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FACTORS ASSOCIATED WITH ANEMIA AMONG CHILDREN AGED 6-23 MONTHS IN RWANDA

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Abstract

Introduction: Anemia is the form of micronutrient deficiency encountered all over the world. The WHO estimates that, globally, it reaches the figure of 2 billion affected individuals. The statistics show a very high rate of the children (6-59 months) suffering from anemia (37%) and a relatively high rate of women (15-49 years old) suffering from the same disease (13%). Despite the severe global burden of anemia with more impact in developing countries including Rwanda, only limited studies have been done locally. This study aimed to analyze the factors associated with anemia among children aged 6-23 month in Rwanda

Methods: The data used were obtained from the 2019-2020 Rwanda Demographic and Health Survey. A sample of 1203 children aged 6-23 months were included. Data were analyzed using SPSS software version 21.0. A multilevel ordinal logistic regression model was fitted and adjusted odds ratio with 95% confidence interval was obtained.

Results: The finding study revealed the prevalence of anemic was found high (52.9%); 39.7% of the children are aged 6-12 months and 32.9% are aged 13-18 months. Also, 36.5% of the children had different kind of illnesses in last two weeks. In addition, 93.5% of the mothers live with their partners and 92.8% of the children are not underweight.79.8% live in rural area and 44.7% are poor. Bivariate analysis showed that being aged between 6-12 months presented a good association with childhood anemia with 65.8%, X^2=60.325, p<0.001. Having no access to clean water presented a significant association with childhood anemia with 56.7%, X^2=7.971, p<0.019 and poverty presented a significant association with childhood anemia with 63.7%, X^2=21.143, p<0.004. Multivariate analysis showed that the children aged 6-12 months were three-fold times more likely to be diagnosed with anemia than 19-23 months and the difference was significant (AOR=3.015; 95% CI 2.253-4.036; p<=0.001). Having no access to clean water was associated with childhood anemia with AOR=3.062(1.301-7.204), p<=0.010 and failing to prepare a balanced

diet regularly is significantly associated with disease of anemia AOR=1.316; 1.018-1.702, p<=0.036).

Conclusion: This study showed that nutritional anemia is the main causes of hospital admission in children aged under 2 years old in Rwanda and the occurrence of iron deficiency among those children is at 37% level. The child age, maternal anemia, having had any illness in last two weeks, absence of access to clean water, absence of disposal replacing the toilet for children, poverty, absence of Vit A supplementation and absence of regular preparation of balanced diet for the child are all associated with childhood anemia. Therefore, Ministry of Health in collaboration with other stakeholders was recommended to plan and conduct programs of alleviating poverty, access to safe drinking water, a program fighting anemia among adult population and encouraging the families to prepare regularly a balanced diet for the children.

Keyword: Anemia, factors associated, children aged 6-23 months, nutritional and health status, hemoglobin (Hgb), Ordinal logistic regression.

Introduction:

Anemia as the form of micronutrient deficiency is encountered all over the world. The WHO estimates that, globally, it reaches the figure of 2 billion affected individuals (McLean et al.,2019), including 9 out of 10 living in developing countries (UNICEF, 2019). In Africa and Asia, anemia is the cause of 3.8% to 13.1% of maternal deaths in the period of pregnancy and childbirth (Khan et al., 2016). According to estimates of the World Health Organization (WHO), anemia caused by malaria is responsible of 190,000 to 974,000 deaths of children under 5 per year (Crawley, 2017). In tropical and subtropical countries, this disorder also affects a significant number of men, i.e. 21.9% to 27% in Africa (McLean et al., 2019).

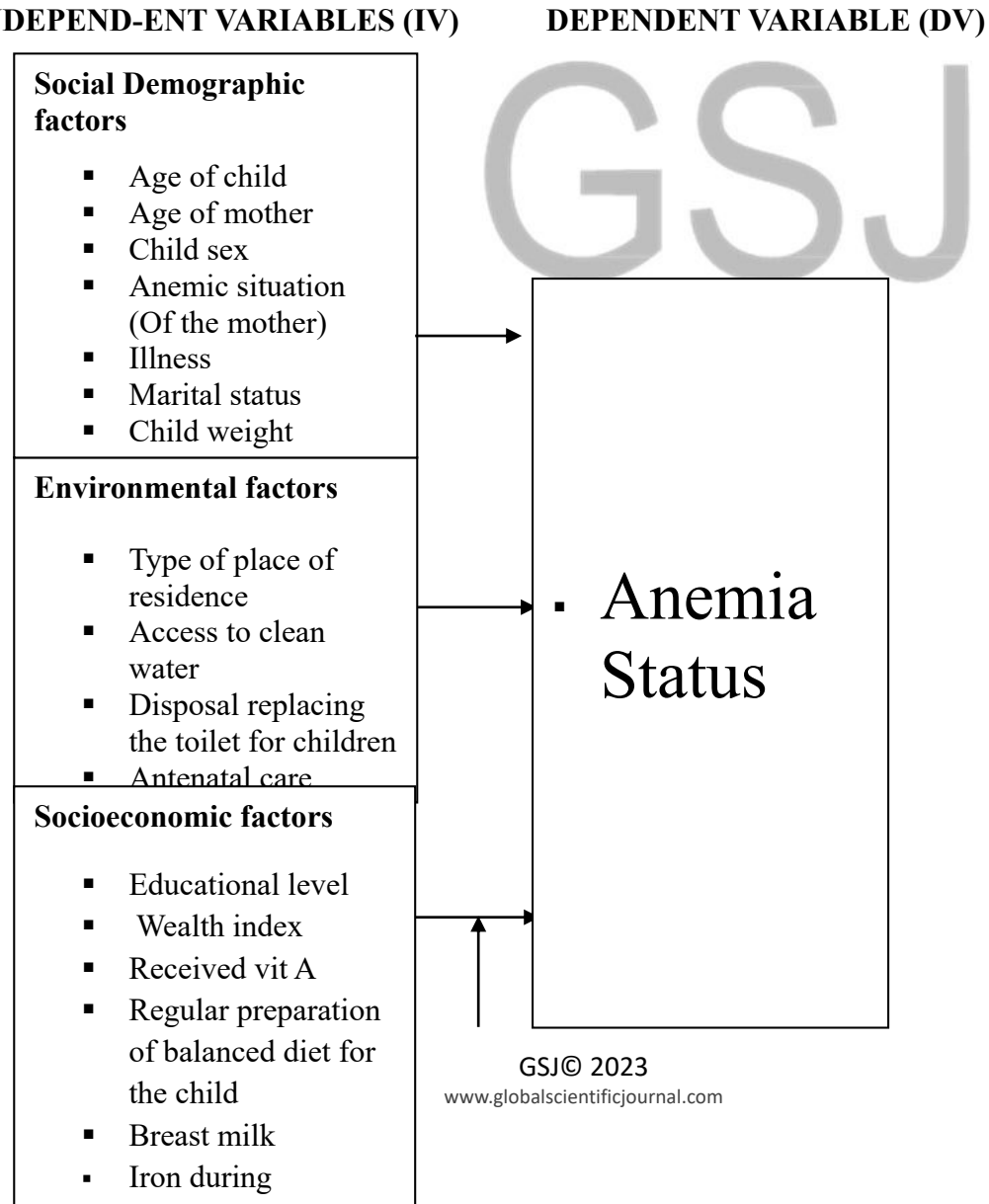
The etiology of anemia is the multifactorial and depends on the physiological and biological characteristics associated with the living conditions of the individual. The WHO reports that approximately a half of anemia cases are caused by iron deficiency and non-dietary causes include infectious diseases, particularly malaria, intestinal parasites, tuberculosis and HIV infection (Van Den Broek et al., 2018). Hemoglobinopathies, mainly sickle cell disease, constitute the form of sickle cell anemia that is particularly common in black populations (WHO, 2018). Cancers, rheumatic diseases and other chronic diseases are also causes of anemia, particularly affecting the elderly (Badham, 2017). The role of iron deficiency compared to the prevalence of anemia is well established by various studies. In most developing countries where it is thought to be responsible for half of the cases of anemia (WHO, 2018), the common diet in the majority of households provides only a bioavailability of dietary iron of 15-25µg Fe/kg /j (Hallberg et al., 2018).

The situation found in most developing countries is almost the same as the one found in Rwanda. Indeed, the situation of anemia is the sign of a good or poor alimentation of the people, especially the children. About 38% of children below 5 years old are suffering from chronic malnutrition, of which 25% suffer from severe chronic malnutrition. 4% of children under 5 are wasted and anemia is a significant health problem in Rwanda, which has not recorded significant changes since the 2015 DHS (NISR, 2021). In sum, the statistics show a very high rate of the children (6-59 months) suffering from anemia (37%) and a relatively high rate of women (15-49 years old) suffering from the same disease (13%) (RDHS, 2020).

Considering these aspects and although attempts to diminish the incidence of anemia have been progressive for more than ten years, the situation is still unchanged in the world, in Africa and in Rwanda in particular (UNICEF, 2019). One of the reasons for this apparent failure according to Badham et al. (2017), could come from the assumption considering the iron deficiency as the unique reason cause of anemia. This situation is the cause of having several control programs towards the management of nutritional anemia targeting groups of children of a certain age (Normally 5 years) and women of a certain age (Normally childbearing age). The determination of any intervention would therefore require adaptation to the specific context of each country. That is why this study was conducted on the factors associated to anemia among children aged 6-23 month in Rwanda using the analysis of Rwanda Demographic and Health Survey 2019/2020. Indeed, the existing studies have targeted children below 5 years old but this one is targeting those aged between 6 and 22 months. Finally, this study aimed to conduct the factors associated to anemia among children aged 6-23 month in Rwanda using the analysis of Rwanda Demographic and Health Survey 2019/2020.

Conceptual Framework

Here, the independent variables include socio-demographic, socioeconomic and environmental factors while the dependent variable is the anemia.



Intervening variables

- Heath policy
- Nutritional policy
- Anti anemic policy
- Culture

Materials and Methods:

Data Source

Data were extracted from the nationally 2019-2020 RDHS. The 2019-2020 RDHS was implemented by the national institute of statistics of Rwanda (NISR) in collaboration with the ministry of Health of Rwanda under the technical assistance of inner city Fund through the demographic Health Survey (DHS). To have access to the NISR database, the researcher wrote a letter to that institution to let them know that he wanted to conduct a study based on their information. The data were downloaded from the DHS program website, https://dhsprogram.com/,after obtaining permission, the title and concept note of the thesis proposal was sent through the DHS website. An authorization letter was obtained from ICF international permission to use the RDHS data and accessed data were used for this study only and RDHS dataset was not shared to any other third party.

Research Design

Design of the research is the structure and the plan of investigation so conceived as to allow the researcher to answer the questions of their research. There is the complete scheme of a work (Robson, 2015). The study used cross sectional design and have employed quantitative approach. In order to achieve the stated objectives, the researcher used a strategy of case study and the case study here is Rwanda DHS 2019-20. This is a nationally representative sample survey.

Target population

The 2019-20 RDHS included a module dedicated to the situation of nutrition of children and women, in recognition of the seriousness of the problem of anemia among children. Therefore, the total population of the survey is composed of all children aged 6–23 months in Rwanda (RDHS, 2020). According to the Rwandan Ministry of Health, these children are 526,119 (MoH, 2022). They are disseminated countrywide and all of them have been concerned by the survey. All the 30

Districts of Rwanda have been concerned with a certain number of children aged between 6-23 months.

Sample size

In this study, Yamane's formula (Yamane, 1967) has been used and is stated as follows:

$n= \frac{N}{1+Ne^2}$

with N= Population = 526,119 and e= Margin error /error of tolerance = (0.0288)

$n= \frac{526,119}{1+526,119(0.0288)^2}$ = 1202.8=**1203**

Therefore, these 1203 children constitute the sample for the present study.

Sampling procedure

Systematic random sampling technique was employed to recruit the households to be surveyed. On that issue, the researchers used the following systematic sampling interval:

$$K = \frac{N}{n} \equiv \frac{526,119}{1203} 437.3 \equiv 437$$

After having obtained the systematic sampling interval, the researchers counted 437 children aged between 6-23 months before choosing the following child to be included in the sample and continued until the number of 1203 is reached.

Data collection Methods

Socioeconomic and demographic characteristics of the family and child, feeding practice, health care utilization, and child morbidity status (within two weeks before data collection) were collected by using a pretested and structured questionnaire through interviewing the mother/caretakers of the child. Hemoglobin level of the child was measured from capillary blood and one drop of capillary blood was carefully collected from the middle finger of the child by finger prick. Strict aseptic technique and a separate lancet for each child were employed.

Automated hemoglobin machine made from Germany with model kx-21 and serial number b-0839 Model was used to determine the hemoglobin concentration and the result was expressed in g/dL and the presence and severity of anemia were determined according to age-based criteria of WHO cut-off point. For children aged 6–24 months who have hemoglobin level >11 g/dL, they were considered as non-anemic, 10.0–10.9 g/dL as mildly anemic, 7–9.9 g/dL moderately anemic, and <7 g/dL as severely anemic.

Questionnaire

This is a collection of carefully formulated questions that a researcher prepares and distributes to research participants in order to collect the same factual data in writing. It is thus a series of interconnected questions organized in a particular order with the goal of collecting data from the study's survey participants (Grinner & William, 2010). The study used close-ended questions in order to ease the process of analyzing the collected data. In this study, the questionnaire has been administered to mothers of children selected to be part of the sample and they were encountered in their respective households.

Through the NISR dataset obtained as a response to the researcher's request, a questionnaire has been framed in compliance with the study's objectives. The questionnaire is composed of four sections. The first one concerns socio demographic factors in which the following information has been collected: Child age groups, Sex of child, Maternal age and had any illness in last two weeks. The second section concerns anemic situation of the child and the mother in which the following information has been collected: Anemic situation of the child and Anemic situation of the mother. The third section concerns Environmental factors in which the following information has been collected: Type of place of residence, Has access to clean water and Disposal replacing the toilet for children. The fourth section concerns Socioeconomic factors in which the following information has been collected: Highest educational level, Wealth index, Received vit A and Regular preparation of balanced diet for the child. The questionnaire used in data collection is attached to this study as appendix II.

Documentary review

According to Grinner and William (2015), documentation is a data collection technique based on reading books and other documents like reports and brochures in order to get the back ground and find out information of studies on similar topics. While collecting data, different books, brochures, reports, websites, daily information through Internet etc. have been consulted. This technique helped to get and give the theoretical framework of this research thanks to literature and theories of previous researchers and quotes.

Administration of Instruments of data collection

Concerning the procedure used, questions on the situation of anemia of children were asked to woman in each selected household for the module dedicated to the situation of anemia among children interview. The random selection of women to be asked questions were done through selection sampling procedure built on the Kish grid, that was constructed into the household questionnaire (Kish, 2015)

Data analysis procedure

The data analysis was done by using Statistical package for Social Science. Therefore, descriptive statistics including percentages or frequencies have been computed and the results were further presented in tables and figures. In addition, the treatment of information related to the association between variables was done based on the result provided by SPSS through the measure of the association between independent and dependent variables. On this issue, logistic regression analysis was used. A descriptive statistic, bivariate and multiple logistic regression was carried out to test the significant factor towards childhood anemia. The significance level will be set at P-value < 0.05 and certainty level of 95%.

Ethical Consideration

Ethical considerations were considered by the researcher (Boll & Gall, 2016). First of all, the researcher obtained ethical clearance from Mount Kenya University and this one is enclosed to this study as appendix. Second, the right of every respondent to be informed for everything relevant

with the particular research was highlighted. Third, the researcher was engaged himself to protect the identities of the participants, ensuring that their answers are private and confidential.

On the one hand, although ethical considerations have been remarked as quite important from the Market Research Society reassuring that respondents' rights are being protected, on the other hand, according to Lovett (cited by Boll & Gall, 2016) a researcher's ethical responsibilities should be concerned with those of his fellow researchers or the members of the community. During the research process, it was clearly said in the beginning that answers of the respondents would be used in the research objectives and that would be kept confidential.

Also, as it is known, conducting research does not only necessitate expertise but also honesty and dignity. The ethical actions below are essential to the research by way of guarding the rights of an individual, acquiring an informed consent and submitting an original research work for the university review. All these ethical factors were taken care of in this study; thus, the researchers conducted the study with honesty and confidentiality. The researchers ensured that the views expressed by respondents are protected with the highest degree of confidentiality and used by the researchers exclusively for scientific purposes. The researchers issued with a data collection letter from NISR, which worked as an official introduction of the researchers to the respondents.

To have access to the NISR database, the researcher wrote a letter to that institution to let them know that he wanted to conduct a study based on their information. A copy of this letter is annexed to this study. Then, NISR responded favorably to the researcher's request and sent a soft copy of this database. The researcher processed it using SPSS software to find the information he needed to complete his work.

Results

This chapter analyzed the data collected from the respondents, presents, interprets and discusses them. As a recall, the results are presented based on the objectives of the study. But, before analyzing the data related to objectives of the study, the researcher presented the anemic situation among children and mother.

Socio-demographic characteristics of children 6-23 months

Table 4.1 Socio-Demographic Characteristics of Respondents

Variables	Frequency	Percentage
Child age groups		
6-12	478	39.7
13-18	396	32.9
19-23	329	27.3
Sex of child		
Male	634	52.7
Female	569	47.3
Maternal age		
15-24	243	20.2
25-34	600	49.9
35-49	360	29.9
Had any illness in last two weeks		
Yes	439	36.5
No	764	63.5
Marital status		
Living without partner	78	6.5
Living with partner	1125	93.5
Child weight		
Not underweight	1116	92.8
Underweight	87	7.2

Source: RDHS Data, 2020

The results in table 4.1 showed that 39.7% of the children are aged 6-12 months and 32.9% are aged 13-18 months. Also, 36.5% of the children had different kind of illnesses in last two weeks. In addition, 93.5% of the mothers live with their partners and 92.8% of the children are not underweight.

Anemic situation of the child and the mother

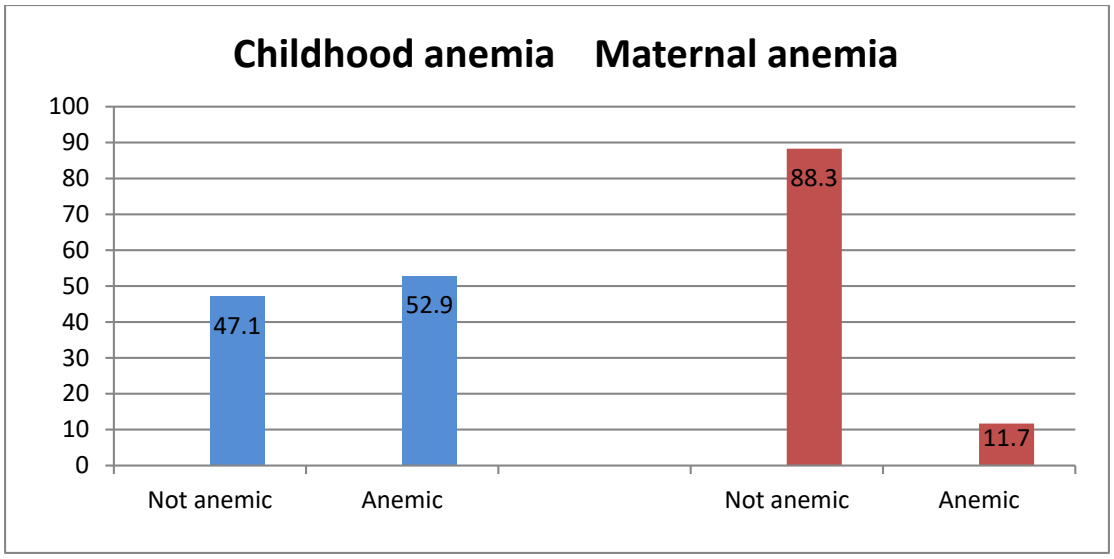


Figure 4.1Childhood and maternal anemia

Source: RDHS Data, 2020

The results presented in Figure 4.1 showed that 52.9% of the children were anemic while 47.1% of the children were not anemic. Only 11.7% of the mothers were anemic.

Socio-demographic factors associated with anemia

Objective one of the studies were to determine socio-demographic factors associated with anemia among children aged 6-23 months in Rwanda. The researcher conducted a bivariate analysis which depicted the relationship of the socio-demographic factors with childhood anemia. In addition, the researcher considered a p-value less than 0.05 statistically significant. Also, chi-square was calculated to show the association between expected and observed items. Finally, a multivariate analysis was done to determine association between different factors and childhood anemia.

Table 4.3 Bivariate analysis of socio-demographic factors associated with childhood anemia for children 6-23 months (2019/2020 RDHS)

Particulars	**Anemia status**		**Chi-square(X2)**	**p-value**
	Yes n (%)	No n (%)		

Age group of the child			60.325	**0.001**
6-12	313 (65.8%)	163 (34.2%)		
13-18	192 (48.6%)	203 (51.4%)		
19-23	128 (38.9%)	201 (61.1%)		
Maternal anemia			3.766	**0.032**
Not anemic	550 (51.8)	512 (48.2%)		
Anemic	83 (60.6%)	54 (39.4%)		
Sex of child			0.005	0.943
Male	334 (52.8%)	298 (47.2%)		
Female	299 (52.6%)	269 (47.4%)		
Mother Age in 10-year groups			0.228	0.892
15-24	129 (53.1%)	114 (46.9%)		
25-34	312 (52.1%)	287 (47.9%)		
35-49	192 (53.6%)	166 (46.4%)		
Had any illness in last two weeks			8.599	**0.003**
Yes	183 (41.7%)	256 (58.3%)		
No	384 (50.5%)	377 (49.5%)		
Marital status			0.190	0.376
Living without partner	43 (55.1%)	35 (44.9)		
Living with partner	590 (52.6%)	532 (47.4%)		
Child weight			2.633	**0.049**
Not underweight	581 (52.1%)	534 (47.9%)		
Underweight	52 (61.2%)	33 (38.8%)		

Source: RDHS Data, 2020

The findings of this study showed that the association of age of the child towards childhood anemia was statistically significant with p<0.05. Indeed, being aged between 6-12 months presented a positive association with childhood anemia with 65.8%, X^2=60.325, p<0.001. Also, having an anemic mother presented a visible association with childhood anemia with 60.6%, X^2=3.766, p<0.032. Having had illness in last two weeks presented a positive association with childhood anemia with 58.3%, X^2=8.599, p<0.003. Being underweight presented a positive association with childhood anemia with 61.2%, X^2=2.633, p<0.049. Other factors analyzed (sex of the child, marital status and mother age) presented no association with childhood anemia.

Environmental factors associated with anemia

Table 4.4 Bivariate analysis of environmental factors associated with childhood anemia for children 6-23 months (2019/2020 RDHS)

Particulars	**Anemia status**		**Chi-square(X2)**	**p-value**
	Yes n (%)	No n (%)		
Type of place of residence			0.251	0.882
Urban	129 (54.2%)	109 (45.8%)		
Rural	493 (52.4)	448 (47.6%)		
Not a permanent resident	11 (52.4%)	10 (47.6%)		
Has access to clean water			7.971	**0.019**
Yes	319 (51.0%)	307 (49.0%)		
No	248 (43.3%)	325 (56.7%)		
Disposal replacing the toilet for children			30.025	**0.001**
Yes	174 (37.3%)	292 (62.7%)		
No	393 (53.5%)	341 (46.5%0		
ANC			0.162	0.367

<4ANC	330 (53.6%)	286 (46.4%)
>=4ANC	285 (52.4%)	259 (47.6%)

Source: RDHS Data, 2020

The findings of this study showed that the association of two factors out of three analysed on this objective toward childhood anemia were statistically significant with $p<0.05$. In fact, having no access to clean water presented a significant association with childhood anemia with 56.7%, $X^2=7.971$, $p<0.019$. Also, having no disposal replacing the toilet for children also presented a significant association with childhood anemia with 51%, $X^2=30.025$, $p<0.001$.The type of place of residence and the number of ANC visits done presented no association with childhood anemia.

Socioeconomic factors associated with anemia

Table 4.5 Bivariate analysis of socioeconomic factors associated with childhood anemia for children 6-23 months (2019/20 RDHS)

Particulars	**Childhood anemia**		**Chi-square**	**p-value**
	Yes n (%)	No n (%)		
Highest educational level			1.272	0.736
No education	65 (55.6%)	52 (44.4%)		
Primary	402(52.7%)	361 (47.3%)		
Secondary	137(53.1%)	121 (46.9%)		
Higher	29 (46.7%)	33(53.2%)		
Wealth index			21.143	**0.004**
Poor	396(63.7%)	226 (36.3%)		
Middle	204(48.7%)	215 (51.3%)		
Rich	21 (13.0)	141 (87.0%)		
Received vit A			26.981	**0.001**
No	536(49.8%)	541 (50.2%)		
Yes	31 (25.2%)	92 (74.8%)		
Regular preparation of balanced diet for the child			4.392	**0.036**
Yes	430(49.1%)	446 (50.9%)		

No	137(42.3%)	187 (57.7%)		
Breast milk			1.445	0.188
No	39 (46.4%)	45 (53.6%)		
Yes	594 (53.2%)	522 (46.8%)		
Received iron during pregnancy			0.179	0.118
No	105 (54.4%)	88 (45.6%)		
Yes	510 (52.7%)	457 (47.3%)		

Source: RDHS Data, 2020

The findings of this study showed that the association of three out of six factors analyzed on this objective presented statistically significant association toward childhood anemia with $p<0.05$. Thus, poverty presented a significant association with childhood anemia with 63.7%, $X^2=21.143$, $p<0.004$. Also, having not received Vit A supplementation presented a significant association with childhood anemia with 49.8%, $X^2=26.981$, $p<0.001$. The absence of regular preparation of balanced diet presented a significant association with childhood anemia with 49.1%, $X^2=4.392$, $p<0.036$. Education level of the mother, breast milk and having received iron during pregnancy presented no association with childhood anemia.

Table 4.6 Multivariate analysis of socio demographic, environmental and socioeconomic factors associated with childhood anemia

Particulars	**AOR**	**95% C. I**		**p-value**
		Lower	**Upper**	
Child age groups				
6-12	3.015	2.253	4.036	**0.001**
13-18	1.485	1.104	1.998	**0.009**
19-23	Ref.			

Maternal anemia				
Not anemic	0.699	0.486	1.005	**0.032**
Anemic	Ref.			
Had any illness in last two weeks				
No	0.702	0.554	0.890	**0.003**
Yes	Ref.			
Has access to clean water				
No	3.062	1.301	7.204	**0.010**
Yes	Ref.			
Disposal replacing the toilet for children				
No	2.334	1.050	5.188	**0.038**
Yes	Ref.			
Wealth index				
Poor	3.139	1.862	5.506	**0.002**
Middle	1.481	0.711	3.092	0.288
Rich	Ref.			
Received Vit A				
No	2.638	1.201	5.794	**0.016**
Yes	Ref.			
Regular preparation of balanced diet for the child				
No	1.316	1.018	1.702	**0.036**
Yes	Ref.			
Child weight				
Underweight	1.448	0.922	2.275	0.108

Not underweight	Ref.

Source: RDHS Data, 2020

Multivariate analysis demonstrated that the children aged 6-12 months are three-fold more anemic compared to those aged between 19-23 months, (AOR=3.015, 95% CI 2.253-4.036), and the difference was significant (p<0.001). Also, having an anemic mother is associated with childhood anemia with AOR=0.699(0.486-1.005), p<=0.032. Having not had illness in last two weeks is associated with the absence of childhood anemia with AOR=0.702(0.554-0.890), p<=0.003. Having no access to clean water was associated with childhood anemia with AOR=3.062(1.301-7.204), p<=0.010. The absence of the disposal replacing the toilet for children is three-fold significantly associated with anemia compared to its presence, AOR=2.334(5.188-1.050), p<=0.038. Being poor is three-fold significantly associated with anemia compared to being rich, AOR=3.139(1.862-5.506), p<=0.002. Having received no vitamin A supplementation is associated with childhood anemia with AOR=2.638(1.201-5.794), p<=0.016. And, failing to prepare regularly a balanced diet is significantly associated with anemia, AOR=1.316(1.018-1.702), p<=0.036.

Discussion

Socio demographic factors associated with anemia

The study findings on the prevalence of anemia among children aged between 6-23 months revealed a high rate of anemic children as 52.9% of them were found anemic. These proportions are very high if we compared to the results of other studies. Indeed, Premji et al. (2015) in Tanzania found lower rates of anemia prevalence among children under 5 years old. According to their studies, 39.7% of the concerned children were found anemic.

The study also found that 39.7% of the children are aged 6-12 months and 32.9% are aged 13-18 months. Also, only 11.7% of the mothers were anemic and 63.5% of the children had different kind of illnesses in last two weeks. The reason of higher anemia rates in Rwanda compared to the situation in Tanzania can be explained by the increased nutritional deficiencies, particularly iron deficiency, found in a high level among children in Rwanda.

Bivariate analysis showed that the association of age of the child toward childhood anemia was statistically significant with p<0.05. Indeed, being aged between 6-12 months presented a good association with childhood anemia with 65.8%, X^2=60.325, p<0.000. Also, having an anemic mother presented a visible association with childhood anemia with 60.6%, X^2=3.766, p<0.032. Having not had illness in last two weeks is associated with the absence of childhood anemia with AOR=0.702(0.554-0.890),p<=0.003.Being underweight presented a positive association with childhood anemia with 61.2%, X^2=2.633, p<0.049. Other factors analysed (sex of the child, marital status and mother age) presented no association with childhood anemia. These findings are almost similar to Yip's ones (2017). According to this author, having an anemic mother presented an association with childhood anemia with 62%, X^2=3.41, p<0.006. Moderate and severe anemia is encountered in children from families with anemic mothers like in the present study.

These results are almost the same as those found by Stella (2011). According to her, anemia is found in children under 3 years old compared to the oldest (69% against 26.5% for moderate to severe anemia, 46.5% against 19.4% for mild anemia). Anemia also decreases with age. It is higher in children aged 24-35 months (59%) compared to older children (p=0.005). However, in her study, she found that there is a significant difference according to the sex of the child. Boys seem more anemic than girls (57% versus 50%, p=0.044). Also, women under 35 have a higher prevalence of anemia than their older counterparts (p=0.038) (Stella, 2011). These results are the contrary of the results of the present study. Indeed, the researcher found no effect of sex of the child to his anemic situation. The reason of such contradiction in results could be found in the similar existence of iron among boys and girls in Rwanda due to the lifestyle of the population which is different from the one in Zambia. Concerning religion, Latham (2001) noted a high prevalence of anemia among Christians compared to other beliefs (p=0.02) (Stella, 2011). The present study found no effect of the religion to anemia.

Environmental factors associated with anemia

Bivariate analysis done on association between environmental factors and childhood anemia showed that having no access to clean water presented a significant association with childhood anemia with 56.7%, X^2=7.971, p<0.019. Also, having no disposal replacing the toilet for children also presented a significant association with childhood anemia with 51%, X^2=30.025, p<0.000.

The type of place of residence and the number of ANC visits done presented with no association with childhood anemia.

The results of the present study are not very different from Yip's (2017) who found that sharing toilets with other households would be positively associated with 82 women's anemia. The prevalence of anemia in children is lower in wealthier households possessing improved toilets (p=0.001). The researcher found also that anemia is pathology of the child's environment, the standard of living of households with poverty and even the choice of food, hygiene with the supply of drinking water. Concerning water source, he found that the households using clean water are less concerned with anemia problems compared to those not using clean water (p=0.014). These results confirm the ones obtained by the present study.

Multivariate analysis showed that having no access to clean water was associated with childhood anemia. The absence of the disposal replacing the toilet for children is three-fold significantly associated with anemia compared to its presence. The results of this study are not the same as those of Fotso (2005). Indeed, this author showed on the literature of DHS data concerning the influence of environmental factors on anemia that anemia is most visible in rural areas than in urban areas where it was mainly concentrated the wealthiest class of the population. The authors concluded that children from urban areas were less anemic than those from rural areas. In the study by Pongou et al. (2006) in Cameroon, it appears that children of the cities have a good anemic situation, particularly among those living in the western or coastal provinces compared to inhabitants of the north of Cameroon.

Socioeconomic factors associated with anemia

Bivariate analysis done on socioeconomic factors showed that poverty presented a significant association with childhood anemia with 63.7%, X^2=21.143, p<0.004. Also, having not received Vit A supplementation presented a significant association with childhood anemia with 49.8%, X^2=26.981, p<0.000. The absence of regular preparation of balanced diet presented a significant association with childhood anemia with 49.1%, X^2=4.392, p<0.036. Education level of the mother, breast milk and having received iron during pregnancy presented no association with childhood anemia.

With little differences, in a study conducted by El Hiou et al. (2009), it was found that the prevalence of anemia decreases significantly ($p < 0.05$) with the education level of the mother. Education level of the mother is associated with anemia among the child ($p=0.015$). The more the mothers are educated, the less the children have anemia. These results contradict the present results as in this study, no effect of education on anemia was found.

Multivariate analysis showed that being poor is three-fold significantly associated with anemia compared to being rich, AOR=3.139(1.862-5.506), p<=0.002. Having received no vit A supplementation is associated with childhood anemia with AOR=2.638(1.201-5.794), p<=0.016. And, failing to prepare regularly a balanced diet is significantly associated with anemia.

These results contradict the Yip's ones (2017). Indeed, according to him, the socioeconomic status of the community is particularly associated with anemia in children ($p=0.041$). Moderate and severe anemia are encountered in children from communities of medium and low socioeconomic levels on a high level compared to those belonging to communities of higher socioeconomic levels (40%, 32% and 24% respectively). That of mild anemia decreases with increasing socioeconomic status of the community.

In the same perspective, Hallberg (2018) found no relationship in relation with protein consumption. These findings are the contrary of the ones found by Hallberg (2018) because he found that wealth index, level of education and ability to give children meat and Vit A supplementation are in relationship with the prevalence of anemia among under five years old children.

The limitations of this study, normally, on anemia among children aged 6-23 months should not neglect malaria and other parasitic infections and chronic illness among the indicators of the occurrence or not of anemia since different authors have demonstrated that there is a close relationship between these diseases and anemia. However, after obtaining permission (author letter is already obtained), the dataset was downloaded from the website at http://www.DHSprogram.com. And fully, dataset have been given to the researcher does not contain the data relating to malaria and other parasitic infections. Therefore, the researcher was forced not to analyze the relationship between anemia and malaria and parasitic infections due to lack of data on this disease despite the desire he had to do such an analysis.

Conclusion

Refereeing to the preceding pages, nutritional anemia is classified as the main causes of hospital admission in children aged under 2 years old in Rwanda. According to the 2019-2020 Rwanda Demographic survey, the occurrence of iron deficiency among those children is at 37% level. This rate remained stagnant for the whole decade as in 2015, thirty-seven percent of children age 6-59 months were anemic, which represent a slight decline from 38 percent in 2010.Iron deficiency impairs learning abilities of young children and their subsequent social and economic integration as it affects their cognitive development. Having noticed the persistence of increased rates of anemia among children, this study wishes to understand and analyze the factors associated with anemia among children aged 6-23 month in Rwanda using the data of Rwanda Demographic and Health Survey 2019/2020. The overall results showed that child age, maternal anemia, having had any illness in last two weeks, absence of access to clean water, absence of disposal replacing the toilet for children, poverty, absence of Vit A supplementation and absence of regular preparation of balanced diet for the child are all associated with childhood anemia. Other indicators used to measure the association with anemia have been found not significant.

Limitations

Normally, a study on anemia among children should not neglect malaria among the indicators of the occurrence or not of anemia since different authors have demonstrated that there is a close relationship between these two diseases. However, the database that NISR gave to the researcher does not contain the data relating to malaria. Therefore, the researcher was forced not to analyze the relationship between anemia and malaria due to lack of data on this disease despite the desire he had to do such an analysis.

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