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ORIGINAL ARTICLE

Assessment of Nutritional Status of Rural Primary School Students at Abu-Kbeer District, Sharkia Governorate

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ABSTRACT

Background: Malnutrition is one of the leading causes of morbidity and mortality in childhood worldwide. **Aim of the study:** to evaluate overall prevalence of malnutrition, and to assess influence of selected risk factors upon nutritional status, through assessment of nutritional status of rural school children (6-12 years) of Abu-Kbeer district, Sharkia Governorate, measurement of Hb level, and identification of factors associated with malnutrition of the studied group.

Subjects and methods: a cross section study was conducted in Abu-Kbeer district, Sharkia Governorate during the academic year 2017-2018 on 1732 rural school students (6-12 years), all were subjected to hemoglobin estimation, measurement of weight and height and calculating BMI and assessment of socio- demographic status , feeding practices and diet quality through a semi-structured Arabic questionnaire for their parents.

Results: 8.4% of the students were stunting, 12% were underweight, 5.5% were overweight, 7.4% were obese and 58.5% were anemic.93.5% had incomplete diet. Anemia is statistically significantly associated with female sex, very low social class, incomplete diet, stunting and underweight. No significant association was detected between anemia and age.

Conclusion: prevalence of malnutrition is high among rural school students; and anemia is strongly associated with incomplete diet. We recommend increasing public awareness especially mothers about nutritional needs of children.

Key words: Nutritional status**,** school students**,** assessment, malnutrition.

INTRODUCTION

The term malnutrition refers to both undernutrition and overnutrition [1]. Undernutrition (stunting and underweight) is the most common type of malnutrition among children in developing countries causing low school enrolment, impaired immune systems and lowered productivity [2].

Overweight children are more at risk for adult health problems such as heart disease [3]. Obese children are at greater risk for joint problems, sleep apnea and psychological problems [4].

The best global indicator of children's well-being is growth. Assessment of growth is the single measurement that best defines the nutritional status of children. [5].

Iron deficiency anemia is considered the most common nutritional deficiency around the world [6]. Potential consequences of iron deficiency include depressed immune function, impaired cognitive functioning, decreased school performance, and impaired growth [7].

In Egypt, according to EDHS, 25% of children aged 5-19 years are overweight,10% are obese, 2% or less were thin or severely thin, and 20% were anemic [8].

Rationale:

The school age is the prime time to build up body nutrient stores in preparation for rapid growth of adolescence. Malnutrition remains one of the world's highest priority health issues, because of its widespread and long lasting effects, and it can be eradicated.

Therefore, it becomes very important to know the nutritional status of school going children. Where, the best global indicator of children's well-being is growth. Assessment of growth is the single measurement that best defines the nutritional status of children.

Aim of the study: to evaluate prevalence of malnutrition, and to assess influence of selected risk factors upon nutritional status.

Objectives: to assess nutritional status, to measure Hb level and to identify factors associated with malnutrition in rural school children (6-12 years) of Abu-Kbeer district, Sharkia Governorate during the period of 8 months,

Subjects and methods:

Study design and type of study : A cross section study was conducted in rural schools in Abu-Kbeer district, Sharkia Governorate during the academic year 2017-2018.

Target population: rural school children (6-12 years).

Sample size: was calculated using Epi-info program version 6.04 using the following: the number of rural school children (6-12 years) of Abu-Kbeer district was 34230 (Administration of statistics and data at the Educational Directorate Abu-Kbeer District, 2017) and the prevalence of malnutrition was 5 % among the same age group [9]. At confidence level 95%, 80% statistical power of test, and 10% non response, so the estimated sample size was 1732 student.

Sampling technique: Multistage sampling technique was used. 10 schools out of 45(assuming that each class include 30 students in each grade (6 grades) so we select 180 students from each school , the calculated sample was near to 1800 students , so we selected randomly 10 schools to complete the sample) schools were randomly selected from Abu-Kbeer district (simple random) (1st sampling stage). One Class from each grade was selected randomly from each chosen school (6 classes from each chosen school, 60 classes) (2nd sampling stage). All pupils in these chosen classes (about 30 students) were included in the study as a cluster sample (3rd sampling stage).

Data collection: Each school needed 7 visits. letters were sent to the parents, including (the purpose, activities, informed consent, and questionnaire sheets).

Tools used included: The semi-structured Arabic questionnaire included 2 sections:

-Socio- demographic data of the studied students including age, sex and 7 domains; 1- Education and cultural domain for both mother and father (assess the highest level of education of both and ways to access to health information). 2- Occupation domain for both mother and father. 3- Family domain (assess the residence, number of family members, number of earning family members, and education of siblings). 4- Economic domain (assess income from all sources, governmental support, and tax payment).

5- Family possessions domain.

6- Home sanitation domain (assess available services, type of house, and crowding index).

7- Health care domain (assess the usual source of health care) [10].

- Assessment of feeding practice; amount of food taken from each food item [11].

Measurements: measurement of weights (kg) after checking the electronic scale for accuracy, to the nearest 0.1 kg with students wearing light clothing and without shoes, and measurement of students' height to the nearest 0.1 cm with a wooden stadiometer on flat surface.

Investigations: All participants were subjected to estimation of hemoglobin level by using The DiaSpect Hemoglobin T System (98.1% sensitivity) [12],

Pilot test:

Before the start of the study, the questionnaire was pre-tested on 20 parents of students, not included in final analysis, to evaluate applicability of the questionnaire , ensure that the wording, format, length, and sequencing of questions are appropriate, the necessary modifications were done then the questionnaire was tested for validity and reliability.

Data management:

Scoring of socio-economic status: Total scoring of the 7 domains is 84. Socio-economic status is classified into 4 socioeconomic levels according to the 3 quartiles depending on the score calculated:

Score 0-21 (very low), > 21-42 (low), > 42-63 (middle), > 63-84(high) [10].

Scoring for evaluation of hemoglobin (%): Children aged between (6 -< 12years) and (12years) were considered anemic if their Hb level was below 11.5 and below 12 respectively [13]**.**

Scoring for evaluation of quality of diet: The students were considered taking complete diet or incomplete diet if they took or didn't take respectively the recommended daily requirement from each food item (as shown in the following table) [11].

Food group	*No. of daily servings*	
	(6 -8)years of age	*(9- 12)years of age*
Grains	5 ounces	5 ounces
Vegetables	1½ cups	2 cups for girls 2½ cups for boys
Fruits	1 to 1½ cups	1½ cups
Dairy milk and milk products	2½ cups	3 cups
Meat or meat substitutes	4 ounces	5 ounces

The Anthropometric indices were calculated: using the 2000 CDC Growth Charts for children and adolescents from ages 2 to 20 years [14]**:**

Height for age percentile: The charts use the 5th and the 95th percentiles as the outermost percentile cutoff values indicating abnormal growth.

BMI for age percentile: The body mass index "BMI"/age for males and females charts was used to determine the body status as follows:

Underweight: < 5th percentile

Normal weight: 5th - <85th percentile

Overweight: 85th - <95th percentile

Obese: > 95th percentile.

Computer using Statistical Package of Social Services version 22 analyzed the collected data (SPSS) [15]**.** Data were represented in tables and graphs as frequencies and percentages. Suitable statistical tests of significance including Chi-square and correlation co-efficient tests were performed. The results were considered statistically significant when the significant probability ≤ 0.05.

Administrative and Ethical consideration: An official permission from Zagazig University, Faculty of medicine was taken to the selected rural primary schools. The title and objectives of this study were explained to them to insure their cooperation. Approval of the study protocol by the institutional review board (IRB) taking the number (2549) at 28/2/2016. The local authority and headmaster of schools were informed about the nature and steps of the study and written consent was taken. The Students and their parents were informed about the nature and the purpose of the study and informed consent was taken from their parents before their participation. Students' data were confidential.

RESULTS

In our study, 1732 rural school going students (6-12 years) were included; nearly 59.4% of our students were between (9-12) years old. With nearly equal percents of boys and girls (50.8 %, 49.2%) respectively. About 47.5% of families were of low social class.

Nearly 58.5% of our studied students were anemic **(Figure 1)**.

Figure (2) demonstrated that 81.7 % were of normal height for age, while 8.4 % were stunted and 9.9 % were tall.

Figure (3) showed that 75.1% were of normal weight, twelve percent of the students were underweight, 5.5 % were overweight and 7.4% were obese.

As regard feeding practices and diet quality, 93.5% had incomplete diet; about 30% did not eat fruits and vegetables, nearly 40% did not take milk. Also, 29.5% took sufficient vegetables, and 12.5% took sufficient dairy products. About 35.7% took sufficient fruits, 63.9 % took sufficient protein sources, and 94.9% took sufficient carbohydrates.

Table (1): showed that there was significant association between anemia and sex, social

class, diet type, height for age and BMI for age.

Table (2): showed that there was significant association between height for age and age, sex, social class, diet type and BMI for age.

Table (3): showed that there was significant association between BMI for age and age, sex, social class, and diet type.

Table (4): showed that female children were three times likely to be anemic. children of very low social class were 1.5 times to be anemic , children with incomplete diet were 22 times more likely to be anemic, stunted children were twice times to be anemic, underweight children were 3 times more likely to be anemic. No significant association was detected between anemia and age.

Table 1. Relation between anemia and risk factors:

Variables	Normal		Anemic		X2 Test	P value
	(n=718)	%	(n=1014)	%		
Age:						
-6-< 9 years (n=704)	281	39.1	423	41.7		
-9-12 years (n=1028)	437	60.9	591	58.3	1.1	> 0.05*
Sex:						
-Boys (n=879)	488	68	391	38.6	145.4	< 0.001**
-Girls (n=853)	230	32	623	61.4		
Social class:						
-Very low (n= 321)						
-Low (n= 823)	110	15.3	211	20.8		
-Middle (n=563)	311	43.3	512	50.5	35	< 0.001**
-High (n=25)	280	39.0	283	27.9		
	17	2.4	8	0.8		
Diet type:						
Complete (n= 113)						
Incomplete (n= 1619)	105	14.6	8	0.8	132	< 0.001**
	613	85.4	1006	99.2		
Height for age:						
Stunted (n=145)	39	5.4	106	10.5		
Normal (n= 1415)	630	87.8	785	77.4	30	< 0.001**
Tall (n= 172)	49	6.8	123	12.1		
BMI for age:						
Underweight (n=208)	41	5.7	167	16.5		
Normal weight(n=1300)	588	81.9	712	70.2	53	< 0.001**
Overweight (n=96)	46	6.4	50	4.9		
Obesity(n=128)	43	6	85	8.4		

***P > 0.05 is non significant**

****P ≤ 0.001 is highly significant**

Table 2. Relation between height for age and risk factors:

Variables	Stunted (n=145)	%	Normal (n=1415)	%	Tall (n=172)	%	X2 test	P value
Age:								
6- < 9 years (n=704)	76	52.4	563	39.8	65	37.8		
9-12 years (n=1028)	69	47.6	852	60.2	107	62.2	9.3	< 0.05*
Sex:								
-Boys (n=879)	58	40	738	52.2	83	48.3	8.3	< 0.05*
-Girls (n=853)	87	60	677	47.8	89	51.7		
Social class:								
-Very low (n= 321)	38	26.2	258	18.2	25	14.5		
-Low (n= 823)	82	56.6	656	46.4	85	49.4		
-Middle (n=563)	25	17.2	488	34.5	50	29.1	36.0	< 0.001**
-High (n=25)	0	0.0	13	0.9	12	7.0		
Diet type:								
Complete (n= 113)	2	1.4	81	5.7	30	17.4		
Incomplete (n= 1619)	143	98.6	1334	94.3	142	82.6	10.8	< 0.05*
BMI for age:								
Underweight (n=208)	91	62.8	97	6.9	20	11.6		
Normal	45	31.0	1218	86.1	37	21.5	948.	
weight(n=1300)	9	6.2	53	3.7	34	19.8	8	< 0.001**
Overweight (n=96)	0	0.0	47	3.3	81	47.1		
Obesity(n=128)								

***P < 0.05 is significant**
****P ≤ 0.001 is highly significant**

Table 3. Relation between BMI for age and risk factors:

Variables	Underweight		Normal		Overweight		Obese		X2 Test	P value
	(n= 208)	%	(n=1300)	%	(n=96)	%	(n=128)	%		
Age:										
6-< 9 years (n=704)	95	45.7	550	42.3	13	13.5	46	35.9	39.0	<0.001**
9-12 years (n=1028)	113	54.3	750	57.7	83	86.5	82	64.1		
Sex:										
-Boys (n=879)	74	35.6	713	54.8	57	59.4	35	27.3	58.8	<0.001**
-Girls (n=853)	134	64.4	587	45.2	39	40.6	93	72.7		
Social class:										
-Very low (n= 321)	54	26.0	224	17.2	13	13.5	30	23.4		
-Low (n= 823)	110	52.8	621	47.8	58	60.4	34	26.6		
-Middle (n=563)	44	21.2	442	34.0	25	26.1	52	40.6	113.	<0.001**
-High (n=25)	0	0.0	13	1.0	0	0.0	12	9.4	8	
Diet type:										
Complete (n= 113)	0	0.0	113	8.7	0	0.0	0	0.0		
Incomplete (n= 1619)	208	100. 0	1187	91.3	96	100. 0	128	100. 0	40.2	<0.001**

***P < 0.05 is significant**

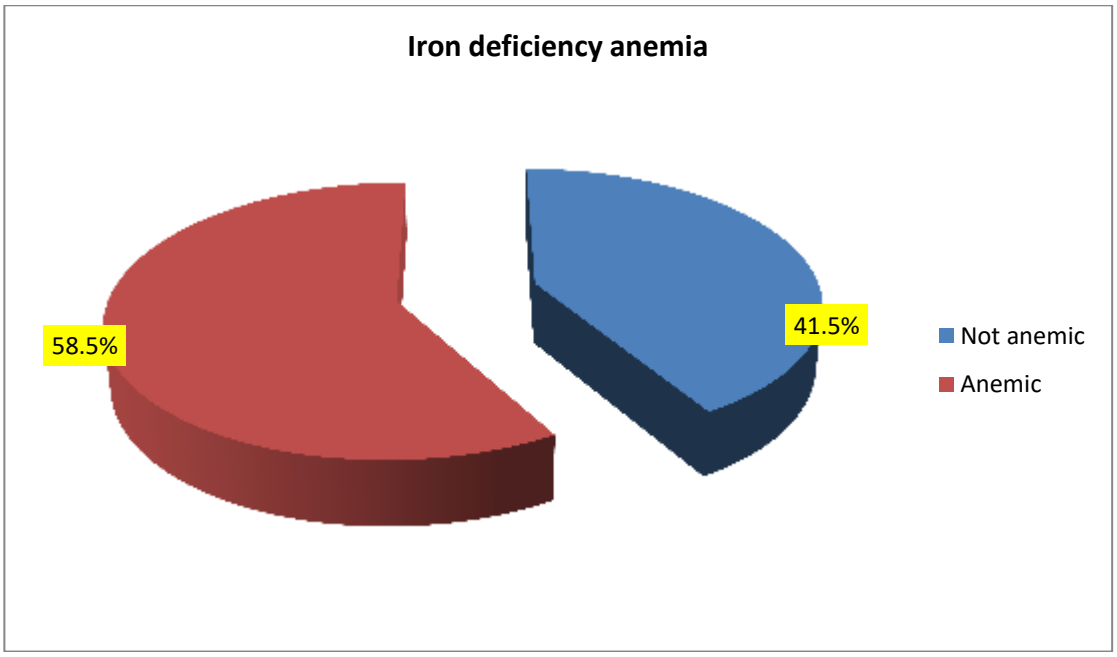
****P ≤ 0.001 is highly significant**

Table 4. Multivariate analysis determinants of anemia among the studied school children:

Variables	OR	C.I (95%)	P value
Age			
-6-< 9 years	1.11	(0.915-1.35)	> 0.05*
-9-12 years	0.89	(0.739-1.09)	> 0.05*
Sex			
-Boys	0.29	(0.24-0.361)	< 0.001**
-Girls	3.37	(2.76-4.13)	< 0.001**
Social class:			
-Very low	1.45	(1.12-1.87)	< 0.001**
-Low	1.33	(1.10-1.61)	< 0.001**
-Middle	0.60	(0.49-0.74)	< 0.001**
-High	0.32	(0.14-0.76)	< 0.001**
Diet type:			
Complete	0.04	(0.02-0.09)	< 0.001**
Incomplete	21.53	(10.42-44.51)	< 0.001**
Height for age:			
Stunted	2.03	(1.38-2.97)	< 0.001**
Normal	0.47	(0.36-0.62)	< 0.001**
Tall	1.88	(1.33-2.66)	< 0.001**
BMI for age:			
Underweight	3.25	(2.27-4.64)	< 0.001**
Normal weight	0.52	(0.41-0.65)	< 0.001**
Overweight	0.75	(0.50-1.14)	> 0.05*
Obesity	1.43	(0.98-2.10)	> 0.05*

***P > 0.05 is non significant**

****P ≤ 0.001 is highly significant**



Cutoff points for diagnosis of anemia:-

- **Hb (g/dL) <11.5 (Children aged between 5-<12 years).**
- **Hb (g/dL) <12 (Children aged between 12-14 years).**

Figure 1. prevalence of iron deficiency anemia among our studied students.

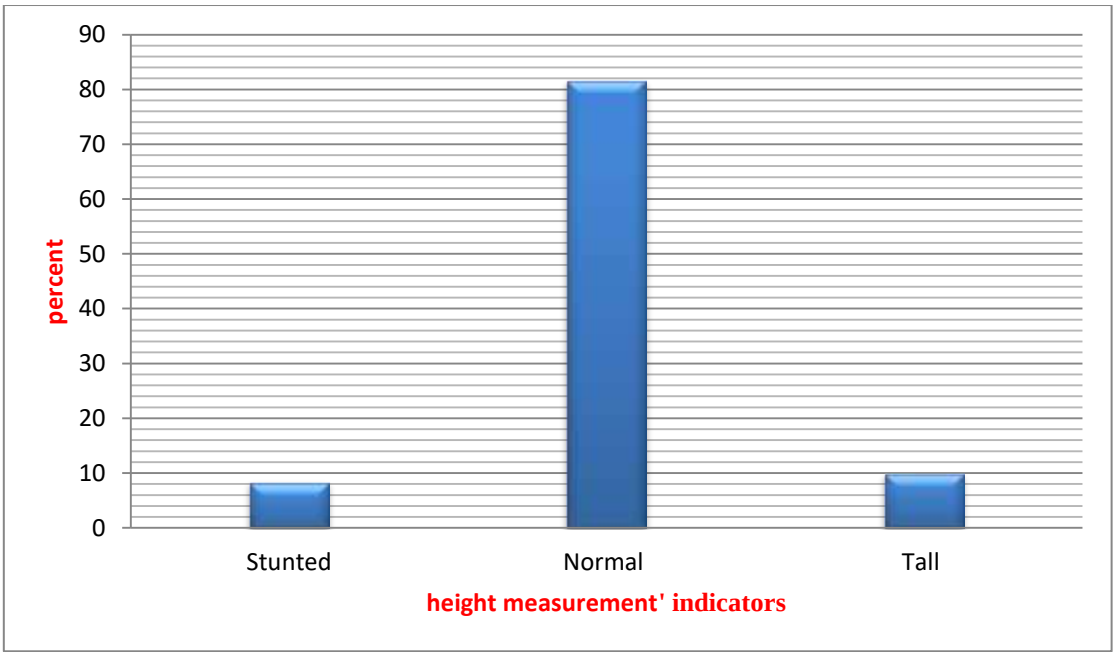


Figure 2 height measurement' indicators in the studied sample

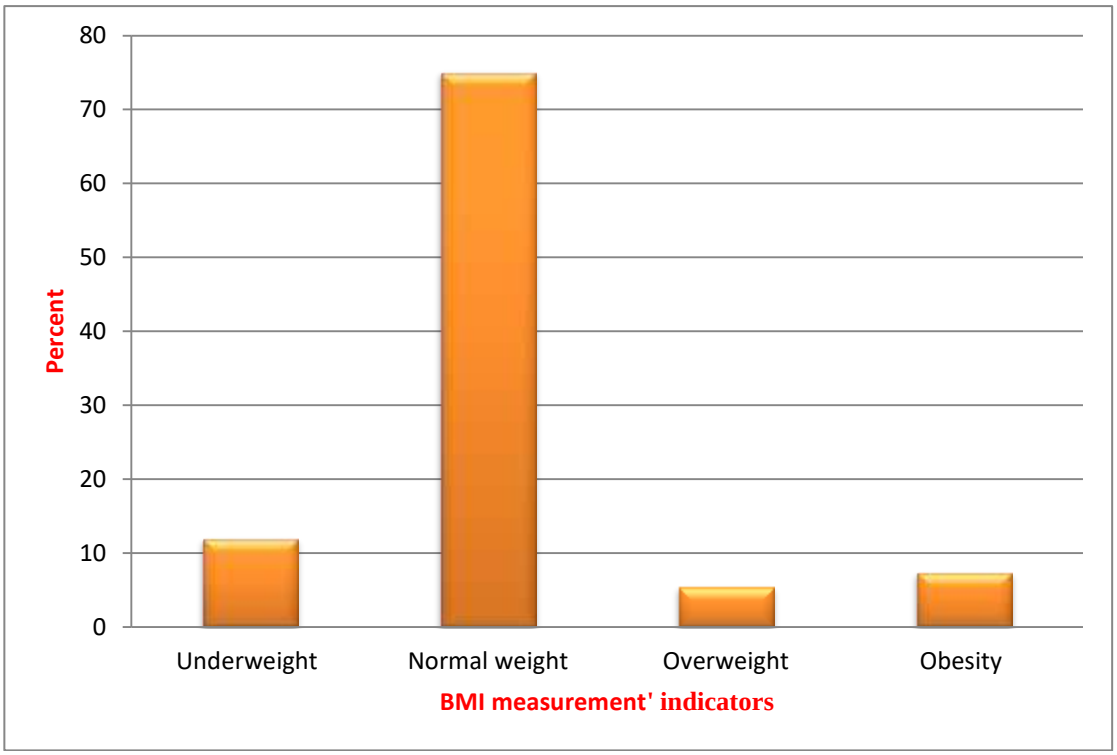


Figure 3. BMI measurement' indicators in the studied sample

DISCUSSION

Malnutrition remains one of the world's highest priority health issues. Iron deficiency is the most common nutritional deficiency worldwide especially in developing countries. Stunting is likely to impact brain development and impair motor skills. In our study, 58.5% of our studied students were anemic **(Figure 1)** which is less than **Bhoite and Iyer** who found that 73% of school children were anemic [16] and higher than **(Emam et al., 2005)** in Egypt who found that prevalence of iron deficiency anemia among studied students was (19.8%) [17]. Our high prevalence, mainly due to low intakes of total dietary iron, high consumption of non-heme compared to heme iron. **Figure (2)** demonstrated that 81.7 % were of normal height for age, while 8.4 % were stunted, and 9.9 % were tall. Our result was in agreement with **Agarwal et al.** where most of his students were of normal height (88%), while (12%) were stunting [18]. Higher prevalence of stunting was found by **Sarma et al.** in who found that prevalence of stunting among students was (32.2%)[19]**.** This can be explained by the social, demographic, economic, nutritional intake and culture differences between them. In current study, 75.1% were of normal weight, 12 % were underweight, 5.5 % were overweight and 7.4% were obese (**Figure 3).** Our result was in agreement with **El-Zanaty** who stated that according to EDHS, 60% of children aged 5-19 years had normal BMI, 2% of children were thin, 25% were overweight, and 11% were obese [8]**.** Our results were not in accordance with **Emam et al.** [17] in Egypt where 69.3% of the students were underweight and 23.6% were normal weight, 5% were overweight and 2% were obese. This difference can be explained by the fact that slum areas, where this study was carried out, are characterized by adverse living conditions mostly worse than rural areas. In our study, 93.5% of the students had incomplete diet; 30% did not eat fruits and vegetables, 40% did not take milk. 29.5% took sufficient vegetables, 12.5% took sufficient dairy products. 35.7% took sufficient fruits, 63.9 % took sufficient protein sources, and 94.9% took sufficient carbohydrates. These findings were in agreement with **Ayogu et al.** [20]

who stated that about 70% of the students took inadequate energy.

Table (1) showed that no statistical significance difference was found between anemia and age**.** And 61.4% of the anemic group was girls**.** Also (50.5% and 43.3%) of anemic and normal Hb groups were of low social class respectively**.** However, these findings were not in accordance with **Alelign et al.** who found that the prevalence of anemia was nearly similar between male and female groups and between children with different socio-economic status [21]**.** In our study, anemic group was significantly more having incomplete diet than normal Hb group. Also we found that stunting was affecting (10.5% and 5.4 %) of the anemic group and the normal Hb group respectively. And (16.5% and 5.7 %) of the anemic and normal Hb groups were underweight for age respectively **(Table 1).** In the same line, **Taher et al.** stated that there is significant association between stunting and anemia [22]**.** (52.4%) of the stunting group was significantly among the younger age group (6-<9 years) group, 60% of the stunting group were girls. And 82.8% of the stunting group were of very low and low social classes **(Table 2).** Our results were in agreement with **Thilakarathne and Wijesinghe** [23] who found that stunting was significantly affecting girls more than boys. This can be explained by the effect of cultural preference for boys. Also **Francis et al.** [24] who found that the prevalence of stunting was significantly higher among children of low social class. This can be explained by that the poorer the families, the less quality and quantity of food that children can get. **Table (2)** also demonstrated that nearly all stunted children were having incomplete diet. Majority of normal height students were of normal weight which can be explained by that the growth of a child is a dynamic statement of the general health of that child, so different growth parameters are interrelated. Our results were in line with **Hassan et al.** [25] who found that stunting was higher among children with inadequate diet.

In this study, (86.5% and 64.1%) of overweight and obese groups were among older age group (9-12 years) respectively, also (72.7% and 64.4%) of obese and underweight groups were females respectively **(Table 3).** This was in line with **Hassan et al.** [25] who stated that girls had a significantly higher prevalence of underweight than boys which may be due to cultural preference for boys in rural areas which might translate into a better chance of adequate food. **Table (3)** showed that (78.8% and 73.9%) of underweight and overweight groups were of very low and low social classes respectively. All abnormal weight groups had incomplete diet. Underweight among low socioeconomic status children is mostly due to unavailability or bad quality of food. Obesity among people of low socioeconomic status can be explained by depending on starchy sheep carbohydrates in their diet. Our result was in line with **Igbokwe et al.** [26] who stated that underweight group were of low social class But, our result was in opposite to **Alelign et al.** [21] who stated that the prevalence of underweight was similar between children from different socio-economic status.

Table (4) showed that female children were three times likely to be anemic also children of very low social class were 1.5 times to be anemic, children with incomplete diet were 22 times more likely to be anemic. Stunted children were twice times to be anemic, also underweight children were 3 times more likely to be anemic. No significant association was detected between anemia and age. This result agreed with **Hashizume et al.** [27] who stated that the estimated risk of anemia was elevated in children with low social class than in children with high social class. And in contrast with **Alelign et al.** [21] who found that the odds of developing anemia was similar between children with different socio-economic status.

Conclusion: prevalence of malnutrition is high among rural school going students; the most prominent risk of anemia was incomplete diet**.** Other risks included female sex, very low social class, underweight, and stunting.

Recommendations: we recommend nutritional education for teachers and parents to enforce healthy eating habits among children and for children at schools to encourage healthy eating habits and exercises,

regular health examination and provision of food fortification and mid day meals to all the school children.

This work was fully funded by the authors.

Limitations:

-The current study is cross-section which does not establish causal relationship between anemia, malnutrition and the socio-demographic, and dietary habits among studied school students.

- Lack of cooperation of some parents regarding participation in our study.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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