Assess the Risk Factors of Malnutrition among Children in primary healthcare Centers in Saudi Arabia, 2024

Oash Jaber Salim[1], Abduraheem Mohammad Alshahry[2], Bashayr Nasser Munyif Alotaibi[3], Nahhal Hathal Abdullah Albahli[3], Alanoud Miqad Qarrash Alotaibi[3], Reem Abdulrahman Alrifaai[4], Waad Yousef Alrohily[5], Aisha Mohammed Ali Salhabi[6], Hussain Abdullah Hussain Alharbi[7], Kholod hendi alenezi[8], Abdullah Saud Mishan Alotaibi[9], Fehed Ayed Awadallah Alotaibi[10], Fawziah Ayidh Helal Alotaibi[11], Muneera Rheel Alshammari[12]

[1]Specialist Nurse, East jeddah Hospital, Saudi Arabia.
[2]Senior clinical dietitian, Kidney Care Center, Aseer Health Cluster, Khamis Mushait, Saudi Arabia.
[3]Technician-Nursing, Dawadmi General Hospital, Saudi Arabia.
[4]Nursing specialist, Yanbu alnakhal hospital, Saudi Arabia.
[5]Nursing specialist, King salman medical city, Saudi Arabia.
[6]Nursing technician, Al Ruwais primary health care, Saudi Arabia.
[7]Nurse technician, Primary health care center al shobikiyah, Saudi Arabia.
[8]Nursing technician, Extened care hospital, Saudi Arabia.
[9]Nursing technician, Alhufairah PHC, Saudi Arabia.
[10]Nursing technician, Al Quwayiyah General Hospital, Saudi Arabia.
[11]Health Assistant, Al-Saada Health Center, Saudi Arabia.
[12]Nurse, Al-Saada Health Center, Saudi Arabia.

Abstract:
Background: Child malnutrition is one of the most serious and least addressed health problems in the world and in Saudi Arabia. Continuous nutritional assessment of the vulnerable groups especially children is very important for the evaluation of health and nutritional status besides the result of evaluation may be a base for future Planning, prevention and control programs of the nutritional problems. Healthy nutrition is a necessary for people mental health, because of that nutritional habits effect on school performance.
The study aimed: To assess the nutritional status and to identify the associated risk factors of malnutrition among children in primary healthcare centers in Saudi Arabia.
Materials and Methods: A cross-sectional study conducted among 341 children aged (6-12) years in primary healthcare centers in Makkah, Saudi Arabia. The assessment done by filling questionnaire about socio-demographic data, clinical examination, laboratory tests for hemoglobin detection and stool examination for all children.
Results: Underweight was present in 21.9% of cases, whereas stunting was present in 21.4% of cases. The frequency of hair lice was 10.9%, parasitosis was 32.8%, and anemia was 53.1%. The findings showed a substantial correlation between stunting and poor socioeconomic class, parasitosis, and underweight. Anemia, parasitosis, and low socioeconomic status were all substantially correlated with underweight.
Conclusion and Recommendations: The findings of the current study demonstrated a high frequency of malnutrition in children, which is strongly linked to parasitosis and anemia. Therefore, we advise highlighting the significance of anemia and parasitosis screening programs, with a particular emphasis on schoolchildren.

Keywords: Malnutrition; Anemia; Parasitosis.

Introduction

Malnutrition among school-age children is a serious worldwide health issue that has a significant impact on the prospects and general well-being of these susceptible groups [(1)]. Despite global efforts, the landscape of child malnutrition continues to evolve, marked by disparities and persistent threats to children and adolescents in developing nations [(1, 2)]. Malnutrition is an inadequate or imbalanced intake of essential nutrients and it consists of both under nutrition and over nutrition [(3)]. Malnutrition encompasses both under nutrition, characterized by an insufficient intake of essential nutrients leading to deficiencies, and over nutrition, marked by excessive consumption often resulting in obesity and related health issues [(3)].
It reflects a spectrum of dietary imbalances that can have profound impacts on health and wellbeing. Its challenges compromise health, educational attainment, and overall human development [(4-6)], acting as a formidable barrier to achieving Sustainable Development Goals (SDGs), particularly those related to health, education, and poverty alleviation [(2, 7)]. The public's mental health depends on eating a healthy diet, which also has an impact on academic achievement. Accordingly, several studies of the pediatric age group have found a substantial correlation between high consumption of sugar, fat, and fast food meals and poor academic achievement as well as numerous disorders like metabolic disease [(8, 9)]. These days, it's typical to skip one major meal, like breakfast. Breakfast is crucial for people's cognitive development, learning, and skill acquisition since it provides them with a variety of vital

micronutrients, such as vitamins, glucose, and others, which are crucial for the health of the brain and the caliber of its power and functions [10].

The World Health Organization has previously recommended that health professionals be encouraged to actively participate in promoting robust nutritional activities and that nutrition care be provided. In their communities, general practitioners (GPs) offer individuals and families comprehensive medical care. As a result, GPs interact with individuals, and patients anticipate receiving health information from their doctors [11, 12]. A child's school age is a dynamic time for both their physical and mental development. It spans the years 6–12, when childhood development is most active. Schoolchildren are particularly vulnerable to a number of health issues, including parasitosis, non-communicable diseases, and malnutrition [13].

Malnutrition in children is seen as a serious public health issue in developing nations, impacting not only the physical health of the kid but also their social, emotional, and spiritual well-being [14]. A state of malnutrition is characterized by an excess or shortage of calories, protein, and other nutrients that has quantifiable negative impacts on bodily processes and overall health [15]. Over 200 million school-age children worldwide suffer from stunting and underweight. More than one billion school-age children will have psychological and physical developmental disabilities by 2020 [16]. About 48% of school-age children in underdeveloped nations are underweight, and 52% are stunted [17, 18].

Another significant public health issue is anemia, which is defined as a condition when the hemoglobin concentration is below normal. Children's motor and cognitive development suffers, and adults become less productive at work [19]. Almost a quarter of the world's population suffers from anemia. There are notable differences in its incidence by sex and age. It affects about 47% of preschool children, 42% of pregnant women, 30% of non-pregnant women, and 25% of school aged children [20]. About 3.5 billion people worldwide are afflicted by parasitosis, of whom 300 million are symptomatic and 50% are schoolchildren. It is also regarded as a serious public health issue [21]. The growth and hemoglobin levels of youngsters are both impacted by parasites. Intestinal parasites primarily afflict school-age children, who also experience the highest morbidity rates from these parasites [22].

They experience the highest prevalence of parasite infections, which manifest mostly as malnutrition, low appetite, food indigestion; mal-absorption, growth retardation, and anemia. Malnutrition and parasitosis anemia together have detrimental effects on a child's growth and development [23]. Therefore, the assessment of nutritional status is essential for making development towards improving overall health of the school age children [24]. The aim of this study is to assess the nutritional status and to identify the associated risk factors of malnutrition among children in primary healthcare centers in Saudi Arabia.

Materials and Methods

A Cross sectional study was conducted in primary healthcare centers in Makkah, Saudi Arabia from January to October 2024. The age range for inclusion was 6–12 years old. Children with long-term conditions that impact their development, such as diabetes mellitus, thyroid disorders, renal disorders, or congenital heart disease, were excluded. Additionally, children under the age of six or older than twelve, as well as those using iron supplements or anti-parasitic drugs at the time of the trial, were not allowed to participate. Convenient sample among 341 children aged from 6 to 12 years was obtained.

The data were collected by three methods: structural questionnaire, clinical examination and laboratory investigations. **Structural questionnaire includes:** ***first part was socio-demographic and socioeconomic data*** (age, sex, order of birth, family number, number of rooms, parents education and occupation, house hold income) using questionnaire developed by El Gilany et al., (2012) [25]. ***Second part was dietary habits and feeding pattern*** were obtained through adopted questionnaire from Mt (Mount) Washington pediatric hospital Feeding day treatment program family questionnaire (validation was done by translation and back translation and revision by three experts). Dietary habits were studied depending on questions addressed as regard daily and weekly consumption of the common food groups [26]. Food types which assessed were (dairy milk products, egg, meat, fish, starchy food, oily food, fruit and vegetables, fresh fruit juice and junk foods). The frequency of consumption of each food item was counted as follow: Never (no time/week), sometimes (1-2/ week), usually (3-4/week), regularly (every day).

Clinical examination includes: ***General examination*** for the presence of Pallor, jaundice, organomegally, abdominal pain, itching, nails clubbing, palpitation, and headache. ***Hair examination*** for hair lice presence; ***Anthropometric measures***: Body weight and height were measured. Children weights were recorded by using scale to the nearest 0.1 kilogram (Kg). Children were told to wear light clothes and no shoes. Heights were measured to 0.1centimeters (Cm) with a wooden stadiometer placed on a flat surface. **Laboratory investigations:** Include (blood examination for Hb detection and stool analysis).

Pilot study was carried out on 10 % of study sample attending in primary healthcare centers in Makkah, Saudi Arabia to test the questionnaire with the most appropriate terms (as regard understanding, consistency and clarity), It also helped estimation of the time needed for data collection. Those children were excluded from the main study sample. The time needed for filling the questionnaire ranged from (10 to15) minutes. Each selected children was interviewed in private room to fill the questionnaire and to be examined clinically, after that the samples were taken to the lab for doing tests. An official permission was obtained from ethical committee of the primary healthcare centers.

Discussion had been taken with the directors of primary healthcare centers regarding the purpose and the contents

of the data collection tools, and permission was obtained to conduct the study. Children and their parents (guardian) were informed about the objective of the study; they had the right to accept or refuse to participate in the study. An informed written consent was obtained from the parents (guardian).
Data were checked, entered and analyzed using SPSS version 28 for data processing. The data were presented as frequency and tables. The independent t –test was used to examine the difference in quantitative data. Chi Square test or Fishers exact test, (which over appropriate) was used to examine the differences for qualitative data. Univar ate logistic regression analysis had been used to clarify the independent variables that are significantly related to the outcomes (anemia, parasitic infestation, underweight and stunting) between the children who were involved in the study. ORS (odds ratio) and CIs (confidence intervals) were calculated. For all above-mentioned statistical tests done, the threshold of significance was fixed at 5% level (P-value) when; P value of > 0.05 indicates non-significant results. P value of < 0.05 indicates significant results.
Calculation and scoring of the socioeconomic level was based on the modified social score for family social leveling (Modified by El-Gilany et al., 2012) and had been classified into: High social state: Score (63) or more, Moderate social state: Score (43-62), Low social state: Score (22-42), Very low social state: Score (0-21). To assess nutrition status of the students, anthropometric measurements were used. Weight, height and age data were used for calculation Z-score. The obtained values were assessed with reference to the (WHO/NCHS) World Health Organization/ National Center for Health Statistics [27]. Underweight defined as weight for age less than 2SD, While stunted defined as height for age less than 2SD. Students older than 10 years (NO= 113) defined as body mass index for age (BMI/A) z- scores{underweight(<-2SD) or obese (>+2SD)}. Students were classified as anemic if hemoglobin concentration was less than 11.5g/dl [28].

Results

Table (1) shows that the mean age of the studied group was (9.1±2) ranged from (6-12), (50.1%) of them are females and (80.1%) are of moderate social class.

Table (1): Socio-demographic characteristics of the studied group (341):

Variable	**The studied group(341)**	
Age (years):	**mean ± SD** 9.1±2	
	Range (6-12)	
	Median 9	
Variable	**NO (341)**	**%**
Age group		
6-9years	184	53.9%
>9 years	157	46.1%
Sex		
Male	170	49.9%
Female	171	50.1%
Socio-economic class		
Low	43	12.6%
Moderate	273	80.1%
High	25	7.3%

SD: Standard deviation No: Number

Table (2) shows that the prevalence of stunting and underweight in the study group was (21.4%) and (21.9%) respectively, Anemia prevalence was 53.1%, parasitosis prevalence was 32.8%, while hair lice prevalence was 10.9%.

Table (2): Prevalence of Stunting, Underweight, Anemia, Parasitosis and Hair lice in the studied group (341)

Variable	**NO(341)**	**%**
Stunting		
No	268	78.6%
Yes	73	21.4%
Weight		
Normal	257	75.4%
Underweight	75	21.9%
Overweight	9	2.6%
Anemia		
No	160	46.9%
Yes	181	53.1%
Parasitosis		

Variable	NO(341)	%
Absent	229	67.2%
Present	112	32.8%
Hair lice		
Absent	304	89.1%
Present	37	10.9%

NO: Number

Table (3) shows that the underweight, parasitosis and socio-economic level were the significant predictor risk factors for stunting in the studied group.

Table (3): Uni-variate analysis (Logistic regression) for the potential risk factors for stunting in the studied group (341)

Variable		Stunting	Prevalence	Odds Ratio	CI	p-value
		No				
Age				1.1		
6-9	184	30	16.3		(0.3-5.3)	
9-12	157	43	27.4			0.6
Sex				0.5		
Male	170	50	29.4			
Female	171	23	13.5			
					(0.4-5.5)	0.9
Socio-economic level				2.6		
Moderate and high	298	63	21.1		(1.6-4.8)	**0.003***
Low	43	10	42.9			
Anaemia				1.6		
Absent	160	29	18.1		(1.1-6.7)	0.4
Present	181	44	24.3			
parasitosis				3.1		
Absent	229	51	22.3		(1.2-4.2)	**0.005***
Present	112	22	59.4			
Hair lice				1.5		
Absent	304	36	11.8		(0.7-5.8)	0.09
Present	37	37	100.0			
Underweight				7.3		
Absent	266	8	3.1		(1.2-3.4)	**0.001****
Present	75	65	86.7			

NO: Number

CI: Confidence Interval

Table (4) shows that the underweight was found to be high among students aged below 9, male students and those of low socioeconomic class.

Table (4): Comparing weight as regard socio-demographic characteristics of the studied group (341)

	Weight						Total		χ^2
	Normal No(257)	%	*Underweight* No (75)	%	*Over-weight* No (9)	%	*NO*	%	p-value
Age									
6-9years	152	82.6	29	15.8	3	1.6	***184***	100%	11.4
>9years	105	66.9	46	29.3	6	3.8	***157***	100%	**0.003***
Sex									
Male	126	74.1	42	24.7	2	1.2	***170***	***100%***	8.1
Female	131	83.4	33	19.3	7	4.1	***171***	***100%***	**0.02***
Socio-economic level									
Low	31	72.1	9	20.9	3	7.0	***43***	***100%***	11.6
Moderate	202	74.0	66	24.2	5	1.8	***273***	***100%***	**0.02***
High	24	96.0	0.0	0.00	1	4.0	***25***	***100%***	

*Statistically significant difference (P ≤ 0.05) NO: Number

Table (5) shows that the stunting, anemia and parasitic infestation were significantly related to underweight.

Table (5): Comparing weight as regard stunting, anemia, parasitosis and hair lice in the studied group (341):

	Normal **No(257)**	**%**	***Underweight*** **No (75)**	**%**	***Over-weight*** **No (9)**	**%**	**Total N0(341)**	**%**	**χ^2**	**p-value**
Stunting										
Absent	207	77.2	52	19.4	9	3.4	***268***	***100%***	6.8	
Present	50	68.5	23	31.5	0.0	0.00	***73***	***100%***		**0.03***
Anemia										
Absent	134	83.7	20	12.5	6	3.8	***160***	***100 %***	16.6	
Present	123	68.0	55	30.3	3	1.7	***181***	***100%***		**0.001****
Parasitosis										
Absent	183	79.9	38	16.6	8	3.5	229	100 %	13.8	
Present	74	66.1	37	33.0	1	0.9	112	100 %		**0.001****
Hair lice										
Absent	231	76	64	21.1	9	2.9	304	100 %	2.3	
Present	26	70.3	11	29.7	0.0	0.00	37	100 %		0.3

* *Statistically highly significant difference (P ≤ 0.001) NO: Number

Table (6) shows that the highly daily consumed food staff by the studied group is starchy food (94.7%) followed by oily food (74.7%) , junk foods (73.6%) then fruit and vegetables(50.1%).

Table (6): Food pattern among the studied group (341)

Food staff	**No**	**%**
Dairy milk products		
Every day	133	39
Usually (3-4/week)	145	42.6
Sometimes (1-2/week)	54	15.8
Never	9	2.6
Meat		
Every day	00	00
Usually (3-4/week)	98	28.7
Sometimes (1-2/week)	241	70.7
Never	2	0.6
Fish		
Every day	00	00
Usually (3-4/week)	17	4.5
Sometimes (1-2/week)	273	80
Never	51	15.5
Fruit and vegetables		
Every day	171	50.1
Usually (3-4/week)	151	44.3
Sometimes (1-2/week)	17	5
Never	2	0.6
Starchy food (rice,macron,etc)		
Every day	323	94.7
Usually (3-4/week)	13	3.8
Sometimes (1-2/week)	5	1.5
Never	0	0
Oily food		
Every day	255	74.7
Usually (3-4/week)	73	21.4
Sometimes (1-2/week)	7	2.1
Never	6	1.8
Junk foods		
Every day	251	73.6
Usually (3-4/week)	83	24.3

Sometimes (1-2/week)	5	1.5
Never	2	0.6

Discussion

All types of childhood malnutrition are serious health issues that are linked to a high death rate in children under five and a loss of years of healthy adult life [29]. The total frequency of stunting and underweight in children varies greatly among nations, despite the fact that it is most common in underdeveloped nations [18].The current investigation was carried out in Makkah, Saudi Arabia, at basic healthcare facilities. The cumulative deficient growth linked to long-term causes such insufficient food intake and poor health conditions brought on by recurring infections, an unpleasant environment, low socioeconomic position, and poor cleanliness is known to be measured by stunting [27].

In Egypt, data shows that there has been an increase in the stunting prevalence among children from 17.6% to 28.9% in recent years [30]. Saudi Arabia is 'on course' to meet the target for stunting, with 9.3% of children under 5 years of age affected, which is lower than the average for the Asia region (21.8%). There is insufficient data to assess the progress that Saudi Arabia has made towards achieving the target for wasting; however, the latest prevalence data shows that 11.8% of children fewer than 5 years of age are affected. This is higher than the average for the Asia region (8.9%) and among the highest in the world. The prevalence of overweight children under 5 years of age is 6.1% and Saudi Arabia is 'off course' to prevent the figure from increasing [31].

In the present study, prevalence of stunting is 21.4%, which is less than what was stated in a survey conducted earlier study that was 34.2% [30]. It was also less than what was reported in a survey conducted Abdel Aziz et al., (2015) [18] the prevalence of the stunted children was 53.2%. Underweight is usually used as a composite indicator to reflect both acute and chronic under nutrition, However it can't differentiate between them. In the present study, underweight prevalence is 21.9% which is higher than what was reported from estimated data where underweight prevalence was 10.0% and 3.4% respectively [18, 32]. This difference may be the result from the fact that the population studied included both urban and rural areas with different socio-demographic characteristics than what is recorded in the present study.

A study was conducted in rural region in India estimated that the prevalence of stunting was 32% and underweight was 70% [33]. In Turkey, only 5.7% of children were stunted [34]. In Nigeria, the prevalence of stunting and underweight was 17.4%, 19.8% respectively, among children. This difference can be the result of their social, demographic, economic, nutritional intake, and culture differences between them [35]. The present study estimated that 53.1% of the examined children were anemic. Although anemia prevalence is high, it is less than what was reported in a survey conducted earlier; where the prevalence of anemia was (59.3%) [36].

This finding is higher than other related studies done in developing countries. In Uganda, more than one third of the children were anemic [29]. It was (35.8%) among Saudi Arabia female aged 6-12 years and (36.4%) among Vietnamese school age children [37]. The high prevalence reported in the present study may be related to high rate of parasitic infection and poverty between the study population that result in poor access to adequate diet and proper health care.

The prevalence of parasitosis in current study is (32.8%). This is similar to data reported from a survey among children in Egypt where prevalence of intestinal parasitic infection was 37% [38]. On contrast, the prevalence of parasitic infection among children in Gondar, Ethiopia was lower than our results (22.7%) [39]. Differences in behavioral, hygienic, environmental or climatic conditions may be the cause of variations in the prevalence of infection. The present study showed that parasitosis (stunting is more 3.1 time in children with parasitosis), underweight (stunting is more 7.3 time in underweight students) and socioeconomic class (stunting is more 2.6 time in low Socioeconomic class) were the most significant predictor of stunting. This is in contrast with previous studies in Egypt, China, Peru and Tanzania, which demonstrated that parasitosis was the only significant predictor of stunting [23].

The results showed that children above age of 9 years were more stunted than those < 9 years but with no statistical significance. This is in agreement with previous studies [23]. This is may be due to inadequate nutrient intake and increase requirement because of increase growth rate. In relation to gender, our findings revealed that there is no significant difference reported in stunting prevalence, while underweight was significantly higher in males (24.7%) than females (19.3%). These results are similar to the EDHS one (Egypt Demographic and Health Survey), which was conducted on the never-married female, male youth and young adults (10 -19 years). The EDHS study showed that males (5.0%) were more underweight than females (3.0%) in the age group (10–19 years), with higher prevalence in rural areas [40].

However, in another survey it has been reported that females were more underweight than males [30]. Bhargava et al., (2015) [41] reported that females were more stunted and underweight than males especially in rural schools in India. This may be explained by the cultural preference of boys over girls in rural areas which might translate into a better chance for adequate food. The results showed that underweight was high among students of low socioeconomic class. It is found to be significantly associated with anemia (30.3 of anemic children are underweight). Parasitosis results in poor appetite and decrease food intake leading to decrease the growth rate [23]. This is in agree with the result of the present study where underweight is significantly associated with parasitosis (33.0 of students with parasitosis are underweight).

The finding of this study showed that the contribution of starchy foods, oily food and junk foods was higher than that of dairy milk products, meat, fish, fruits and vegetables; this is in agreeing with a study conducted in Nigeria,

where starchy food was the major stable food of the people. That's may be due to lack of nutritional knowledge of the students, high price of food and low/moderate socioeconomic status. Such scenario could impact on the children's nutritional status [42]. In this regard, the nutritional status of children in the developing countries should be emphasized for the improvement of health of children in the coming generation.

Conclusion

The results of the current study demonstrated a high frequency of stunting and underweight in children, which is strongly linked to anemia and parasitosis. Anemia, parasitosis, and school-age children's anthropometric status are positively correlated. Therefore, we advise highlighting the significance of anemia and parasitosis screening programs (early diagnosis and treatment even being symptomatized).Malnutrition and anemia control programs in low- and middle-income countries can also include health education, good nutritional knowledge, personal hygiene, a safe water supply, good sanitation, and school feeding programs that include micronutrient supplements and feeding.

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