14 – 18 years of age)	Puberty is completed. For boys, physical growth continues while it slows for girls.	Increased development of the capacity for abstract thought, Increased ability to set goals, Desire for moral reasoning. Considering the purpose of life.	High expectations and fluctuating low self-esteem, Intense self-involvement. Persistent desire of independence. Compelled to make new connections and more dependent on them. Popularity can be a significant issue for them, love and passion-related emotions.
Late Adolescence (19 – 21 years of age)	Complete development takes place in young women. Young males continue to become taller, heavier, more muscular and develop body hair.	The capacity of thinking develops. Ability to postpone gratification, examination of personal feelings along with increased worry about the future. Ongoing interest for moral reasoning.	A stronger feeling of self, stronger sense of emotional steadiness, greater awareness about others. Increased self-reliance and independence. Peer relationships are still vital. Emergence of more committed

			relationships, Social and cultural customs become more significant.
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Adapted from the American Academy of Child and Adolescent's Facts for Families.

Development of Adolescence

Different psychological and social theories offer various viewpoints for comprehending the characteristics and developmental processes of adolescents. The lifetime viewpoint, the learning perspective, the humanistic perspective, the ecological perspective, the sociocultural perspective and the perspective on the development of positive adolescent are among them^[7]. The table shows the theories of adolescence^[8,9].

Primary Theorist	Developmental Area	Features
G. Stanley Hall, Arnold Gesell, James Tanner.	Biological	Genes and biology influence the way individuals develop physically and sexually.
Sigmund Freud, Anna Freud	Psychological	sexual apprehension and excitement.
Erik Erikson	Psychosocial	Adolescents struggle with forming their identities and avoiding identity diffusion.
Urie Bronfenbrenner	Ecological	Teenagers grow up and are impacted by their family, friends, religion, schools, the media, and their community.
Jean Piaget	Cognitive	Formal operational thought is the transition beyond concrete, experiential thinking to logical, abstract thinking.
Margaret Mead, Carol Gilligan	Cultural	In a society child development takes place in society.
Albert Bandura	Social Cognitive	Learning, social and environmental factors and how they affect behavior are related. Children acquire abilities through modeling.

A study of clinical medicine is played out in the management of adolescent patients against a backdrop of rapid physical, psychological and social developmental changes. These

alterations result in distinct illness patterns, atypical symptom presentation and most importantly, new communication and treatment issues. Parents are responsible for all areas of a child's health as they enter adolescence. By the conclusion of adolescence, the young person will be nearly fully responsible for his or her own health. The problem is to keep a good clinical relationship going as the health responsibilities shift from the parents to the child^[10]. In research for social interaction, one must be able to deduce the mental and emotional states of others. Although studies on the development of this skill, known as Theory of Mind (TOM), adolescence develops quickly. Using age-related changes in social-perceptual and social-cognitive TOM, a study examined the two components model. The findings confirm the separation of TOM components and show that adolescence is a vital time for the development of social-perceptual TOM skills^[11]. In a study, the relationship between teenage social media use and psychosocial adolescent adjustment was examined. Teenagers who reported having a large number of social media accounts from their parents and who also reported having a large number of lonely and FOMO (fear of missing out) profiles had the greatest levels of anxiety and depressed symptoms^[12].

Nutritional Status

Anthropometric Measurement of Adolescence

Investigation on the nutrition of the world's 1.2 billion teenagers (10-19 years old) will shape the future of the globe. India is home to a fifth of the world's teenage population at about 253 million. To achieve India's demographic dividend, it is vital to ensure that the country's adolescents are well fed and grow properly. Every second teenager in India is either too short, too thin or overweight. Boys are slimmer than girls but girls are shorter than boys. Thinness is strongest in 10-12 year old with huge differences between states in 10-14 and 15-19 year old. Every third teenage female and every fourth adolescent boy between the ages of 10 and 19 are underweight for their age. In most Indian states, at least one out of every five girls and boys are underweight for their age. Adolescent obesity is a major public health concern in most Indian states. There is a difference in the prevalence of malnutrition between 10-14 years and 15-19 years old within states. In Bihar, for example, 18 % of 15-19 year old females are short, compared to 36 % of 10-14 year old girls^[13]. Breakfast has been dubbed "the most essential meal of the day" as their findings of 47 studies in children and adolescents looked at the relationship between breakfast eating and nutritional adequacy (nine studies), body weight (16 studies), and academic performance (22 studies). Despite the fact that the quality of breakfast varied between studies, children who reported having breakfast on a regular basis had nutritional profiles that were superior to those of their breakfast-skipping peers^[14]. G Samuelson stated in his study that many adolescents skip their breakfast, dinner and school lunch program. Their samples take snacking and light meals contributing 25-35% of the daily energy intake. So, obesity and overweight are becoming more prevalent in all the Nordic Countries^[15]. In an investigation of

tribal people, they claimed that all nutrients were ingested at amounts below the recommended RDA and micronutrient deficiencies, particularly in iron, vitamin A and riboflavin, were severe. 42% of adolescent girls and about 63% of adolescent boys were underweight. Undernutrition is strongly correlated with socioeconomic parameters such as family type, size of land holdings and the occupation of the head of household were observed^[16]. In North Sumatera Utara's Medan, a study was conducted to ascertain the prevalence of nutritional status and its relationship to eating practices among adolescents. Underweight, overweight, and obesity rates were 23.3%, 13.0% and 6.5%, respectively. Adolescents aged 10 to 12 were found to be more likely to be underweight (32.0%). (Early adolescent). Teenage boys experienced underweight more frequently (37.8%) than teenage girls (18.6%)^[17]. In a study, anaemia and nutritional condition of teenage girls in the Babile District of Eastern Ethiopia were evaluated. Both urban and rural adolescents had poor nutritional status. However, the proportion of severely underweight adolescents in rural areas (39.3%) were higher than that in urban areas (37.5%). Place of living, father's profession, source of drinking water and teenagers' ages were factors that were independently linked to stunting^[18]. In Adama city, a cross-sectional quantitative study based on institutions were conducted among adolescent girls who were enrolled in school. According to the survey, 15.6% of teenage females were stunted, 3.3% were overweight, 1.0% were obese and 21.3% were underweight. Subjects from Government Schools had higher rates of wasting, stunting and limited dietary diversity than those from private schools^[19]. A study was performed looking at socioeconomic and anthropometric information on adolescent boys and girls. About 23% of teenage girls wed before turning 18 years old. About a quarter of married adolescent girls had short height and 18.6% were underweight. Almost 39% of the adolescents were stunted, regardless of gender. Adolescents from the scheduled caste population had a higher prevalence of stunting (42.7%). Approximately 70% of teenagers exceeded their RDA for energy intake. Intakes of micronutrients like riboflavin and vitamin A were incredibly low. Adolescent females in rural areas may be more susceptible to nutritional stress because of early marriage and conception before finishing their physical growth^[20]. In India, undernutrition among teenagers in tribal communities is a problem. A study evaluates the nutritional status of adolescent girls as well as their hygiene habits and awareness of adolescent programmes. 67% of them were stunted, and 55% of them were wasted. 81.6% of people had moderate anaemia, and the mean haemoglobin level was 9.57 ± 1.4 g/dl. Ninety two percent of people were found to wash their hands with soap after defecation. Only 2.5% of respondents were aware of youth government initiatives. The study found that tribal adolescent girls had extremely poor nutritional status. The urgent need is for interventions to lower the prevalence of malnutrition and anaemia in this age group^[21]. By describing adolescent girls' nutritional status, their exposure to information and services, knowledge and practices in nutrition, health, family planning and water, sanitation and hygiene (WASH), as well as contextual factors and quantifying variation by stage of adolescence, a study sought to support the design of an evidence-based adolescent

programme (Suaahara) in Nepal. Younger adolescents had the highest rate of underweight^[22]. In a study, WASH habits are evaluated in relation to teenage girls' nutritional status. Between May 2016 and April 2017, three Indian states hosted this study (Bihar, Odisha and Chhattisgarh). 20% of adolescent girls had MUAC 19 cm, 17% were skinny and one-third had stunting. Adolescent females' poor nutritional status was significantly correlated with poor WASH behaviors, such as access to water outside of the home, inadequate sanitation and failure to use soap after defecating^[23]. In a study, it was investigated how anthropometric status and eating habits of adolescents were related to their body image dissatisfaction. 19.5% of the teenagers showed signs of body image dissatisfaction. When compared to teenagers who were content with their body image, those with moderate body image dissatisfaction were less likely to adhere to a Western-style food pattern^[24]. A cross-sectional study of teenage girls, aged 16 to 19, revealed that 36.2% of them were malnourished, with 33.7% of them being obese and 66.3% being undernourished. Malnutrition has been found to be highly correlated with the age and educational level of the parents^[25]. In the Dev Bhumi Dwarka District of Gujarat which is located in the Western portion of India, the study evaluated nutritional status, associated factors that contribute to malnutrition and their access to health-care facilities. 19.6% of people were underweight, 8.9% were overweight, and 2.6% were obese. Nearly 79.6% of people were unaware of iron deficiency anemia, approximately 70% did not know of the hemoglobin test and 44% were not aware of the advantages of using sanitary napkins. Existing nutritional programme must emphasize about nutrition, health and hygiene^[26]. In a rural area of a District in Maharashtra, a study was carried out to examine some features of the socio-demographic profile and to determine the nutritional status of adolescent girls. In this study, stunting and underweight prevalence rates were 36.54% and 48.37%, respectively. Stunting and age group, religion and educational attainment were statistically significantly associated. In this study, the prevalence of thinness was 18.87% and socioeconomic class, religion and family structure of all were substantially predicted it^[27]. In India, the population between the ages of 10 and 19 makes up 21.4% of the total population. The nutritional condition and pattern of morbidity among teenagers were evaluated in a school in the Burdwan District of West Bengal. Underweight and stunting were more common in boys than in girls, with prevalence rates of 53.31% and 47.41%, respectively, in early adolescence and late adolescence respectively^[28]. A community-based cross-sectional study was carried out in the Amdanga Block of West Bengal's North 24 Parganas District among 143 teenage girls (10-19 years old) chosen from a sample through a multistage sampling approach. There was a 14.7% and a 37.8% overall prevalence of "thinness" and "stunting" respectively^[29]. A study was carried out to assess the nutritional status of young adolescent school girls from rural and urban areas. The average nutritional indicators for girls in rural areas were found to be substantially lower than those for girls in urban areas (underweight, stunting, and thinness). To combat undernourishment, it is necessary to establish numerous developmental and healthcare programmes specifically for rural communities^[30]. A cross-sectional study was conducted to investigate the physical

development and nutritional status of 238 adolescent Bhumij males in the Khatra Block in the Bankura district of West Bengal, India. The findings indicated that the investigated Bhumij boys were heavier and slightly shorter than the national average at each age. Undernourishment was seen at a prevalence of 53.36% among all. The findings of this study generally showed that the teenage Bhumij boys had alarmingly high rates of undernutrition^[31]. In a study, the nutritional condition of 16 to 18 year old school age children in Bankura District, West Bengal's rural and urban areas was evaluated among which 65% of people were found to be underweight. This study shows that the Bankura District's rural school-going youngsters come from lower socioeconomic levels and experience varying degrees of malnutrition from their urban counterparts^[32]. Based on a study of 386 rural adolescent females from Paschim Medinipur, 35.8% of adolescent girls were underweight. According to WHO guidelines, the study population (rural adolescents in Paschim Medinipur) is undernourished which indicates a serious situation^[33]. The goal of a study was to determine the incidence of malnutrition among adolescents aged 10 to 17 and its relationships to socio-demographic parameters. 49% of teenagers were underweight and 54% of them were stunted. Significantly more adolescents from lower social classes had stunted and skinny growth patterns. A significant contributor of adolescent undernutrition is shown to be poverty^[34]. In the Dharwad district, rural adolescent girls were the subject of a study to ascertain their nutritional condition and investigate the demographic factors influencing it. According to a study, 14.9% of adolescent girls in rural areas were underweight for their age. According to BMI, 3.7% of girls were over nourished and 25.2% of girls were undernourished. Adolescent girls are more likely to be undernourished than boys and this is linked to micronutrient deficiencies including anaemia. To better meet the dietary requirements of adolescent girls in rural regions, awareness-building is necessary^[35].

Nutrient Intake Among Adolescents

For both boys and girls, adolescence is a period of rapid growth. During adolescence, nutritional requirements are higher in ratio to body size. There is a high frequency of malnutrition among girls in a country like India with different social practices and similar beliefs against females. West Bengal and Punjab have both reported high levels of acute malnutrition. In a study the subjects were categorized into three groups such as 10-12yrs. (Group A), 13-15 yrs. (Group B) and 16-18 yrs. (Group C) for nutrient intake. The nutrient intake was compared with Recommended Dietary Allowance (RDA) laid down by the ICMR, 1993. The mean calorie consumption per day was 1246.0±410.8 Kcal, 1363.6±404.7 Kcal and 1521.3±413.5 Kcal for group A, B and C respectively. The mean protein intake daily in Groups A, B and C was 40.1±13.7 g, 43.7±13.69 g and 48.4±14.02 g respectively, as against the RDA. Their study found that teenage girls in rural Rajasthan have a height and weight deficit owing to dietary deficiencies. Intervention approaches to improve the nutritional condition of adolescent girls who will be future "mothers-to-be" are needed^[36]. Malnutrition is a condition that many teenagers face all over the

the world and is correlated with an insufficient dietary intake. Consumption of nutrients is linked to quality of life (QOL). The association between nutritional intake and teenagers' quality of life was examined in a study. Despite the detection of certain substantial negative associations, there was a significant positive link between the intake of several nutrients and adolescents' QOL. The results of this study suggest that in order to raise adolescents' quality of life, emphasis should be given to their nutrient consumption^[37]. The Department of Community Medicine at Sewagram, adopted four villages for the purpose of the cross-sectional study. The daily average calorie intake, 1239.6 ± 176.4 Kcal, was 39% below the RDA. The daily protein consumption was 39.5 ± 7 gm on average. It was 36% insufficient and the daily average consumption of 13.2 ± 2.5 mg of iron was 48% inadequate. The results confirm that adolescent girls' dietary deficiencies have a negative impact on their nutritional status^[38]. The nutrient intake of children aged 13 to 15 who lived in rural Shimla District, Himachal Pradesh were evaluated. Comparing boys' calorie, iron, zinc, and calcium intake to recommended dietary allowances, it was discovered that they had deficits of 37.9%, 53.7%, 35.5%, and 22.4%, respectively (RDA). In comparison to the RDA, the girls' percentage deficits for calorie, iron, zinc and calcium intake were 47.7%, 61.5%, 53.6%, and 43.6%, respectively. The results of this study showed that adolescents between the ages of 13 and 15 had insufficient nutritional consumption^[39]. The objectives of this study were to describe the eating habits of a sample of urban Indian adolescents. The adolescents reported low nutritional intake, 30% of them said they didn't consume any vegetables and 70% said they had three or more portions of high-calorie snacks the day before. 47% of respondents said they drank three or more servings of energy-dense beverages whereas 45% said they didn't eat any portions of fruit. In general, girls consumed a diet that was more nutrient-dense than boys. The findings showed the need to create effective nutrition promotion initiatives to support healthy eating in adolescence and address the supply and availability of food, as the Indian teenagers reported poor food consumption patterns^[40].

Nutritional Deficiency Sign

Iron deficiency anemia is most common nutritional deficiency disorder in developing countries like India. Girls in the sixth to ninth grades of secondary schools between the ages of 12 and 15 were chosen for the study. By using ELISA, the serum ferritin concentration was calculated. One multi-component test for memory, attention and verbal learning as well as the students' IQ scores were utilized to determine the cognitive function in mathematics score. Academic performance, IQ and scores on the mental balance, attention and concentration, verbal memory and recognition tests were lower in iron-deficient females than in non-iron-deficient girls^[41]. Approximately 55.18% of participants in the study exhibited pallor, 40.33% had dental caries, 33.49% had refractive errors, 23.11% had a history of worm infestation, 38.90% had skin issues and 68.61% of adolescents had ENT issues. The health and nutritional status of adolescent students were found to be inferior^[28]. Anaemia (44.8%),

dental caries (25.9%), angular stomatitis (15.4%) and other nutritional deficiency illnesses

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were prevalent. From June to December 1999 a cross-sectional community research was carried out in the Amdanga Block of North 24 Parganas District in West Bengal^[29]. The aim of the study was to determine the haemoglobin level and anaemia prevalence in tribal children from West Bengal. There were total of 1,010 tribal children with a male to female ratio of 1:1.35. 46.34% (n=468) of them had children anaemia. It is alarming how common anaemia is in tribal youngsters among West Bengal^[42]. Deficiency in iron Anemia (IDA) is a widespread health issue. It involves people of various ages and sexual orientations. However, teenage girls are more susceptible to it. For a period of six months, a cross-sectional investigation was carried out in the biochemistry clinical laboratory of the Indira Gandhi Institute of Medical Sciences in Patna, Bihar, India (April 2015-October 2015). Out of 200 adolescent girls 50% were found to be anaemic. 43.3% of the population had mild anaemia, 3.3% had moderate anaemia, and 3.3% had severe anaemia^[43].

Nutritional Knowledge of Adolescent

In a study the eating patterns and nutritional understanding of adolescent females from various schools were examined. Depending on their socioeconomic circumstances, adolescent girls consumed less millets and more aerated drinks, bakery goods, and fast food according to FFQ data on nutritional intake. Vegetables, green leafy vegetables and fruits were moderately consumed. Following treatments 1 and 2, the experimental group showed a significant increase in nutrition-related knowledge when compared to the baseline data. However, because the children in the experimental group had already acquired nutrition knowledge from print media, there was no discernible improvement in nutrition knowledge levels with the second intervention over the first intervention^[44]. A study stated that almost a third of adolescent and adult females were malnourished. In both adolescents and adult women, factors other than dietary adequacy and diversity had a stronger impact on undernutrition. Nondietary variables (e.g., older age, greater household income status, improved water availability, better maternal work status and living in better types of dwellings) predicted good nutritional status in teenage females^[45]. The main knowledge gaps and to propose research lines that developed within the European Union-Funded 'Healthy Lifestyle in Europe by Nutrition in Adolescence' (HELENA) project, concerning the nutritional status, physical fitness and physical activity of adolescents in Europe. Lack of harmonized and comparable data on food intake; lack of understanding regarding the role of eating attitudes, food choices and food preferences; the key knowledge gaps regarding the nutritional status issue of European teenagers include the lack of harmonized and comparable data on physical activity and physical fitness, the prevalence of obesity and body composition, and the status of micronutrients^[46]. In Raina-I Block of West Bengal's Purba Bardhaman District, 100 rural adolescent females between the ages of 10 and 19 participated in this cross-sectional survey. The study makes an effort to quantify the rate of obesity,

stunting, wasting, thinness, and health awareness. According to the study, thinness rather than obesity is the main cause of health issues for adolescent girls in rural areas.

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In general, 20% of the subjects are considered to be slim, whereas 6% are considered to be obese. Rural living, which is characterized by poverty, illiteracy, unemployment, food shortages, etc., may be the cause of the increased rate of thinness^[47]. In order to assess the knowledge, attitudes and practices of school going teenage females from a school in Malda, West Bengal, an evaluation was created. A secondary girls' school undertook a cross-sectional observational study of students in classes IX and X. 89% skipped one major meal and 52.1% missed breakfast. Despite being aware of the sources, 63% did not eat foods high in iron. Consuming foods high in vitamin A and iodine was not regular. By raising the eligibility age for the midday meal programme beyond class VIII and include breakfast in the programme, the gap might be addressed^[48]. The goal of the study was to determine how well informed the adolescent girls participating in the nutritional awareness programme in the Anganwadis of Changanacherry Taluk of the Kottayam District were about nutrition. The findings make it evident that the majority of the individuals had either poor or fair levels of knowledge about the significance of nutrition. Because diet affects future nutritional status, emphasis was placed on dietary recommendations during adolescence in their nutritional education^[49]. In a study, an effort was undertaken to assess the effects of educating school age male and female students about nutrition. To increase the nutritional status and wellbeing of school aged children, nutrition education was provided. It was discovered that nutrition instruction was very helpful for raising school children's status and had a favourable impact on their knowledge scores. Maximum and minimum knowledge gains were recorded in the age groups of 16–17 years for males and 10-12 years for girls. The maximum knowledge growth was 33.95% and the minimum was 25.85%. The largest attitude gain was seen in females aged 16-17, at 30.04%, while the lowest score was shown in girls aged 10-12, at 25.68%. Good eating habits can be developed and adolescents' nutritional status can be improved through nutrition education^[50].

CONCLUSION

Adolescents are in the transitional stage of life lying halfway between childhood and adulthood. Because adolescents are our countries "future mother and father", their nutritional state is crucial for their growth and development. Adolescent females who are undernourished are at risk as well as perpetuating the intergenerational cycle of malnutrition. Adolescent nutritional status is a good predictor of a community's level of health. The growth and nutritional status of adolescents in various parts of the world have been evaluated. However, there is very little data available on the population of rural India. Malnutrition has emerged as one of the major issues affecting teenagers globally, particularly in underdeveloped nations. There are different studies where the researchers concluded the adolescents are under nourished and the nutrient intake of this age group is not met properly according to RDA. Different Nutritional deficiency like anemia is most common in

adolescent age group. Proper nutritional knowledge will be the bridge which will meet the gap between nutrient requirement and nutrient taken by the adolescents.

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