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Anthropometric Indices in Primary School Children of Iranshahr City, Iran

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ABSTRACT

Background: Malnutrition, as a serious health problem in children, has an increasing prevalence in the developing countries. This study aimed to evaluate the anthropometric indices of primary school children in Iranshahr, a city in central region of Sistan and Baluchestan province, Iran. **Methods:** This cross-sectional study was conducted on a sample of 1000 6-14 year-old primary school children studying in 16 public and 5 private schools in Iranshahr city from May to June 2017. The sampling was done using multistage cluster random method. The school records were used to determine the students' ages. Their weight, height, and body mass index (BMI) were measured. Anthropometric indices including weight-for-age, height-for-age, and BMI-for-age were assessed using the National Center for Health Statistics/World Health Organization international growth reference and Center for Disease Control and Prevention (2000). **Results:** The rate of thinness was significantly higher in public than private schools (18.1% vs 1%; P < 0.0001). Overweight/obesity was lower in public schools' children compared to students of the private schools (0.1% vs 9.3%; P = 0.007). The rates of stunting and underweight in public and private schools' children were 50.2% vs. 53.3% (P = 0.11) and 46.6% vs 35% (P < 0.0001), respectively. **Conclusion:** Findings showed that although nutritional status was better in private schools than public schools, malnutrition is still a potential public health problem in this area. Therefore, the nutrition interventions are suggested at national and regional levels to increase the parents' awareness.

Keywords: *Underweight; Stunting; Wasting; Primary schools; Children*

Introduction

Malnutrition, as a serious health problem in children, has an increasing prevalence in the developing countries (Jafari *et al.*, 2014, Srivastava *et al.*, 2012). The school-age children represent an active phase of physical growth and mental development (Srivastava *et al.*, 2012). According to the studies in the developing countries, over nutrition and obesity are more common among

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the children from high socioeconomic status (Alkali *et al.*, 2015). However, children from low socioeconomic status are more likely to be affected by under nutrition and poor health outcomes (Agbozo *et al.*, 2016). This affects their school achievements subsequently (Wisniewski, 2010). The evidence demonstrates that not only overweight disorders, but also under-nutrition causes many nutritional problems in children, such as micronutrients' deficiency, anemia, susceptibility to parasitic infections, reduced educational achievements, and high risk of chronic diseases in later ages (Daboné *et al.*, 2011, Srivastava *et al.*, 2012). Thus, growth assessment is one of the best methods for evaluating nutritional condition in communities (Srivastava *et al.*, 2012). Anthropometric measurements, including age, weight, and height as well as indices such as height-for-age and weight-for-height can assess the health and nutritional status in childhood (Srivastava *et al.*, 2012) . Underweight is considered as a low weight – for-age. It is a general indicator of a nutritional and health status in populations, which shows both acute and chronic malnutrition. Stunting is considered as a low height-for-age and reflects chronic malnutrition due to prolonged food deprivation and/or illness (Agbozo *et al.*, 2016, Mohseni *et al.*, 2018) . Both stunting and underweight can be used as determiners of malnutrition compared with the healthy reference populations (Shafieian *et al.*, 2013) .Body mass index (BMI-for-age) has also been recommended as the best anthropometric indicator of thinness and overweight during childhood and adolescence (Blössner *et al.*, 2001) . Global estimates reported nearly 151 million stunted, 51 million wasted, and 99 million underweight children in the world. A form of malnutrition has also emerged as overweight and obesity; approximately 38.3 million children were overweight in 2017 (UNICEF/WHO, 2018). The prevalence of underweight in Iranian children is one of the most common nutritional disorders (Ziaee V, 2006).The "Iranian National Study of Malnutrition Prevalence in 28 provinces of the country" demonstrated that 4.7% of the Iranian children suffered from stunning , 2.5% were underweight, and 3.7% were wasted in 2008 (Sheikholeslam et al 2008). Given the paucity of data on anthropometric indicators of school children in this area, we evaluated the children's anthropometric indicators to monitor their health status, as an essential process for planning and implementing nutritional interventions. In this regard, the present study was conducted to evaluate the prevalence of underweight, stunting, thinness, and overweight/obesity among primary schools' children attending private and public schools in Iranshahr in central region of Sistan and Baluchestan province, South-east of Iran.

Materials and Methods

Design and participants: In this cross-sectional study, a total of 1000 6-14 year-old primary school children (468 girls and 532 boys) were selected from 16 public (689 pupils) and 5 private schools (311 pupils) in Iranshahr. Data collection was performed by two nutrition students at the second term of the academic year from May to June 2017. The sampling was done using multistage cluster random method. The two sub-districts in Iranshahr were studied as two clusters and 16 public and 5 private schools were randomly selected from each cluster. The type of elected schools represented the social status of the household. According to statistics, selected private schools were one-third of the public schools; so, the number of pupils selected from private schools was almost one-third of the public schools.

The children whose exact birth dates were unclear, children with chronic diseases and chromosomal disorders, and those who consumed growth hormone or corticosteroid therapy were excluded from the study.

Measurements: Weight was measured using a digital scale to the nearest 100 g. Height was measured using a stadiometre to the nearest 0.1 cm and BMI was calculated by weight (kg) / height square (m^2). Thinness, underweight, stunting, and overweight/obesity were assessed as the anthropometric indices for the school children. Underweight was indicated as weight-for-age Z-scores (WAZ) and stunting was defined as the

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height-for-age Z-scores (HAZ). To assess underweight and stunting, the cutoff point below -2 and Z-score of the National Center for Health Statistics reference were used (Srivastava *et al.*, 2012).

According to the standard chart of Center for Disease Control and Prevention), cutoffs of BMI-for-age were determined as follows: <5th percentile was considered as thinness and ≥95th percentile as overweight /obese (Kuczmarski *et al.*, 2000).

Ethic considerations: The protocol of this study was approved by Ethics Committee of Zahedan University of Medical Sciences (Code No: IR.ZAUMS.REC.1396.28). At the beginning of research, the study goals were explained to the pupils' parents and they were asked to sign the informed consent forms.

Data analysis: Data were analyzed using *Epi-Info* software version 7. In order to analyze the data, results of *Epi-Info* data file were exported into the Statistical Package for Social Sciences (SPSS) version 21 (Chicago IL). Chi-square and student *t-test* were used to check the variables' proportions and compare the means in public and private schools. A *P*-value of less than 0.05 was considered as significant.

Results

In this study, a total of 1000 pupils participated from 16 public and 5 private schools (age ranged from 6 to14 years). The selected schools were from two areas of the city: 689 pupils (68.9%) (303 girls and 386 boys) studied in public schools, whereas 311 (31.1%) (165 girls and 146 boys) pupils studied in private schools. The results showed that the mean age of pupils in the public and private schools were 9.1 ± 1.8 and 9.5 ± 2 years, respectively ($P > 0.05$). The majority of pupils in public and private schools were within the age range of 6–14 years (65 % and 73%, respectively). The mean weight and height of pupils in public schools decreased significantly compared with the private schools [(23.7 ± 5.6 *vs.* 31 ± 8.4 kg ($P < 0.0001$); and 123 ± 11.4 *vs.* 131 ± 13.2 cm ($P = 0.009$), respectively]. The mean BMI of pupils in public schools was 15.6 ± 2.1 kg/m^2, which was significantly lower than the private schools (17.8 ± 3.1 kg/m^2) ($P < 0.0001$). With regard to education, majority of the pupils' mothers were under diploma (83.9% in public and 83% in private schools) and most of them were housewife (94% and 92.3%, respectively) in both schools (**Table 1**).

The nutritional status based on the Z-scores of BMI, weight for age, and height for age among the public and private schools children by gender are described in **Table 2**. According to BMI Z-score, 125 (18.1%) children who attended public schools were thin, which was significantly higher than this rate among students of the private schools 3 (1%) ($P < 0.0001$). Furthermore, a great proportion of thinness was observed between boys and girls (9.9% and 8.3%) attending public schools compared with those studying at private schools (1% and 0%, respectively). Only one case (0.1%) of overweight/obesity (boy) was reported in public schools, but this rate was higher (9.3%) between boys (6.4%) and girls (2.9%) in private schools and the difference between the genders was significant ($P = 0.007$).

Based on the weight-for-age Z-scores, 321 (46.6%) public schools' children were underweight compared to 109 (35%) of the private schools' children ($P < 0.0001$). The differences observed among girls and boys attending public and private schools was also statistical significant ($P < 0.0001$).

According to height-for-age Z-score, 346 students (50.2%) of public schools and 166 students (53.3%) of private schools suffered from stunting. However, the difference between children attending public and private schools was not significant ($P = 0.11$).

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Table 1. Demographic and anthropometric data of school children

Variables	Public schools (*n* = 689)	Private schools (*n* = 311)	*P*-value
Girls/ Boys	303/386	165/146	-
Age (y)	9.1 ± 1.8[a]	9.5 ± 2.0	0.43[b]
Weight (kg)	23.7 ± 5.6	31 ± 8.4	0.0001[b]
Height (cm)	123 ± 11.4	131 ± 13.2	0.009
Body mass index (kg/m^2)	15.6 ± 2.1	17.8 ± 3.1	0.0001[b]
Age groups (y)	N (%)	N (%)	
6-9	448 (65.0)	227 (73)	0.095[c]
10-14	241 (35.0)	84 (27)	
Diploma and over	111 (16.1)	53 (17)	
Mother's occupation			
Housewife	648 (94)	287 (92.3)	0.49[c]
Employee	31 (6)	24 (7.7)	

[a] : Mean ± SD), [b]: Student t-test, [c]: Chi square test

Table 2. Z-scores of body mass index, weight for age, height for age by gender

Z-scores status	Public schools (n = 689)			P-value[a]	Private schools (n = 311)			P-value[a]
	Total N (%)	Girls N (%)	Boys N (%)		Total N (%)	Girls N (%)	Boys N (%)	
Body mass index								
Normal	563 (81.7)	246 (35.7)	317 (46)	*0.62*	*279 (89.7)*	156 (50.2)	123 (39.5)	0.007
Thinness	125 (18.1)	57 (8.3)	68 (9.9)		*3 (1)*	0 (0)	3 (1)	
Overweight/Obese	1 (0.1)	0 (0)	1 (0.1)		*29 (9.3)*	9 (2.9)	20 (6.4)	
Weight-for-age								
Normal	368 (53.4)	161 (23.4)	207 (30)	0.0001	202 (65)	131 (42.2)	71 (22.8)	0.0001
Underweight	321 (46.6)	142 (20.6)	179 (26)		109 (35)	34 (10.9)	75 (24.1)	
Height-for-age								
Normal	343 (49.8)	137 (19.9)	206 (29.9)	0.05	145 (46.7)	80 (25.7)	65 (21)	0.34
Stunting	346 (50.2)	166 (24.1)	180 (26.1)		166 (53.3)	85 (27.3)	81 (26)	

[a]: Chi square test

Discussion

In the present study, we evaluated the anthropometric indices of primary school children to determine their malnutrition status. The type of school was also used as an indicator of the socio-economic status of the school children. The comparison of nutritional status in children based on the school type demonstrated that the rates of underweight and thinness were higher among children attending public schools than private schools (46.6% and 18.1% *vs.* 35% and 1%, respectively). The difference rate between boys and girls attending public schools was higher compared with the difference rate of the male and female students attending private schools. Similarly, several studies revealed that underweight in public schools pupils was higher than private schools (Agbozo *et al.*, 2016, Ashok *et al.*, 2014). Besides, underweight was higher among students who did not consume breakfast before going to school or those who had only two meals per day than those who took breakfast or had at least three to four meals per day (Agbozo *et al.*, 2016). The prevalence of wasting and underweight were reported as 3.1% and 9.48% among school children in the west of Iran, respectively(Rezaeian 2014). In a systematic review and meta-analysis, the prevalence of

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malnutrition, were found to be 7.8% and 10.5% in terms of wasting and underweight in Iranian children, respectively (Mohseni *et al.*, 2018).

A study in India also showed that most malnourished children were underweight, 33.3% of children were wasted, and 18.5% were stunted. Furthermore, the results showed that the prevalence rates of stunting and underweight were higher in age group of 11 to 13 years (Srivastava *et al.*, 2012). The findings of several other studies also showed that underweight was more common in age groups 5-6 and 11-12 years, respectively; whereas, high prevalence of wasting was found in age group 7-8 years (Srivastava *et al.*, 2012). In our study, higher rates of underweight and stunting were observed in children aged 10-14 years who attended public schools compared with those who attended private schools in the same age group.

The prevalence rate of stunting in this study was higher compared to the previous studies. According to the report of 2008 and 2018 Iranian National Study of Malnutrition Prevalence, 4.7% and 12.4% of the Iranian children suffered from stunning (Sheikholeslam et al. 2008 (Mohseni *et al.*, 2018). The prevalence of stunting was 2.85% among school children in the west of Iran (Rezaeian 2014).

According to the type of school, results showed that the rate of stunting was higher in students who attended private schools (53.3 %) than those who attended public schools (50.2 %). However, the differences between children attending public and private schools as well as between the two genders were not significant. Dissimilar findings were reported in several studies (Agbozo *et al.*, 2016, Daboné *et al.*, 2011, Jafari *et al.*, 2014). The discrepancy in results can be due to various study methods and reference values. Nevertheless, considering public health impacts of short stature such as reduced cognitive capacity, delayed mental development, reduced productivity in the work force, high risk complications during child birth due to smaller pelvis, etc. (Jafari *et al.*, 2014), findings of the present study suggest that children of this province are at a serious risk and should be given more attention.

Similar to the previous studies (Agbozo *et al.*, 2016), we found that the overweight/obesity rate was higher in private schools than public schools (9.3% *vs* 0.1%). This suggests that the type of school (public vs. private), as an indicator of socio-economic status, can be associated with nutritional status of students (Agbozo *et al.*, 2016). The rate of overweight/obesity was higher in private schools' children, especially among 10-14 year-old than 6-9 year- old boys. On the opposite, a study reported that obesity decreased with age from 10.3% in the 6-9 year-old group to 3.3% in the 10-12 year-old group; while the prevalence of central obesity did not show any significant difference between the two age groups (6-9 years and 10-12 years) (Daboné *et al.*, 2011). The evidence shows that the obesity rates increase gradually as children grow older. This situation may be due to the variations in the nutritional behavior and lifestyle such as excessive time spent for watching television and using the Internet (Ashok *et al.*, 2014, Bener *et al.*, 2011) , consuming fast foods, having low physical activity, and playing computer games (≥ 3 hr/day), which are more prevalent in high socioeconomic households. As a result of these factors, the incidence of malnutrition increases in the developing countries (Agbozo *et al.*, 2016, Ashok *et al.*, 2014) . In addition, evidences show that overweight and obesity are more common in the developing countries among the high socioeconomic people (Alkali *et al.*, 2015, Ashok *et al.*, 2014). Therefore, high prevalence of overweight in private schools (Daboné *et al.*, 2011) may be related to higher economic status, better nutrition, and sedentary lifestyle in children who go to private schools (Ashok *et al.*, 2014, Gaddah *et al.*, 2016). However, further studies are necessary to evaluate nutritional status in school children in public and private schools. Various causes are involved in the incidence of malnutrition in children. It seems that the differences of malnutrition prevalence in various studies may be due to differences in the study setting (Srivastava *et al.*, 2012), methods, definitions of malnutrition, standards used for malnutrition assessment, genetic, sedentary

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lifestyle, and environmental variations(Jafari *et al.*, 2014), women's education level, socioeconomic status, lack of women's awareness about appropriate nutrition, low quality of drinking water, poor health, nutrient deficiencies, infection, and parasitic diseases (Karajibani *et al.*, 2003, Srivastava *et al.*, 2012). Several studies revealed that malnutrition in boys was consistently more common than girls (Jafari *et al.*, 2014 , Kyriazis *et al.*, 2012, Shafieian *et al.*, 2013, Srivastava *et al.*, 2012), which is similar to the present study. A study conducted among school children of urban slums in India showed that under nutrition was significantly more prevalent in girls than boys. These differences may be related to family size, gender bias, parents' attention to boys, and also parental preferences for boy children in some areas (Srivastava *et al.*, 2012). Previous studies demonstrated that occupation and education level of mothers was associated with nutritional status of children (Boyle *et al.*, 2006, Waters *et al.*, 2004). Since housewives have more time to take care of their children, their children have a better nutritional status than children whose mothers are employee. In the present study, the rate of overweight/obesity was higher in the children whose mothers had diploma and higher educational status compared to the children whose mothers had lower educational levels. However, mothers' working status was not associated with nutrition status of children. These findings differ from earlier studies (Singh 2003, Srivastava *et al.*, 2012), which indicated that the level of maternal education and their working status were important predictors of nutritional status in children. In Iranshahr, we are faced with poor sanitation, difficult living conditions in some parts of the city, poor knowledge of people about health and nutrition, as well as inappropriate food habits, which can lead to health and nutritional problems. Thus, high prevalence of malnutrition in public schools may be related to some of these factors, which require more study.

One of the limitations of this study was lack of evaluating food intakes and factors related to malnutrition, which could be helpful in determining the nutritional status of children. The strength of this study was a large sample size, which led to identification of more at-risk children.

Conclusion

According to the findings, although nutritional status was better in private schools' children than those who attended public schools, malnutrition is still a potential public health problem in this area. Therefore, the authorities are recommended to conduct nutrition interventions at national and regional levels to increase awareness of the parents.

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Conflict of Interest

The authors have no competing interests.

Authors' contributions

Montazerifar F designed the study. Montazerifar F and Karajibani M drafted the paper. Asoudeh H and Asoudeh M collected data. Dashipour A analyzed data. All authors reviewed and approved the final manuscript.

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