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Assessment of Health and Nutritional Status in Children Based on School Screening Programs

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Background: Even though the screening programs of common morbidities in schoolchildren are routine in many countries, a large number of patients with different problems may be found at school age.
Objectives: The current study aimed to investigate the prevalence of nutritional problems such as stunting, underweight and wasting as well as dental caries and hypertension among schoolchildren.
Materials and Methods: This cross-sectional study of student's health status assessment was conducted on primary, middle, and high school students of Sarvabad, a city in the West of Iran, in 2012. Nutritional status was determined by using body mass index for age and gender according to the World Health Organization references.
Results: Out of 2596 children, 1113 (42.9%) and 1483 (57.1%) were girls and boys, respectively. The prevalence of caries was 62.8% (95% CI: 60.9, 64.6) with a decayed, missing and filled tooth (DMFT) mean of 0.74 (95% CI: 0.71, 0.76). Totally, 16.41% of the study samples had gingivitis. The prevalence of wasting, underweight, and stunting among schoolchildren was 3.1%, 9.48% and 2.85%, respectively. Hypertension was detected in 5.55% (95% CI: 4.67, 6.43). The prevalence of caries, gingivitis, and hypertension was more common in boys than in girls.
Conclusions: Although the high prevalence of health disorders was found among schoolchildren, these rates were lower than those of previous studies in other regions. Results of the current study can help health policy makers to design educational programs concerning dental and public health interventions to deal with nutritional problems in children.

Keywords: Dental Caries; Gingivitis; Nutritional Status; Screening; Iran

1. Background

One of the best and effective methods to improve individuals' health status is health promotion program (1). Schools are considered as perfect settings for health promotion among children and school staff (2, 3). Most countries have established screening programs to implement health promotion in their educational system as well as to identify children who have early signs of health problems (4). The number of countries that have implemented School health screening program is increasing (5-8), which allows early intervention and providing the specialists' treatment. For example, Sekhar et al. (5) have reported that school-based hearing screening is currently required in 67% of the United States. Even though the screening programs in schools are routine in many countries (9), still a large number of patients with different problems can be found at school age and adolescence.

In Iran, school health screening program, investigates behavioral, hearing, and visual disorders, oral health status (dental caries), pediculosis, hypertension, body mass index, and physical examination. The current study assessed the nutritional problems, hypertension and oral health status for the following reasons. Nutritional problems are still highly prevalent in developing countries, particularly Iran (10, 11). Schoolchildren may be at high nutritional risks such as stunting, underweight, and wasting (11-13). Screening in schools by anthropometric surveys can detect the effects of the nutrition transition in its early stages (14). Dental caries and gingivitis are reported as major oral health problems in Iran (15-17) and other countries (18-20). Few studies have assessed the oral

Implication for health policy/practice/research/medical education:
The current study aimed to investigate the prevalence of nutritional problems such as stunting, underweight and wasting, as well as dental caries and hypertension among schoolchildren. Results of the current study showed the high prevalence of health disorders among children, and the findings can help health policy makers to design educational programs for dental and public health interventions to deal with nutritional problems among children.

health status and socio-behavioral factors (19-21). According to the previous studies, chronic diseases are associated with poor oral health (22, 23).

2. Objectives

The current study - which to the best of our knowledge is the first of its kind in Iran - aimed to investigate the prevalence of nutritional problems such as stunting, underweight and wasting as well as dental caries and hypertension among schoolchildren.

3. Materials and Methods

This cross-sectional study of assessing student's health status was conducted on primary, middle, and high school students of Sarvabad, a city in Kurdistan Province, Iran, in 2012. This study assessed the prevalence of dental caries, nutritional status, and hypertension of 2596 children from primary (first grade, 7 years old), middle (first grade, 12 years old), and high schools (first grade, 15 years old) based on census method. Data were obtained from annual school dental records as a part of the dental health care delivery system (DHDS) run by Ministry of Health and Medical Education, Iran (24). These record cards included information about demographic data (age, gender and ethnicity), oral health condition (caries experience and gingivitis), and the needed treatments for each student. According to the World Health Organization (WHO) diagnostic criteria (25), the number of decayed, missing, and filled teeth (DMFT) were recorded as dental caries prevalence. A trained dental therapist examined oral cavity. The presence of dental caries was recorded.

Anthropometric measurements were performed at schools by a healthcare assistant responsible for providing primary health care to the target groups in the rural areas. Body weight was measured in kilograms up to 100 g precision using a digital weight scale. Children were weighted wearing minimal clothes without shoes. Height was measured without shoes in centimeters up to 0.1 centimeters precision using SECA marked stadiometer. Body mass index (BMI), calculated by dividing weight in kilograms on height in square meters, was used to determine the nutritional status of the schoolchildren. Underweight (weight for age with Z score less than -2 standard deviation (SD)), wasting (BMI for age with Z score less than -2SD), and stunting (height for age with Z score less than -2SD) were defined according to the definitions by centers for disease control and prevention (CDC) and WHO (25-27).

After resting for at least five minutes, the blood pressure (BP) of the child was also measured by a healthcare assistant in sitting position. According to the fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents (28), in the current study hypertension in children was defined as average systolic BP or diastolic BP $\geq$ 95th percentile measured at least on three different occasions considering age, gender, and height. Student's t test was employed to compare unpaired values between boys and girls, as well as different binary groups such as location of residence (rural/urban). One-way ANOVA was used to assess the mean differences among the levels of education (primary, middle and high school). Stata 11 statistical package (Stata Corp, College Station, Texas, the USA) was employed for data analysis. All statistical analyses were conducted at 95% significance level.

4. Results

The distribution of subjects' basic characteristics is shown in Table 1.

Table 1. Total Sample Distribution of Subjects' Characteristics

Characteristics	No. (%)
Gender	
Female	1113 (42.9)
Male	1483 (57.1)
Level of education	
Primary	795 (30.6)
Middle	828 (31.9)
High school	973 (37.5)
Location of residence	
Rural	2151 (82.9)
Urban	445 (17.1)

In the current study 2596 children were examined, 1113 (42.9%) children were girls, 1483 (57.1%) were boys, 445 (17.1%) were urban and 2151 (82.9%) rural. The range of the children age was 8 years. Primary and middle school students comprised 30.6% and 31.9% of screened students, respectively, and the rest were high school students. Among the students (n = 1630; 62.8%) with dental caries experience (DMFT), the majority (n = 1319; 50.8%) had one or more decayed teeth (D-component), few (n = 449; 17.3%) had one or more teeth missing due to caries (M-component) and a small number (n = 140; 5.4%) had one or more teeth filled due to caries (F-component). The total DMFT mean was 0.74 (95% CI: 0.71, 0.76); the DMFT was significantly higher in boys than in girls (0.77 and 0.70, respectively; $P < 0.001$) and in middle schoolchildren than in primary and high schools ($P < 0.001$). The overall DMFT showed no difference between rural and urban areas (0.74 and 0.71, respectively; $P = 0.191$); however, there was a significant difference in the overall caries experience between rural and urban areas (64.50% and 54.38%, respectively; $P < 0.001$). Table 2 shows that 16.41% of the study samples had gingivitis.

The prevalence of gingivitis was significantly higher in

children from rural areas in comparison to those from urban areas (17.71% and 10.11%, respectively; P < 0.001), and in boys in comparison to girls (21.31% and 9.90%, respectively; P < 0.001). The prevalence of the respective anthropometric measures indicated that 3.10%, 9.48% and 2.85% of the schoolchildren were wasted, underweight and stunted, respectively (Table 2). Although not statistically significant, the prevalence rates of stunting and underweight were relatively higher among girls and rural children. In all three levels of education, most of the malnourished children belonged to the underweight category (Table 3).

Overall, the prevalence of high BP was 5.55% (95% CI: 4.67, 6.43). The frequency of hypertension was 6.40% in boys and 4.40% in girls (P = 0.027). There was no statistically significant difference in the prevalence of hypertension between rural and urban children. As shown in Table 3, there was a significant gradual increase in the prevalence of high blood pressure with advancement of the age of children. This prevalence increased from 2.52% in primary schoolchildren aged 7 to 8.22% in 15-year-old children (P < 0.001).

5. Discussion

To the best of our knowledge, the current study was one of the few Iranian studies that provide the first estimates of previously undiagnosed health disorders among schoolchildren in Sarvabad district, the west of Iran, in 2012. Although the nationwide report of the prevalence of common disorders using school health screening program in Iran was previously published (9), results of the current study concluded that the prevalence of dental caries was low (DMFT 0.74). The findings indicated that a DMFT mean of 1.5 is lower than the World Health Organization (WHO) target (29). According to the data from a longitudinal study within a period of ten years (1989 - 1999), there has been a clear decrease from 4 DMFT to 1.5 DMFT, in 12-year-old Iranian children during the past three decades (30).

Table 2. Comparing the Proportion of Nutritional Status, Hypertension, Swelling of Gum and DMFT Indexes in Schoolchildren Considering Gender and Region, Using t Test

Variable	Gender		P value	Location		P value	Total, % (range)
	Female	Male		Rural	Urban		
DMFT [a], cumulative, Mean ± SD	0.70 ± 0.6	0.77 ± 0.6	< 0.001	0.74 ± 0.6	0.71 ± 0.7	0.191	0.74 (0.71 - 0.76)
Decayed	46.63	53.94	< 0.001	55.64	27.41	< 0.001	50.81 (48.80 - 52.73)
Filled	6.73	4.38	0.008	3.53	14.38	< 0.001	5.40 (4.52 - 6.26)
Missing	15.54	18.61	0.040	14.83	29.21	< 0.001	17.30 (15.84 - 18,75)
Swelling of gum	9.90	21.31	< 0.001	17.71	10.11	< 0.001	16.41 (15.00 - 17.83)
Stunting	3.32	2.50	0.208	2.97	2.24	0.400	2.85 (2.21 - 3.49)
Wasting	1.70	4.11	< 0.001	2.88	4.04	0.196	3.10 (2.41 - 3.75)
Underweight	10.42	8.77	0.154	9.72	8.31	0.358	9.48 (8.35 - 10.60)
Hypertension	4.40	6.40	0.027	5.50	5.84	0.764	5.55 (4.67 - 6.43)

[a] Abbreviation: DMFT, decayed, missing and filled tooth.

Table 3. Comparing the Proportion of Nutritional Status, Hypertension, Swelling of Gum and DMFT Indexes in Schoolchildren Regarding Education Level by Using One Way Analysis of Variance

Variable	Level of Education			F value	P value
	Primary School	Middle School	High School		
DMFT [a], cumulative, Mean ± SD	0.62 ± 0.5	0.80 ± 0.6	0.78 ± 0.7	19.11	< 0.001
Decayed	45.03	61.11	46.76	26.58	0.762
Filled	0.00	0.97	13.57	110.88	< 0.001
Missing	16.72	17.63	17.47	0.13	0.819
Swelling of gum	24.65	13.77	11.92	29.57	< 0.001
Stunting	2.51	3.26	2.77	0.42	0.001
Wasting	1.00	5.20	3.00	12.03	< 0.001
Underweight	12.45	11.71	5.14	17.41	< 0.001
Hypertension	2.52	5.31	8.22	13.79	< 0.001

[a] Abbreviation: DMFT, decayed, missing and filled tooth.

In addition, Bayat-Movahed et al. (31) carried out a nationwide survey to assess the oral health status of children in the Islamic Republic of Iran. They indicated that the mean decayed, missing and filled teeth indices for Iranian children were 1.9 for three-year-old children, 5.0/0.2 for six-year-old children, 3.6/0.9 for nine-year-old children and 0.6/1.9 for 12-year-old children (31). The results of the present study indicated a decline in these rates.

Dental caries is one of the most prevalent chronic childhood diseases worldwide (32) and heavy expenses of dental treatment is one of its economic consequences (33). Accordingly, during the past decades, there has been a considerable increase in the number of papers pertaining to dental problems by Iranian researchers (34). In the current study, significant differences in dental caries prevalence with regard to gender, urban/rural residence, and level of education were found. Similar findings have been reported by other researchers in other countries. For example, Gorbatova et al. (35) conducted a study to estimate the prevalence and experience of dental caries among 6-year-old children in a remote region of Northwest Russia. These findings indicated considerable differences in the number of decayed, missing, and filled teeth between rural and urban areas, but not in the overall prevalence of caries or caries experience. Hamissi et al. (36) reported that boys had a higher DMFT mean value than girls (2.88 vs. 2.54; $P > 0.05$).

The total prevalence of gingivitis in the region was 16.41%. This finding is discordant with results of previous studies. Jalaleddin et al. (17) assessed the gingival status in six to nine years old children in Iran. They found that the prevalence of gingivitis was 97% in 6 to 7 years old children, 98.1% in 7 to 8 years old children, 98.5% in 8 to 9 years old children and 97.9% in all groups. Saha et al. (20) reported that 63% of respondents had swelling of gum. Findings of the current study portray that boys carry the biggest burden of gingivitis that could be explained by boys' behaviors such as inadequate tooth-brushing habits.

In the present study, prevalence of hypertension was 5.5%, with a higher occurrence among boys and the older group. Studies on the prevalence of high BP among children have been recently conducted in several developing countries (37-39) and other regions (40). A study of blood pressure levels among schoolchildren found that the overall prevalence of hypertension was 19.4% in Iran (37), 3.6% in Egypt (38) and 7.4% in rural areas of Canada (40). In addition, current study revealed that there was no statistically significant difference in the prevalence of hypertension between rural and urban children. This finding is in agreement with other studies (41). However, Mohan et al. (42) conducted a study to evaluate the prevalence of sustained hypertension and obesity in apparently healthy school children in rural and urban areas of Ludhiana. They reported that 5.7% of students had hypertension; the prevalence of sustained hypertension was 6.69% (n = 165) and 2.56% (n = 24) in urban and rural areas, respectively. The increase of childhood hypertension not only increases the prevalence of hypertension later in adulthood, but also correlates with further increased in cardiovascular morbidities and mortality (43). Therefore, the study on the prevalence and early diagnosis of hypertension in childhood is one of the important strategies for public control and prevention of cardiovascular diseases.

Another main finding of the present study was the prevalence of malnutrition based on underweight, stunting, and wasting. The prevalence of malnutrition indices was 15% in the overall sample. Specifically, the prevalence of stunting, wasting, and underweight among schoolchildren were 2.85%, 3.10% and 9.48%, respectively. Similar to other studies (11), malnutrition indices were more prevalent in girls and in rural areas. According to Iranian literature of investigating the nutritional status among schoolchildren, Veghari (11) reported that the prevalence of malnutrition based on underweight, stunting, and wasting among schoolchildren in Gorgan (a province in the north of Iran) were 3.20%, 4.93% and 5.13%, respectively. Kelishadi et al. (44) stated that the prevalence of underweight had been 13.9% (8.1% of boys and 5.7% of girls) among Iranian schoolchildren. Darvishi et al. (45) conducted a study to assess nutritional status in primary school children in Kurdistan Province, in the West Iran. They demonstrated that the prevalence of malnutrition were 27.5%, 32.3%, and 36.9% for indices of underweight, wasting and stunting, respectively. According to the current study results, the prevalence of stunting, wasting and underweight as markers of malnutrition was lower than those of some developing countries (46, 47).

This study had some limitations and strengths that should be considered when interpreting its findings. The large sample size is the strength of the present study. A trained dental therapist examined the oral cavity. This issue may reduce the possibility of information bias. In this study, BMI was used as an indicator of the nutritional status in the schoolchildren; however, the cut-off points used in studies with children vary. This issue may raise the possibility of the information bias. In conclusion, although a high prevalence of health disorders was found among schoolchildren, the rate was lower than those of the previous studies in this region or other regions of Iran. School health screening program may be one reason for the descending trend of the incidence and prevalence of health disorders among children. Last but not least, not only there is an urgent need for a systematic education about dental health to schoolchildren but also the public health interventions should urgently deal with nutritional problems among this population.

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Authors' Contribution

All authors have similar contributions in sampling, data analysis and manuscript preparation.

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