Research Article

Determinants of Underweight School Children in Lahore

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Abstract

Objective: To determine the frequency of underweight and socio-demographic factors associated with it among school going children.

Methods: A cross-sectional study with convenient sampling technique was carried out at Shalamar Medical and Dental College. Children from public and private schools of Lahore, were included in the study. Assent was taken from the participants after the consent was granted from their parents. Data was recorded on a questionnaire. Body weight and height were recorded and Body Mass Index (BMI) calculated. Children were classified as underweight and normal weight according to BMI. Student "t" test, "One way ANOVA" and "Chi-square" tests were applied to analyze the data through SPSS version 21.

Results: The mean age of the participants was 12 years, 17% of school children were found to be underweight. Among underweight children, 74% belonged to middle and 20% to low socioeconomic class, and 50% had illiterate parents. There was significantly greater prevalence of underweight among girls (78%) than boys. Children belonging to pre-adolescent age group (6-11 years), low socioeconomic status, taking 1-2 meals per day, having illiterate parents and sleeping for >10 hours per day had significantly ($p<0.05$) less BMI were underweight. Significant association was also observed with age, gender, parent's education, and sleeping hours in underweight school children.

Conclusion: Frequency of underweight school children in Lahore was 17%. Female sex, parent's education, and more sleeping hours were significantly associated with underweight.

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Key Words: Underweight, School children, Demographic factors.

Introduction

Underweight is a vital gauge to assess malnutrition in children[1]. Under-nutrition and underweight badly affects the dynamic prospective of a society[2]. In the last few years along with obesity increase there is also increase in the underweight children and adolescents in Asia and Africa[3].

A healthy diet is of utmost importance for the optimal growth and development of a child[4]. Undernutrition is considered as the leading cause of underweight in developing countries. Under nutrition can be due to decreased access to food rich in nutrition and poverty, low literacy rate of parents and infectious disorders are also considered as factors contributing

to underweight[5]. Under-nutrition is considered the main reason for infant morbidity and mortality all over the world, as it makes a child more susceptible to vulnerable infections such as pneumonia and diarrhea. The negative consequences regarding underweight include hindered physical growth, weak muscular power and less bony mass that ultimately reduce daily efficiency of life[5]. In Asia the predominant predictor for pre-school and school-going underweight children is low birth weight babies. There are about 60 million underweight children in India with more percentage of them based in rural areas[6]. Prolonged chronic infections and an imbalance between nutritional consumption and work load are its prime determinants[7].

India has highest frequency of undernourished children across the world[1]. In Oman the frequency of juvenile under-nutrition is still in the medium range as per the criteria of World Health Organization (WHO)[8]. According to National Baseline Health Research the frequency rate of Indonesian underweight school children was 12.1% in 2007, which has now been decreased. Pakistan is still one of the highest rated nations with juvenile malnutrition around the Globe[9]. According to National Nutrition Survey 33% of all children in Pakistan were underweight[10]. Literature from Pakistan exhibited more focus towards underweight children < years of age[5], hence paucity found in the prevalence of underweight among school going children aged 6-16 years and the associated factors of underweight in the under said age group. The present study was carried out to determine the frequency of underweight among school children and to determine the demographic factors associated with it among school going children of Lahore, Pakistan.

Methods

A cross-sectional study was conducted on total 443 school children aged 6-16 years from 10 private and public sector schools of Lahore. All of them belonged to upper, middle or lower socioeconomic. The study was carried out after taking permission form Institutional Review Board (IRB).

Convenient sampling technique was done, after parental consent; the assent was taken from all participants before data collection. Both male and female school going children between 6-16 years of age were included in the study. While students with <6 years or >16 years of age, college going students, those who were with any severe or chronic mental/physical diseases, or taking certain medications were excluded from the study. Data was collected on a questionnaire in the classrooms from the participants. The questionnaire contained information with respect to associated variable i.e. gender, education sector, socioeconomic class, parents, education, meal frequency, sleeping time and life style.

Age was confirmed from school records, age (in years) was taken between 6 to16 because <6 were usually not enrolled in school as far as public sector schools were concerned and students with >16 years of age were mostly college going. The socioeconomic (low, middle and upper) class of each child was determined by knowing the income of his/her parents. The considered cut off income (in Pak rupees) for low, middle and upper socioeconomic class was < 20,000, 50,000 - 100,000, and > 200,000 respectively A = 11. Parent with minimum secondary school certificate was marked as educated B=12. Meal Frequency was categorized into two subgroups: those who were used to take 1-2 full meals and those who were taking $\geq$.3 full meals in a day. Variable of Sleep Time was subdivided into two categories: those who were taking $\leq$ 8 hours sleep and those who were taking >10 hours of sleep daily. Life style was classified into three subclasses i.e. sedentary (those performing light physical activities e.g. typical daily routine tasks), moderate (walking upto 2 kilometers daily/ cycling/playing tennis) and active (a minimum of 30-45 minutes brisk walk or any other similar kind of vigorous activity in a day C=13).

The procedure regarding measurements of height and weight was briefed to the all participants. Height in meter was measured with the help of a measuring tape placed along the wall, without shoes on a flat floor with standing posture of buttocks, shoulder and occiput all touching the wall. Body weight was measured on weighing scale with minimal clothing in kg. Children were classified as underweight, normal weight and obese according to Body Mass Index (BMI) for age growth charts (CDC, 2000).

The data was entered into Microsoft Excel and coding was done. Analysis of data was done through SPSS version 21. Independent student “t” test was used to compare two groups and sub-groups, while one-way “ANOVA” was used to compare the dif-

ference among >2 groups and sub-groups. "Chi-square" test was applied to determine the association of the underweight with the variables studied. P value of <0.05 was taken as significant for all statistical tests applied.

Results

A total of 443 school children participated in the study with mean age 12.84 ± 0.11 years, 33% were males and 67% were females. According to the BMI categories of school children the frequency of underweight (BMI<5th percentile), normal weight (BMI 5th - 85th percentile) and overweight/obese (B-MI > 85th percentile) was 17%, 63% and 20% respectively.

There was 17% underweight school going children with mean age of 12.24 ± 0.26 years. On stratification according to gender 78% were females with mean age of 12.53 ± 0.31 years and 22% were males with mean age of 11.24 ± 0.34 years. The average BMI of underweight children was 14.03 ± 0.13 Kg/m^2.

Underweight school children belonging to low, middle and upper socioeconomic class was 20%, 74% and 6% respectively. Moreover 50% of underweight school going children had both illiterate parents and 22% had only one educated parent, while 28% of them had both educated parents.

The BMI of underweight school children was analyzed in relation to variable i.e. age, gender and education sector by using the statistical test called student's t test. The data was divided into two subgroups according to age i.e. pre-adolescents and adolescents, it was noticed that the BMI of preadolescents was significantly less compared to adolescents (p = 0.0001). Male children were more underweight compared to females (p = 0.03). The parameter of parent's education further categorized into three subgroups i.e. children with one educated parent, both educated parents, and illiterate parents.

To analyze the BMI of underweight school children with respect to socioeconomic class and parents, education, one way ANOVA was applied. Underweight children whose parents were illiterate or only one parent educated were significantly more underweight with less BMI compared to those with both educated parents (p = 0.0001). However no signifycant difference in BMI was observed in relation to 'Education Sector'. When the data was analyzed according to socioeconomic status, the children with low socioeconomic status were found to be more underweight compared to middle and upper socioeconomic class (p < 0.05) (Table 1).

Table 1: *Study Variables in Underweight School Children according to BMI*

Variables		BMI (Kg/m^2) mean±SEM	p-value
Age (year)	Pre-Adolescent (6-11)	13.42±0.14	0.0001*
	Adolescent (12-16)	14.23±0.11	
Gender	Males	13.02±0.17	0.03*
	Females	14.22±0.14	
Education Sector	Private	13.99±0.20	0.74
	Public	14.07±0.14	
Socioeconomic Class	Low	13.60±0.21	0.046*
	Middle	14.26±0.132	
	Upper	14.72±0.54	
Parents Education	Both Educated	14.86±0.24	0.0001*
	One Educated	13.63±0.2	
	Both Illiterate	13.35±0.15	
Meal Frequency (meals/day)	1-2	13.77±0.14	0.04*
	≥3	14.3±0.21	
Sleeping Time (hours/day)	≤8 hrs	14.44±0.24	0.01*
	>10 hrs	13.79±0.13	
Life Style	Sedentary	14.68±0.28	0.05
	Moderate	13.94±0.15	
	Active	13.22±0.26	

***p-value** <0.05 was taken as statistically significant

Variables of Meal Frequency and Sleep Time were statistically assessed by using Student T Test while their Life Style was analyzed through One Way A-NOVA. The underweight children who were taking 1-2 meals/day had a significantly less BMI and were more underweight compared to those taking ≥ 3 meals/day (p = 0.04). According to hours of sleeping, stratification of underweight school

children showed that those who were taking > 10 hours sleep / day had less BMI compared to who were sleeping for ≤ 8 hour / day (p = 0.01). Underweight children with active life style were more underweight compared to those with sedentary life style but this was not a statistically significant difference (p = 0.05) (Table 1).

A significant (p < 0.05) association was observed with age, gender, parent's education, and sleeping hours in underweight school children. On the other hand there was no significant association (p > 0.05) with education sector, socioeconomic class, meal frequency and life style (Table 2).

Table 2: *Association of Underweight School Children with Socio-demographic and Dietary Variables*

Demographic Variables		Under weight n (%)	Normal weight n (%)	Chi square χ^2	p-value
Age (year)	Pre-Adolescent (6-11)	34(45)	85(30)	6.12	0.013*
	Adolescent (12-16)	42(55)	194(70)		
Gender	Males	17(22)	96(34)	3.79	0.05*
	Females	59(78)	183(66)		
Education Sector	Private	39(51)	132(47)	0.27	0.6
	Public	37(49)	147(53)		
Socio-economic Class	Low	15(20)	34(12)	3.97	0.13
	Middle	56(74)	231(83)		
	Upper	5(6)	14(5)		
Parents Education	Both Educated	21(28)	113(41)	10.01	0.018*
	One Educated	17(22)	72(26)		
	Both Illiterate	38(50)	94(34)		
Meal frequency (meals/day)	1-2	53(70)	188(67)	0.55	0.45
	≥3	23(30)	91(33)		
Sleep Time (hours/day)	<8 hrs	28(37)	138(49)	4.29	0.03*
	>10 hrs	48(63)	141(51)		
Life Style	Sedentary	13(17)	57(20)	0.51	0.77
	Moderate	43(57)	162(58)		
	Active	20(26)	60(22)		

p-value < 0.05* was taken as statistically significant

Discussion:

Underweight is a reflective term to mark the degree of physical and mental underdevelopment[7].

According to UNICEF (United Nations International Children's Fund) there is 16% frequency of underweight children around the Globe[10]. There was 29.5% frequency of underweight school children in Pakistan in 2012[10] while compared to Pakistan in other developing countries of the World it was 14.7% in Qatar, 11.3% in China, and 10.2% in Russia. Among Filipinos, this percentage was quite high i.e. 32.9%[14]. A study conducted on the students of medical schools of Dominican Republic aged 15-29 years stated only 7% frequency of underweight students. Underweight frequency was 16.6% in India according to National Family Health Survey-4 (2015-16)[7]. The frequency of Pakistani underweight school children has been improved from the past years, as in 2012 it was around 29.5%, while present study revealed 17% underweight school going children in the public and private schools of Lahore, province Punjab of Pakistan[10]. Another study from Pakistan in 2006 has documented that 24% school children in urban areas were underweight[15]. In 2015 a study from KPK, Pakistan showed a 15% frequency rate of underweight children[16]. An alarming frequency rate of 54% has been reported in rural Sin-dh areas of Pakistan in 2013[17].

Paucity prevails in literature with respect to related causes of underweight among adolescents, though many studies tried to explore these causes among children < 5 years of age. However present study displayed lower BMI in preadolescents compared to adolescents. Our results exhibited a greater percentage of females that were underweight compared to males; these findings are similar to a study conducted in South Africa, where they also found a signif-

icant large proportion of underweight females aged 10-12 years in their local primary schools[18].

In-line with Chinese study in year 2018[16] present study also exhibited a gender-based significant difference in underweight school children. Hamad *et al* in 2016 reported more undernourished males compared to females[17], while other studies suggested no association of gender in this regard[21-22].

The current findings expressed significant associateion of socioeconomic status with underweight children, similar to a study conducted in district Doda of Jammu and Kashmir where socioeconomic class was ranked a significant determinant of underwei-ght school children aged 6-14 years[7]. Khattak *et al* in 2010 exhibited a significant association of malnutrition among children with household income, and family size[23]. While according to Gul and Kibria the prime related causes of underweight were multiparities and uneducated mothers[24], whereas the current study indicated low socioeconomic status and illiterate parents as the major attributes among the underweight school children.

Present study showed age, gender, parental education, meal frequency and sleep hours as the significant parameters among underweight school children; however other studies have reported maternal education, age of the mother, maternal stress and alcohol consumption rates in mothers as the factors associated with underweight children in other countries of the world. Likewise Batool *et al* and Mushtaq *et al* in 2012 declared poor income class, low literacy and overloaded homes as the pre-dominant associated variable with respect to underweight / undernourished Children.

The strengths of present study included the selected age group of underweight school children (6-16 years) as scarcity found with respect to this particular age group in previous literature. Moreover maximum children belonged to middle socioeconomic class included in the study that has been ignored in earlier studies from Pakistan. There are also few limitations of the current study. Study population should involve more number of schools though only 10 schools have been targeted, furthermore few demographic factors have been overlooked in the study like marital status of the mothers (widow, single, divorced), which should also be covered in the study.

Conclusion:

Frequency of underweight school children in Lahore was 17%, amongst them 74% belonged to middle and 20% to low socioeconomic class. Significantly higher number of girls was underweight compared to boys but BMI of underweight boys was less as compared to girls. Preadolescents, females, illiterate or less educated parents, less food intake and more sleeping hours were significantly associated with underweight.

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