COLLEGE OF MEDICINE AND HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

Underlying factors associated with anaemia among women aged 15-49 in Southern Province and Kigali City of Rwanda: A secondary data analysis of 2014/15 Rwanda Demographic and Health Surveys (RDHS)

A dissertation submitted in the partial fulfilment of the requirement of Rwanda-College of Medicine and Health Sciences for a MASTER OF SCIENCE IN PUBLIC HEALTH.

By

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Declaration

I, SADICK NTAKIRUTIMANA hereby declare that this thesis has been written by me without any external unauthorized help, is my original work and has not previously been submitted elsewhere. Also, I do declare that a complete list of references is provided indicating all the sources of information quoted or cited without exception.

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Declaration by the supervisor:

I confirm that the work reported in this thesis was carried out by the candidate under our supervision.

Dr SEMASAKA SENGOMA Jean Paul

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Abstract

Background: The increasing prevalence of anaemia from 17% in 2010 and 19% in 2014/15 (1–3), among women aged 15-49 in Rwanda shows that Anaemia is still a public health concern and if not addressed, it will continue to have a negative health, social and economic consequences. However, there still gaps in availability of evidence about the underlying risk factors associated with anaemia among women in reproductive age which need to be addressed while implementing public health interventions.

Methodology: This study was a quantitative, cross-sectional study using secondary data analysis of Rwanda Demographic and Health Survey (RHDHS) 2014-2015. The outcome for this study was anaemia status and 2,650 women in reproductive age who had haemoglobin results and anaemia status were included in this study. Analysis was presented in frequency and Logistic regression was used to test the association between anaemia and exposures. Significant variables were assessed using odds ratio (OR), their 95% confidence interval (CI) and p-value <0.05. Stata v.13 was used for analysis and were applied in all steps of the analysis.

Results: The results from this study demonstrated that in the Southern province, being poor was highly associated with being anaemic [OR=2.04 (95% CI: 1.55-2.68), p=0.000]. Users of modern family planning methods had more risks of having anaemia in the Southern province [OR=1.44(95% CI: 1.05-1.97), p=0.023] as well as Kigali city [OR=1.92(95% CI: 1.22-2.01), p=0.004].

CONCLUSION

This study demonstrates that few factors were found to be associated with anaemia among women of reproductive age in both provinces. Using family planning methods was found to be a shared determinant of having anaemia among women in reproductive age in both the Southern province and Kigali city, while the only found specific risk factor of having anaemia among women of reproductive age in the Southern province was being in poor index wealth category.

Keywords: Anemia, Women of Reproductive Age, associated factors

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Dedication

“This work is dedicated to my lovely wife, UWANYIRIGIRA Roseline and to My family members. Without their caring support, it would not have been possible to complete this work. May God bless and keep you always”.

List of symbols and acronyms

%:	Percentage
ANC:	Antenatal care
BCC:	Behaviour Change Communication
BMI:	Body Mass Index
CHW:	Community Health Workers
CI/IC:	Confidence Interval /Interval de Confiance
FP:	Family Planning
HIV:	Immunodeficiency Virus
IDA:	Iron Deficiency Anaemia
IEC:	Information Education and Communication
IUD:	Intra Uterus Device
LLITNs:	Long Lasting Insecticide Treated Nets
MDGs:	Millennium Development Goals
MOH:	Ministry of Health - Rwanda
NISR:	National Institute of Statistics of Rwanda
OR:	Odds ratio
RDHS:	Rwanda Demographic and Health Survey
SPH:	School of Public Health
UR:	University of Rwanda
WHO:	World Health Organization
WRA:	Women of Reproductive Age

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Chapter 1: Study background

Since the medieval period, anaemia has been a public health concern and it affects about 1.62 billion people globally with a threshold consideration for all levels significant levels being <90g/L (4–6). The prevalence ranges from 9% in advanced countries and 43% in growing countries. Most of the affected population are mainly children and women of reproductive age, who represent anaemia prevalence of 30 %, where Asia and Africa are affected at 85% (6). This disease is more serious because it affects everyone on the planet but varies in terms of severity, duration, and impact(7). The annual estimation of 115,000 for maternal deceases and 591,000 perinatal mortalities globally are associated with anaemia (6).

Maternal and child mortalities are public health concerns in low income and middle in countries. In 2015 at least 303 000 women died at time of pregnancy and childbirth and 45% of children died on or before one month after birth (8,9).

It has been estimated that in 2013, approximately 90,000 deaths from all age group both sex globally was due to iron deficiency anaemia (4). Women of reproductive age normally 15-49 years usually have iron-deficiency anaemia caused by heavy bleeding during periods like menstruation. Iron deficiency anaemia may be prevented by healthy diets(5,7). It has shown that the Iron deficiency anaemia may result be the result of intellectual and motor growth which trigger tiredness and low production (4), increases the probability of low birth weight (6%) (10), and preterm children. The global threshold for mild anaemia in women aged 15-49 is <120g/L but <110g/L for pregnant women(4,6). Anaemia is estimated to affect about 528.7 million women between 15-49 years of age giving a percentage of 29.2%, and among them, 20.2 million are severely anaemic and the great majority of those severely affected are found in Africa (4). Anaemia increases with individuals place of habitation, education level, wealth index status, having malaria and smoking(4,6).

Even though Rwanda has met the Millennium Development Goals (MDGs) 4 and 5 through maternal and child health promotion (5), maternal and child mortalities are still a public health concerns especially in all developing countries including Rwanda. Different studies have been shown that anaemia is a contributing factor of maternal and child mortalities and morbidities(11–14).

Different measures and strategies have been applied in Rwanda to lower anaemia among the population. These include systematic purveying of Iron Folic Acid (IFA), periodic deworming among population at risk, promotion of balanced diet for feeding by using local resources, malaria prevention by using treated bed nets and clean water supply among population. Anaemia prevalence trend In Rwanda, among women aged 15-49 years, has been 26% in 2005, 18% in 2007-8, 17% in 2010 and 19% in 2014/15(1–3), however, this prevalence is less prevalent compared to those in other age groups like in children which is at 37%(2,3).

The cause of anaemia in Rwanda are known to be insufficient diet intake, malabsorption of iron and other micronutrients, infectious diseases including malaria and excessive red blood cells losses(2). Factors like smoking habit, inadequate educational level, place of residence, as well as wealth quintile, have been mentioned as underlying risk factors related to the prevalence of anaemia among these women in the country(10).

The occurrence of anaemia from 17% in 2010 to 19% in 2014/15 (1–3), among women of reproductive age in Rwanda shows that, Anaemia still a public health concern and if not addressed, it will continue to have a negative impact on the effort made in terms of maternal and child health promotion and other advanced progress initiatives. However, there still challenges for evidence-based with risk factors associated with anaemia among WRA which need to be addressed while implementing public health interventions. Therefore, we need to develop scientific evidence for appropriate interventions aiming to reduce the prevalence of anaemia on countrywide especially in district with high prevalence.

I.2. Problem statement

Although the prevalence of anaemia nationally is 19%, the Southern province with the prevalence of (23%), and especially with Gisagara district(37%) which represents the highest prevalence of anaemia among WRA in Rwanda (15). Furthermore, Kigali city, with prevalence of anaemia of 15%, represents the lowest prevalence of anaemia among WRA in Rwanda (10).

To reduce anaemia among these women is a priority. There is a need of understanding why the Southern province of Rwanda has high prevalence of anaemia compare to Kigali city, in order to identify required interventions to minimize anaemia trend among women of reproductive age in southern province by providing specific risk factors associated to anaemia.

I.3. Study rationale

The Rwandan Demographic Health Survey 2014/2015 have shown that anaemia prevalence is high in South province than in Kigali city. Currently, in our knowledge, there are few studies conducted in Rwanda comparing factors related to anaemia among women of reproductive age in the provinces with high to low prevalence, once understanding factors associated to anaemia different strategies will be developed to reduce this burden, within our country for sustainable development with healthier and active population.

This study aimed at evaluating and determining the level of underlying risk factors associated with anaemia among women of reproductive age between Southern province and Kigali city of Rwanda. The study outcomes will be served as a start point to illustrate recommendations that will be used to address the underlying risk factors associated with anaemia among WRA between the Southern province and Kigali city.

I.4. Definition of term.

Anaemia is a decrease in the amount of circulating haemoglobin in the Red Blood Cells and lowered ability to carry oxygen that leads to poor health caused by limited supply of oxygen to human organs(7). It is classified into three levels of public health significance:

Women aged 15-49: This is related to all women who are in reproductive age i.e: the period in which a woman can conceive.

Demographic and Health Surveys (DHS): is a national representative household surveys that provide data for a wide range of monitoring and impact evaluation indicators in the areas of population, health, and nutrition. There are two main types of DHS Surveys(16)**:**

- **Standard DHS Surveys:** have large sample sizes conducted every 5 years for comparison over time.
- **Interim DHS Surveys:** focus on all impact evaluation.

This study used the Standard DHS Survey

I. 6. Research objectives

I.6.1. General objective

To evaluate and determine the level of risk factors associated with anaemia among women aged 15-49 between Southern province and Kigali city of Rwanda.

I.6.2. Specific objectives

- To determine socio-demographic characteristics of women with anaemia aged 15-49 in Southern Province and Kigali city of Rwanda.
- To determine health factors of women with anaemia aged 15-49 in the Southern Province and Kigali city of Rwanda.
- To determine the level of risk factors associated with anaemia among women aged 15-49 between Southern province and Kigali city of Rwanda.

From the above background and objectives of this study, the later will respond to the following questions.

- What are the socio-demographic characteristics of women with anaemia aged 15-49 in Southern Province that lead to anaemia?
- What are the health factors of women with anaemia aged 15-49 in South Province and Kigali city of Rwanda?
- What factors are associated with anaemia among women aged 15-49 between Southern province and Kigali city of Rwanda?

Chapter 2: Literature Review

2.1. Overview of the study

2.1. 1. Generalities about anaemia

Anaemia is an illness in which the amount of red blood cells is less than the required amount to meet the daily physiological needs. Different determinants may influence physiological needs such as age, gender, residential area, smoking habit, and pregnancy status. Iron deficit is supposed to be the main shared cause of anaemia globally, but other nutritional deficits, acute and chronic inflammatory conditions, parasitic infections, and congenital or acquired disorders that affect haemoglobin synthesis, red blood cell production or red blood cell stability, can all cause anaemia (17).

Only haemoglobin level can't be used as reference to determine iron deficit. Though, the level of haemoglobin should be quantified, even though not all anaemia is triggered by iron deficiency. The prevalence of anaemia is an essential as health indicator and once used with other measurements of iron level the haemoglobin concentration can offer information about the gravity of iron deficit (18).

Table 1: Haemoglobin levels to determine anaemia (18)

		Anaemia		
Population	**Non - anaemia**	**Mild**	**Moderate**	**Severe**
Children 6 - 59 months	110	100-109	70-99	less than 70
Children 5 - 11 years	115	110-114	80-109	less than 80
Children 12 - 14 years	120	110-119	80-109	less than 80
Non-pregnant women (15 years and above)	120	110-119	80-109	less than 80
Pregnant women	110	100-109	70-99	less than 70
Men (15 years and above)	130	110-129	80-109	less than 80

*g/dl

There are different types of anaemia and the treatment, as well as its intervention, will depend on the cause, its risk factors and its impact on the population. (19)

2.1.2. Anaemia classification by public health significance

WHO developed and categorized the anaemia prevalence, to find out at what instinct anaemia can be a public health concern in the population, these classification help to determine if anaemia is significantly a public health concern, to decide which interventions required (19).

Table 2: Category of anaemia by public health significance (19)**.**

Prevalence of anaemia (%)	**Categories**
≤4.9	No
5.0–19.9	Mild
20.0–39.9	Moderate
≥40.0	Severe

2.1.3. Aetiology

Anaemia is the consequence of a wide-ranging variation of sources that can be prevented, although some of them coincide with its occurrence. Generally, the greatest significant contributor to anaemia is iron deficiency. It has shown that 50% of the cases of anaemia are owed by iron deficiency (20), but the rate may vary among population and in different areas giving the local nutritional habit.

The key predictors for IDA comprise; insufficient iron consumption, malabsorption of iron from diets, and in different conditions where iron is required in high demand especially during pregnancy. Anaemia also may be a result of, unusual menstruation, parasite infections, acute and chronic infections such as malaria, cancer, tuberculosis, and HIV can lower blood haemoglobin concentrations. (19)

The occurrence of other micronutrient deficit, such as vitamins A and B12, folate, riboflavin, as well as copper can rise also the anaemia. however, in some instance, the impact of abnormal haemoglobin on anaemia prevalence should be taken in consideration in some populations. (19)

2.1.4. Health effects

Anaemia is a sign of both inadequate diet status and individual wellbeing. The greatest negative outcome of anaemia is the risk of maternal and child mortalities and morbidities as results of severe anaemia. In addition, the Iron Deficiency Anaemia has a negative impact on intellectual and physical growth of children, as well as physical functioning, mainly work output in adults (20).

2.1.5. Assessing anaemia

At the community level, the haemoglobin concentration is the reliable measure to determine anaemia, contrary to the clinic setting where other factors should be considered to make decision. Determining haemoglobin concentration is quite easy and reasonable price and can be treated as a substitution mean of iron insufficiency. Though, anaemia can be a result of different factors other than iron defect. The key objective to assess anaemia is to inform policymaker on the kind of strategies needed to adopt while installing control measures of anaemia. This suggests that in addition to the haemoglobin dosage, the causes of anaemia should be identified due to the fact, it may vary in different population. (19).

2.1.6. Control of anaemia

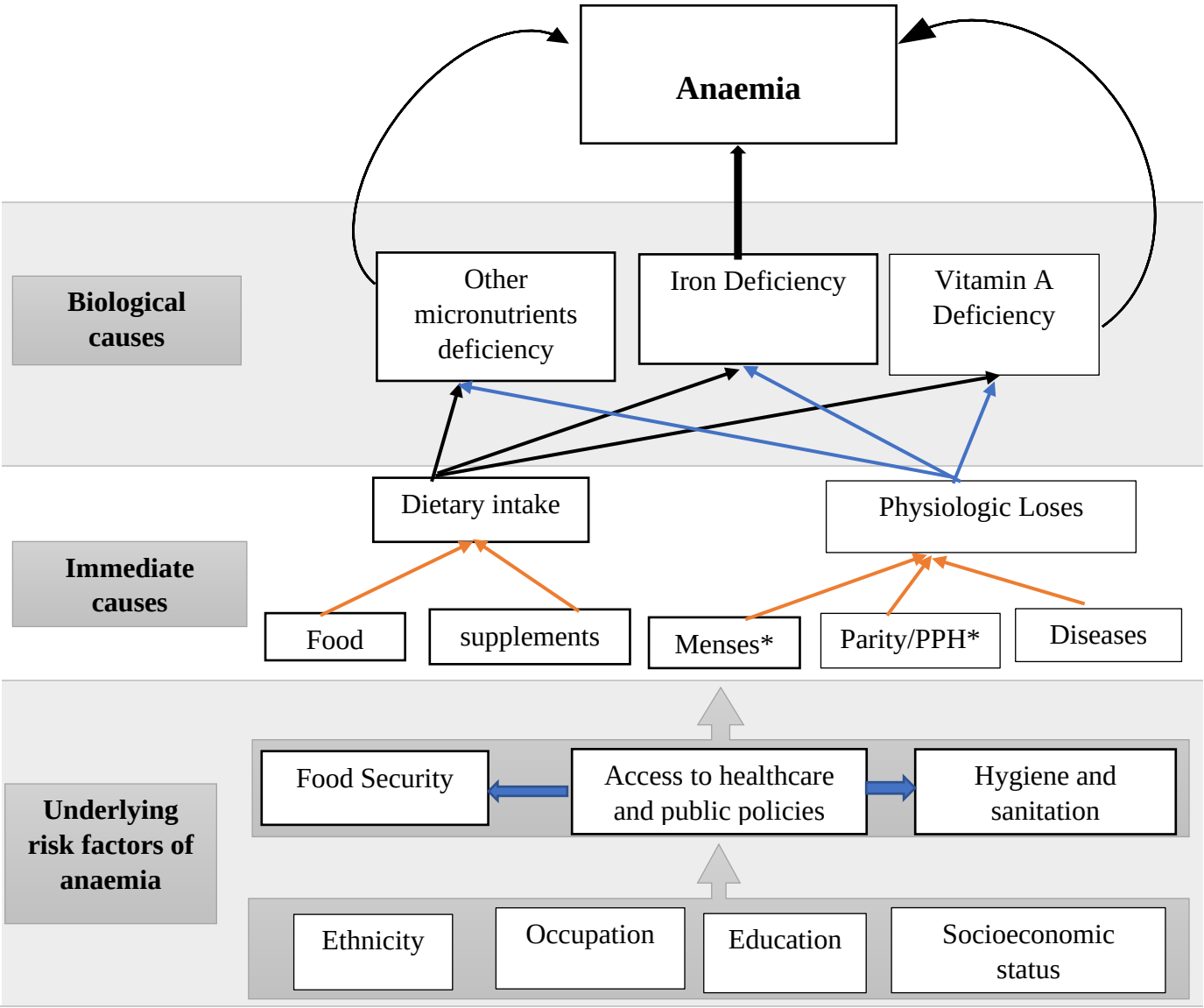
2.1.6.1. Correcting anaemia

Based that anaemia is a disease involving or depending on several factors or causes, treating anaemia needs a systematic approach, to make sure that all contributing factors are identified and addressed accordingly. Different measures should take into consideration the additional iron intake through iron supplements to population at risk, food reinforcement and dietetic variation, as well as sustainable strategies to prevent iron deficiency anaemia in the affected community. The suitable way to overcome anaemia is to introduce different strategies to fight against anaemia into primary health care for the existing program. (19)

2.2. Factors associated with anaemia among women of reproductive age

Anaemia predicting factors range from socio-demographic factors and mother's health characteristics.

2.3. Conceptual Framework



***PPH**: Post-Partum haemorrhage*

Figure 1. Conceptual framework

Referring to UNCEF conceptual framework that presents the causes of anaemia at various levels (biological, immediate and underlying) was used to propose potential pathways that lead to anaemia in developing country setting. The following conceptual framework characterizing the complex aetiology of anaemia (figure1), includes key micronutrient deficiencies, namely iron, vitamin A and other micronutrients, as important direct biological causes of anaemia, followed by the immediate causes of these micronutrient deficiencies, namely inadequate dietary intake and

nutrient losses. Finally, the underlying causes are food insecurity, inadequate health care, poor hygienic practices and deficient sanitation, influenced in turn by socioeconomic status, education and other demographic characteristics such as ethnicity and occupation.

Chapter 3: Methodology

3. 1. Study setting

Rwanda is located in central Africa with 5 provinces namely Kigali city, Southern province, Northern province, Eastern province, and Western Province(1,3). Kigali city is the capital of the country and accommodates 11% of the general population while the Southern province accommodates 20%(3,10). About 64.4% of residences of the Southern province are independent farmer with 14.5% wage farm compared to Kigali city which has 12.6% independent farmer with only 4.8% wage farm (EICV%). About 19% of the Southern province inhabitants have no education, 68.5 % have primary education mostly male and only 1.1% having higher education. There are 68.1% of southern province residence having health insurance, 9% and 16% of women are underweight and obese or overweight respectively(10,15). Comparatively to Kigali city, where 9.8% of the population without education, 58.2% have primary education and 7.2% of the population has higher education. Further, 70.8% of Kigali city occupants, have a health insurance where 6 % are thin and 34% obese or overweight(10). The fertility rate of Kigali and south province are respectively3.7 and 4.0 (3).

The Rwanda government, has put much efforts to correct anaemia prevalence through integrated methods like the Integrated Improved Livelihood Program (IILP) and the National Multi-sectorial Food and Nutrition Policy and Strategic plan for 2013-2018, all also aligning with the countries plan to reduce poverty and make it a middle income country by 2020 (1–3).

3.2. Study design

This study was a cross-sectional analysis using secondary data analysis of the RDHS 2014/2015.

3.3. Study population

Women of reproductive age participated in RDHS 2014/2015 recruited for anaemia assessment.

3.4. Sampling methodology

3.4.1. Sample size.

The study is a secondary data analysis of RDHS 2014/2015, conducted to get data about health and demographic related indicators. Samples are randomly selected from households across Rwanda. Data collection for anaemia on women were conducted and the total of 13,497 women aged 15-49 participated in the survey but only 6,681 were recruited for the anaemia survey. Among them, 942 were from Kigali city and 1,708 from south making a total of 2,650 women representing the sample size of this study.

3.5. Data collection procedures and tools.

3.5.1. Data collection procedures

The study made use of secondary data collected by the RDHS. During data collection for this study, raw measured values of blood haemoglobin were obtained using the HemoCue instrument and adjusted for altitude and smoking status from women 15-49. Only those that consented were recruited to be part of the study.

A written application was made to the DHS board to have access to dataset. Upon approval (July 15th, 2018), the dataset was downloaded, and all Women in Reproductive Age (15-49 years) in Kigali city and south province having available data about anaemia status were extracted and included in the study as variables.

3.6. Description of main variables

3.6.1. Outcome variable

Anaemia status for women of reproductive age (15-49years).

3.6.2. Independent variables

3.6.2.1. Socio-demographic factors

- **Age of the woman**: Categorized with 5 years' intervals
- **Type of residence**: Determine living in rural or urban areas
- **Educational level**: Categorized by primary, secondary, and higher.
- **Wealth index/ Economic status**: Categorized by poorest, poorer, middle, richer, richest.
- **Marriage status**: Categorized by living with partner and not living with partner.

3.6.2.2. Women' health status

- **Pregnancy status**:
  Categorized by not pregnant and pregnant.
- **Number of Children ever born:**
  Categorized by had no child, having 1-3 children, 4 children and more.
- **Breastfeeding status**:
  Categorized by breastfeeding and not breastfeeding.
- **Have mosquito bed net for sleeping**:
  Categorized by who had mosquito bed net and not.
- **Respondent slept under mosquito bed net:**
  Categorized by who slept under mosquito bed net and who did not.
- **Use of family planning (FP) methods:**
  Categorized by who use any family planning method and those who don't.
- **Source of drinking water:**
  Categorized by who use improved source of drinking water and who don't.
- **Access to health facility***:*
  Categorised by who consider as a big problem and those who do not.

3.7. Data analysis and procedures

Stata version 13. Were used, frequency and percentage for all categorical variable were computed to describe socio-demographic and women's health risk characteristics of anaemia among WRA for Kigali city and Southern province as exploratory analysis. Thereafter, logistic regressions have been performed for bivariate and multivariate analysis to determine factors associated with anaemia. A confidence interval 95% with p-value 5% were used for the study.

III.8. Ethical considerations

The RDHS 2014-2015 before taking palace it has to get approval for ethical and methodological considerations by the Rwanda National Ethics Committee and the National Institute of Statistics of Rwanda.

Chapter 4: Results

Diverse factors were used to define the study population according to their anaemia status. Study population with anaemia were described in general with different factors leading to anaemia as well as the proportion of who were not anaemic. A total of 2650 women in reproductive age, 35.5% were from Kigali city and 64.5% from Southern Province.

4.1. Socio-demographic characteristics of study population by provinces

In Kigali city, almost a half of participants (43.2%) were aged <24 years old, 81% reside in urban area, 48.4% have completed primary education and 4.6% of participants had no education. More than three quarts of participants (85.1%) were from the rich wealth index, and 56.3% were not in living with their partners.

In Southern province, 37% of participants were aged <24 years old, 83.7% were living in rural areas, 68.9% have completed primary education and 10.7% had no education. Only 42.9% of participants were from the rich wealth index, and 37.1% were from the poor wealth index and 50.9% were not living with their partner.

Other socio-demographic characteristics of the study population by provinces are presented in Table 3.

Table 3:Socio-demographic characteristics of study population by provinces. n=2,650

Variables	Value	Kigali city		Southern Province	
		Total	Percentages	Total	Percentages
Age	15-19	202	21.4	346	20.3
	20-24	205	21.8	286	16.7
	25-29	175	18.6	299	17.5
	30-34	151	16.0	274	16
	35-39	111	11.8	189	11
	40-44	60	6.4	161	9.4
	45-49	38	4.0	153	8.9
Place of residence	urban	763	81	278	16.3
	Rural	179	19	1,430	83.7
Education level	Higher	100	10.6	38	2.2
	Secondary	343	36.4	311	18.2
	Primary	456	48.4	1,176	68.9
	No education	43	4.6	183	10.7
Wealthy	Rich	802	85.1	732	42.9
	middle	31	3.3	342	20
	Poor	109	11.6	634	37.1
Marital status	Not living with a partner	530	56.3	869	50.9
	Living with a partner	412	43.7	839	49.1

4.2. Health risk determinants of study population by provinces

In Kigali city, almost every participant (93.6%) own a mosquito net, but only three-quarters of them (78.2%) reported to sleep under a mosquito net. A few numbers of participants 6.9% were pregnant, 42.4% had between 1-3 children and 19.3% were breastfeeding. Almost one-quarter of participants (27.3%) reported to use a family planning method, and 91.7% reported to use an improved toilet facility. The great majority of participants 91.5% confirmed that the access to health facility is not a big distance, and most of them 99.2% were not smokers.

Furthermore, in the Southern province, 87.1% own a mosquito bed net, and 70.2% of them reported to sleep under a mosquito net. Only 7.3% of participants were pregnant, 39.2% of participants have more than 4 children and almost one-third of participants were breastfeeding. Almost three-quarters of participants 71.2% reported to not use any kind of family planning methods, 92.6% of participants reported to have an improved toilet facility and only two-third of them reported to use

improved toilet facility. More than three-quarters of participants 78.0% confirmed that the access to health facility is not a big distance, and most of them 98.7% were not smokers.

Other health risk determinants of study population by provinces are presented in Table 4.

Table 4:Health risk determinants of study population by provinces. n=2,650

Variables	**Value**	**Total**	**Percentages**	**Total**	**Percentages**
Pregnant status		**Kigali city**		**Southern Province**	
	No	877	93.1	1,583	92.6
	yes	65	6.9	125	7.3
Number of children	Never had children	388	41.2	600	34.8
	<3	399	42.4	669	35.1
	4-12	155	16.5	908	39.2
Brest feeding	No	760	80.7	1,184	69.3
	Yes	182	19.3	525	30.7
Have Mosquito net	Yes	882	93.6	1,488	87.1
	No	60	6.4	220	12.9
Have slept under	Yes	737	78.2	1.199	70.2
mosquito net	No	205	21.8	509	29.8
Family planning	No user	685	72.7	1,216	71.2
	User	257	27.3	492	28.8
Water sources	Improved	864	91.7	1,193	69.9
	Non improve	78	8.3	515	30.2
Access to health facility	Not a big distance	862	91.5	1.333	78
	Big distance	80	8.5	375	22
Smoking status	No	934	99.2	1,686	98.7
	Yes	8	0.9	22	1.3
Outcome variable					
Anaemic	Anaemic	152	16.1	397	22.7
	Not anaemic	790	83.9	1321	77.3

4.3. Comparative analysis of risk factors for anaemia by provinces

4.3.1. Results of comparative analysis for socio-demographic characteristics factors and anaemia status by province' of residence

In the Southern province, as shown in Table 7, the comparative analysis showed that women with age between 25–29 years [OR: 1.54 (1.05-2.25)] together with women aged between 35-39 years [OR: 1.69 (1.07-2.66)] were found to be more likely to have anaemia, compared to women aged between 15–19 years.

In Kigali City, women aged between 40-44 years were found less likely to have anaemia [OR:0.40(0.19-0.83)] compared to women with 15-19 years old.

In the Southern province, coming from the poor wealth index category was associated with being anaemic and statistically significant [OR:2.07 (95% CI: 1.58-2.71)], although not strongly associated among the middle wealth index [OR:1.09 (95% CI: 0.81-1.46)].

The table 7 below show the detailed results of comparative analysis of socio-demographic factors:

Table 5:Comparative analysis for socio-demographic characteristics and anaemia status by Province of residence. n=2,650

Variables	Kigali city n=942			Southern province n=1708		
	COR*	**CI, 95%**	**P.value**	**COR**	**CI, 95%**	**P.value**
Age						
15-19	1			1		
20-24	0.63	[0.36-1.11]	0.108	0.93	[0.65-1.33]	0.694
25-29	0.71	[0.39-1.27]	0.249	1.54	[1.05-2.25]	**0.029**
30-34	0.79	[0.42-1.47]	0.459	1.11	[0.76-1.61]	0.590
35-39	0.65	[0.34-1.25]	0.200	1.69	[1.07-2.66]	**0.025**
40-44	0.40	[0.19-0.83]	**0.014**	1.39	[0.87-2.20]	0.165
45-49	0.51	[0.20-1.22]	0.133	0.72	[0.47-1.10]	0.131
Place of residence						
Urban	1			1		
Rural	1.01	[0.65-1.56]	0.979	0.99	[0.74-1.36]	0.999
Educational level						
Higher	1			1		
Secondary	1.20	[0.69-2.09]	0.510	1.51	[0.71-3.21]	0.281
Primary	1.72	[0.99-2.98]	0.054	1.45	[0.71-2.96]	0.308
No education	1.16	[0.46-2.87]	0.744	1.03	[0.47-2.22]	0.947
Wealth index						
Rich	1			1		
Middle	1.33	[0.46-3.86]	0.600	1.09	[0.81-1.46]	0.552
Poor	1.15	[0.65-2.01]	0.637	2.07	[1.58-2.71]	**0.000**
Marital status						
Not living with partner	1			1		
Living partner	0.11	[-0.24-0.46]	0.535	0.26	[0.041-0.49]	**0.020**

*COR: crude old ratio

4.3.2. Results of comparative analysis for health risk characteristics and anaemia status by province' of residence

O top of socio-demographic characteristics which were statistically significant, in Southern province, not having mosquito bed net was also statistically associated with anaemia [OR: 1.68 (1.23-2.29), p=0.001] compared to those who don't have, not sleeping under mosquito bed net was also associated with anaemia [OR :1.53 (1.20-1.94), p=0.000] compared to those who slept under mosquito net, using a family planning method was also associated with anaemia [OR :1.64 (1.25-2.15), p=0.000], and having improved facility as source of drinking water is a protective factor of anaemia [OR :0.49 (0.34-0.73), p=0.000] compared to those who use unimproved facility as source of drinking water. In Kigali city, only the use of family planning method was associated with anaemia and statistically significant [OR: 1.63 (1.07-2.52), p=0.024]. compared to those who don't use any family method.

The table 6 shows details of comparative analysis for mothers' health factors:

Table 6: Comparative analysis for health characteristics and anaemia status by Province of residence. n=2650

Variables	Kigali city n=942			Southern province n=1708		
	COR*	**CI, 95%**	**P.value**	**COR**	**CI, 95%**	**P.value**
Pregnancy status						
No	1			1		
Yes	0.62	[0.33-1.13]	0.118	1.25	[0.79-1.98]	0.338
Number of children						
Never had child	1			1		
<3	0.07	[-0.31-0.45]	0.715	0.13	[-0.13-0.39]	0..324
4-12	-0.02	[-0.52-0.48]	0.937	0.94	[-0.19-0.39]	0.528
Breastfeeding status						
No	1			1		
Yes	1.26	[0.79-2.00]	0.328	1.06	[0.83-1.26]	0.640
Have mosquito bed net for sleeping						
yes	1			1		
No	0.75	[0.39-1.46]	0.402	1.68	[1.23-2.29]	**0.001**
Respondent slept under mosquito bed net						
Yes	1			1		
No	0.77	[0.52-1.15]	0.205	1.53	[1.20-1.94]	**0.000**
Use of family planning method						
No	1			1		
Yes	1.63	[1.07-2.52]	**0.024**	1.64	[1.25-2.15]	**0.000**
Source of drinking water						
Unimproved facility	1			1		
Improved facility	1.06	[0.56-2.02]	0.851	0.49	[0.34-0 .73]	**0.000**
Access to health facility						
Not a big distance	1			1		
Big distance	1.57	[0.77-3.21]	0.218	0.94	[0 .72-1.24]	0.672

*__NA:__ the independent variable can't explain the dependent.
*COR: crude old ratio

4.4. Results of comparative analysis for factors associated with anaemia by province of residence with final model

The results demonstrate that in the Southern province, WRA coming from the poor wealth index category were more likely to be anaemic and statistically significant [OR:2.04 (95% CI: 1.55-2.68), p=0.000] and those who use family planning methods, were more likely to be anaemic [OR:1.44(95% CI: 1.05-1.97), p=0.023]. While in Kigali city, only users of family planning methods were more likely to be anaemic [OR:1.92(95% CI: 1.22-2.01), p=0.004].

The table 7 gives details about the findings of the multivariate analysis in the final model:

Table 7: Results of comparative analysis for risk factors associated with anaemia – final model

Variables	Kigali city			Southern Province		
	AOR	CI, 95%	P.value	AOR	CI, 95%	P.value
Age						
15-19	1			1		
20-24	0.58	[0.33-1.02]	0.059	0.87	[0.60-1.27]	0.478
25-29	0.57	[0.31-1.04]	0.071	1.37	[0.89-2.10]	0.155
30-34	0.63	[0.34-1.19]	0.160	0.92	[0.59-1.42]	0.701
35-39	0.50	[0.26-0.99]	**0.049**	1.46	[0.89-2.42]	0.138
40-44	0.32	[0.15-0.67]	**0.003**	1.15	[0.69-1.90]	0.598
45-49	0.47	[0.19-1.15]	0.098	0.68	[0.43-1.06]	0.091
Wealth index						
Rich				1		
Middle				1.15	[0.85-1.54]	0.360
Poor				2.04	[1.55-2.68]	**0.000**
Marital status						
Not living with partner				1		
Living partner				0.96	[0.71-1.99]	0.771
Have mosquito bed net for sleeping						
Yes				1		
No				0.82	[0.55-1.23]	0.338
Respondent slept under mosquito bed net						
Yes				1		
No				0.80	[0.58-1.09]	0.165
Use of family planning method						
No	1			1		
Yes	1.92	[1.22-2.01]	**0.004**	1.44	[1.05-1.97]	**0.023**
Source of drinking water						
Improved facility				1		
Unimproved facility				1.00	[0.78-1.29]	0.979

Chapter 5: Discussion and conclusion

5.1. Discussion of the results

5.1.1. Risk factors of anaemia among WRA

In Kigali city, almost a half of participants (43.2%) were aged <24 years old, 81% reside in urban area, 48.4% have completed Primary education and 4.6% of participants had no education. More than three quarts of participants (85.1%) were from the rich wealth index, almost one quarter of participants (27.3%) reported to use a family planning method, and most of them (99.2%) were not smokers. In Southern province, 37% of participants were aged <24 years old, (83.7%) were living in rural areas,(68.9%) have completed primary education, and (10.7%)with no education, Only (42.9%) of participants were from the rich wealth index, and (37.1%) were from the poor wealth index and (78.2%) of them reported to sleep under a mosquito net, almost three quarters of participants (71.2%) reported to not use any kind of family planning methods, and (30.2%) reported to use unimproved water sources facility.

The study found that using family planning methods was the main determinant of having anaemia among women of reproductive age in Southern province [OR:1.44(95% CI: 1.05-1.97), p=0.023] and Kigali city [OR:1.92(95% CI: 1.22-2.01), p=0.004]. Being in poor index wealth category has been proven as the proper factor of having anaemia among women of reproductive age in southern province [OR:2.04 (95% CI: 1.55-2.68), p=0.000**]**.

Geographical location has been associated with anaemia among women of reproductive age in different studies similar to our study findings. The same results were found in a study conducted in Tanzania, about variations of anaemia according to geographical location (13) with some findings from Ethiopia (12). Our study findings show that women of reproductive age in Southern province have a bigger risk of anaemia, and can be justified by that, is in the provinces of Rwanda where we have a big number of malaria cases, especially in Gisagara district. And malaria is a potential predictor of anaemia in the community (21). Due to the fact that this was a secondary data analysis and data for malaria in the Southern province and Kigali city were not available, we couldn't manage to demonstrate its association between anaemia among WRA.

The wealth index quantile among women of reproductive age was found to be associated with anaemia in Southern province, where it shows that coming from the poor wealth index category was associated with anaemia, which is similar to what found in Bangladesh by Kamruzzaman et al where women who lived in poor households were more likely to be anaemic than women who lived in rich households (P<0.001). This significant association may be described by the fact that these poor population are rural dwellers, older, and less exposed to educational materials that could provide them with enough knowledge on anaemia and how they can use the resources at their disposal to help themselves out of this condition.

Our study findings reveal that in both provinces the use of family planning method was associated with anaemia, similarly to that conducted in Tanzania (13)(12). The findings from RDHS 2014-2015, revealed that Anaemia is much more prevalent among women using an IUD than among women not using this method (29 per cent and 19 per cent, respectively), and the most common reason for discontinuing a method (34%) is health concerns or side effect included bleeding (16). Different study has shown that there are, very few serious health risks associated with using an IUD such as; uncommonly heavier menstrual bleeding due to a copper-bearing, and IUD may contribute to anaemia if the woman already has low iron stores before insertion(24). And again, the most common side effects of injectables are bleeding changes. At first, injectables may cause irregular, heavy, or prolonged bleeding (25).
The findings also have shown that the use of water from nonimproved facilities has a higher likelihood of increasing anaemia prevalence in the Southern province of the country however not significant. The ability of unimproved drinking water source to cause anaemia in the Southern Province may not be directly linked to the water source, this result is similar to those found from Ethiopian where the authors found that lack of clean water and unimproved latrine facilities would increase the occurrence of soil-transmitted infection which, in turn, could lead to anaemia, which might explain some of the observed geographical differences.(30,31,)(27).

Despite the striking result of this study presents, there are some limitations to consider when utilizing the findings. However, since few studies has been traced in Rwanda, the results from this study may be considered in the future as baseline of the anaemia situation among women in Kigali city and the Southern province.

Furthermore, due to the fact that this study was a secondary data analysis, we were not able to explore some other determinants that may explain the differences in the prevalence of anaemia

between the two province of Rwanda such as the medical history of participants (malaria history and intestinal parasite history) and nutrition status that were not collected on non-pregnant women.

5.2. Study limitation

The study is not free from limitations because made use secondary data analysis of Rwanda Demographic health survey which didn't allow more investigations on other factors that may be associated to anaemia among women of reproductive age in both the Southern province and Kigali city such as;

- Immediate causes (Diet intake, physiological loses such as acute and chronic diseases)
- Biological causes (Micronutrients deficiency, iron deficiency, vitamin A deficiency)

5.3. Conclusion

This study demonstrates that few factors were found to be associated with anaemia among women of reproductive age in both the Southern province and Kigali city. Using family planning methods was found to be a shared determinant of having anaemia among Women of Reproductive Age in both the Southern province and Kigali city, while the only found specific risk factor of having anaemia among women of reproductive age in the Southern province was being in poor index wealth category.

Further research studies are advised to understand the determinants of anaemia in Both provinces.

5.4. Recommendation

- Further research studies are advised to understand how to limit anaemia among users of family planning method.
- Empower women economically through revenue-producing activities especially in rural area of southern province.

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