

## BioScientific Review (BSR)

Volume 4 Issue 4, Fall 2022


ISSN(P): 2663-4198 ISSN(E): 2663-4201

Homepage: <https://journals.umt.edu.pk/index.php/bsr>



Article QR



- Title:** Assessment of Eating Behaviors and Nutritional Status of Adolescents: A School-based Cross-Sectional Study Conducted in Lahore, Pakistan
- Author (s):** Ayesha Amjad<sup>1,2</sup>, Azmat Ullah<sup>1</sup>, Savaiba Khattak<sup>2</sup>, Saira Khalid<sup>2</sup>, Arooj Abid<sup>1</sup>
- Affiliation (s):** <sup>1</sup>University of Veterinary and Animal Sciences, Lahore, Pakistan 54000  
<sup>2</sup>Riphah International University, Lahore, Pakistan
- DOI:** <https://doi.org/10.32350/BSR.44.06>
- History:** Received: April 11, 2022, Revised: June 20, 2022, Accepted: June 29, 2022
- Citation:** Amjad A, Ullah A, Khattak S, Khalid S, Abid A. Assessment of eating behaviors and nutritional status of adolescents: A school-based cross-sectional study conducted in Lahore, Pakistan. *BioSci Rev.* 2022;4(4):00–00. <https://doi.org/10.32350/BSR.44.06>
- Copyright:** © The Authors
- Licensing:**  This article is open access and is distributed under the terms of [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/)
- Conflict of Interest:** Author(s) declared no conflict of interest



UMT

A publication of  
The Department of Life Sciences, School of Science  
University of Management and Technology, Lahore, Pakistan

## Assessment of Eating Behaviors and Nutritional Status of Adolescents: A School-based Cross-Sectional Study Conducted in Lahore, Pakistan

Ayesha Amjad<sup>1,2\*</sup>, Azmat Ullah<sup>1</sup>, Savaiba Khattak<sup>2</sup>, Saira Khalid<sup>2</sup>, Arooj Abid<sup>1</sup>

1 Department of Food Science and Human Nutrition, University of veterinary and animal sciences, Lahore, Pakistan

2 Department of Human Nutrition and Dietetics, Riphah College of Rehabilitation and Allied Health Sciences, Lahore, Pakistan

\*Corresponding Author: [ayesha.amjad@riphah.edu.pk](mailto:ayesha.amjad@riphah.edu.pk)

Article Info	Abstract
<i>Received: 11-04-22</i>	Healthy eating patterns, if adopted early in life, support the growth, learning ability, and overall health of children and adolescents. The latter are more vulnerable to nutritional deficiencies due to their inappropriate food choices, peer pressure, unhealthy eating habits, and increased nutritional demand. The current study aimed to determine the degree of compliance of adolescents to the recommended dietary guidelines. A multi-stage stratified cluster sampling design was used to conduct qualitative research during the period January-August 2019. The study population comprised the students of public and private high schools in Lahore, Punjab, Pakistan. A semi-structured questionnaire that focused on the general dietary intake and physical activity patterns in school setting was filled by interview technique. The determinants of eating behaviors were investigated using descriptive statistics and chi-square. As per the BMI percentiles, 46.2% (651) were underweight, 2.3% (33) were obese, and 6.2% (88) were overweight. The data indicated that the eating behaviors of participants did not follow the recommendations of the Food Guide Pyramid (FGP). However, on a scale of 1-10, it was found that family and advertisements have the highest impact on the food choices of adolescents with the scores of $6.5 \pm 2.69$ and $6.1 \pm 2.77$ , respectively. The study concluded that adolescents in Lahore do not follow a healthy eating pattern. Nutritional education and interventions must be prioritized to promote healthy eating habits among adolescents.
<i>Revised: 20-06-22</i>	
<i>Accepted: 29-06-22</i>	
<b>Keywords</b> adolescents, eating behaviors, food knowledge, meal consumption habits	

### 1. Introduction

Adolescence is the transitional stage before adulthood. It is marked by rapid physical growth accompanied by behavioral, emotional, and psychological changes [1].

Dietary habits developed during this phase act as major determinants of the learning ability and overall health of adolescents [2]. Evidence supports that food habits developed in childhood persist until

adulthood and more often, this progression is accompanied by the addition of unhealthy dietary patterns [3]. Globally, more than 150 million children are stunted [4]. While, approximately 2.28 million are overweight [5]. This number accounts for 10% of the world's school going children, of which a quarter is said to be obese. So far, studies have reported a strong association between nutritional status and environmental and behavioral factors including diet, lifestyle, and physical activities [6]. Furthermore, it has also been reported that family environment also influences the food choices of adolescents. The consumption of meals with family leads to a higher intake of fruits and vegetables, as well as lower consumption of fizzy beverages in adulthood [2, 7]. Among all these determinants, poor eating behaviors during childhood, such as increased consumption of unhealthy, highly processed foods and beverages, are presumably associated with a higher risk of childhood obesity [8]. On the contrary, in low- and middle-income countries, the prevalence of childhood nutritional diseases is shifting from mere undernutrition to double burden of malnutrition (DBM) - the coexistence of undernutrition and over nutrition. Several studies have focused on multiple dimensions of the problem at hand by identifying the causes and consequences of this health crisis [9].

Pakistan has the highest prevalence of DBM at the household level among South Asian countries [10]. Inadequate dietary intake of macro and micronutrients [11], increased consumption of high saturated fat, sugar, refined foods, and a sedentary lifestyle have been observed among Pakistani adolescents [12]. Dietary recommendations, as per the Food Guide Pyramid (FGP), focus upon the

consumption of a variety of foods, maintaining balance between physical activity and usual food intake, choosing plenty of vegetables, fruits and grains, and keeping the intake of salt, saturated fat, sodium, and sugar in moderation [13, 14]. Most of the available data is from developed countries [15, 16] and very limited data of developing countries is available [17]. The current study aims to determine the degree of compliance of adolescents with the recommended dietary guidelines and to bridge the link between background variables, such as parents' education level, nutritional status, physical activity level, and the eating patterns of the target group.

## 2. Methodology

### 2.1 Study Design and Setting

This study was conducted as a descriptive cross-sectional survey during January-August 2019. It was carried out in Lahore, a metropolis of 10 million people and the capital city of the Punjab province. The population comprised the adolescents attending private and public high schools. A multi-stage stratified cluster sampling design was used to obtain a representative sample of the adolescent population.

### 2.2 Selection of Schools

The sampling frame consisted of all high schools from five tehsils of Lahore. Schools were stratified into private and public schools. In the first stage a total of twenty (10 private and 10 public schools each) were selected from each stratum using simple random sampling technique. If any school did not agree to participate in the study it was replaced by another school using the same sampling technique. Among the selected schools, 9 were girls schools, 5 were boys schools, and the remaining were co-educational. The second stage of

sampling consisted of a random selection of students from 7<sup>th</sup> - 10<sup>th</sup> grades, in general corresponding to the age group of 11-15 years. These students were selected at random, one from each grade per school.

### 2.3 Sample Size Calculation

Sample size was calculated based on a single population proportion formula, considering prevalence (P) 50%, absolute precision (d) 3%, confidence interval (CI) 95%, design effect of 1.2, and a non-response rate of 20% which yielded 1409 adolescents.

### 2.4 Recruitment of the Participants

This study was conducted according to the guidelines laid down in the Declaration of Helsinki. Moreover, all procedures involving research participants were approved a priori by the Institutional Review Committee for Biomedical Research, University of Veterinary and Animal Sciences, Lahore, Pakistan. All students of the selected classes were deemed eligible for the current study and invited to participate in it. Written consent forms were given to the parents of children and only those children whose parents gave consent were included in the sample.

Data was collected using a semi-structured questionnaire, modified to be used in the current study. It was based on one developed by [15] (permission obtained by personal communication). Prior to this research, the questionnaire was subjected to pilot study for the evaluation of its functionality. The pilot study helped to determine repetitive questions which were then rephrased. A total of 1536 students aged 11 to 15 years were enrolled in this study. The questionnaires were filled by the interview technique.

### 2.5 Anthropometric Assessment

The current study was initiated by recording the anthropometric data of each student. The height was measured by a standard stadio-meter set on a wall with the subject's head in the Frankfurt plane, while the weight was recorded using a digital weighing scale (Certeza, GS-807, Hamburg, Germany). Necessary precautions, such as removing the shoes and other heavy wears, were taken while measuring the height and weight of the students. Height and weight measures were, in turn, used to calculate the Body Mass Index (BMI, Kg/m<sup>2</sup>). Adolescents were classified as underweight, overweight, and obese according to the Center for Disease Control (underweight: < 5<sup>th</sup> percentile; overweight: BMI  $\geq$  85<sup>th</sup> to < 95<sup>th</sup> percentile; obese: BMI  $\geq$  95<sup>th</sup> percentile) [18].

### 2.6 Data Collection

The questionnaire was translated from English to Urdu by a professional translator. The validity of translation was checked via the back translational method by involving another translator. The questionnaire consisted of questions that focused on the general dietary intake, physical activity patterns, family and peer pressure, and areas which covered the participants' general knowledge about a healthy food intake and its benefits. Well-trained dietitians administered, verified, and quantified the responses of all questionnaires. All factors traced in the literature that influence food choices were rated independently on a 10-point scale (ranging from 1: least effective to 10 : most effective). Additionally, questions were included to assess nutritional awareness and practices regarding recommendations specified in FGP [13]. The respondents were asked to list the food groups according to the FGP recommendations based on their

food consumption a day before the interview. Furthermore, questions were included to assess behaviors related to physical activities (sports participation, cycling, walking) as well as sedentary habits (watching TV, playing computer games, or doing homework).

### 2.7 Statistical Analysis

All analyses were conducted using the Statistical Package for Social Sciences (SPSS version 23; SPSS Inc., Chicago, IL, USA). Descriptive statistics (frequencies, percentages) were applied to characterize the sample. Chi-square ( $\chi^2$ ) test was used to test the significance of the association between the participants' demographics, physical activity status, and eating patterns. The level of significance for acceptance was  $p < 0.05$ .

### 3. Results

A total of 1409 students participated in the current study with a response rate of 91.7%. The average age of the participants was  $13.47 \pm 1.01$ , with the majority being of females (61.5%). Background variables are illustrated in Table 1. As per the BMI percentiles, a significant proportion of the participants, that is, 46.2% ( $n=651$ ) was underweight. Internationally documented cutoff points were used for the classification of participants among BMI categories [18]. The findings about eating patterns illustrated in Table 2 indicate that 68.3% of adolescents skip at least one meal of the day. Surprisingly, a significant percentage of the participants, that is, 60.2% reported receiving a lesson about healthy eating, previously. It was also observed that eating patterns of the participants were not affected by their nutritional status, that is, underweight, obese, or over-weight, as well as their regular sports activities.

**Table 1.** Demographics of the Participants

Variables		n	%
Age Groups	12	298	21.1
	13	381	27.0
	14	497	35.3
	15	233	16.5
Maternal Educational Status	Illiterate	211	15.0
	Elementary school	273	19.4
	Middle school	400	28.4
	College	346	24.6
	University	179	12.7
Paternal Educational Status	Illiterate	152	10.8
	Elementary school	227	16.1
	Middle school	411	29.2
	College	304	21.6
	University	315	22.4
Body Mass Index (BMI)	Underweight	651	46.2
	Normal	637	45.2
	Overweight	88	6.2
	Obese	33	2.3

**Table 2.** Eating Patterns of the Participants

		Frequency	Percent
Main meals per day	1-2	842	59.8
	3	475	33.7
	$\geq 4$	92	6.5
Having breakfast	Daily	604	42.9
	1-2 per week	344	24.4
	3-4 per week	252	17.9
	Never	209	14.8
Fast food consumption	Once or more per day	302	21.4
	2-6 per week	271	19.2
	once a week	523	37.1
	Never	313	22.2
Choice of snacks	Fast food	1058	75.1
	fruit	206	14.6
	Dairy Products	145	10.3

		Frequency	Percent
Skipping meals	At least once a day	963	68.3
	7-8 o clock	530	37.6
Timing of dinner	9-10- o clock	715	50.7
	10-11 o clock	164	11.6
Place of meals	At table with family	876	62.2
	In front of TV or computer; or while doing homework	378	26.8

When asked to rate the factors affecting their food choices on a scale of 1-10, the participants rated family, friends, teachers, health, and advertisements as  $6.5 \pm 2.69$ ,  $5.9 \pm 2.87$ ,  $5.797 \pm 2.67$ ,  $5.01 \pm 2.67$ , and  $6.1 \pm 2.77$ , respectively. However, teachers remained the most influential factor for female participants, while health remained so for male participants. Furthermore, eating patterns were found to be significantly associated with gender (Table 3).

**Table 3.** Eating Patterns of Adolescents by Gender

	Male n=542	Female n=867	P
<b>Do you skip any meal?</b>			
Yes	64.8%	70.6%	0.02
No	35.2%	29.4%	
<b>How often do you eat breakfast</b>			
Daily	47.0%	40.3%	0.01
3-4 per week	14.6%	20.0%	
1-2 per week	22.3%	25.7%	
Never	16.1%	14.1%	
<b>How do you consume food at home?</b>			
With family	56.5%	65.7%	0.001
Alone	9.8%	9.7%	

	Male n=542	Female n=867	P
Alone	9.8%	9.7%	0.0001
In front of tv	31.7%	23.8%	
others	2.0%	0.8%	
<b>How often you consume fast food?</b>			
Once or more per day	20.5%	22.0%	0.0001
2-6 per week	24.9%	15.7%	
once a week	34.1%	39.0%	
Never	20.5%	23.3%	

Upon asking to list food groups of FGP in the correct order of their recommended intake, only 155 (11%) respondents out of 1409 were able to do it correctly. About 59.5% of the participants listed fats in the correct order, while fruits, vegetables, grains, meat, and milk were put in the right order by 24.3%, 31.2%, 31%, and 25.4% of the participants, respectively. The data showed that none of the participants were eating according to the recommended food servings in the FGP. In comparison to the male participants, female participants seemed to be well-informed about fat intake recommendations and the recommended servings of different food groups.

The findings indicated that significantly more boys were overweight than girls (13% vs 9%,  $\chi^2 = 5.57$ ,  $p = 0.018$ ). Upon dividing the participants into two groups as per the criteria of listing at least 3 food groups of FGP in the correct order of their recommended consumption frequency, underweight participants whose parents were educated successfully listed (at least) 3 food groups correctly as compared to normal-weight participants whose parents were illiterate (Table 4). Weight of participants have no significant association with their nutrition-related knowledge.

**Table 4.** Distribution of Food Pyramid Knowledge among Study Subgroups

	Participants listed 3 food groups of FGP correctly	Participants listed $\leq 2$ food groups of the FGP correctly	Total % (n)	X <sup>2</sup>	p
Male	21.6 (117)	78.4 (425)	100 (542)	5.57	0.018
Female	25.7 (223)	74.3(644)	100 (867)		
Mother Illiterate	14.7 (31)	85.3(185)	100 (211)	12.07	0.001
Mother Educated	25.8 (309)	74.2 (889)	100(1198)		
Father Illiterate	7.9(12)	92.1(140)	100 (152)	24.53	0.0001
Father Educated	26.1(328)	73.9(929)	100(1257)		
Underweight	26.6(173)	73.4(478)	100(651)	3.94	0.04
Normal weight	22(167)	78(891)	100(758)		

Interestingly, 43.4% of the participants regularly participated in sports activities, with  $1.2 \pm 1.5$  mean number of days per week spent in regular sports activities. The average hours spent on the following sedentary activities were  $1.3 \pm 1.8$  for book or newspaper reading,  $2.5 \pm 1.2$  for computer and mobile phone games,  $1.6 \pm 1.09$  for DVD, video, cinema, and  $3.11 \pm 1.8$  for school homework.

#### 4. Discussion

This study indicates that eating behaviors of adolescents are structured by a number of different factors. These factors include maternal and paternal education, eating meals with family, food choices, and knowledge about FGP. Food preferences and eating behaviors of adolescents change over time with exposure, peer influence, and emerging eating trends [17]. The results of the current study highlight the higher prevalence of under-nutrition among adolescents which could negatively affect their cognitive behavior and physical well-being. Furthermore, under-nutrition is usually accompanied by micronutrient

deficiencies which are known to increase the risk of recurring infections [19], compromise immune system [20], and induce the early onset of various chronic diseases [21].

The analysis revealed that the eating patterns of the participants did not comply with FGP. Only 24% of the participants reported consuming at least three food groups in the correct order. These findings complement previous literature [15, 22, 23] by emphasizing the role of nutrition related knowledge in shaping the eating behaviors of adolescents. The consumption of fruits and vegetables according to the recommended servings was also uncommon in the target group. It was found that only about 29.4% of the participants consumed fruits and vegetables as per the FGP recommendation, while only 31.2% consumed fats to the recommended level. These findings are in line with [15, 24-26], which reported a low intake of fruits and vegetables and a high consumption of saturated fats. A vast majority (75%) preferred fast food including snack foods,

which remains a common food preference among adolescents [15, 27, 28].

An overwhelming majority (68%) of the participants skipped at least one meal a day. For the current sample, meal skipping was found to be significantly related to gender, since female participants skipped more meals than male participants. This observation is in good agreement with studies conducted on Australian [29] and Turkish adolescents [15] which revealed that meal skipping is a habitual characteristic of adolescents around the globe. Furthermore, it was found that female participants engaged more in poor eating behaviors, such as meal skipping and binge eating, which indicated their poor nutritional status [16] and an increased risk of chronic diseases.

Among all meals, breakfast is the most important meal of the day as it may have a role in weight management and prevention of various chronic diseases.

Several studies postulate that meal skipping is most common among adolescents [30-32]. A similar trend was seen in the current study in which only about 43% of the participants consumed breakfast every morning, while the rest (57%) of them skipped their breakfast regularly. The data revealed that 15% of the participants regularly skipped breakfast [29]. The routine of irregular breakfast intake in the current study group can be associated with the dinner timings of the participants. More than half of them (51%) ate their dinner between 9 pm to 10 pm which could be a reason that affects their daily breakfast intake.

Frequent meals with family reportedly have a significantly good impact on children's and adolescents' dietary intake [33, 34]. The findings of this study showed that every 2 out of 3 adolescents took their

meals with their family gathered around a table, which shows why family remains the most influential factor in their food choices. Many studies have reported that family meals are associated with healthy eating behaviors in children [25, 35-37]. There is conclusive evidence that supports the various health benefits of daily physical activities in children and adolescents. Physical activities promote a healthier lifestyle and help in the prevention of diseases [38, 39]. The average response regarding the maximum number of days spent doing regular physical activities was 3 days. Adolescents are recommended to spend at least 60 minutes per day in physical activities, while the findings revealed that more time was spent on sedentary activities, such as reading, playing games on computers and mobile phones, spending time on videos and watching DVDs, and doing school homework. It was reported that physical activities significantly decrease during adolescence and activities that require less physical effort increase [40]. The American Academy of Pediatrics recommends a screen time of (a maximum of) two hours a day [41].

The findings also showed that female participants were more concerned about their body image than male participants, which is in concordance with the existing literature [42, 43]. Surprisingly, no direct association was observed between the health status and knowledge about the correct order of food recommendations. Moreover, normal-weight participants were not found to have better knowledge about healthy eating habits than the underweight ones. However, most of the students reported receiving a lesson on healthy eating habits. School-based interventions in terms of providing regular lessons on healthy lifestyle patterns should be



introduced to promote health among adolescents, while nutritional education may help to improve their health status. The results showed that the target group reflects a need for proactive and practical messages regarding healthy eating and even general eating habits [44, 45].

The results obtained from the targeted sample size may differ from any other study conducted in the same region, as the data collected in this research was mostly from public schools. The students enrolled in these schools usually come from a low socioeconomic background and their eating patterns may vary from students with a high socioeconomic background. Also, the data was rooted in the declarations made by the participants. Hence, the dietary recalls may involve some under or over-reporting.

#### 4.1 Conclusion

The assessment of eating patterns among adolescents provides indispensable information. The current study concludes that eating patterns of adolescents do not meet the dietary recommendations of FGP. Hence, nutritional education must be provided to students in order to enhance their knowledge. Regular educational interventions must be prioritized to promote health and prevent the onset of chronic diseases.

**Acknowledgment:** The authors wish to thank all those who participated in this study.

**Author Contribution:** Azmat Ullah Khan supervised the research and reviewed the manuscript. Ayesha Amjad conceptualized and designed this study and participated in the acquisition, analysis, and interpretation of data and also drafted the initial manuscript. Saviaba Khattak and Arooj Abid carried out the research and participated in the acquisition, analysis, and

interpretation of data. Saira Khalid reviewed the manuscript critically for important intellectual content. All authors contributed to manuscript revisions and approved the final version.

**Declaration of Competing Interest:** The authors declare that they have no conflict of interest.

#### References

1. Unicef. *The state of the world's children 2011: adolescence - an age of opportunity*. Unicef. <https://data.unicef.org/resources/the-state-of-the-worlds-children-2011-adolescents-an-age-of-opportunity/>. 2011.
2. Moreno LA, Rodríguez G, Fleta J, Bueno-Lozano M, Lázaro A, Bueno G. Trends of dietary habits in adolescents. *Crit Rev Food Sci Nutr*. 2010;50(2):106-112. <https://doi.org/10.1080/10408390903467480>
3. Van Cauwenberghe E, Maes L, Spittaels H, et al. Effectiveness of school-based interventions in Europe to promote healthy nutrition in children and adolescents: systematic review of published and 'grey' literature. *Br J Nutr*. 2010;103(6):781-797. <https://doi.org/10.1017/S0007114509993370>
4. IFPRI. Global food policy report. IFPRI. <https://www.ifpri.org/publication/2017-global-food-policy-report>. 2017.
5. WHO. Obesity and overweight fact sheet. WHO. <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight#:~:text=Facts%20about%20>

- [20overweight%20and%20obesity&tx=In%202016%2C%2039%25%20of%20adults,tripled%20between%201975%20and%202016](https://doi.org/10.1186/1471-2458-9-185). 2021.
6. Abudayya AH, Stigum H, Shi Z, Abed Y, Holmboe-Ottesen G. Sociodemographic correlates of food habits among school adolescents (12–15 year) in North Gaza Strip. *BMC Public Health*. 2009;9(1):1-13. <https://doi.org/10.1186/1471-2458-9-185>
  7. Larson NI, Neumark-Sztainer D, Hannan PJ, Story M. Family meals during adolescence are associated with higher diet quality and healthful meal patterns during young adulthood. *J Acad Nutr Diet*. 2007;107(9):1502-1510. <https://doi.org/10.1016/j.jada.2007.06.012>
  8. Schmidt AB, Lund M, Corn G, et al. Dietary glycemic index and glycemic load during pregnancy and offspring risk of congenital heart defects: a prospective cohort study. *Am J Clin Nutr*. 2020;111(3):526-535. <https://doi.org/10.1093/ajcn/nqz342>
  9. Fanzo J, Hawkes C, Udomkesmalee E, et al. 2018 global nutrition report. City University of London. <https://openaccess.city.ac.uk/id/eprint/22797/>. 2018.
  10. Anik AI, Rahman MM, Rahman MM, Tareque MI, Khan MN, Alam MM. Double burden of malnutrition at household level: A comparative study among Bangladesh, Nepal, Pakistan, and Myanmar. *PloS one*. 2019;14(8):e0221274. <https://doi.org/10.1371/journal.pone.0221274>
  11. Rifat-uz-Zaman ZI, Ali U. Dietary intakes of urban adolescents of Sialkot, Pakistan do not meet the standards of adequacy. *Pak J Nutr* 2013;12:460-467.
  12. Mushtaq MU, Gull S, Abdullah HM, Shahid U, Shad MA, Akram J. Prevalence and socioeconomic correlates of overweight and obesity among Pakistani primary school children. *BMC Public Health*. 2011;11(1):724. <https://doi.org/10.1186/1471-2458-11-724>
  13. Welsh S, Davis C, Shaw A. Development of the food guide pyramid. *Nutrition Today*. 1992;27(6):12-23.
  14. USDA. Dietary guidelines for Americans 2015-2020. USDA. [https://health.gov/sites/default/files/2019-09/2015-2020\\_Dietary\\_Guidelines.pdf](https://health.gov/sites/default/files/2019-09/2015-2020_Dietary_Guidelines.pdf). 2015.
  15. Akman M, Akan H, İzbirak G, et al. Eating patterns of Turkish adolescents: a cross-sectional survey. *J Nutr*. 2010;9(1):e67. <https://doi.org/10.1186/1475-2891-9-67>
  16. Bede F, Cumber SN, Nkfusai CN, et al. Dietary habits and nutritional status of medical school students: the case of three state universities in Cameroon. *Pan Afr Med J*. 2020;35:15. <https://doi.org/10.11604/pamj.2020.35.15.18818>
  17. Murimi M, Chrisman M, McCollum H, Mcdonald O. A qualitative study on factors that influence students' food choices. *J Nutr Health*. 2016;2(1):e6.
  18. Ogden CL, Kuczmarski RJ, Flegal KM, et al. Centers for disease control

- and prevention 2000 growth charts for the United States: Improvements to the 1977 national center for health statistics version. *Pediatrics*. 2002;109(1):45-60.
19. Lindenmayer GW, Stoltzfus RJ, Prendergast AJ. Interactions between zinc deficiency and environmental enteropathy in developing countries. *Adv Nutr*. 2014;5(1):1-6. <https://doi.org/10.3945/an.113.004838>
  20. Chandra RK. Nutrition and the immune system: an introduction. *Am J Clin Nutr*. 1997;66(2):460S-463S. <https://doi.org/10.1093/ajcn/66.2.460S>
  21. Bauer J, Jürgens H, Frühwald MC. Important aspects of nutrition in children with cancer. *Adv Nutr*. 2011;2(2):67-77. <https://doi.org/10.3945/an.110.000141>
  22. Munoz KA, Krebs-Smith SM, Ballard-Barbash R, Cleveland LE. Food intakes of US children and adolescents compared with recommendations. *Pediatrics*. 1997;100(3):323-329. <https://doi.org/10.1542/peds.100.3.323>
  23. Sebastian RS, Enns CW, Goldman JD. US adolescents and MyPyramid: associations between fast-food consumption and lower likelihood of meeting recommendations. *J Am Diet Assoc*. 2009;109(2):226-235. <https://doi.org/10.1016/j.jada.2008.10.053>
  24. Garipağaoğlu M, Sahip Y, Budak N, Akdikmen Ö, Altan T, Baban M. Food types in the diet and the nutrient intake of obese and non-obese children. *J Clin Res Pediatr Endocrinol*. 2008;1(1):21-29. <https://doi.org/10.4008/jcrpe.v1i1.5>
  25. Arcan C, Neumark-Sztainer D, Hannan P, van den Berg P, Story M, Larson N. Parental eating behaviours, home food environment and adolescent intakes of fruits, vegetables and dairy foods: longitudinal findings from Project EAT. *Public Health Nutr*. 2007;10(11):1257-1265. <https://doi.org/10.1017/S1368980007687151>
  26. Vadiveloo M, Zhu L, Quatromoni PA. Diet and physical activity patterns of school-aged children. *J Am Diet Assoc*. 2009;109(1):145-151. <https://doi.org/10.1016/j.jada.2008.10.012>
  27. Elbel B, Gyamfi J, Kersh R. Child and adolescent fast-food choice and the influence of calorie labeling: A natural experiment. *Int J Obes*. 2011;35(4):493-500. <https://doi.org/10.1038/ijo.2011.4>
  28. Andreyeva T, Kelly IR, Harris JL. Exposure to food advertising on television: Associations with children's fast food and soft drink consumption and obesity. *Econ Hum Biol*. 2011;9(3):221-233. <https://doi.org/10.1016/j.ehb.2011.02.004>
  29. Shaw ME. Adolescent breakfast skipping: An Australian study. *Adolescence*. 1998;33(132):851-862.
  30. Giovannini M, Verduci E, Scaglioni S, et al. Breakfast: a good habit, not a repetitive custom. *Int J Med Res*. 2008;36(4):613-624. <https://doi.org/10.1177/147323000803600401>
  31. Savage G, MacFarlane A, Ball K, Worsley A, Crawford D. Snacking behaviours of adolescents and their association with skipping meals. *Int J*

- Behav Nutr Phys Act.* 2007;4(1):e36.  
<https://doi.org/10.1186/1479-5868-4-36>
32. Deshmukh-Taskar PR, Nicklas TA, O'Neil CE, Keast DR, Radcliffe JD, Cho S. The relationship of breakfast skipping and type of breakfast consumption with nutrient intake and weight status in children and adolescents: The national health and nutrition examination survey 1999-2006. *J Am Diet Assoc.* 2010;110(6):869-878.  
<https://doi.org/10.1016/j.jada.2010.03.023>
  33. DeJong CS, van Lenthe FJ, van der Horst K, Oenema A. Environmental and cognitive correlates of adolescent breakfast consumption. *Prev Med.* 2009;48(4):372-377.  
<https://doi.org/10.1016/j.ympmed.2009.02.009>
  34. Hammons AJ, Fiese BH. Is frequency of shared family meals related to the nutritional health of children and adolescents? *Pediatrics.* 2011;127(6):e1565-e1574.  
<https://doi.org/10.1542/peds.2010-1440>
  35. Mota J, Fidalgo F, Silva R, et al. Relationships between physical activity, obesity and meal frequency in adolescents. *Ann Hum Biol.* 2008;35(1):1-10.  
<https://doi.org/10.1080/03014460701779617>
  36. Neumark-Sztainer D, Larson NI, Fulkerson JA, Eisenberg ME, Story M. Family meals and adolescents: what have we learned from Project EAT (Eating Among Teens)? *Public Health Nutr.* 2010;13(7):1113-1121.  
<https://doi.org/10.1017/S136898001000169>
  37. Larson NI, Story M, Eisenberg ME, Neumark-Sztainer D. Food preparation and purchasing roles among adolescents: associations with sociodemographic characteristics and diet quality. *J Acad Nutr Diet.* 2006;106(2):211-218.  
<https://doi.org/10.1016/j.jada.2005.10.029>
  38. Janssen I, LeBlanc AG. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *Int J Behav Nutr Phys Act.* 2010;7(1):40.  
<https://doi.org/10.1186/1479-5868-7-40>
  39. Hills AP, King NA, Armstrong TP. The contribution of physical activity and sedentary behaviours to the growth and development of children and adolescents. *Sports Med.* 2007;37(6):533-545.  
<https://doi.org/10.2165/00007256-200737060-00006>
  40. Butt J, Weinberg RS, Breckon JD, Claytor RP. Adolescent physical activity participation and motivational determinants across gender, age, and race. *J Phys Act Health.* 2011;8(8):1074-1083.  
<https://doi.org/10.1123/jpah.8.8.1074>
  41. Bar-On ME, Broughton DD, Buttross S, et al. Children, adolescents, and television. *Pediatrics.* 2001;107(2):423-426.  
<https://doi.org/10.1542/peds.107.2.423>
  42. Harper B, Tiggemann M. The effect of thin ideal media images on women's self-objectification, mood, and body image. *Sex Roles.* 2008;58(9-10):649-

657. <https://doi.org/10.1007/s11199-007-9379-x>
43. Grossbard JR, Lee CM, Neighbors C, Larimer ME. Body image concerns and contingent self-esteem in male and female college students. *Sex Roles*. 2009;60(3-4):198-207. <https://doi.org/10.1007/s11199-008-9535-y>
44. Taechangam S, Pinitchun U, Pachotikarn C. Development of nutrition education tool: healthy eating index in Thailand. *Asia Pac J Clin Nutr*. 2008;17(S1):365-367.
45. Freeland-Graves JH, Nitzke S. Position of the academy of nutrition and dietetics: total diet approach to healthy eating. *J Acad Nutr Diet*. 2013;113(2):307-317. <https://doi.org/10.1016/j.jand.2012.12.013>