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Original Article

Biochemical and Anthropometric Evaluation of the Dietary and Nutritional Status in School Children Aged 5-15 Years: A Descriptive, Cross-Sectional Study

Aziz Ur Rehman,[1] Farid Ullah Shah,[2] Mohammad Israr,[3] Babar Shehzad,[1] Feroz Khan,[1] Nasreen Akhtar,[4] Iqra Jalil,[5] Wasim Ahmad[6]

[1]Rahman Medical College Peshawar-KP, [2]Pak International Medical College Peshawar-KP, [3]Bacha Khan Medical College Peshawar-KP, [4]Mohtarma Benazir Bhutto Shaheed Medical College, Mirpur, Azad Kashmir, [5]PAEC General Hospital Pharmacy, Islamabad,[6]SHS Peshawar-KP

Abstract

Objective: The objective of this study was to assess the biochemical and anthropometric evaluation of the dietary and nutritional status in school going children aged 5-15 years in district Peshawar-KPK.

Methods: This cross-sectional study was assessed from September 2021 to February 2022 in district Peshawar. The research team visited numerous government and private sector schools and enrolled a population of 810 children from 35 schools. For biochemical assessment and dietary intake, blood samples of 220 students was taken. We collected the anthropometric data at selected schools. Weight of the study participants was calculated using a digital weighing machine (SR1501). Height was measured using a calibrated height measuring tape. We measured the waist circumference of the study participants with the help of a Lufkin-like metallic tape using cross-handed procedure. The upper edge of the iliac crest was used for measurement purpose.

Results: The anthropometry results of our study revealed that 1.8% (n=14) children had possessed low weight. Excessive weight in 48.4% (n=392) with a severe obesity in 4.40% (n=17) children, obesity in 18.0% (n=70) and overweight in 26% (n=102) children. The proportion varied by the nutritional status was 76.9% among obese children, 100% among severely obese children, and 13.4% among overweight children.

Conclusion: Our study concluded the incidence of superfluous higher weight in comparison to those previously measured. Boys were stood victims for obesity risk whereas; morning breakfast seemed as a protecting feature in contradiction of obesity and overweight."

Keywords: Obesity, Overweight, Child Nutrition, Nutritional Status, Adolescent Nutrition

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Corresponding Author: Dr. Wasim Ahmad **Email:** vazim4847@gmail.com

Introduction

Childhood obesity has emerged as a global epidemic in the last 25-30 years.[1-3] To structure the lifestyle and eating habits in the children, early school going and adolescence age play a critical role because they it has effects on their entire life.[4] The developing countries of the world are facing many health related problems and micronutrient's deficiency is among one of them. Micronutrients play an important role in the growth and development of the children and their deficiency affect the learning abilities of the children as well.[5]

Specific micronutrient's deficiency causes childhood malnutrition which might not be diagnosed through anthropometry.[6] Deficiency of Iron and vitamin D contribute more towards childhood malnutrition. Malnutrition is a main distress for health care professionals. Globally, one quarter of children under-five years of age are malnourished. Malnutrition has become significant public health concern in both developing and developed countries of the world. Nutritional parameters include those reflecting changes in body size, composition, and/or function.

The co-existence of micronutrient's deficiency with obesity and weight gain is not only the area of concern in Pakistan but it has also been experienced in the developed countries of the world.[7] Researchers from Argentina reported the obesity in 3 out of 10 children[8-10] and the ratio is on the move with the passage of time in the rest of the world.[11] A study from Dhaka Bangladesh concluded that substantial fraction of female children considered as malnourished and iron deficient had possessed lower BMI and lower hemoglobin level.[12]

As most of the available data from Pakistan was on the nutritional status of the pregnant women and orphans, the rationale of this study was to assess the biochemical and anthropometric evaluation of the dietary and nutritional status in school going children aged 5-15 years in district Peshawar-KPK.

Methods

Our team conducted this descriptive, cross-sectional study from September 2021 to February 2022 in district Peshawar. The research team visited numerous government and private sector schools and selected a population of 810 children. The team included all the selected children in their study after getting permission from their parents and respective head of school. 35 schools (15 government and 20 private) were invited for children screening. Sample size was calculated using open Epi software, which was 860. The research team remained successful in enrolling 810 schoolchildren having an age group 5-15years. The research team asked about the medical condition of the children from their parents telephonically and children with some chronic medical condition were excluded from the study. The sample size for biochemical assessment and dietary intake was selected as 250 but only 220 students were selected for the purpose. The research team selected the children for their biochemical assessment randomly.

The working group collected the anthropometric data at selected schools. Weight of the study participants was calculated using a digital weighing machine (Sr1501). Height was measured using a calibrated height measuring tape. We measured the waist circumference of the study participants with the help of a Lufkin-like metallic tape using cross-handed procedure. The upper edge of the iliac crest was used for measurement purpose. Average measurement was considered taking values twice. The research team hired trained nursing staff for collection of blood specimen. The blood sample processing was done within two hrs after collection. EDTA (Ethylene-diamine tetra acetic acid) were used for Hb and hematocrit while for rest of the tests, tubes without an anticoagulant were incorporated. Samples analysis was done in Chughtai Lab. Peshawar-KP. A pharmaceutical company sponsored the Chughtai lab testing facility through discounted coupons.

The research workers were divided into two groups having medical nursing staff, a nutritionist, and a physician. The research team groups assessed three schools in a single week and each school was visited won weekly basis for consecutive three weeks. The sociodemographic outcome measures were: age, sex, parent's education level, number of daily meals, eating habits etc. a signed informed consent was taken from the parents of the study children before commencement of the study. The approval for the study was granted from Institutional Review Board of Rahman Medical College, Hayatabad-Peshawar-KP.

Statistical analysis was done using Epi Info 7 software. For anthropometry, WHO Anthro Plus whereas for dietary intake, the SARA (analysis system and food registry) was used. For continuous variables, we used mean and standard deviation (SD) whereas; for categorical values, we used proportions with 95% CI (confidence intervals). We used χ^2 test for proportions and t test for continuous variables.

We considered an alpha error of 5% as a suitable value. For a measure of association, the OR (Odds Ratio) with 95% confidence interval was considered. For intake, we assessed Ca, Zn, Fe, Vitamin A, Fibers, calories, protein, fats, carbohydrate, and folate. We compared our results with the DRI (dietary reference intake).

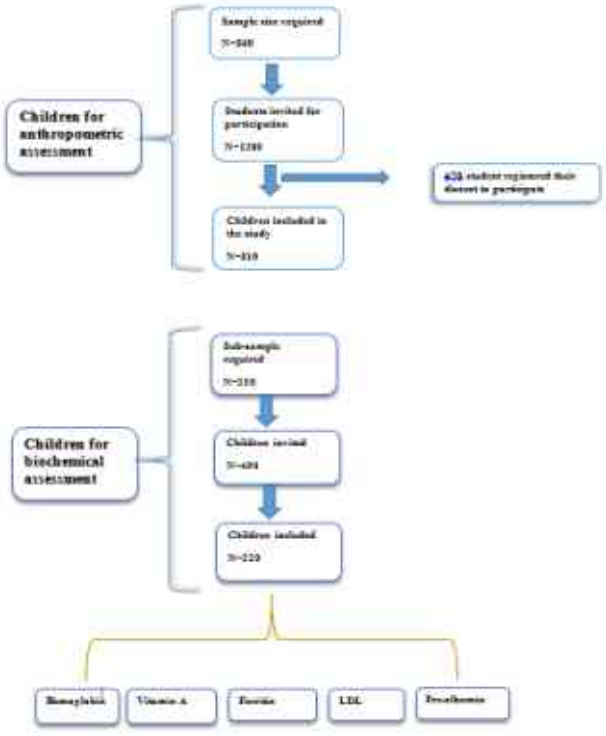

Figure 1. *Schematic representation of the study*

Results

The survey and the anthropometric valuation was done in 810 students from 35 schools; the research team collected 220 children blood sample. The overall scheme of our study is mentioned in figure 1 below.

The anthropometry results of our study revealed that 1.8% (n=14) children had possessed low weight. We observed an excessive weight in 48.4% (n=392) with a severe obesity in 4.40% (n=17) children, obesity in 18.0% (n=70) and overweight in 26% (n=102) children. 49.8% children were fall in normal weight category. Figure 2 below shows the results.

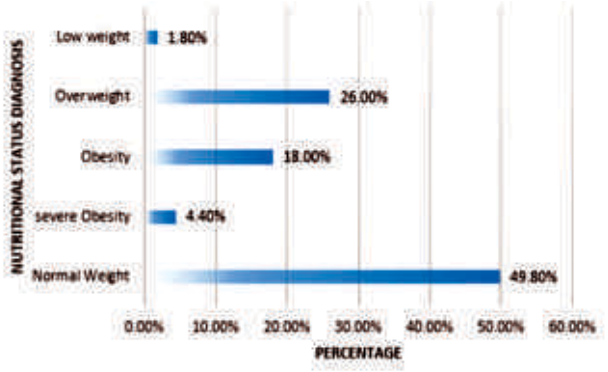

Figure 2. *Distribution of Nutritional Status*

An increased waist circumference was observed in 18.0% (n=146) children. The proportion varied by the nutritional status was 76.9% among obese children, 100% among severely obese children, 13.4% among overweight children, and 0.41% among those having a normal weight. As respect to intake practices, 78.0% of children had 4 daily meals; 20.0% had 2 meals; and only 2.0% had 1 meal.

Multivariate analysis

Multivariate analysis was done in order to measure the related results that were observed due to obesity, severe obesity and overweight conditions. Children's age, nature of schooling or lunch and dinner practices were not associated or connected with the obesity and severe obesity. Breakfast was related to a higher risk for obesity, severe obesity and overweight conditions. High school children were associated with a higher prevalence of overweight, obesity and severe obesity. Boys were connected to a upper risk for obesity, severe obesity and overweight. The results are shown in table 1.

Laboratory investigations

The biochemical assessment explored a relatively higher level of Zn as compared to Cu in study population. Similarly, overweight, obese and severely obese children possessed relatively higher levels of cholesterol and triglycerides. The results of the biochemical assessment of the children are shown in table 2.

Table 1: *Description of the Participated Children*

Demographics	Frequency %	Overweight %	P value	Obesity %	P value	Severe obesity %	P value
Age groups							
5-9	30.0 (n=243)	7.4	0.7	4.4	0.7	1.8	0.5
12-15	70.0 (n=567)	18.6		13.6		2.6	
Gender							
Boys	46.91 (n=380)	22.3	0.16	10.8	0.005	2.8	0.007
Girls	53.08 (n=430)	3.8		7.2		1.6	
School							
Private	41.97 (n=340)	12.0	0.02	19.0	0.004	2.9	0.006
Public	58.02 (n=470)	14.0		8.0		1.5	
Education							
Primary	73.95 (n=599)	8.0	0.06	6.4	0.12	1.0	0.10
Secondary	26.04 (n=211)	18.0		11.6		3.4	
Health coverage							
Insurance	33.33 (n=270)	10.0	0.04	6.0	0.02	0.80	0.01
Self	66.66 (n=540)	16.0		12.0		3.6	
Breakfast							
Yes	79.25 (n=642)	18.0	0.08	12.0	0.06	3.8	0.04
No	20.74 (n=168)	8.0		6.0		0.6	

Table 2: *Biochemical assessment of the study population (Sub-group)*

(n=)		Zinc (µg/dl)		Copper (µg/dl)	
		Mean± S.D	Range	Mean± S.D	Range
Total Children	810	102± 18	66-150	88± 16	64-124
Gender					
Boys	280	106± 20	63-152	88± 16	62-126
Girls	430	104± 18	68-148	89± 17	66-120
Age group					
5-9 years	243	108± 16	82–152	90± 14	64-118
10-15 years	567	96± 22	60-144	92± 18	63-138
Outcome measures		**Overweight %**		**Obese %**	**Severe %Obese**
Cholesterol	Normal	8.8		7.2	4.2
	High	12.4		12.8	13.6
	Borderline	78.8		80.0	82.2
HDL	Normal	88.4		70.0	66.0
	Low	11.6		30.0	34.0
LDL	Normal	90.0		86.0	80.0
	High	10.0		14.0	20.0
Triglyceride	Normal	68.2		60.0	56.8
	High	18.6		22.0	24.4
	Low	13.2		18.0	18.8

Table 3: *Comparison of dietary intake in study population in comparison with RDA*

	5-9 years				10-15 years			
	Boys		Girls		Boys		Girls	
Nutrients	**RDA**	**Actual**	**RDA**	**Actual**	**RDA**	**Actual**	**RDA**	**Actual**
Carbohydrates (g/day)	182-262	232.0	171-247	227.0	234-338	280-310	209-302	290
Proteins (g/day)	40-212	55-188	38-114	102	52-156	50-190	46-139	110
Energy (KCal)	1614	2044	1519	1320	2082	2230	1856	2040
Fibers (g/day)	25	13.4	25	11.8	31-38	10-16	26.0	14.8
Ca (mg/day)	800	678	800	466	1100	980-1020	1100	820
Fe (mg/day)	4.1	5.8	4.1	6.0	5.9	8-9	5.7	10.4
Vitamin A (µg/day)	275	220	275	244	445	310-400	420	360
Folate (µg/day)	160	80	160	110	250	320	250	340

RDA= Recommended Dietary Allowance

Similarly, the intake in children is given in the table 3 in comparison to recommended dietary allowances.

Geo-referencing

We observed a homogenous distribution of the children across the Peshawar district about both the anthropometric and biochemical parameters. For none of the studied results, we did not observe any pre-dominant area.

Discussion

In this Pakistani study, a higher prevalence of school-children was observed bearing an excessive weight. The results were consistent with the findings of some other researchers.[8-10] The research team was expecting the same trend as a growing trend of obesity and weight gain is reflected in this age group children. The issue of obesity and overweight is declared as dangerous and emphasis is given to address the problem, in a technical report by the World Health Organization. This is the reason that WHO recommended preventing overweight and obesity issue in schoolchildren and adolescents

through advocating active lifestyle and consumption of fruits and vegetables.[11-15]

The multivariate analysis model showed that male gender was more associated with higher obesity risk in comparison with the female gender. Such association is evident from many studies.[16-20] Similarly, breakfast in children's routine life was noticed to be a protective factor, which is evident from many studies.[21-23] Researchers showed that children with no breakfast habit possessed a higher incidence of obesity and overweight.[24] It is our keen observation that the children who do not take breakfast on daily basis, always attracted towards fast food, which is always high in fat and caloric content. Our results also showed that high school attendance was associated with a low risk for overweight. This might be due to eating habits and doing exercises among high school children. The study did not show an association between obesity and age. The children possessing severe obesity had waist circumference more than p90. This increase in abdominal fatty tissues might be considered as risk factor for CV diseases. A study demonstrated a connotation between crucial fat mass dissemination calculated by waist circumference and anomalous triglyceride, LDL (low density lipoprotein), HDL (high density lipoprotein) and insulin levels.[25]

The results of the study showed a lower level of anemia, which was, expected in the study participants. A minor incidence of anemia has been considered in school going children in comparison to those in early childhood and adolescence age, given the better variation between intake and nutritious necessities. Flour fortification may have subsidized to a decrease in anemia in Argentina. Yet, more specific research is needed for explanation of such outcomes.[26,27]

This study is steered based on a steady approach for height, weight, waist, and biochemical dimensions. A few limitations of this study are: the absence of information on results such as physical activity, screening time, and some other factors linked to surplus weightiness.

Conclusion

Our study concluded the incidence of superfluous higher weight in comparison to those previously measured. Boys were stood victims for obesity risk whereas; morning breakfast seemed as a protecting feature in contradiction of obesity and overweight. The study also concluded that high blood cholesterol/triglyceride levels and a higher fat/low fiber contributes more towards over nutrition which is a rampant community health problem."

Conflict of Interest: *None*

Funding Source: None

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