

Investigating the Prevalence of Malnutrition and Its Relationship with the Educational Status of Elementary School Students in Zahedan, Iran

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Introduction

Children make up a large part of the world's population. Therefore, prosperity and growth at this stage of life ensure a healthy society (Moridi and Fathi, 2009). Nutrition in childhood is critical because childhood is a stage of development in which health behaviors are mainly transferred to adolescence and adulthood (Owusu *et al.*, 2017).

ABSTRACT

Background: Malnutrition and improper nutrition may lead to physical and mental growth disorder and cognitive function. This study aims to determine the prevalence of malnutrition and its relationship with educational status among primary school children in Zahedan, Iran. Methods: During a cross-sectional study with a multi-stage random sampling method of 780 boy and girl students, first, second, and third grades of elementary school were included to study. Demographic and anthropometric of students were collected based on the sample size. Malnutrition was assessed according to World Health Organization indicators for the relevant age group. This assessment was based on body mass index (BMI) for age, height for age, and weight for age. **Results:** The prevalence of malnutrition was severe wasting, wasting, overweight, and obesity which were 0.8, 4.6, 6.4, and 5%, and severe underweight and underweight which were 0.9 and 4.7%, respectively. Severe stunting and stunting were observed in 0.3 and 2.8%, respectively. A statistically significant relationship was found between BMI for age, height for age and weight for age and educational status (P < 0.05). Moreover, the educational status of students showed a statistically significant relationship with first and second-grade gender, birth rank, and Parent's job and education (P<0.0001). Conclusion: Different forms of malnutrition among the students can negatively affect their performance, especially their educational status. Therefore, proper nutrition and increasing nutritional knowledge of primary school children and parents may help to prevent the problem.

Nutrition of mother, neonate, and child plays an important role in proper growth and development of social and economic status of the child in the future (Narayan *et al.*, 2019).

Malnutrition is defined as a state of imbalance of energy or protein and other nutrients that leads to measurable adverse effects in human body

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(Saunders and Smith, 2010). Malnutrition in children is a public health problem in many developing countries, and in addition to enormous human suffering, both physical and mental, it also has a negative impact on the development prospects of these countries (World Bank, 2009). Malnutrition in children also causes a delay in body's growth, stunting, frequent diseases and infections, disorder in mental development, lack of educational progress, decrease in work efficiency, and mortality (Fenske et al., 2013, McSweeney et al., 2015, Moestue and Huttly, 2008, Mohammadi et al., 2018, Siddiqi et al., 2011). Malnutrition accounts for 54% of child deaths worldwide (Duggan et al., 2016). According to World Health Organization (WHO) estimates in developing countries, 52% and 34-62% of school-age children are stunted and underweight, respectively (De Onis et al., 2012, World Health Organization, 2006). Factors such as insufficient intake of food, lack of nutritional knowledge, parents' education level, household economic conditions, infection. psychological problems, high food prices, food shortages, and digestive problems are involved in the occurrence of malnutrition in children (Akhtar, 2016, Akombi et al., 2017, Arthur et al., 2015, Khan et al., 2017a, Khan et al., 2017b, Motedayen et al., 2019). Nutritional deficiency in early life can affect cognitive growth, behavior, illness, and increased symptoms of headache and stomachache, which lead to absenteeism in school and reduced academic performance of students. Therefore, nutrition access increases students' cognition, concentration, and energy level and improves their academic progress (Ross and Anderson, 2010). In many studies, the mutual influence of nutritional status, growth, intelligence, and educational status has been reported (Asmare et al., 2018, JM and Cáceres, 2001, Sarma et al., 2013).

Ayalew's study, which was conducted on 505 elementary school students living in the village, who did not study regularly, being underweight and stunted was associated with a decrease in academic achievement, and higher education of the mother was associated with an increase in academic achievement (Ayalew *et al.*, 2020). Also, based on the studies conducted in developing and low-income countries, the occurrence of recurrent and intermittent diseases and insufficient nutrition are related to the academic performance of children in school (Pollitt, 1994). Studies have been conducted on the prevalence of malnutrition in primary school children in Iran, which show the high prevalence of malnutrition in this section of society (Darvishi *et al.*, 2009, Dehghan *et al.*, 2011, Karimi *et al.*, 2016, Namakin *et al.*, 2011, Veghari, 2013). One of the most common nutritional deficiencies among students in Iran is the general lack of food, which causes children's growth to be delayed (Aghamolaei and Sobhani, 2004).

Growth monitoring in childhood and identifying nutritional problems and the health level of society have a direct relationship with health in old age. Furthermore, the appropriate physical development of primary school children provides the basis for increasing their learning power and progress in the future. The present study was conducted to investigate the prevalence of malnutrition and its relationship with the academic status of first, second, and third-grade students in Zahedan, Iran.

Materials and Methods

Design and participants

During a cross-sectional study in 2018, 780 students were selected by multi-stage random sampling from the first, second, and third grades of elementary schools in Zahedan, Iran. The sample size was calculated based on the study of Pasdar *et al.* in Kermanshah (Pasdar *et al.*, 2014), by taking into account (P=0.14, d=0.05):

$$n = \frac{\left(z_1 - \frac{\alpha}{2}\right)^2 p(1-p)}{d^2}$$

According to above formula, 740 students were calculated. Taking into account possible attrition, 780 students were included in the study and were examined. Necessary arrangements were made to get admission to the schools and obtain the necessary information by presenting a letter of introduction from Zahedan University of Medical Sciences to the General Department of Education, and the selected schools were referred.

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At each school, verbal consent to participate in the study and a written consent form from the parents for entering the study was obtained from the students, and the students who met the criteria for entering the study were evaluated.

The inclusion criteria included first, second, and third-grade students and giving consent to participate in the study. Exclusions include having any underlying medical or mental illness, an incomplete academic record, non-cooperation of the child during the measurement of anthropometric indicators, the death of the father, mother, or both, and a student renewing the course of that section.

Measurements

To measure anthropometric variables, the weight and height of the students were measured. Weight was measured with a Seca scale (Germany) with minimum clothes and no shoes with an accuracy of 100 grams. Height was measured with a Seca (Germany) measuring tape with an accuracy of 0.1 cm when the student was without shoes and stood in front of the measuring tape in such a way that the back of the heel, legs, hips, and shoulders were in contact with the measuring tape and the head to form a 90-degree angle with the horizon. Body mass index (BMI) was obtained by dividing the weight (kg) by the square of height (m^2) .

In addition, demographic information and the report card at the end of the academic year of the students were recorded in the information form prepared by the researcher. Educational status was measured based on the final descriptive evaluation of the first, second, and third-grade students in all the students. To measure malnutrition in the studied children, the following indicators were used. BMI for age, weight- for- age, and height -for- age, according to WHO standards and the classification of Z-score was considered as follows: Based on the Z-score of BMI for age, the values between -2 and +1 standard deviation were considered normal, between +1 and +2 standard deviation were considered overweight, and the values above +2standard deviation were classified as obese. Values less than -2 and -3 standard deviation were considered wasting and severe wasting, respectively.

Based on weight-for-age Z-score, the values less than -2 and -3 standard deviation were considered underweight and severe underweight, respectively. Values more than -2 standard deviation were classified as normal.

Based on the Z-scores of the height-for-age, the values less than -2 and -3 standard deviations were considered stunted and severely stunted, respectively; Z-score values between -2 and +3 standard deviation were considered normal, and Values above +3 standard deviation were classified as very tall,(Pangaribowo *et al.*, 2013, World Health Organization, 2021)

Ethical considerations

It should be mentioned that this research was approved by the ethics committee of Zahedan University of Medical Sciences with Registration No IR.ZAUMS.REC.1397.509.

Data analysis

Data analysis was done using SPSS.22 software. Centrality and dispersion indices were used to describe quantitative data, frequency distribution tables (absolute and relative) were used to describe qualitative data, and the chi-square test was used to analyze data. P-value less than 0.05 was considered significant.

Results

The mean age of the students was 8.00 ± 0.81 , and the mean age of the mothers was 35.09 ± 6.33 years. The findings of the descriptive analysis of the data are shown in **Table 1**.

The frequency of indicators such as BMI-forage, height-for-age, and weight-for-age are shown in **Table 2**. Based on BMI-for-age, 6.4% of the students were overweight based on height -for age, 2.8% of students were stunted and based on weight-for-age, 4.7% of the students were underweight. The educational status of the studied students was also evaluated, and the findings showed that 48.3% of them had a very good academic status, and 7.8% needed more effort.

The relationship between anthropometric indices and the educational status of the students was measured, the findings of which are shown in **Table 3**.

 Table 1. Frequency distribution of demographic characteristics of students.

| Variable | n | % |
|---|---|--|
| Grade | | |
| First | 258 | 33.1 |
| Second | 264 | 33.8 |
| Third | 258 | 33.1 |
| Gender | | |
| Boy | 370 | 47.4 |
| Girl | 410 | 52.6 |
| Father job | | |
| Unemployed | 59 | 7.6 |
| Employee | 144 | 18.5 |
| Driver | 61 | 7.8 |
| Self-employed | 516 | 66.1 |
| Mother job | | |
| Housewife | 701 | 89.9 |
| Employed | 79 | 10.1 |
| Father education | | |
| Illiterate | 88 | 11.3 |
| Primary and middle school degree | 391 | 12.5 |
| High school and diploma degree | 188 | 24.1 |
| Higher education | 113 | 14.5 |
| Mother education | | |
| Illiterate | 120 | 15.4 |
| Primary and middle school degree | 390 | 50.0 |
| High school and diploma degree | 178 | 22.8 |
| Higher education | 92 | 11.8 |
| Boy GirlFather jobUnemployedEmployeeDriverSelf-employedMother jobHousewifeEmployedFather educationIlliteratePrimary and middle school degreeHigher educationIlliteratePrimary and middle school degreeHigher educationIlliteratePrimary and middle school degreeHigher educationIlliteratePrimary and middle school degreeHigh school and diploma degreeHigh school and diploma degreeHigh school and diploma degreeHigher education | 370 410 59 144 61 516 701 79 88 391 188 113 120 390 178 92 | 47.4 52.6 7.6 18.5 7.8 66.1 89.9 10.1 11.3 12.5 24.1 14.5 15.4 50.0 22.8 11.8 |

Accordingly, there was statistically а significant relationship between BMI-for-age and the educational status of the studied students (P=0.04). Hence, 75.8% of the students with a normal BMI had a good and very good educational status, and 8% of them had a poor educational status (Table 3). A statistically significant relationship was observed between the weight-for-age index and educational status (P=0.03). 94.2% of the students who had a very good educational status had normal weight, and the status of 5.8% of them was mild to severely underweight (Table 3).

A statistically significant relationship was also observed between the height-for-age index and the

educational status of students (P=0.009). Among the students who had a very good educational status, 97.1% had a normal height, and 2.9% were stunted and severely stunted (**Table 3**).

Table 2 Frequency distribution of anthe

| indices of the students. | | | | | | | | | |
|---|-----|------|--|--|--|--|--|--|--|
| | | | | | | | | | |
| Anthropometric indices | n | % | | | | | | | |
| Body mass index-for-age | | | | | | | | | |
| Severe wasting ($Z < -3SD$) | 6 | 0.8 | | | | | | | |
| Wasting (-3SD <z <-2sd)<="" td=""><td>36</td><td>4.6</td></z> | 36 | 4.6 | | | | | | | |
| Normal (-2SD < Z <+1SD) | 649 | 83.2 | | | | | | | |
| Overweight (+1SD < Z <+2SD) | 50 | 6.4 | | | | | | | |
| Obese ($Z > +2SD$) | 39 | 5.0 | | | | | | | |
| Height-for-age | | | | | | | | | |
| Severe stunting ($Z < -3SD$) | 2 | 0.3 | | | | | | | |
| Stunting (-3SD <z<-2sd)< td=""><td>22</td><td>2.8</td></z<-2sd)<> | 22 | 2.8 | | | | | | | |
| Normal (-2SD <z<+3sd)< td=""><td>750</td><td>96.1</td></z<+3sd)<> | 750 | 96.1 | | | | | | | |
| Tall ($Z > +3SD$) | 6 | 0.8 | | | | | | | |
| Weight-for-age | | | | | | | | | |
| Severe underweight (Z <-3SD) | 7 | 0.9 | | | | | | | |
| Uunderweight (-3SD <z<-2sd)< td=""><td>37</td><td>4.7</td></z<-2sd)<> | 37 | 4.7 | | | | | | | |
| Normal (Z >-2SD) | 736 | 94.4 | | | | | | | |
| Total | 780 | 100 | | | | | | | |

Discussion

The findings of the present study showed that the prevalence rates of severe wasting, wasting, overweight, and obesity were 0.8, 4.6, 6.4, and 5%, respectively.

In a study conducted by Pasdar *et al.* on 704 elementary students in Kermanshah, Iran, the prevalence rates of underweight, overweight, and obesity were 16.7, 13.2, and 4.3%, respectively. The prevalence of obesity was almost the same as this study, but wasting and overweight was higher in Pasdar's study.

In Karimi *et al.*'s study, which was conducted on 2195 elementary school students in Semnan, Iran, the prevalence rates of wasting, underweight, and stunting were reported as 12.5, 9.2, and 9%, respectively (Karimi *et al.*, 2016), and the prevalence rate of wasting was higher than the values obtained in the present study.

| | Educational status | | | | | | Tatal | | | | |
|--------------------------------------|------------------------|------|------------|------|------|------|-----------|------|---------|------|-----------------------------|
| Anthropometric indices | Need to make an effort | | Acceptable | | Good | | Very good | | - Iotal | | P-value ^a |
| | n | % | n | % | n | % | n | % | n | % | |
| Body mass index-for-age | | | | | | | | | | | |
| Wasting and severely wasting | 6 | 9.8 | 3 | 2.4 | 11 | 5.0 | 22 | 5.8 | 42 | 5.4 | 0.041 |
| Normal | 52 | 85.3 | 105 | 85.4 | 191 | 87.2 | 301 | 79.8 | 649 | 83.2 | |
| Overweight and obese | 3 | 4.9 | 15 | 12.2 | 17 | 7.8 | 54 | 14.4 | 89 | 11.4 | |
| Height-for-age | | | | | | | | | | | |
| Stunted and severely stunted | 6 | 9.8 | 1 | 0.8 | 6 | 2.7 | 11 | 2.9 | 24 | 3.1 | 0.009 |
| Normal | 55 | 90.2 | 122 | 99.2 | 213 | 97.1 | 366 | 97.1 | 756 | 96.9 | |
| Weight-for-age | | | | | | | | | | | |
| Underweight and severely underweight | 8 | 13.2 | 3 | 2.4 | 11 | 5.0 | 22 | 5.8 | 44 | 5.6 | 0.03 |
| Normal | 53 | 86.8 | 120 | 97.6 | 208 | 95.0 | 355 | 94.2 | 736 | 94.4 | |
| Total | 61 | 7.8 | 123 | 15.8 | 219 | 28.1 | 377 | 48.3 | 780 | 100 | |

Table 3. Frequency distribution of anthropometric indices according to the educational status of the students.

^a: *Chi- square test*

Malnutrition as well as the inappropriate selection and consumption of food groups, especially lack of attention to the consumption of dairy products, meats, and not eating breakfast, are among health threatening factors and can have a negative effect on students' performance, especially their academic progress (Pasdar *et al.*, 2014).

The findings of the current study on the prevalence of malnutrition using BMI-for-age did not match the results of Meshki *et al.*'s study, which was conducted on 375 elementary school students in Gonabad, Iran, because in their study, all the samples based on this index were in the normal range (Moshki *et al.*, 2011). These inconsistencies may be attributed to people living in different geographical and cultural regions and to different economic and social deprivations in provinces.

Evaluating malnutrition using the weight-forage index, the findings of the present study showed that the prevalence rates of severe underweight and underweight were 0.9% and 4.7%, respectively. Dehghan *et al.*'s study on 876 elementary school students showed that the rate of severe underweight among the studied students was 7.3% and mild underweight was 26.3%. Compared to similar findings obtained from the present study, the study showed a higher prevalence of underweight among the studied students (Dehghan *et al.*, 2011).

In the current study, the prevalence rates of severe stunting and stunting were 0.3 and 2.8%, respectively, which was much lower than the values obtained from Karajibani *et al.*'s research on 2067 elementary school students conducted in Zahedan, Iran. They reported a 15% stunting (Karajibani *et al.*, 2005). Furthermore, the results of the study by Namakin *et al.* on 1211 students aged 7 to 14 in South Khorasan in Iran showed that 70% of the students suffer from stunting, which was much higher than the amount obtained in the present study. Also, the results indicated the existence of a statistically significant relationship between the prevalence of stunting and the increase in mother's education level, such that the

prevalence of stunting decreased with increase in mother's education level (Namakin *et al.*, 2011); this was while such a relationship was not observed in the present study.

The findings of this research showed that there was a statistically significant relationship between BMI of the students and their educational status. As the status of BMI-for-age of the students goes towards optimal direction, the academic level of the students also improves, which was in line with the findings of the study by Pasdar (Pasdar *et al.*, 2014).

In the present study, there was a significant statistical relationship between the height-for-age index of the students and their educational status; the more the number of students with the ideal height for age was, the higher was the student's academic evaluation. In Sarma *et al.*'s study, which was conducted on 802 elementary school students in Sri Lanka, a significant relationship between the height-for-age index and educational status was observed(Sarma *et al.*, 2015), which was in line with the results of the present study.

In this study, a significant and direct relationship was seen between BMI-for-age with student's educational level and mother's education. As the student's educational level increases; the BMI-forage does not increase favorably. In this regard, the study by Lazzeri et al. on 1751 students aged 8 to 9 in Italy showed that there was a significant relationship between BMI- for-age of the students and the level of education of the mother (Lazzeri et al., 2011), which was in line with the findings of the present study. In the present study, the largest number of students who had an unfavorable BMIfor-age had housewife mothers. It can be said that having a working mother is effective in improving the economic status of the family, and as a result, the children have better nutrition and the cases of malnutrition decrease.

Also, a good educational status was observed in students with employee fathers, compared with the students with driver, unemployed, and selfemployed fathers. It can be said that the stability of the employees' income can be effective in improving economic status and nutritional

conditions of household members, including students. The findings of the research by Obiakor-Okeke et al. on 302 elementary school students in Nigeria showed a significant relationship between parents' occupation and the incidence of malnutrition in children (Obiakor-Okeke, 2014). The findings of Abebe et al.'s research on 630 elementary school students in Ethiopia showed that educational status had a significant relationship with demographic indicators such as gender, educational level, parents' income status, and parent's education level. Thus, girl students had a better academic status than boy students (Abebe et al., 2017), which was in line with the results of the present study in this field in first and second grades. Also, students with educated parents had better academic performance than students whose parents were illiterate (Abebe et al., 2017), which was in line with the results of the present study.

Non-cooperation of some students and parents to participate in the study was the limitation of this study. On the other hand, the strength of this study was measuring the relationship between educational status and malnutrition, which few studies have addressed, and also using several important anthropometric indices as a tool to measure malnutrition in the studied groups.

Conclusion

The findings of the present study showed that there are various forms of malnutrition in the studied students (underweight, wasting, obesity, stunting) which can have negative effects on their academic performance. Paying more attention to a healthy lifestyle, especially the correct nutrition of students, increasing nutritional awareness, and providing job opportunities with stable household income are among the effective factors in improving the educational status of school-aged children and adolescents.

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Conflict of interest

The authors declared no conflict of interests.

Authors' contributions

Mortazavi Z, Mokhtari S and Moein AA designed research; Mokhtari S conducted the research; Mortazavi Z analyzed data; and Eslahi H, Mortazavi Z, Jamalzehi A wrote the paper. Mortazavi Z had primary responsibility for final content. All authors read and approved the final manuscript.

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