Original Article

Nutritional Status of school-going adolescents in urban and rural areas in the Duhok District

Masood Abdulkareem Abdulrahman[1], Hoger Anwar Sadeeq[2]

[1,2]Department of Public Health, College of Health and Medical Technology / Shekhan, Duhok Polytechnic University, Kurdistan Region of Iraq,

Email: masood.abdulkareem@dpu.edu.krd

Abstract

The assessment of nutritional status as a part of the school health component can serve as a screening tool to identify adolescents who need nutritional intervention and to prevent further deterioration in their nutritional status with reducing the risk of poor school performance.The study aimed to assess and compare anthropometric indices among school adolescents in the rural and urban areas in the Duhok district. Anthropometric indices including height, weight, and Body mass index were used to estimate the adolescent nutritional status. The data were analyzed by using WHO Anthro Plus software.

A cross-sectional study was conducted to understand the malnutrition scenario among the rural school children of 6-15 years age group and interplay of different sociodemographic factors contributing to it. Anthropometric data were analysed using WHO Anthro Plus version 1.0.4 software for assessing the growth of the children and by using appropriate statistical methods. A cross-sectional study was conducted to understand the malnutrition scenario among the rural school children of 6-15 years age group and interplay of different sociodemographic factors contributing to it. Anthropometric data were analysed using WHO Anthro Plus version 1.0.4 software for assessing the growth of the children and by using appropriate statistical methods A total of 650 students were assessed. About 65.7% normal BMI, while the rest distributed as 10.8% obese, 17.4% overweight, 5.4% thin, and 0.8% severe thinness. The obtained results show that there is no significant statistical association between BMI and sex, age, socioeconomic status of the families and residency.

Keywords: Nutritional status, School adolescent, residency, Duhok district.

Introduction

World Health Organization (WHO) defined adolescence as a period of life ranging from 10 to 19 years old which is the transition from dependent childhood to independent adulthood.[1] More than 1.2 billion are adolescents worldwide.[2]

Adolescence is a critical period of growth and development. As adolescents go through the second growth spurt in this period, it is crucial that they receive the required nutrients, and is a particularly unique period in life because it is a time of intense physical, psychosocial, and cognitive development. Growth is faster than at any other time in the individual's life except in the first year. Increased nutritional needs at this juncture relate to the fact that adolescents gain up to 50% of their adult weight, more than 20% of their adult height, and 50% of their adult skeletal mass during this period. [3]

Body Mass Index (BMI) is the most widely used diagnostic tool to distinguish the nutritional status of a population. It is specified for each age and gender and very simple way of calculation and estimation, and it always determines whether a subject is underweight, healthy, overweight or obese.

Address for correspondence: Masood Abdulkareem Abdulrahman,
College of Health and Medical Technology / Shekhan,
Duhok Polytechnic University, Kurdistan Region of Iraq
Email: masood.abdulkareem@dpu.edu.krd

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[4]The nutritional status assessment provides the data necessary to study the effects of nutrition on health and disease, identify critical nutrients in a specific population and the groups within this collection that are at risk of deficiency, and develop effective public health policies to prevent and cure nutrition-related diseases).[5]

Undernutrition leads to decreased immunity whereas overweight adolescents are predisposed to non-communicable diseases.[6] It is a total of an individual's anthropometric indices and factors that influence the dietary pattern of that individual. These include external factors such as food safety, cultural, social, economic factors and internal factors which include age, sex, nutrition, behavior, physical activity and diseases of the person.[1]Nutritional status is one of the main factors that could affect academic achievement by limiting students' ability to learn. [7] Several studies were conducted on the magnitude and consequences of nutritional status of adolescent students. [8] Under nutrition inhibits academic attainment through poor growth and mental development, reduced motivation and poor cognitive development .[9] while, overweight and obesity has the potential to impair academic performance via social pathways such as discrimination and stigma. [10]

Globally, the prevalence of overweight has increased from less than 1% in 1975 to 5% among girls and 8% among boys in 2016, while the prevalence of obesity has increased in all the regions of the world. The trend of over-nutrition amplified from 5 million in 1975 to 50 million in 2016 among girls, and 6 million in 1975 to 74 million in 2016 among boys globally. Under nutrition and over nutrition among adolescents in over 200 countries from 1975 to 2016 were found to be over 31 million. This shows the accelerating increase in the burden of malnutrition globally.[11]This study aimed to assess the nutritional status of adolescent students in the Duhok district .

Materials and Methods

A cross sectional study design was applied during the period between from 1st October 2021 to 1st March 2022 at intermediate and high school students (class seven to twelve) in Duhok district within the boundaries of Duhok General Education Directory. A total of (650) students aged between 13 – 19 years (368 girls, 282 boys) enrolled in the study, a simple random technique was used for selection of 13 schools (intermediate and high schools) in the Duhok district. The schools are belonged to both east and west educational directorates, (7) schools from west educational directorate, out of them 3 rural, and 6 schools from east educational directorate, this selection was based upon proportion of student's number. For purpose of samples collection (50) students were selected from each school, at the rate of three days visits a week. It took (15) minutes for completion of each student questionnaire and anthropometric measurements. Study data were obtained through adopting two techniques. The first one was through measuring students' height and weight in order to calculate the students' BMI in schools. The second one was through direct interview with students in order to obtain the information related to student's nutritional status , food behaviors and socio- demographic characteristics.

Measuring weight by using an electronic scale (Uniscale-Secca 874)- Mobile flat scales for mobile use with push buttons and a double display The double display lets the patient and medical personnel read the results from two different prospects at the same time. Third by measuring Height by using special device Adult Height Measuring Device (Microtoise) {UNICEF Height measuring instrument (0-2 m)}.

Weight measurement:

1. Digital electronic scale was placed on a firm floor.
2. Students were asked to remove shoes and bulky clothing like sweaters and jackets.
3. Students were asked to stand straight with both feet in the center of the scale.
4. Weight was recorded in Kg to the nearest 100 gm.

Height measurement:

1. A Room with well natural light, firm flooring and a wall with no moulding was selected for height measurement.
2. Students were asked to remove shoes, bulky clothing, hair ornaments and cap.
3. Students were asked to stand with feet flat, together and against the wall with straight legs, arms at the side, head, shoulder, buttock and heel touching the wall and looking straight ahead and advised not to lean backwards, forward, and sideward.
4. After students stand correctly flat board was placed on the top of the head and measurement was done by measuring tape and reading was done in centimeters to the last completed 0.1 cm.
5. Measurement in centimeter is converted to meter and recording was done.

BMI was calculated as the ratio of the weight in kilograms to the square of the height in meters. WHO classification of BMI per age as the followings :Overweight BMI-for-age >1SD, Obese BMI-for-age >2SD , Thin BMI-for-age < –2 to –3 SD , Severely thin BMI-for-age < -3SD , the rest regards as normal BMI for age ISD -> -2SD.[12]

Statistical analysis:

The collected data were analyzed using the SPSS computer-based software version 25, it used for descriptive data analysis. The statistical analyses included descriptive statistics (frequency, percentage, distributions and statistical tables) and inferential statistics (Pearson's chi-square test) to determine the association between the BMI and sociodemographic characteristics. P value considered to be significant if $p \leq 0.05$. The anthropometric measurements will

be analyzed by using WHO Anthro plus software.

RESULTS

Table (1) shows the demographic distribution of the study samples. The total number of surveyed samples was 650, males constitute 43.4% (282) and the rest 56.6% (368) were females. The most common age was 15 years old (16.6%), and the least was 14 years old (12.0%).

Table 1: Distribution of the study sample by age and sex.

Age in years	Sex		Total No. (%)
	Males No. (%)	Females No. (%)	
13	25(3.8)	72(11.1)	97(14.9)
14	28(4.3)	50(7.7)	78(12.0)
15	26(4.0)	82(12.6)	108(16.6)
16	41(6.3)	47(7.2)	88(13.5)
17	45(6.9)	40(6.2)	85(13.1)
18	70(10.8)	25(3.8)	95(14.6)
19	47(7.2)	52(8.0)	99(15.2)
Grand Total	282(43.4)	368(56.6)	650(100.0)

Table 2. Association between student`s socioeconomic status and their nutritional status.

Nutritional status	**Socioeconomic status**			**Total No. (%)**	**Sig.**
	Poor No. (%)	Medium No. (%)	High No. (%)		
Obesity > 2 Z score	17(2.6)	46(7.1)	7(1.1)	70(10.8)	P=0.976
Overweight > 1 Zscore-2 Z score	26(4.0)	79(12.2)	8(1.2)	113(17.4)	
Normal +1Z score to - 2 Z score	107(16.5)	288(44.3)	32(4.9)	427(65.7)	
Thinness < -2 Z score to 3 Z score	7(1.1)	25(3.8)	3(0.5)	35(5.4)	
Severe Thinness < -3 Z score	2(0.3)	3(0.5)	0(0.0)	5(0.8)	
Grand Total	159(24.5)	441(67.8)	50(7.7)	650(100.0)	

The students distributed from grade 7th to 12th according to the following percentages: 14.9% , 12.0% ,16.6%, 13.5%,13.1% , and29.8%. Table 2. shows the distribution of socioeconomic status of study population and their nutritional states. Which is the highest percent 427(65.7%) of them is moderate socioeconomic status. Depicts no significant association between socioeconomic status and nutritional status of adolescent. There are no cases of severe thinness in rural areas and the cases of overweight were more in urban areas. There is no significant statistical association between BMI with residency Table 3.

Table 3. BMI per Residency of the studied sample

BMI	Residency		Total No. (%)	Sig.
	Urban No. (%)	Rural No. (%)		
Obesity	52(8.0)	18(2.8)	70(10.8)	P=0.675
Overweight	90(13.8)	23(3.5)	113(17.4)	
Normal	326(50.2)	101(15.5)	427(65.7)	
Thinness	27(4.2)	8(1.2)	35(5.4)	
Severe Thinness	5(0.8)	0(0.0)	5(0.8)	
Grand Total	500(76.9)	150(23.1)	650(100.0)	

Table 4. BMI per age of the studied sample

Age in years	BMI						Sig
	Obesity No. (%)	Overweight No. (%)	Normal No. (%)	Thinness No. (%)	Severe Thinness No. (%)	Total No. (%)	
13	16(2.5)	14(2.2)	60(9.2)	5(0.8)	2(0.3)	97(14.9)	P=0.263
14	3(0.5)	17(2.6)	55(8.5)	3(0.5)	0(0.0)	78(12.0)	
15	15(2.3)	13(2.0)	70(10.8)	9(1.4)	1(0.2)	108(16.6)	
16	8(1.2)	20(3.1)	59(9.1)	1(0.2)	0(0.0)	88(13.5)	
17	5(0.8)	13(2.0)	63(9.7)	4(0.6)	0(0.0)	85(13.1)	
18	10(1.5)	17(2.6)	59(9.1)	8(1.2)	1(0.2)	95(14.6)	
19	13(2.0)	19(2.9)	61(9.4)	5(0.8)	1(0.2)	99(15.2)	
Grand Total	70(10.8)	113(17.4)	427(65.7)	35(5.4)	5(0.8)	650(100.0)	

Table 4. shows that the BMI status of the students distributed as more than 65.7% normal, 10.8% obese, 17.4% overweight, 5.4% thinness, and 0.8% severe thinness. Obesity is more common at age 13. There is no significant statistical association between BMI with age. The mean of the sample's BMI and associated SD was (0.15 ±1.44) Z-score. The minimum BMI was -4.59 Z-score and the maximum BMI was +4.36 Z-score. Regarding sex distribution for the males the BMI means with SD was (0.11 ± 1.56) Z-score, minimum BMI was -3.37 Z-score and maximum BMI was +4.36 Z-score. For females, BMI mean with SD was (0.18± 1.35) Z-score minimum BMI was -4.59 Z-score and the maximum BMI was +3.28 Z-score.Table 5. shows that the thinness and severe thinness are more common in females while obese and overweight are more common among females. There is no significant statistical association between BMI with sex. Comparison of Height per age with WHO child growth standards

Table 5. BMI per sex of the studied sample

BMI	sex		Total No. (%)	Sig
	Male No. (%)	Female No. (%)		
Obesity	29(4.5)	41(6.3)	70(10.8)	P= (0.552)
Overweight	43(6.6)	70(10.8)	113(17.4)	
Normal	189(29.1)	238(36.6)	427(65.7)	
Thinness	18(2.8)	17(2.6)	35(5.4)	
Severe Thinness	3(0.5)	2(0.3)	5(0.8)	
Grand Total	282(43.4)	368(56.6)	650(100.0)	

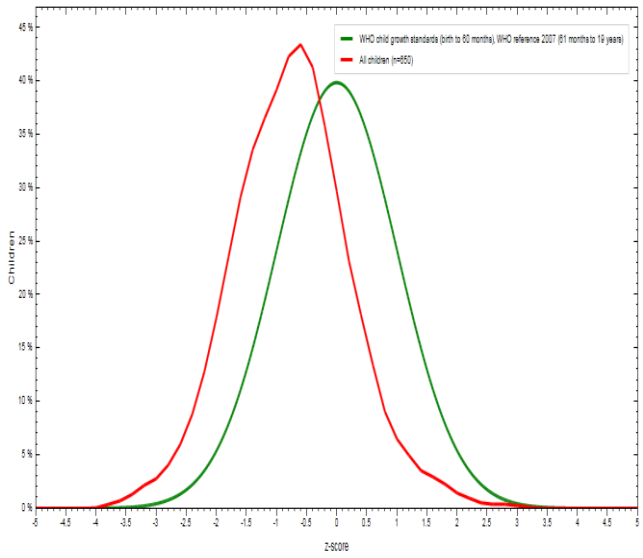

Figure 1: Height per age with WHO child growth standards

Figure 1. shows that the mean Z-core of the sample's height is -0.75 and the sample's height curve deviated to the left of the WHO child growth curve.

Comparison of Height per sex with WHO child growth standards

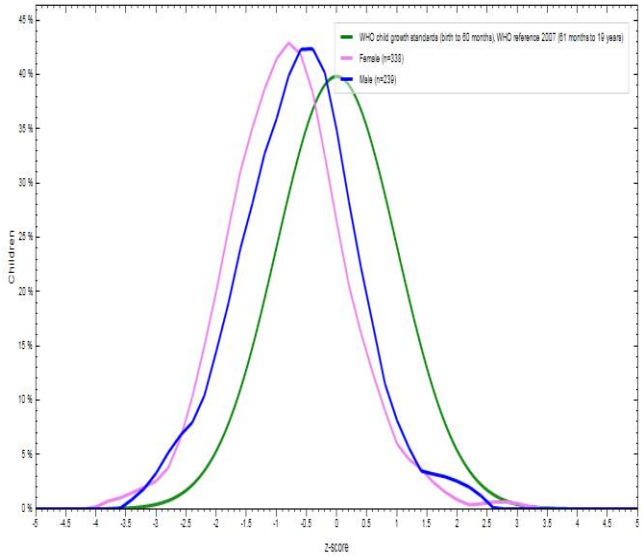

Figure 2: Height per sex with WHO child growth standards

Figure 2 shows that the mean Z-core of the sample's height for males is -0.64 and for females is – 0.82. The sample's height curve for both sexes deviated to the left of the WHO child growth curve.

Comparison of BMI per age with WHO child growth standards

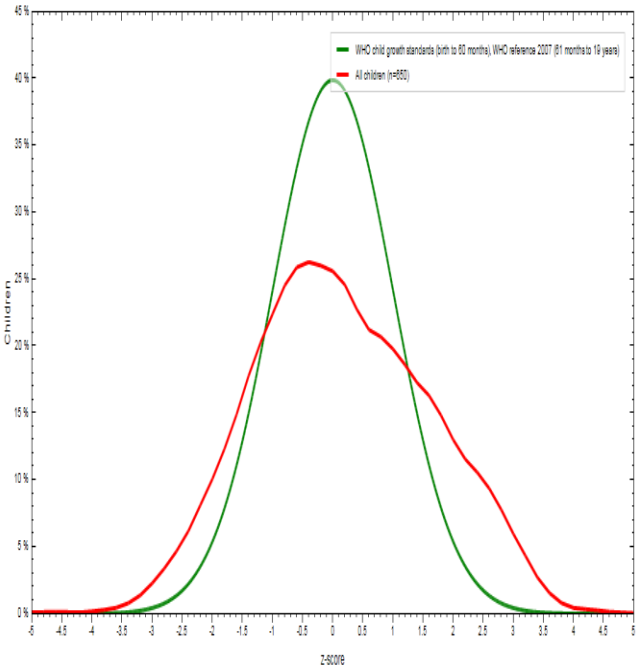

Figure 3: BMI per age with WHO child growth standards

Figure 3 shows that the normal distribution curve of the BMI for the studied sample is wider than the normal WHO child growth standards and it spreads out of the width of distribution along the X-axis.

Comparison of BMI per sex with WHO child growth standards

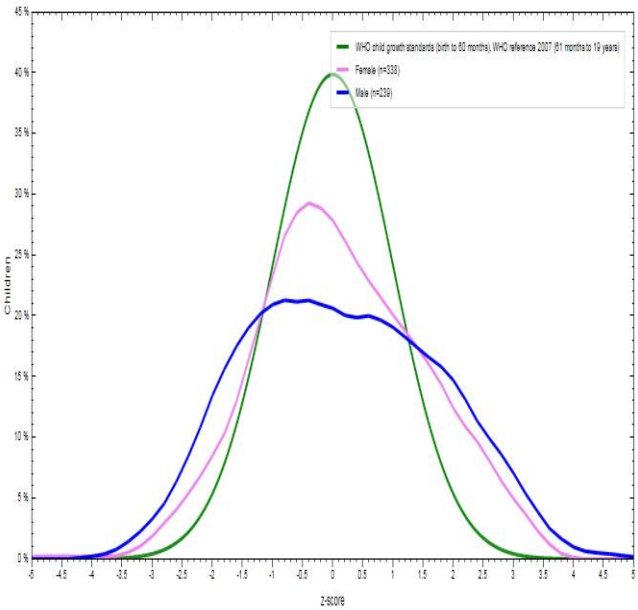

Figure 4: BMI per sex with WHO child growth standards

Figure 4 shows that the normal distribution curve of the BMI for the studied sample of both sexes is wider than the normal WHO child growth standards and it spreads out of the width of distribution along the X-axis. The curve for the males is even wider than the curve for females.

Discussion

The aime of the presint study was to assess the nutrional status of school going adolescents through anthropometric measurements. School age is well-thought-out as an active period of growth and development because adolscent experience physical, mental, social and emotional changes.This study was based on school visit among urban & rural as well as in different socioeconomic status. Thus, the result of this survey is representative of school going adolescent going of rural and urban area belonging to different socioeconomic status.The current study revealed that there was significant association between nutrational status and socioeconomic among adolescents,similar results were found in other studies..[13]which found that economic status associated with BMI among adlolescent in India.A similar study done among adolescent of Mysore also found the prevalence of obesity and overweight among urban adolescent 4 times higher than rural adolescent (8.0% vs 2.8%).[14] On analyzing the factors responsible for higher prevalence of obese and overweight children in urban group, it was found that higher familial income, frequency of restaurant and school canteen food and lesser frequency of physical training sessions conducted in schools are the factors significantly associated.Several studies showeed higher prevalence of overweight and obesity among sdolescent of higher and middle socioeconomic status. [13,15-16]Reduced Physical activity at school is significantly related with overweight and obesity as also reported in other studies.The present study has concluded that the prevalence of thinness was found in 5.4% an it apeared more less than a study conducted among adolsent school in esterian part of Nepal that was 30.85%.[17]

It is apparent from the present investigation, that there is a very high prevalence of undernutrition among rural early adolescent school girls as the prevalence of stunting and thinness was found to be 34.20% and 40.94% respectively based on WHO reference data. [18]In the present study BMI for age was used as an indicator of thinness. The WHO expert committee has recommended that it is the best indicator for the children to assess thinness.There are a number of studies reporting the prevalence of thinness utilizing BMI for age as an indicator among Nepalese children. In the present study, it was concluded that the prevalence of thinness among adolscent was found to be (5.4%) which was near to The studies done in Addis Ababa that was (6.2%) ,and lower than the studies Ambo City (27.5%), Wukro District (26.1%), and Seychelles (27.7%).[19-21] This deviation may be due to the variance in socioeconomic status, lifstyle, and type of meals among the districts. The prevalence of obesity and overweight increased from 16.3% in 2001 to 19.3% in studies reported after 2010. Therefore, there is increasing trend in prevalence of overweight and obesity among children and adolescents in India. In current study the prevalence of obese, overweight, normal and underweight adolescent was 10.8% (70), 17.4% (113), 65.7% (427) and 5.4% (35) respectively .The result similar to a study done in five different geographical regions in Indiaand it showed that the prevalence of obesity among male 17(20.2%) was slightly higher vs. female 16(15.4%) but statistically not significant .[22]In our study the event of overweight and obesity was found to be 17.4% and 10.8%, respectively. Perhaps this is on the ground that in Duhok district there is accessibility of wide range of fastfood, fizzy drinks, snacks, mobile and pads devices, games and possibly most of adolscent parents having cars which are contributing for the increased prevalence of overweight and obesity in adolescents. This finding agree with results of a study were done in four urban schools in Panta , India , and the prevalence of overweight and obesity was18.4% and 10.9% respectivel.[23]

Conclusions

The study reveals that more than half of primary school students were within

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The prevalence rate of thinness and sever thinness among the intermediate and high school adolescent in Duhok district. The incidence and prevalence of malnutrition may differ among rural and urban population, due to a variety of factors is higher than national level while the prevalence rate of overweight/ obesity is lower. Local authorities to overcome causes of malnutrition should adopt a well-constructed program for all forms of malnutrition and treat the existing cases. It is important to invest in preventive interventions so that no gap in knowledge, practice or action paves way for any level of adolescent malnutrition.

Authors' Declaration Statements

Ethics approval and consent to participate

Ethical approval will be obtained from the ethical committee of Duhok Directorate General of Health (on 18.8.2021), and General Directorate of Education at Duhok Province (no.12968 on 27.9.2021) to conduct this study. All the students were interviewed and examined after obtained informed consent, with regard to consideration the specific privacy for each student.

Availability of data and material

The data used in this study are available and will be provided by the corresponding author on a reasonable request.

Competing interests

There is no conflicts of interest many of the authors concerning

the publishing this manuscript.

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None.

Authors' Contributions

All authors contributed equally.

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