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Assessment of Anaemia in Adolescent Girls Aged between 10-19 Years Old Attending St Therese Clinic

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Anaemia is one of the major public health problems worldwide and is associated with morbidity and mortality. Anaemic adolescent girls are at high risk of having physical and cognitive functional disorders. According to the WHO global database, anaemia affects 46% of school children globally. Because of health and socioeconomic problems, the prevalence of anaemia is higher in developing countries than in developed ones with 50% in Africa where children, adolescent girls and pregnant women are the most vulnerable groups to anaemia. In Rwanda, there is little national data on anaemia and its likely causes amongst adolescent girls. This study aimed to assess the extent of anaemia and associated risk factors among adolescent girls aged between 10-19 years old attending St Therese Clinic located in Eastern province of Rwanda. A cross sectional study design was conducted at St Therese Clinic and included 231 adolescent girls aged between 10-19 years old who were conveniently selected from the consented participants. The hemocue apparatus which uses a modified azide-methaemoglobin reaction was used to measure Haemoglobin (Hb) level in the whole blood. Pre-tested structured questionnaires were used to collect data on anticipated risk factors. The prevalence of anaemia was found to be 29% among adolescents girls. Among 67 anaemic girls (29%), 45 girls (19.47%) had mild anaemia while 18

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girls (7.79%) had moderate anaemia and 4 grils (1.73%) had severe anaemia. It was found that malaria, menarche, educational status of their parents and meal intake frequency are significantly associated with anaemia, p value <0.05. Anaemia is highly prevalent in adolescent girls. Thus, policy makers has to prevent and control anaemia in this particular vulnerable group through but not limited to Iron/folic acid supplement, malaria eradication and promoting nutrition education programme targeting adolescent girls and their mothers, heads of primary and secondary schools mainly on the utilisation of easily available and affordable iron rich diet.

Keywords: Anaemia; adolescence; malaria; menarche; education; iron and folic acid supplement.

1. BACKGROUND OF THE STUDY

Anaemia is a condition in which the number and size of red blood cells, or the haemoglobin concentration, falls below an established cut-off value, consequently impairing the capacity of the blood to transport oxygen around the body. Anaemia is an indicator of both poor nutrition and poor health [1]. Haemoglobin is a conjugated protein in the blood that carries carbon dioxide from tissues to the lungs and oxygen from the lungs to tissues. Usually, in most anaemic patients, oxygen deficiency is behind all signs and symptoms. According to WHO, adolescence is as a period of life between the ages of 10 to 19years for both sexes. Nutritionally, the adolescent for this period of life is nutritionally the most vulnerable due to augmented growth and development [1].

According to the recommendations of UNICEF/WHO report, which classifies adolescent girls as a vulnerable group to anaemia, all countries are encouraged to assess rapidly the prevalence of anaemia and its associated factors in these vulnerable groups [2]. There are about 1.2 billion adolescents in the World, which is equal to one-fifth of the World's population and their numbers are increasing. Out of these, five million adolescents are living in developing countries. In Rwanda, Adolescents counted 24.2 percent of the total population in 2012. Anaemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development [3]. Globally anaemia prevalence was between 22.9% and 26.7% (about 1.62 billion people) and the major associated factors are medical history like age at menarche, history of worm infestation, excessive menstrual bleeding in the past 3 months and dietary history. Anaemia occurs at all stages of the life cycle. Generally, 50% of all anaemia is attributable to iron deficiency. Iron need increases during adolescence period because of onset of menstruation and adolescent growth spurt [4].

In adolescents, it has a direct and immediate effect on productivity, cognitive functioning lowers school achievement and lowers physical working capacity [4]. For instance, a school-based cross sectional study conducted by Mohammed, et al. in 2017 among adolescent School Girls in Kebena District, Southwest Ethiopia showed that the anaemia prevalence was 12% with 95% of anaemic status impacting their academic performance.

According to the World Health Organization (WHO) global database, anaemia affects 46% of school children globally [5]. Because of health and socioeconomic problems, the prevalence of anaemia is higher in developing countries with 50% in Africa where children, adolescent girls and pregnant women are the most vulnerable groups to anaemia [6]. In Asia and Africa, the prevalence of anaemia among adolescent girl is high compared to America and Europe [7]. In Pakistan the prevalence is estimated to 60% [8], Nepal 42% [9], Saudi Arabia 25.9% [10] and India 83% [11]. Due to many previous studies that showed the elevated prevalence of anaemia among adolescent girls, India tried a program of weekly iron-folic acid supplementation for adolescent girls that were piloted in fifty-two districts in thirteen states. After one year of implementation, this program showed an impact of 24% reduction in the prevalence. Due to this reduction, the project was expanded to cover eleven entire states by the end of 2011. In 2013, the government of India introduced the national implementation of weekly iron-folic acid supplementation to approximately one hundred and twenty million adolescent girls [12]. However in USA, the prevalence was found to be only 2% [13].

In Africa, the prevalence of anaemia in adolescent girls was carried out in different countries. In Ghana, the study done yielded the

prevalence of 41.5% [14], Egypt 35.9% [15], Kenya 26.5% [7], Ethiopia 30.1% [16] and Ethiopia 45.9% [17]. In Egypt took control of this problem by distributing iron-folic acid supplements. In this program, 200 mg ferrous fumarate and 300 mg folic acids were given to individual girl weekly [18].

Anaemia is one of the major public health problems in children, adolescent girls and pregnant women and is associated with lost schooling, physical and cognitive functional disorders, low weight babies and even fatal complications during delivery, once pregnant [19]. According to the World Health Organization (WHO) global database, anaemia affects 46% of school children globally [5]. Because of health and socioeconomic problems, anaemia is highly prevalent in developing countries than in developed countries with 50% in Africa [6].

In Rwanda, anaemia was gradually reduced from 2005 to 2015, where the prevalence of anaemia among children was 54% in 2005 and 38% in 2010 [20]. Among pregnant women, the prevalence of anaemia was 35% in 2005 and 20% in 2010. Rwanda Demographic Health Survey (RDHS) reported the overall prevalence of anaemia of 11.5% and prevalence in pregnant women of 14.5% [20]. This shows a great reduction of anaemia compared to other African countries as well as global prevalence. This decline in anaemia was probably due to multiple interventions like availability and quality of health services, long lasting insecticide nets for both women and children for fighting malaria, iron-folic acid supplementation for pregnant women. Despite the efforts, the coverage has not reached the World Health Organization recommendation of 180 mg iron-folic acid supplements for pregnant women [21]. Therefore a significant work is needed to increase the coverage of iron intake, both in food and supplements, expand helminths control and malaria control.

Despite these efforts to reduce the anaemia in other vulnerable groups in Rwanda, there are no programs directed to fighting anaemia in adolescent girls. This is mainly because there is no data on the extent of anaemia and its likely causes amongst adolescent girls for that reason this study aimed to assess anaemia and its associated risk factors among adolescent girls aged between10-19 years attending St Therese Clinic.

2. METHODOLOGY

2.1 Study Design

The study was conducted at St Therese Clinic which is located in the Eastern province, Rwamagana district, Kigabiro sector. St Therese Clinic is a private health facility that provides possible quality healthcare services to the population of but not limited to Rwamagana district. A descriptive cross-sectional study was carried out. Target population for this study was all adolescent girls aged between 10-19 years old who attended St Therese Clinic during this study period. Adolescent girls who were under iron, and folic acid supplement and those ones who did not consent to participate in this study were excluded from this study.

2.2 Sample Size

The estimated sample size was 384 people, however the sample size achieved during the current study period was 231 adolescent girls.

In this cross-sectional study, the following formula was used. [22]

Formula $\mathrm{n} = \frac{z^2 p(1-p)}{d^2}$ [22]

Where

n is sample size,
z: is a statistic for the level of confidence, 1.96 on 95% confident interval
P: prevalence ever recorded since there is no prevalence, we assume that it is 50%
d: precision, if 5% is equivalent to 0.05

Sample size $= \frac{1.96^2 X 0.5(1-0.5)}{0.05^2}$ = 384.16≈ 384 adolescent girls aged between 10-19years old.

2.3 Sampling Strategy

Convenient sampling strategy was used. The study included voluntary adolescent girls aged between 10-19 years old who attended St Therese Clinic during data collection. Capillary blood was collected and used in haemoglobin level estimation by Hemocue analyzer.

2.4 Data Collection Instruments

Haemoglobin level was estimated by Hemocue analyzer. Questionnaire was used to collect information on common associated risk factors

with anaemia, including education, iron supplements food, meal frequency per day, menstrual bleeding, and the previous history of diagnosed malaria.

2.5 Procedure of Haemoglobin Measurement using Hemocue

To perform a test using capillary blood, the cuvette was put in loading position. The middle or ring finger for sampling was selected for each patient. Finger was cleaned using a disinfectant and was allowed to dry. The Puncture of the finger was done using a lancet and wiped the first two to three drops, after which the pressure was reapplied towards the fingertips until another drop of blood appeared. When the blood was enough, microcuvette was filled in one continuous process by avoiding air bubbles. Filled microcuvette were placed in the in cuvette holder contained in hemocue apparatus and gently slided the cuvette holder to the measuring position. After 15 to 60 seconds, the haemoglobin value of the sample was displayed [23]. Normal Value of Adolescent girls: 12.0–16.0 g/dl [1].

Haemoglobin concentration less than the cut-off of 12.0 g/dl was used to define anaemia in non-pregnant girls [4]. Severity of anaemia in adolescent girls was classified at three levels: mild anaemia (Hb 10.0-11.9 g/dl), moderate anaemia (Hb 7.0-9.9 g/dl), and severe anaemia (Hb less than 7.0 g/dl) respectively.

2.6 Data Analysis

Data was analyzed with computer using statistical program for social sciences (SPSS) version 21. The extent of anaemia was in percentages. The associations between anaemia and risk factors were determined using multivariate analysis.

2.7 Ethical Consideration

Data was collected after getting Ethical clearance from Mount Kenya University and granted the permission by the administration of St Therese Clinic to collect data. The participants were explained about the study, and those who accepted to participate signed a consent form. The ones under 18 years old were given assent form for their parents/guardians. Data was collected from those who consented to participate in the study. The participant's confidentiality was guaranteed by using a code label and their results were accessible by researchers only.

3. RESULTS

3.1 The Prevalence of Anaemia in Adolescent Girls

The Table 3.1 illustrates the extent of anaemia and its classification according to their haemoglobin levels in 231 adolescent girls who participated in this study. Overall, the adolescent girls free from anaemia comprised 71%. Among anaemic girls; the mildly affected occupied the highest portion which is approximately one fifth of the participants, whereas only 4 adolescent girls (1%) were evinced to be severely anaemic, and around 7% of the participants were moderately anaemic.

Table 3.1. The prevalence of anaemia in adolescent girls

Anaemia status	Frequency	Percentage
Normal	164	71%
Mild	45	19.47%
Moderate	18	7.79%
Severe	4	1.73%
Total number of anaemic girls	67	29%

3.2 Anaemia and Menarche

From results of Table 3.2, the current study showed the impact of menstrual bleeding on anaemia which is statistically significant with p-value = 0.003. Educational status of their mothers showed significant association with anaemia (p=0.001). Malaria was found to be statistically associated with anaemia (p=0.008).

Table 3.5 shows the impact of Iron/Folic acid supplement on anaemia, however during this study no participant was taking these supplements. Meal per day showed a significant with a p-value of (p=0.048). Table 3.7 displays the association between different food intake and anaemia. However, none of them showed a statistically significant association with all p-value higher than 0.05.

Table 3.2. Anaemia and Menarche

Risk factor		Anaemic (%)	Non-anaemic (%)	p-value
Menarche status	attained	65(97.02)	140(85.36)	0.003
	Not attained	2(2.98)	24(14.64)	

Table 3.3. Anaemia in adolescent girls and Educational status of their mothers

Risk factor		Anaemic (%)	Non-anaemic (%)	p-value
Educational status of their mothers	None	45(67.16)	56(34.14)	0.001
	Primary	20(29.85)	77(46.95)	
	Secondary	2(2.98)	18(10.97)	
	University or more	0(0)	13(7.92)	

Table 3.4. Anaemia and Malaria

Risk factor		Anaemic (%)	Non-anaemic (%)	p-value
Malaria status in the last 6 weeks	Experienced	19(28.35)	14(8.53)	
	Not experienced	48(71.64)	150(91.46)	0.008

Table 3.5. Anaemia and Iron/ Folic acid Supplement

Risk factor		Anaemia present (%)	Anaemia absent (%)	p-value
Iron/Folic acid supplement	Yes	0(0)	0(0)	-
	No	67(100)	164(100)	

Table 3.6. Anaemia and Meal frequency per day

Risk factor		Anaemia present (%)	Anaemia absent (%)	p-value
A meal per day	Once	18(26.86)	14(8.53)	
	Twice	43(64.17)	113(68.90)	0.048
	More than twice	6(8.95)	37(22.56)	

Table 3.7. Anaemia and Specific food intake frequency

Risk factors		Anaemia present (%)	Anaemia absent (%)	p-value
Beans intake	Daily	54(80.59)	117(71.34)	
	Weekly	0(0)	0(0)	0.599
	Occasionally	11(16.41)	32(19.51)	
	Never	2(2.98)	15(9.14)	
Green vegetable intake	Daily	30(44.77)	102(62.19)	
	Weekly	0(0)	2(1.21)	0.228
	Occasionally	32(47.76)	49(29.87)	
	Never	5(7.46)	11(6.70)	
Meat intake	Weekly	21(31.34)	78(47.56)	-
	Occasionally	44(65.67)	77(46.95)	
	Never	2(2.98)	9(5.48)	
Poultry intake	Weekly	3(4.47)	9(5.48)	
	Occasionally	43(64.17)	78(47.56)	1.000
	Never	21(31.34)	77(46.95)	
	Daily	0(0)	0(0)	-
Fruits intake	Weekly	22(32.83)	77(46.95)	
	Occasionally	43(64.17)	77(46.95)	
	Never	2(2.98)	10(6.09)	

4. DISCUSSION

This study showed that among 67 anaemic girls, 65 (97.02%) have attained menarche. This finding highlights the impact of menstrual bleeding on haemoglobin level. These findings are in line with a study conducted in India by Premalatha et al. 2012, where anaemia was highly prevalent (86.75%) in participants who had attained menarche.

The educational status of the adolescent girls' mothers showed to have a considerable effect on the anaemia status of their children where in all anaemic adolescent girls, 67.16% had uneducated mothers. Although, a similar study conducted by Oscar et al. 2014 in Kenya came up with a prevalence of 35.7% having uneducated mothers which is approximately a half of ours, the association between the Level of mother's education and anaemia was significant. This is to mean that, mother's education level has a protective effect on the chance of the child being diagnosed with anaemia. Children whose mothers' has secondary, and higher levels of education, are less likely to be anaemia positive. In addition to that, most of non-educated mothers have low income and low knowledge about the appropriate food for their girls to compensate the loss during menstrual bleeding.

This survey demonstrated the association between Malaria status and Anaemia in adolescent girls whereby among 67 anaemic girls, 19(28.35%) girls experienced it in last 6 weeks. This finding is beyond no doubt due to the fact that it is a common knowledge that malaria is an haemolytic infection which reduces red cells and consequently favour anaemia and it was undoubtedly found to be statistically associated with anaemia (p=0.008). These results are in line with the findings of CDC in 2008 where malaria was the strongest cause of anaemia in adolescence [18]. The findings of this study went hand in hand with a study conducted in Kenya by Damaris. N, in 2015 on the prevalence and Determinants of Anaemia among Adolescent Girls in Secondary Schools, where the presence of malaria parasitemia increased the risk of one developing anaemia by three times.

Anaemia is induced by lower levels of the consumption of dietary iron derived from foods such as meat, beans, poultry and less intake of the nutrients involved in iron metabolism. This assumption is in line with the findings of this study where the frequency of food intake was shown to be a risk factor of anaemia. On the other hand, specific food intake was not a predator of anaemia in this study which went against the results of a study done in Kenya in 2015 by Damaris N where among the anaemic respondents 60.7% had inadequate iron intake. This disparity can be explained by the low sample size. In 2008, De Benoist et al, also demonstrated that vitamins and minerals are required for the proper production of haemoglobin hence, RBCs. Deficiency in any of these micronutrients may cause anaemia because of inadequate production of RBCs [24].

5. CONCLUSION

From the findings of this study, the overall prevalence of anaemia was found to be 29%. It is seen that malaria, menarche, educational status of their parents and meal intake frequency are significantly associated with anaemia. Considering this alarming prevalence of anaemia in girls during adolescence in this study, there is a need for anaemia prevention, and control. Efforts should be made to prevent adolescent anaemia and its damaging consequences using an appropriate mix of interventions that address the multiple causes of anaemia in adolescent girls.

CONSENT

The participants were explained about the study, and those who accepted to participate signed a consent form.

ETHICAL APPROVAL

Data was collected after getting Ethical clearance from Mount Kenya University and granted the permission by the administration of St Therese Clinic to collect data.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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