

The Prevalence of Iron Deficiency Anemia and its Associated Risk Factors among a Samples of Primary Schools Students in Burao City, Somaliland

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ABSTRACT

Background: Anemia is a global public health problem affecting the majority of the population of the world in both developed and developing countries with major consequences on human health as well as social and economic development. It is the world's second leading cause of disability of the whole global disease burden. It affects 1.62 billion (24.8%) of the population among them it is affecting 305 million (25.4%) school age children (SAC).

Objectives: The main objective of this study was assess prevalence and factors associated with anemia among school-age children in primary schools in Burao city, Somaliland, 2020.

Materials & Methods: A school based cross sectional study design was done in four primary schools in Burao, Somaliland. About 285 school age children with in the age group between 6-14 years were selected with respondent rate of 93.4%. Random sampling was used to select schools and systemic random sampling used to identify children from the selected schools. Socio-demographic data was collected by using questionnaire & interview of respondents in addition to anthropometric measurement, hemoglobin measurement and stool examination. Complete Blood Counting (CBC) was used to determine the mean corpuscular (kor-PUS-kyu-lar) volume (MCV) and hematocrit (HMC) levels to detect of hemoglobin status of the children. Data was entered and analyzed using SPSS statistical software for Windows version 21. Anthropometric data was analyzed using WHO Anthro Plus. Bivariate logistic regression and multivariable logistic regression were used to identify independent predictors of anemia in-school adolescent girls. Statistical significance was set at $p < 0.05$.

Results: A total of 285 school age children were included in this study. The overall prevalence of anemia was (23.1%) (CI: 18.1%, 28.1%) with the mean and standard deviation of (12.7±1.59). Out of the anemic children, 20.4% were mild and 2.3% and 0.4% of them were moderate and severe respectively. Children's from illiterate mothers was (AOR = 2.37; 95%CI: 1.14, 4.94), consuming organ meat less than once a week (AOR = 2.19; 95%CI: 1.05, 4.43) and having parasites on stool were identified as statistically independent associated factors of anemia in school age children's from Burao, Somaliland.

Conclusion: Prevalence of anemia in Burao city, Somaliland primary schools was moderate public health problem in the current study area. Nutrition education, iron folic acid supplementation program, deworming, good hygiene and sanitation are play important role in the prevalence of anemia and we recommend to give them more attention from ministry education and ministry of health in Somaliland.

Keywords: Anemia, Primary Schools, Burao City, Age

Introduction

Anemia is a disease in which reduced hematocrit or hemoglobin levels lead to hemoglobin (Hgb) diminished oxygen-carrying capacity that does not optimally meet the metabolic demands of

the body, as a result of deficiency of one or more essential nutrients, heavy blood loss, parasitic infections and congenital hemolytic diseases [1]. Anemia is a global public health problem affecting the majority of the population of the world in both developed and

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developing countries with major consequences on human health as well as social and economic development. It is the world's second leading cause of disability of the whole global disease burden [1-3]. It is considered as a public health problem when the hemoglobin (Hb) value is below the population-specific Hb threshold. It can be classified as no, mild, moderate and severe public health problem when the prevalence is $\leq 4.9\%$, 5.0-19.9%, 20.0-39.9%, and $\geq 40\%$, respectively [4]. It affects 1.62 billion (24.8%) of the population among them it is affecting 305 million (25.4%) school age children (SAC) [5]. Despite implementation of control programs including iron supplementation, deworming and insecticide-treated bed net distribution, and anemia remains a major global concern in child health, especially in SSA [6]. While it may be difficult to separate the effects of anemia (low hemoglobin (Hb)) from those of its underlying biological mechanisms (eg, nutritional deficiencies, chronic infections, hemoglobinopathies), anemia has been independently associated with overall increased mortality in young children's [7-13]. Several international studies have examined the role of demographic, social, environmental and geographic determinants of anemia as significant risk factors for childhood anemia [14- 16]. Blood loss such as that associated with schistosomiasis, hookworm infestation, hemorrhage in childbirth, and trauma, can also result in both iron deficiency and anemia. Lastly, as with vitamin A deficiency, inhibition of the normal metabolism of iron can result in anemia [9,10]. Despite the high prevalence and adverse health consequence reported internationally, there have been limited national representative findings on the prevalence and factors contributing for the development of anemia in SC, particularly in the study area. Anemia has been shown to contribute to mortality; a recent meta-analysis of nearly 12,000 children from six African countries aged 28 days to 12 years indicates that for each 1 g/dL increase in Hb, the risk of death falls by 24%. Therefore, the present study was carried out as first study and aimed to determine the prevalence of Iron Deficiency Anemia and its associated risk factors among a samples of primary schools students in Burao city, Somaliland. To identify the relationship between anemia and BMI of the school-age children in primary schools in Burao city, Somaliland, 2020 and identify intestinal parasitic infections related.

Materials & Methods

A school based cross sectional study design was done in four primary schools in Burao city, Somaliland. About 285 school age children with in the age group between 6-14 years were selected with respondent rate of 93.4%. Random sampling was used to select schools and systemic random sampling used to identify children from the selected schools. Socio-demographic data was collected by using questionnaire & interview of respondents. Complete Blood Counting (CBC) was used to determine the hemoglobin status of the children. Students (senior lab students) collected blood and bring it to the University of Burao laboratory to analysis them where CBC machine is available. Anemia was defined as Hb<11.5g/dl for SC aged 6-11years, and Hb<12g/dl for children aged 12-14years. These verity of anemia were categorized as mild (Hb between 10 and 11.4g/dl for 6 to 11years, and between 10 and 11.9g/dl for 12 to 14years), moderate (Hb between 7 and 9.9g/dl), and severe (Hb<7g/dl) for 6 to 14 years of age SC based on the adjusted Hb concentration recommended by the WHO scheme [11]. Stool examination also done from each participants in the present study, fresh stool samples was collected following the SSS standard operating procedures (SOPs) in clean and labeled

leak-proof stool cups. The stool specimens was transported in screw-capped cups in 10% formalin to the laboratory. Intestinal helminthes was detected microscopically by direct saline wet mount Preparation and formol-ether concentration method within 2-8 hours after collection at the University of Burao, Biomedical and Laboratory Sciences Laboratory. Data was entered and analyzed using SPSS statistical software for Windows version 21. Anthropometric data was analyzed using WHO Anthrop Plus. Bivariate logistic regression and multivariable logistic regression were used to identify independent predictors of anemia in-school adolescent girls. Statistical significance was set at $p < 0.05$.

RESULTS

To determine the associated socio-demographics factors of anemia, bivariate logistic regression was done and based on that analysis year of studying (grade) and education of children's mothers were associated with anemia using the P value less than 0.25. Children in class year (grade) between 1-4 were more likely to be anemic (COR = 2.12; 95% CI: 1.09, 4.12) and children from illiterate mothers were more likely to be anemic (COR = 3.30; 95% CI: 1.80, 6.05) (Table 1). Using mosquito nets and current stool examination were also associated with anemia with P-value less than 0.25.

Children who use mosquito nets were associated with anemia (COR = 1.51; P- value 0.167; 95% CI: 0.84, 2.71). Children who had parasites in their stool were more likely to be anemic (COR = 4.22; 95% CI: 1.08, 16.38) (Table 2).

Seven independent variables were significant on bivariate binary logistic regression with p value of < 0.25 and all were entered into the multivariate logistic regression models to identify independently associated factors with anemia after controlling confounding factors with P value < 0.05 . Accordingly, education of children's mother, average use of organ meat and stool examination were identified as statistically independent associated factors of anemia. Children from illiterate mothers were 2.37 times more likely to be anemic than children whose mothers were literate (AOR = 2.37; 95%CI: 1.14, 4.94). Children who consume organ meat less than once a week are 2.16 more likely to be anemic compared to those consume organ meat at least once or more in a week (AOR = 2.19; 95%CI: 1.05, 4.43). Children who had parasites on their stool were 5.21 times more risk to be anemic (AOR = 5.21; 95%CI: 1.10, 24.62) (Table 3).

BMI for age Z score, average use of organ meat and average use of flesh meat were associated with anemia using bivariate logistic regression P- value less than 0.25. Children with low MBI for age (wasting) were associated with anemia (COR = 0.58; 95%: 0.26, 1.28) and children that consume organ meat more than once a week were at high risk of anemia (COR = 1.87; 95% CI: 1.04, 3.37). Children who consume organ meat less than once a week were at high risk of anemia (COR = 1.87; 95%CI: 1.04, 3.37), similarly, children who consume flesh meat less than once a week were also at high risk of anemia (COR = 2.03; 95% CI: (1.10, 3.76) (Table 4).

Children were asked if they infected malaria in the last three months and 58 (20.6%) said yes where 51 (18%) said that they were diagnosed with intestinal parasites in the last three months. About 158 (55.6%) of the children use mosquito nets and 148 (52.1%) use insect sides. Almost 229 (81.8%) of the children get water through pipes and 51 (18.2%) get water through water tanker truck (Table 5).

Table 1: Distributions of bivariate logistic regression about socio-demographic factors of school age children with and without anemia in public schools in Burao, Somaliland, 2020 (n=285).

Variable	Categories	Hemoglobin status		Crude Odds Ratio 95% CI	P- value
		Anemic Cases	Normal Cases		
Age of the child	6-11 years	38 (14.4%)	132 (50.2%)	0.87 (0.48, 1.58)	0.662
	12-14 year	23 (8.7%)	70 (26.6%)	1	
Sex of the child	Male	23 (8.7%)	70 (26.5%)	1.15 (0.63, 2.08)	0.644
	Female	38 (14.4%)	133 (50.4%)	1	
Class of studying	01-Apr	47 (17.9%)	123 (46.9%)	2.12 (1.09, 4.12)	0.025*
	05-Aug	14 (5.3%)	78 (29.8%)	1	
Name of the school	Sheikh Ibrahim	25 (9.5%)	72 (27.3%)	0.76 (0.35, 1.67)	0.508
	Mustaqbal	12 (4.5%)	74 (28.0%)	0.35 (0.14, 0.36)	0.022
	21-Nov	10 (3.8%)	26 (9.8%)	0.85 (0.32, 2.23)	0.744
	Candlelight	14 (5.3%)	31 (11.7%)	1	
Family size	≤6	14 (5.3%)	34 (13.0%)	1.46 (0.72, 2.95)	0.288
	>6	47 (17.9%)	167 (63.7%)	1	
Education of the father	Illiterate	7 (2.7%)	28 (10.8%)	0.80 (0.33, 1.95)	0.634
	Literate	53 (20.5%)	171 (66%)	1	
Education of the mother	Illiterate	30 (11.7%)	47 (18.4%)	3.30 (1.80, 6.05)	0.000*
	Literate	29 (11.3%)	150 (58.6%)	1	
Occupation of the mother	Housewife	44 (17.2%)	141 (55.1%)	1.16 (0.60, 2.26)	0.652
	Employed	15 (5.9%)	56 (21.9%)	1	
Occupation of the mother	Unemployed	9 (3.4%)	29 (11.0%)	1.03 (0.46, 2.33)	0.927
	Employed	52 (19.7%)	174 (65.9%)	1	

NOTE: *Reminded the significance of the variable (P value<0.25).

Table 2: Distribution of bivariate logistic regression about history of parasites, prevention of malaria and source of water of school age children with and without anemia in public schools in Burao city, Somaliland, 2020 (n=285).

Variable	Categories	Haemoglobin status		Crude Odds Ratio 95% CI	P- value
		Anemic	Normal		
Infected with malaria in the last three months	Yes	15 (5.7%)	42 (16.1%)	1.22 (0.62, 2.40)	0.553
	No	46 (16.8%)	158 (60.5%)	1	
Diagnosed with intestinal parasite in the last three months	Yes	9 (3.4%)	37 (14.1%)	0.77 (0.34, 1.70)	0.522
	No	52 (19.8%)	165 (62.7%)	1	
Use mosquito nets	Yes	38 (14.4%)	106 (40.2%)	1.51 (0.84, 2.71)	0.167*
	No	23 (8.7%)	97 (36.7%)	1	
Use of insect sides	Yes	28 (10.6%)	109 (41.4%)	0.72 (0.40, 1.28)	0.27
	No	33 (12.5%)	93 (35.4%)	1	
Source of water	Pipe	49 (18.9%)	160 (61.8%)	0.97 (0.47, 2.00)	0.934
	Water tanker truck	12 (4.6%)	38 (14.7%)	1	
Current stool examination	Parasite seen in stool	8 (3.8%)	3 (1.4%)	4.22 (1.08, 16.38)	0.037*
	No parasite is seen in stool	43 (20.7%)	154 (74.0%)	1	

Table 3: Multivariable logistic regression analysis showing factors associated with anemia among school aged children in public schools in Burao, Somaliland, 2020 (n=285).

Variable	Categories	Haemoglobin status		Adjusted Odds Ratio 95% CI	P-value
		Anemic	Normal		
Class of studying	01-Apr	47 (17.9%)	123 (46.9%)	1.61 (0.71, 3.67)	0.252
	05-Aug	14 (5.3%)	78 (29.8%)	1	
Education of the mother	Illiterate	30 (11.7%)	47 (18.4%)	2.37 (1.14, 4.94)	0.020*
	Literate	29 (11.3%)	150 (58.6%)	1	
BMI for age Z score	Wasted	9 (3.5%)	45 (17.4%)	0.58 (0.22, 1.50)	0.267
	Normal	52 (20.1%)	153 (59.1%)	1	
average use of organ meat	Less than once a week	35 (13.5%)	85 (32.8%)	2.16 (1.05, 4.43)	0.036*
	More than or once a week	25 (9.7%)	114 (44.0%)	1	
average use of flesh meat	Less than once a week	23 (8.8%)	48 (18.5%)	1.97 (0.92, 4.22)	0.079
	More than or once a week	36 (13.8%)	153 (58.8%)	1	
Use mosquito nets	Yes	38 (14.4%)	106 (40.2%)	1.49 (0.71, 3.15)	0.288
	No	23 (8.7%)	97 (36.7%)	1	
Current stool examination	Parasite seen in stool	8 (3.8%)	3 (1.4%)	5.21 (1.10, 24.62)	0.037*
	No parasite is seen in stool	43 (20.7%)	154 (74.0%)	1	

NOTE: *Reminded the significance of the variable (P value<0.05).

Table 4 : Distribution of bivariate logistic regression about nutrition related factors of school age children with and without anemia in public schools in Burao city, Somaliland, 2020 (n=285).

Variable	Categories	Haemoglobin status		Crude Odds Ratio 95% CI	P-value
		Anaemic	Normal		
Height for age Z score	Stunted growth	6(2.3%)	15(5.7%)	1.35 (0.50, 3.65)	0.551
	Normal growth	55 (55%)	186 (71.0%)	1	
BMI for age Z score	Wasted	9 (3.5%)	45 (17.4%)	0.58 (0.26, 1.28)	0.184*
	Normal	52 (20.1%)	153 (59.1%)	1	
Average use of fruits	Less than once a week	25 (9.6%)	81 (31.2%)	1.13 (0.62, 2.04)	0.682
	More than or once a week	33 (12.7%)	121 (46.5%)	1	
Average use of organ meat	Less than once a week	35 (13.5%)	85 (32.8%)	1.87 (1.04, 3.37)	0.035*
	More than or once a week	25 (9.7%)	114 (44.0%)	1	
Average use of flesh meat	Less than once a week	23 (8.8%)	48 (18.5%)	2.03 (1.10, 3.76)*	0.024*
	More than or once a week	36 (13.8%)	153 (58.8%)	1	
Average use of flesh meat	Less than once a week	33 (13.0%)	104 (40.9%)	1.23 (0.67, 2.23)*	0.496
	More than or once a week	24 (9.4%)	93 (36.6%)	1	
Average use of milk and milk products	Less than once a week	24 (9.2%)	74 (28.4%)	1.10 (0.61,1.98)	0.741
	More than or once a week	37 (14.2%)	126 (48.3%)	1	

Table 5:- Distribution of history of parasites, malaria prevention and wash of school age children in public schools in Burao city, Somaliland, 2020 (n=285).

Variable	Categories	Frequency	Percentage %
Infected with malaria in the last three months	Yes	58	20.6
	No	224	79.4
	Total	282	100
Diagnosed with intestinal parasites in the last three months	Yes	51	18
	No	233	82
	Total	284	100
Use of mosquito nets	Yes	158	55.6
	No	126	44.4
	Total	284	100
Use of insect sides	Yes	148	52.1
	No	136	47.9
	Total	284	100
Type of hand washing practice	Only water	23	8.1
	Water with soap	260	91.9
	Total	283	100
Source of water	Pipe	229	81.8
	Water tanker truck	51	18.2
	Total	280	100

DISCUSSION

The main objective of this study was to assess prevalence and factors associated with anemia among school-age children in primary schools in Burao. According to WHO cut of point, anemia is considered as a public health problem when the prevalence is more than 5% [4]. However, the magnitude of the problem is defined as mild, moderate, and severe when the prevalence is 5.0-19.9%, 20.0-39.9%, and $\geq 40\%$, respectively [4], respectively. Accordingly, 23.1% prevalence of anemia in SC means that the problem is a moderate public health problem in the study area. The prevalence anemia was similar and comparable to study done in Filtu town, Somali region in Ethiopia which identified anemia as 23.6%. The reason for close similarity could be due to their living sitting and culture are very alike [17-19]. Studies done in Cape Verde, China and two studies from Saudi Arabia [Najran and Riyad] had prevalence of anemia of 23.8%, 24.9%, 22.5% and 22.3%, respectively. These studies were in agreement with the current study [20]. The current study had higher prevalence of anemia among school age children compared to studies done in Gonder town in Ethiopia with prevalence of 15.5% [21], 16.2% in Morocco [22] and study from Indonesia with prevalence of 14% [23]. Study done in Cameroon determined prevalence of anemia as 5% which is much lower to this study [24]. On the other hand, this study had lower prevalence of anemia compared to study done in Kazakhstan with prevalence of 27% of anemia in school age children [25]. Similarly, studies from Arba Minch in Ethiopia, North western Uganda, Al-haram Zone in Egypt, Northwest Ethiopia had prevalence of anemia of 37.3%, 34.4%, 38.7% and 33.9%, respectively Studies from rural Upper Egypt, Odisha, and Nigeria had prevalence of anemia of 59.3%, 79% and 82%, respectively. Those studies had much higher prevalence than the current study. Reasons could be that study from rural Upper Egypt had different age group of target

population which is 6-18 years and study from Odisha used non-probability sampling where study done in Nigeria age group of 7-12 years old children which are all different from this study [26- 27].

Maternal education was found to be significantly associated with anemia among school age children. Children whose mothers were illiterate were 2.3 times more likely to be anemic compared to children from literate mothers. The findings of this study is similar to study done in Gonder town in Ethiopia that identified anemia in school age children to be significantly associated with lower maternal education [25]. Study from in Kenitra, Northwest of Morocco also identified significant relationship between maternal education and school age children anemia [26]. Similarly, study done in Northwest Ethiopia determined that children from illiterate mothers were more likely to be anemic [28]. Finally, similar study was done in Rural China's Elementary Schools that revealed strong association between paternal education and anemia in this age group [22].

The current study found that current intestinal parasite in stool was significant associated with anemia in school age children where children who had parasites on their stool were 5.21 times more risk to be anemic. Similar result was found in study done in Filtu town, Somali region in Ethiopia [19]. Studies from Arba Minch in Ethiopia, rural Upper Egypt and Nigeria identified that parasite on stool was significant associated with anemia in this age group [29]. This study identified that children who consume organ meat less than once a week are 2.16 more likely to be anemic compared to those consume organ meat at least once or more in a week. Studies from Riyadh in Saudi Arabia and Turkey have found that anemia was associated with eating meat [24].

CONCLUSION

This study was intended to identify prevalence and associated factors of anemia among school age children's and out of 285

study subjects, about nearly one quarter of them were at least mild anemic and only one child had severe anemia. Children from illiterate mothers, presence of parasite on stool and not eating organ meat were significantly associated with anemia among school age children.

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