Research article

The effect of nutritional education on nutritional knowledge level and diet quality in volleyball players living in a disadvantaged area

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Abstract

The aim of this study is to determine the effect of nutritional education (NE) planned for volleyball players who live in a socioeconomically disadvantaged area on the level of nutritional knowledge and diet quality. The study was conducted with volleyball players between the ages of 9 and 14 who were studying in schools in disadvantaged areas of Istanbul between July 2022 and August 2022. NE was applied in 3 separate modules. As a data collection tool, the General Information and Nutritional Habits Questionnaire, from which information about the hypothesis of the study will be obtained, was used both pre- and post-NE. A 1-day (24-hour) food consumption record was taken from the study group at the beginning and end of the study. Again, at the beginning of the study, the Diet Quality Index (DQI-I) of the food consumption records was calculated to analyze the current diet quality of the players at the end. The nutritional knowledge level of 40 volleyball players participating in the study increased post NE ($p<0.05$). There is no statistically significant difference in the weight parameters of the pre and post-NE ($p>0.05$). There is no statistically significant difference between the total DQI-I scores ($p>0.05$). The 3-week nutrition education given as a result of the study, which was planned to examine the effect of nutrition education on the nutritional knowledge level and diet quality of volleyball players living in disadvantaged areas, caused a significant increase in the level of nutrition knowledge, while it did not create significant changes in the DQI-I. It is thought that the reason for this situation is related to socioeconomic level, the availability of high nutritional value food, and the level of nutritional knowledge of families. There is a need for necessary practices in the dissemination of nutrition education in the adolescent period.

Keywords: Adolescents; exercise; nutrition education; volleyball

1. Introduction

The health of the people living in a society ensures the development of that society in terms of health and economy. Balanced and adequate nutrition is the most important parameter determining human health. Physical activity and healthy nutrition practices should be popularized in order to protect and improve the health of individuals and to lead a quality life (Rozanski, 2023). It is a scientific fact that when any of the nutrients are consumed inadequately or excessively, growth and development are hindered (Vlaardingerbroek, 2024).

Children and adolescents are not able to choose foods and beverages with high nutritional value because their nutritional knowledge is not sufficient. Adolescence is the period when the start of healthy eating habits is laid. The education conducted during adolescence period is important for adolescents on their way to becoming adults. Physical activity is indispensable for a quality life (Wu et al., 2024). Growth is affected by physical activity as much as external factors such as genetic structure, circadian rhythm, and diet. High physical activity in childhood reduces the likelihood of chronic diseases, especially obesity, in adulthood (Souilla et al., 2024).

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), disadvantaged individuals are defined as individuals who have less chance of social and economic integration because of their gender, economic status, political status, ethnic or religious origin (Atchoarena and Gasperini, 2003). Disadvantaged groups are those who have limited access to facilities such as health, education, and information that are easily accessible to most of society (Kazu, 2019). In a 2010 study conducted in Türkiye, it was concluded that the rate of healthy eating decreases as socioeconomic status worsens according to education level, employment status, and income factors (Simsek, 2010). Hatun et al. (2003) concluded that malnutrition is observed in children of families with low economic levels. It has been determined that the risk of Type-2 Diabetes Mellitus (T2DM) increases when individuals who are fed with limited food for a long time start to be fed with high-calorie and cheap foods. Therefore, T2DM and obesity are the most common diseases after infectious diseases in poor regions of the world. According to the World Health Organization (WHO) report, as poverty increases, the prevalence of low-weight, malnourished children increases (WHO, 2017). The consequences of malnutrition are short stature (stunting), weakened immune system, easy infection, and severe course of infection. Low socioeconomic status negatively affects maternal nutrition. Therefore, inequality between individuals starts during pregnancy (Nguyen, 2023).

Childhood and adolescence are important for the acquisition and maintenance of healthy lifestyle behaviors. Lifestyle and nutritional behaviors develop during adolescence, individuals have more control over their dietary choices, and dietary behaviors acquired during this period affect adulthood (Scheineder, 2016; Winpenny, 2018).

The aim of our study was to determine the effect of healthy nutrition education given to female volleyball players aged 9-14 years living in a socio-economically disadvantaged area on the nutritional knowledge level and diet quality.

2. Materials and methods

This study is a descriptive cross-sectional study. The data collection process of this planned research was carried out between 4 July 2022 and 18 August 2022 after the approval of Bahcesehir University Scientific Research and Publication Ethics Board dated 05.07.2022 and numbered E-20021704-604.01.02-36586. The population of the study consisted of female adolescents between the ages of 9-14 studying in schools located in disadvantaged areas of Istanbul, Turkey. These schools are located in Zeytinburnu, Sisli, Maltepe, Fatih, and Kagithane districts.

The power of the study was determined with the G*Power (G*Power 3.1.9.2, Duesseldorf, Germany) package program. Power analysis was performed in sample selection; type 1 error rate α=0.05 and type 2 error rate β=0.20, power of the test 1-β=0.80 and effect size 0.50 were calculated. In line with this information, it was shown that at least 34 individuals should be included in the study. The study sample was designed to include 40 female adolescents who signed the consent form, considering possible losses. Adolescents who used medication, had chronic diseases, and played sports other than volleyball were not included in the study.

Different methods were used as data collection tools to obtain information about the hypothesis of the study. General Information and Dietary Habits Questionnaire: With the General Information and Nutrition Habits Questionnaire, information such as age, disease information, weight and height, dietary habits (number of main meals and snacks, frequency of fast-food consumption, etc.), nutritional knowledge level and fluid consumption were determined before the individuals were included in the study. The questionnaire was based on a similar study examining the effect of nutrition education on players' nutrition knowledge. The nutritional knowledge test consists of three parts; Multiple Choice: 12 questions, each with one correct answer (+1 point). Scores range from 0 to 12.

True/False: 8 questions, each with one correct answer (+1 point). Scores range from 0 to 8. Food Group Questions: 5 questions, with 25 foods to choose from. Correct answers (+1 point), wrong answers (-1 point). Highest score is +15, lowest is -10. (Akder, 2017). 24-hour food consumption record method: The 24-hour (1-day) food consumption record method was used to determine nutritional status. At the beginning of the study, a 24-hour food consumption record of the previous day was taken from the players. This method is recommended by the European Food Safety Authority (EFSA, 2014).

With this method, players were asked to indicate the foods they consumed at each meal the day before they participated in the study, along with detailed quantities, on the form sent to them. Household measurements (water glass, thin/thick slice, coffee/tea cup, matchbox, tablespoon/teaspoon, etc.) were used to indicate food measurements.

Food consumption records obtained from the players were entered into the Nutrition Information System (NIS) version 7.2 system and macro and micronutrients such as energy, protein, carbohydrate, fat, and fiber were determined. This study was conducted in accordance with the Principles of the Declaration of Helsinki.

Diet Quality Index (DQI-I): (DQI-I) of food consumption records was calculated to analyze the current diet quality of the players at the beginning and end of the study. The DQI-I is a diet quality measurement tool developed in line with the Recommended Dietary Allowance (RDA) recommendations for daily consumption of food and nutrients. The diet quality index consists of 4 main components. These components are diversity, adequacy, dietary moderation, and overall balance. The diversity component is scored between 0-20 points by evaluating the general nutrient diversity and diversity in terms of protein source. The adequacy component is scored between 0-40 points by comparing and scoring protein, grain, fruit, vegetable, pulp, vitamin C, calcium, and iron consumption according to RDA recommendations. The dietary moderation component is scored between 0-30 by evaluating and scoring cholesterol, saturated fatty acids, sodium, total fat, and empty energy nutrients according to RDA recommendations. The overall balance component is scored between 0-10 points by assessing the ratio of macronutrients and fatty acids. After the individual scores of all components are calculated, they are summed to form the DQI-I total score between 0-100. DQI-I is an internationally applicable index that enables the comparison of the nutritional status of developed and developing countries. The increase in the DQI-I indicates an increase in diet quality (Kim, 2003).

3. Results

3.1. Nutrition education

Healthy nutrition training was provided by the dietitian who conducted the study. This training consists of 3 modules.

Module 1. The importance of adequate and balanced nutrition and being at an ideal weight is mentioned. Nutrient, carbohydrate, protein, fat, vitamin, and mineral definitions were made. The benefits of nutrients and the foods in which they are found are given as examples. The importance of water is mentioned in this module. Module 2. The module aims to introduce food groups and explain them with examples. Faulty nutrition behaviors, obesity, causes of weakness, breakfast, and the importance of main meals and intermediate meals are also included in this module. Module 3. In the module, the importance of adequate and balanced nutrition in athletes is explained with examples and recommendations shared. Pre- and post-sport meal recommendations were given. General reinforcement of all modules was done interactively. Nutrition training was completed with a question-answer activity.

After data collection in the first week, the study lasted 4 weeks in total, including 3 weeks of training implementation, 1 time per week.

The General Information and Dietary Habits Questionnaire, 24-Hour Food Consumption Record, and DQI-I calculation, which were administered to the players at the beginning of the study, were also administered at the end of the training. The entire data collection process and training were conducted online.

3.2. Data evaluation

Body Mass Indexes of adolescents were calculated using the formula BMI=weight (kg)/height^2 (m^2). BMI, height and weight percentiles were evaluated according to the standards developed by Neyzi et al. (2015) for Turkish children.

The data obtained were statistically evaluated in SPSS 21.0 package program. Statistical significance was accepted as $p<0.05$ in all analyses. In descriptive statistics, numbers, percentages, mean, lower-upper value and standard deviation values will be included. The square test was applied in the analysis of qualitative variables. The conformity of the data to normal distribution was checked with the Kolmogorov-Smirnov test. The t-test was used to compare means. The distribution of anthropometric measurements of the players in the study is given in Table 1.

Table 1
Distribution of anthropometric measurements of volleyball players.

	Average	Standard Deviation	Minimum	Maximum
n=40				
Age	12,70	0,883	9	14
Body Weight (kg)	50,38	12,382	37	93
Height (cm)	159,00	3,550	154	165
BMI (kg/m^2)	19,38	3,93	14,17	32,17
BMI Z Score	-0,41	1	-1,73	2,84

A total of 40 players participated in the study. The average age of the players was 12.70 (SD=0.883). The youngest player was 11 years old and the oldest player was 14 years old. The mean body weight was 50.38 kg (SD=12.382). The weakest player weighed 37 kg, while the player with the highest body weight weighed 93 kg. The mean height was 159 cm (SD=3,550). The shortest player was 154 cm and the tallest player was 165 cm.

According to the percentile groups of anthropometric measurements of adolescents, 55% of the players in terms of

weight, 47.5% in terms of height and 42.5% in terms of BMI are in the 25-75 percentile range, which is the recommended percentile value. Although the rate of those below the 10th percentile according to weight was 7.5% and the rate of those below the 10th percentile according to height was 2.5%, those below the 25th percentile according to BMI levels constituted 40% of the population. Descriptive statistics of the players' dietary habits before / after the training are presented in Table 2.

Table 2
Distribution of dietary habits of adolescents pre and post NE.

		Pre-NE		Post NE		
		N	(%)	N	(%)	P
Number of main meals consumed	1 Meal	-	-	1	2.5	0.227
	2 Meals	17	42.5	11	27.5	
	3 Meals	23	57.5	28	70.0	
Number of snacks consumed	1 Snack	7	17.5	6	15.0	1.000
	2 Snacks	22	55	22	55.0	
	3 Snacks	11	27.5	12	30.0	
Skipping meals	There is	27	67.5	25	62.5	0.804
	No	13	32.5	15	37.5	
	Evening	3	7.5	2	5.0	
	Snacks	11	27.5	9	22.5	
	Breakfast	7	17.5	6	15.0	
	Noon	8	20	9	22.5	

Before the NE, 57.5% of the players consumed 3 main meals in 3 days, while 42.5% consumed 2 main meals per day. After the training, the number of main meals increased and 70% of the players preferred 3 main meals. In addition, 55% consumed 2 snacks per day, 27.5% consumed 3 snacks per day, and 17.5% consumed 1 snack per day. After the NE, the preference for snacks increased and 30% of the players started to prefer 3 snacks. Those who skip meals are 67.5%. After the training, the rate of skipping meals decreased (62.5%). However, this decrease was not significant ($p>0.05$). The most frequently skipped meal was snacks (27.5%). Lunch was skipped by 20%, breakfast by 17.5% and dinner by 7.5%. The number of players skipping snacks decreased after the training.

Table 3 shows the statistics of the answers given to the questions about the players' dietary preferences before and after the training.

Table 3
Distribution of nutrition preferences of adolescents.

Preferences	Answer Category	Pre-NE		Post NE		
		N	%	N	%	P
	There is	37	92.5	37	92.5	
	No	3	7.5	3	7.5	
Consumption of drinks with added sugar	1 cup or less	23	57.5	20	50.0	1.0
	2-3 cups of water	14	35	18	45.0	
	Total	40	100	40	100.0	
	There is	34	85	35	87.5	
	No	6	15	5	12.5	
Consumption of fast-food (hamburgers, pizza, pasta, etc. not prepared at home)	2-3 times a month	25	62.5	26	65.0	1.0
	2-3 times a week	8	20	7	17.5	
	4-6 times a week	2	5	2	5.0	
	Every day	-	-	1	2.5	
	No	10	25	16	40.0	

When Table 3 is analyzed, 92.5% of the players consumed drinks with added sugar before and after the training. The number of sugar-containing beverages consumed was 1 cup or less for 57.5% of the players. While 35% consumed 2-3 cups of sugar-added beverages before the training, this rate increased to 45% after the training. While 85% of the players consumed fast-food before the training, 87.5% of them consumed fast-food after the training. While the frequency of fast-food consumption was 2-3 times a month for 62.5% of the players before the training, this frequency increased to 65% after the training.

While players preferred crackers, biscuits, and the like, fruit, and chocolate for snacks before the training, the number of those who preferred fruit increased after the training. Although the number of those who prefer chocolate, crackers, biscuits, and the like decreased, they are still the most preferred products for snacks.

Statistical analysis of the players' nutrition knowledge levels before and after the training is presented in Table 4.

Table 4
Analysis of adolescents' nutrition knowledge level scores Pre- and Post-NE.

	Average	N	Standard Deviation	P
Pre-NE Knowledge Level	6.7750	40	1.16548	0.042
Post-NE Knowledge Level	7.9000	40	1.27702	

Statistically, there is a significant difference between the nutrition knowledge levels of the players before and after the

training ($p<0.05$). Therefore, the knowledge level of the players increased after the training.

The results of the analysis on whether there is a significant difference between the players' Diet Quality Index and its components before and after the NE are presented in Table 5. It was determined that NE had a significant effect on food diversity and vegetable intake.

4. Discussion

This study aimed to evaluate the impact of a nutrition education program on volleyball players from socioeconomically disadvantaged areas, focusing on their nutritional knowledge and diet quality. By analyzing pre- and post-education assessments, the research explored changes in knowledge levels and food consumption patterns among players. Studies show that adolescents generally have unhealthy eating habits, especially skipping breakfast and consuming foods with high-calorie content frequently (Zahrah, 2023; Li et al., 2024). This increases the likelihood of obesity. Regular breakfast has been shown to support the protection of health (Xian, 2023). The habit of eating breakfast was found to be 51% in Istanbul.[19,20] Considering the skipping of meals in adolescents in Turkey, it was found that 69.5% in Gaziantep and 81% in Bornova skipped meals. It was shown that breakfast was the most frequently skipped meal (Tanrıverdi, 2011).

In this study, the number of main meals increased after the training and 70% of the players preferred 3 main meals. The preference for snacks increased after the training and 30% of the

Table 5
Results of the analyses of the differences of the diet quality index and its components of adolescents Pre- and Post -NE.

	Pre NE					Post NE							
	N	Average	Std. Deviation	Min	Max	Average	Std. Deviation	Min	Max	Mean	t	df	P
Food Diversity (0-15)	40	11.45	2.791	3	15	9.9	3.153	3	15	1.55	2.401	39	**0.021**
Protein Diversity (0-5)	40	4.2	1.265	1	5	4.08	1.347	0	5	0.125	0.429	39	0.67
Vegetable	40	1.28	0.933	0	3	0.9	0.632	0	3	0.375	2.199	39	**0.034**
Fruit	40	2.53	2.05	0	5	3.1	1.865	0	5	-0.575	-1.518	39	0.137
Grain	40	3.5	1.086	1	5	2.95	1.648	0	5	0.55	1.936	39	0.06
Pulp	40	2.95	1.319	1	5	2.75	1.446	1	5	0.2	0.781	39	0.44
Protein	40	5	0	5	5	4.9	0.441	3	5	0.1	1.433	39	0.16
Iron	40	4.15	1.001	3	5	4.15	1.189	1	5	0	0	39	1
Calcium	40	2.15	1.189	1	5	1.95	1.197	1	5	0.2	0.85	39	0.401
Vitamin C	40	3.8	1.418	1	5	3.35	1.35	1	5	0.45	1.548	39	0.13
Total Oil	40	0.15	0.662	0	3	0.15	0.662	0	3	0	0	39	1
Saturated Fat Oil	40	0.15	0.662	0	3	0	0	0	0	0.15	1.433	39	0.16
Cholesterol	40	3.15	2.537	0	6	4.28	2.242	0	6	-1.125	-1.955	39	0.058
Sodium	40	2.63	2.467	0	6	3.23	2.577	0	6	-0.6	-0.984	39	0.331
Empty Energised Feed.	40	1.13	1.62	0	6	0.9	1.549	0	6	0.225	0.621	39	0.538
Carb/Pro/Oil	40	0	0	0	0	0	0	0	0	0	0	0	-
Fatty Acids Ratio	40	0.35	1.001	0	4	0.5	1.177	0	4	-0.15	-0.595	39	0.555
Diversity	40	15.65	3.773	4	20	13.98	4.252	3	20	1.675	1.957	39	0.058
Competence	40	25.35	5.522	14	36	24.05	5.602	13	34	1.3	1.386	39	0.174
Dietary Measurement. Total	40	7.2	4.339	0	15	8.55	4.163	0	18	-1.35	-1.311	39	0.198
General Balance Total	40	0.35	1.001	0	4	0.5	1.177	0	4	-0.15	-0.595	39	0.555
DQI Total	40	48.2000	8.02624	27	63	46.5750	7.65904	32	62	1.625	0.994	39	0.326

players started to prefer 3 snacks. The rate of skipping meals decreased after the training (62.5%). The number of players skipping snacks decreased after the training. While the players preferred crackers, biscuits, and the like, fruit, and chocolate for snacks before the training, the number of those who preferred fruit increased after the training. Although the number of those who preferred chocolate, crackers, biscuits' and the like decreased, they were still the most preferred products for snacks. Positive effects of nutrition education on the number of main meals, snacks, and snack preferences were observed. Therefore, supplying healthy nutrition education practices during adolescence, when eating habits begin to form, is a strategy that positively affects public health (Ares et al., 2024). After the nutrition education, no positive effects were observed on the consumption of sugar-added beverages and fast-food in the study group. The ease of access to such foods and the difficulty in accessing healthy alternatives are thought to be one of the reasons for this result. Positive changes in the nutritional habits of the players after the training are promising for public health.

According to the DQI-I criteria, scores below 60 indicate poor diet quality, while scores above 60 indicate good diet quality. Improved diet quality in adolescents has positive effects such as decreasing obesity indicators, increasing cognitive functions, and improving mental health (Larruy-Garcia et al., 2024). Having parents with a high level of education, mothers with good nutritional knowledge, a healthy home environment, absence of distractions at breakfast, and regular physical activity are factors that improve diet quality (Arouca, 2019). According to a study conducted in the Balearic Islands of Spain, the average DQI-I value was 43.0.24 A study conducted in southern Spain showed that the DQI-I score was 56.3.25 The mean DQI-I values of Americans and Chinese were 59.1 and 60.5 points, respectively.15 In this study, the mean DQI-I score of adolescents was 48.2 before the training and 46.58 after the training. There was no statistically significant difference between the pre-training and post-training diet quality index measurements, except for food diversity and vegetable intake (p > 0.05).It was determined that the adolescents participating in this study had poor diet quality both before and after the training. This result is not surprising when we consider that our study group resided in areas with low socioeconomic status. There is a need for practices that facilitate access to nutritious and healthy foods in disadvantaged areas (Veldwisch et al., 2024).

A systematic review provides evidence that school-based nutrition education interventions are effective in reducing BMI in children and adolescents, especially if the intervention period is longer than one school year (Mogre et al., 2024). In this study, there was no significant difference between the weights of the players before and after the intervention. This is thought to be due to the fact that the nutrition education we implemented was a short period of 3 weeks.

A healthy and balanced diet is essential for adequate and timely intake of energy and nutrients needed for growth, development, health maintenance, and improved quality of life (Keeley, 2019; Cerf, 2025). However, adolescent growth and nutrition are overlooked in the United Nations (UN) Decade of Action on Nutrition (Mariscal-Arcas, 2007). The Sustainable Development Goals for nutrition do not include adolescent-specific targets (WHO, 2017). Adolescence is a unique point of intervention because people in this age group are more susceptible to lifestyle changes (Bakraina, 2018). Adolescence

should be targeted to promote healthy eating and lifestyle habits as a foundation for community health (TUBER, 2015). A study in Libya showed a significant effect of socio-demographic variables on nutritional status in school-aged children. Schools are considered the best place for food education and childhood is a crucial period when eating habits are formed that continue into adulthood. The benefits of nutrition education as part of the curriculum will have significant impacts on healthy nutrition (Eljamay, 2022; Albin et al., 2024). There have, therefore, been numerous global calls for the integration of food and nutrition education into school curricula as a key strategy to prevent all forms of malnutrition and support the transformation of food systems (WHO, 2017; FAO, 2020).

Statistically, there is a significant difference between the nutrition knowledge levels of the players before and after the training ($p < 0.05$). Therefore, the knowledge level of the players increased significantly after the training. However, when we examined the DQI-I score of adolescents living in disadvantaged areas, no significant increase was observed in parallel with the increased knowledge level after the training. The fact that the increased level of nutrition knowledge did not affect diet quality is thought to be due to the limited access to healthy foods for children living in disadvantaged areas.

4. Conclusion

As a result of the study planned to investigate the effect of nutrition education on nutritional knowledge level and diet quality in female volleyball players living in disadvantaged areas, the 3-week nutrition education provided caused a significant increase in the level of nutritional knowledge but did not cause significant changes in the Diet Quality Index (DQI-I). Nutrition education can help adolescents gain the knowledge and skills they need to make healthy food choices and develop lifelong healthy eating patterns. The nutrition education also had positive effects on some eating habits such as skipping meals, paying attention to the presence of each food group on the plate, and food preferences in snacks, but it did not have a positive effect on the frequency of fast-food consumption. Nutrition education did not cause a significant change in body weight. It is thought that the reason why 3-week nutrition education applied to female adolescents living in disadvantaged regions did not have a positive effect on DQI-I scores and its components while increasing the level of knowledge is related to socioeconomic level, accessibility of nutritious foods, and nutritional knowledge levels of families.

The study has some limitations, including the relatively small sample size and the fact that it was conducted with participants from only one sport, which may limit the generalizability of the findings to other athletic disciplines.

Conflict of interest: The authors declare that they have no conflict of interests.

Informed consent: The authors declare that this manuscript did not involve human or animal participants and informed consent was not collected.

References

Akder, R. N. (2017). *Tabak modeli ile verilen beslenme eğitiminin ilköğretim ikinci sınıf öğrencilerinin beslenme bilgi ve alışkanlıklarına etkisi* (Master's thesis). Ankara University Institute of Health Sciences.

Albin, J. L., Thomas, O. W., Marvasti, F. F., & Reilly, J. M. (2024). Perspective: There and back again: A 40-year perspective on physician nutrition education. *Advances in Nutrition*, 100230.

Ares, G., De Rosso, S., Mueller, C., Philippe, K., Pickard, A., Nicklaus, S., ... & Varela, P. (2024). Development of food literacy in children and adolescents: Implications for the design of strategies to promote healthier and more sustainable diets. *Nutrition Reviews*, *82*(4), 536-552.

Arouca, A., Moreno, L. A., Gonzalez-Gil, E. M., Marcos, A., Widhalm, K., Molnár, D., ... & Michels, N. (2019). Diet as moderator in the association of adiposity with inflammatory biomarkers among adolescents in the HELENA study. *European Journal of Nutrition*, *58*(5), 1947-1960.

Atchoarena, D., & Gasperini, L. (2003). *Education for Rural Development towards New Policy Responses*. International Institute for Educational Planning (IIEP) UNESCO. 7-9 rue Eugene-Delacroix, 75116 Paris, France.

Bakrania, S., Ghimire, A., & Balvin, N. (2018). *Bridging the gap to understand effective interventions for adolescent well-being: An evidence gap map on protection, participation, and financial and material well-being in low-and middle-income countries* (pp. 1-63). New York, NY, USA: UNICEF Office of Research-Innocenti.

Cerf, M. E. (2025). Nutrition and health promotion: The life-course approach. In *Handbook of Concepts in Health, Health Behavior and Environmental Health* (pp. 1-21). Springer Nature Singapore.

Eljamay, S. M., Elgebaily, E. S. M., Eljamay, F. M., & Younis, F. H. (2022). The rate of socioeconomic and demographic factors affecting body mass index (BMI) among teenagers in Derna City, Libya. *African Journal of Advanced Pure and Applied Sciences (AJAPAS)*, 91-97.

EFSA, (2014). European Food Safety Authority, Guidance on the EU menu methodology. *EFSA Journal*, 12(12), 3944. https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2014.3944

FAO, (2020). Food and Agriculture Organisation, School-based food and nutrition education: A white paper on the current state, principles, challenges, and recommendations for low- and middle-income countries, https://openknowledge.fao.org/items/5d1441bb-8d1b-414d-93fb-6d8f48de0423, Last accessed on February, 2025.

Rozanski, A. (2023). New principles, the benefits, and practices for fostering a physically active lifestyle. *Progress in Cardiovascular Diseases*, *77*, 37-49.

Kazu, I. Y. (2019). The problems faced by socio-economically disadvantaged people during their education. *Journal of Dicle University Ziya Gökalp Faculty of Education*, *34*, 38-47.

Hatun, S., Etiler, N., & Gonullu, E. (2003). Poverty and its effects on children. *Journal of Pediatrics*, *46*(4), 251-260.

Keeley, B., Little, C., & Zuehlke, E. (2019). The State of the World's Children 2019: Children, Food and Nutrition--Growing Well in a Changing World. *UNICEF*.

Kim, S., Haines, P. S., Siega-Riz, A. M., & Popkin, B. M. (2003). The Diet Quality Index-International (DQI-I) provides an effective tool for cross-national comparison of diet quality as illustrated by China and the United States. *The Journal of nutrition*, *133*(11), 3476-3484.

Larruy-García, A., Mahmood, L., Miguel-Berges, M. L., Masip, G., Seral-Cortés, M., De Miguel-Etayo, P., & Moreno, L. A. (2024). Diet quality scores, obesity, and metabolic syndrome in children and adolescents: A systematic review and meta-analysis. *Current Obesity Reports*, 1-34.

Li, S., Li, X., Wang, J., Jiang, D., Zhang, Y., Lou, W., ... & Gong, Q. (2024). Associations between insufficient sleep, skipping breakfast, and depressive symptoms in children and adolescents: A school-based cross-sectional study in China. *Preventive Medicine*, *184*, 107978.

Mariscal-Arcas, M., Romaguera, D., Rivas, A., Feriche, B., Pons, A., Tur, J. A., & Olea-Serrano, F. (2007). Diet quality of young people in southern Spain evaluated by a Mediterranean adaptation of the Diet Quality Index-International (DQI-I). *British Journal of Nutrition*, *98*(6), 1267-1273.

Mogre, V., Sefogah, P. E., Adetunji, A. W., Olalekan, O. O., Gaa, P. K., Ayettey Anie, H. N., & Tayo, B. (2024). A school-based food and nutrition education intervention increases nutrition-related knowledge and fruit consumption among primary school children in northern Ghana. *BMC Public Health*, *24*(1), 1739.

Neyzi, O., Bundak, R., Gökçay, G., Günöz, H., Furman, A., Darendeliler, F., & Baş, F. (2015). Reference values for weight, height, head circumference, and body mass index in Turkish children. *Journal of Clinical Research in Pediatric Endocrinology*, *7*(4), 280.

Nguyen, G., Boath, A., & Heslehurst, N. (2023). Addressing inequalities and improving maternal and infant outcomes: The potential power of nutritional interventions across the reproductive cycle. *Proceedings of the Nutrition Society*, *82*(3), 241-252.

Schneider, B. C., Dumith, S. D. C., Lopes, C., Severo, M., & Assunção, M. C. F. (2016). How do tracking and changes in dietary pattern during adolescence relate to the amount of body fat in early adulthood?. *PloS one*, *11*(2), e0149299.

Souilla, L., Larsen, A. C., Juhl, C. B., Skou, S. T., & Bricca, A. (2024). Childhood and adolescence physical activity and multimorbidity later in life: A systematic review. *Journal of Multimorbidity and Comorbidity*, 14, 26335565241231403.

Simsek, H. G., Gunay, T., & Ucku, R. (2010). The effect of social inequalities on coronary heart disease risk factors: A population-based, cross-sectional study in Izmir. *Anatolian Journal of Cardiology/Anadolu Journal of Cardiology*, *10*(3), 190-198.

Tanrıverdi, S., Gonulluoglu, K., & Balık, Z. (2011). Investigation of eating attitudes, eating behaviors, and self-esteem of high school students. *Gaziantep Medical Journal*, *17*(1), 33-39.

TUBER. (2015). TC Sağlık Bakanlığı Yayın, ISBN : 978-975-590-608-9. 1-288.

Veldwisch, G. J., Amerasinghe, P., Letema, S., & Wessels, M. T. (2024). The practices and politics of irrigated urban agriculture. *Water International*, *49*(2), 129-143.

Vlaardingerbroek, H., Joustra, S. D., Oostdijk, W., de Bruin, C., & Wit, J. M. (2024). Assessment of nutritional status in the diagnostic evaluation of the child with growth failure. *Hormone Research in Paediatrics*, *97*(1), 11-21.

Winpenny, E. M., van Sluijs, E. M., White, M., Klepp, K. I., Wold, B., & Lien, N. (2018). Changes in diet through adolescence and early adulthood: longitudinal trajectories and association with key life transitions. *International Journal of Behavioral Nutrition and Physical Activity*, *15*, 1-9.

Wu, Z. J., Han, C., Wang, Z. Y., & Li, F. H. (2024). Combined training prescriptions for improving cardiorespiratory fitness, physical fitness, body composition, and cardiometabolic risk factors in older adults: Systematic review and meta-analysis of controlled trials. *Science & Sports*, *39*(1), 1-18.

WHO, (2017). World Health Organization,Global targets 2025 to improve maternal, infant and young children nutrition. Geneva: World Health Organization, https://pesquisa.bvsalud.org/portal/resource/pt/who-259188, Last accessed on February, 2025

Xian, X., Wang, C., Yu, R., & Ye, M. (2023). Breakfast frequency and sleep quality in college students: The multiple mediating effects of sleep chronotypes and depressive symptoms. *Nutrients*, *15*(12), 2678.

Zahrah, N. I., Fanani, M., & Ardyanto, T. D. (2023). The relationship between emotional eating, meal skipping and unhealthy food consumption pattern in adolescent girls. *The Indonesian Journal of Public Health*, *18*(1), 47-58.