PREVALENCE OF MALNUTRITION AND ASSOCIATED FACTORS AMONG CHILDREN UNDER FIVE YEARS IN RWAMAGANA DISTRICT

By

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ABSTRACT

Malnutrition is a pathological state resulting from a relative or absolute deficiency or excess of one or more essential nutrients. According to World Health Organization, globally child malnutrition is health issue with different major public consequences especially for children survival, damaging the mental and physical development of children as well as the economic productivity of individual and even of societies. Malnutrition covers 50% of all child deaths and 11% of the total global disability. Rwanda is one of the countries in the world with a high prevalence of malnutrition children under five years (~38%) and 36.7% in Rwamagana District. As the Rwanda Demographic and Health Survey 2014-15 reported, the prevalence of malnutrition remains high, and there is still a need for more intensive interventions.

The aim of this study was to assess the prevalence and associated factors with malnutrition among under five years children in Rwamagana District.

Methods: An analytical cross sectional study was used to assess the nutritional status of the children under five years of age in Rwamagana District.

Results: This study reveals that the prevalence of malnutrition in Rwamagana District is 37.8%. Statistical significant risk factors associated with malnutrition among children under five were found namely child's age, maternal occupation, economic status of households, low birth weight, small number of daily meals taken, child illness, place of delivery, vaccination and source of drinking water, all above mentioned risk factors their p-value were less than 0.05.

Conclusion: Much effort from the Government of Rwanda and stakeholders should be focused on malnutrition reduction among children under five years.

RESUME

La malnutrition est un état pathologique résultant d'une déficience relative ou absolue ou d'un excès d'un ou de plusieurs nutriments essentiels. Selon l'Organisation Mondiale de la Santé, la malnutrition infantile est un problème de santé mondial qui a différentes conséquences en particulier pour la survie des enfants, nuisant au développement physique et mental des enfants ainsi qu'à la productivité économique des individus et même des sociétés. La malnutrition couvre 50% de tous les décès d'enfants et 11% du total des handicaps. Le Rwanda est l'un des pays du monde où la prévalence d'enfants de moins de cinq ans souffrant de malnutrition est élevée (~ 38%) et de 36,7% dans le district de Rwamagana. Selon l'Enquête Démographique et de Santé au Rwanda 2014-15, la prévalence de la malnutrition reste élevée et des interventions plus intensives restent nécessaires.

Le but de cette étude était d'évaluer la prévalence et les facteurs associés à la malnutrition chez les enfants de moins de cinq ans dans le district de Rwamagana.

Méthodes: Une étude transversale analytique a été utilisée pour évaluer l'état nutritionnel des enfants de moins de cinq ans dans le district de Rwamagana.

Résultats: Cette étude révèle que la prévalence de la malnutrition dans le district de Rwamagana est de 37,8%. Des facteurs de risque statistiques significatifs associés à la malnutrition chez les enfants de moins de cinq ans ont été découverts, à savoir l'âge de l'enfant, l'occupation maternelle, le statut économique des ménages, l'insuffisance pondérale à la naissance, le petit nombre de repas quotidiens pris, la maladie infantile, le lieu d'accouchement, la vaccination et la source d'eau potable, tous les facteurs de risque mentionnés ci-dessus, leur valeur p était inférieure à 0,05.

Conclusion: le Gouvernement rwandais et les parties prenantes devraient déployer des efforts considérables pour réduire les cas de malnutrition chez les enfants de moins de cinq ans.

DEDICATION

To the College of Medicine and Health Sciences especially the School of Public Health Staff,

To my family,

To those who helped me to accomplish this work, I dedicate this dissertation.

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My heartfelt thanks go to all those who helped me to complete this research.

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LIST OF SYMBOLS AND ABBREVIATIONS

CBHI: Community Based Health Insurance

CFSVA: Comprehensive Food Security and Vulnerability Analysis

CIP: Crop Intensification Program

ECD: Early Childhood Development

EICV: Enquête Intégrée sur les Conditions de Vie des Ménages

GAM: Global Acute Malnutrition

MIDMAR: Ministry of Disaster Management and Refugees

MINAGRI: Ministry of Agriculture and Animal Resources

MINEDUC: Ministry of Education

MINISANTE: Ministry of Health

MIS: Management Information System

MUAC: Middle Upper Arm Circumference

NFNSP: National Food and Nutrition Strategic Plan

NISR: National Institute of Statistics of Rwanda

PEM: Protein Energy Malnutrition

PSTA3: 3rd Strategic Plan for the Transformation of Agriculture

RDA: Recommended Daily Allowance

RDHS: Rwanda Demographic and Health Survey

SAM: Severe Acute Malnutrition

SD: Standard Deviation

SSA: Sub-Saharan Africa

UNICEF: United Nations Children's Fund

U5: Under five years

WFP: World Food Program

%: Percentage

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CHAP.I. INTRODUCTION

1.1. Definition of key terms

Malnutrition: Is a pathological state resulting from a relative or absolute deficiency or excess of one or more essential nutrients(1).

Undernutrition: An insufficient intake and/or inadequate absorption of energy, protein or micronutrients that in turn leads to nutritional deficiency(2).

Nutrition assessment: is the process of identifying characteristics known to be associated with nutrition problems(3).

Stunting: Stunting which is the impaired growth and development that children experience from poor nutrition, repeated infection, and inadequate psychosocial stimulation is also defined as for the height for age value to be less than two standard deviations of the WHO Child Growth Standards median (5).

Wasting : It is defined as a weight-for-age between -3 and -2 z-scores below the median of the WHO child growth standards (6).

Underweight: Is defined as a person whose body weight is considered too low to be healthy. Underweight people have a body mass index (BMI) of under 18.5 or a weight 15% to 20% below that normal for their age and height group (7).

1.2. Background of the study

Malnutrition is still a public health and development concern. Across the world, in 2015, the numbers of stunted, overweight, and wasted children under five years old were about 159 million, 41 million, and 50 million, respectively. This information is not representing the whole continents because three-fourths of the world's malnourished children were found in Sub-Saharan Africa and South Asia(1).

Malnutrition is one of the leading causes of childhood mortality worldwide. Deficiency of macronutrients or micronutrients or both can lead to malnutrition. Every human being requires adequate nutrition as his or her fundamental right. Stunting is one form of malnutrition where the prevalence in children less than 5 years has remained stagnated in Latino America specifically in

Peru from 1992 to 2007; with a rapid reduction stunting followed decreasing trends in all departments, with differing slopes.

Globally, child malnutrition is health issue with different major public consequences especially for children survival, damaging the mental and physical development of children as well as the economic productivity of individual and even of societies. Malnutrition covers 50% of all child deaths and 11% of the total global disability worldwide(15). Geographically, 70% up to 80% of undernourished children worldwide live in lower and middle income countries under nutrition.

Accounts for 45% of deaths of children younger than 5 years, and contributes to more than three million deaths every year. Acute malnutrition is an indicator of an emergency that requires urgent action. The UN estimates that acute malnutrition affects 8% of children (52 million) across the world (1 in 12 children in this age group). Severe acute malnutrition (SAM) is a major cause of child mortality under 5 years of age. Severe acute malnourished children are nine times more likely to die than healthy children (16)**.** The immediate or direct causes are inadequate or inappropriate dietary-intake and infectious diseases, whereas insufficient access to food, childcare, water supply and environmental sanitation are underlying causes. Political, cultural, religious, economic and social systems including women's status in the society are considered as basic causes for malnutrition (14)**.** Malnutrition at the early stages of life can increase risk infections, morbidity, and mortality together with decreased mental and cognitive development. The effect of child malnutrition is long lasting and goes beyond childhood. For instance, malnutrition during early age decreases the educational achievement and labor productivity and raises the risk of chronic illnesses in later age(2).

Globally, more than one third of child deaths are attributable to under nutrition. Nutrition plays a key role in physical, mental and emotional development of children and much emphasis has been given to provide good nutrition to growing populations especially in the formative years of life. Developing countries face with different types of nutrition problem including under nutrition and nutrition disorders which are resulting from inadequate food intake both in quality and quantity, particularly of calories, proteins, vitamins and minerals; parasitic infections and diseases (17).

The prevalence of stunting remains one of the main problems of public, and a significant proportion of people suffer from moderate or severe under nutrition during early childhood, especially in developing countries. Under nutrition in first 1000 days post conception represents

an important wasting of human potential. Any alteration in this stage has long implication and the damage caused by under nutrition in the early years of life is largely irreversible.(18)(19).

Stunting is one form of malnutrition where the prevalence in Latino America for example in Argentina, Brazil, Chile and Jamaica are under 2.5%, whereas, at the other extreme, over 10% of the children in Guatemala, Guyana and Haiti are underweight. Stunting is a problem in most of the countries (67%) and, overall, 10% of the population more than 7 million children fall into this category (19).

Disparities exist within countries as well as between them. For example, in Peru, as of 2014 there was a sharp gap between different areas of the country, with the stunting prevalence standing at 54.6% in Huancavelica but at just 3% in Tacna. These differences are also reflected in the results of the 2016 National Demographic and Health Survey, which indicate that the rate in Tacna was 2.3%, while it was 33.4% in Huancavelica. In Ecuador, sharp differentials were also recorded in that same year, with the highest prevalence being in Chimborazo Province, where the prevalence of low height for age totaled 52.6% and the lowest in El Oro Province (15.2%) (21).

According to Galasso and Wagstaff (2017), stunting in the countries of the world is not being reduced fast enough to attain the targets set for the Sustainable Development Goals, and a discussion is therefore called for regarding the types of policies and programs required in order to reduce the rate more quickly. Figure 1 depicts calculations of the average annual reduction that would be necessary in order to halve stunting by 2030. The countries of the region that are closest to reaching that benchmark are Brazil, Costa Rica, the Dominican Republic and Mexico; the rest will have to redouble their efforts to speed up the rate of reduction in stunting in order to meet the goal (19).

In Peru, the reduction pace was higher from 2007–2008 onwards. The departments with the highest annual stunting reduction were Cusco (-2.31%), Amazonas (-1.57%), Puno (-1.54%), Huanuco (-1.52%), and Ancash (-1.44). Those with the lowest reduction were Ica (-0.67%), Ucayali (-0.64%), Tumbes (-0.45%), Lima (-0.37%), and Tacna (-0.31%).

After many years with little change, Peru was able to reduce dramatically its under-five stunting prevalence at national and departmental level. Stunting reduction may be explained by the adoption of anti-poverty policies and sustained implementation of equitable crosscutting

interventions, with focus on poorest areas and also a comprehensive explanation of this successful story should take into account economic growth, poverty reduction, increased women's education, reduced fertility rates, improved access to basic sanitary facilities, and urbanization, but also the concurrent role of widely concerted enabling policy and system factors, leading to increased equity and efficiency of health and other sectors able to provide essential services that can ensure a safe pregnancy, delivery and infancy. This success story may offer useful lessons to other countries trying to improve the nutrition of their children(6)**.**Even though globally, childhood malnutrition declined relatively during the year 1990's; its prevalence in Africa actually increased even during 1990'.In developing countries, 25.3% of under five years children are malnourished which accounts about 143 million children. Nearly half of all deaths among children under age 5 are attributable to undernutrition(7)**.** The goal of reducing child malnutrition is far from being fulfilled in most developing countries even if some countries have registered only minimal changes for the issue of child health. The 8 million of children are malnourished in the three East African countries of Kenya, Tanzania, and Uganda which represent 21% of the SSA total. Globally, Rwanda is among 24 countries with the large population of young children stunted where the stunting rate was 51% of the total East Africa children. For under five years children, Rwanda has the highest rates of stunting 45%, followed by Uganda and Tanzania (at about 38%) while Kenya with its advanced economy compared with other countries belongs to the same region has the lowest levels of child stunting, 30%, in 2003(8)**.**

In Uganda 5% are wasted,14% underweight and 33% are stunted especially in the southwestern (commonly known as a food basket of Uganda) and Karamoja region of Uganda where notably under five years malnutrition directly and indirectly contributes to up 60% of child mortality(9) but in south Sudan food insecurity is affecting an estimated 4.7 million people (37% of the country's population) including adult and under five children(10)**.**

In Rwanda different ministries including MINEDUC, MINISANTE, MIDMAR and MINAGRI shared the responsibilities of handling the issues of malnutrition through collaboration(11).

Locally, undernutrition can be attributed to about half of all pediatric deaths. Although the consequences of underweight status among children has been well defined in recent decades, the causes of childhood malnutrition are complex and influenced by many contextual factors ranging

from political instability to limited accessibility of food. However, child malnutrition has persisted in Rwanda and serious investigation into the causes is warranted(12).

The percentage of stunted children fell down from 51% in 2005 to 44% in 2010 and 38% in 2014-2015.The percentage of children who are wasted declined from 5% in 2005 to3% in 2010 and 2% in 2014-2015, and the proportion of children who are underweight declined from 18% in 2005 to11% in 2010 and 9% of children below age of 5 in 2014-2015(29)**.** Children in the 18-47 months age group had the highest rates of stunting while the rates of underweight and wasting were high for children belonging to 12-17 months age group.

According to RDHS of 2014-2015; The prevalence of stunting in Rwamagana Districtis36.7% compared to 43.9% of Eastern Province and 38% of the whole country; the prevalence of underweight is3.2% in Rwamagana compared to 9.3% at country level while the prevalence of wasting in Rwamagana is 6.8% compared to 2.2% country wide (29).This pushed the researcher to formulate the research question as mentioned below:

What is the current nutrition status of the children under five years old in Rwamagana District?

What are the associated factors with malnutrition among under five years children of Rwamagana District?

1. 3. Objectives of the study

1.3.1. General objective

To assess the prevalence and associated factors with malnutrition among underfive years children in Rwamagana District

1.3.2. Specific objectives

1. To assess nutritional status of the children under five years old in Rwamagana District.
2. To identify factors contributing to malnutrition among under 5 years children of Rwamagana District.

1.4. Literature review

This chapter presents a review of literature that was studied and which includes classifications of malnutrition, the pathophysiology of malnutrition, a review of similar studies conducted in Rwanda, Africa, and the world, the causes of malnutrition in children, according to the UNICEF conceptual framework for causes of malnutrition in society, and the situation with regard to malnutrition in Rwanda, Africa and the World. A brief conclusion ends the chapter.

14.1. Introduction

According to WHO report estimate that 178 million are malnourished children worldwide but among those 20 million are suffering from the most severe form malnutrition(28). Malnutrition contributes between 3.5 and 5 million annual deaths among U 5.UNICEF estimates that about 195 million children suffering from malnutrition. As consequences, it affects the level of children intelligence, their behavior and school performance but the impaired mental development is taken as the most serious long-term handicap related to U5 malnutrition. In sub-Saharan Africa, 41% of U5 children are malnourished and deaths from malnutrition are increasing on daily basis in the region(20).The burden of under nutrition is slowly decreasing in developing countries but the rate of this decline is low and the current burden of this developing countries is of overweight and obesity .Historically, Low and middle income suffered with this burden of under nutrition due to food insecurity, social-economic and demographic disadvantages, high burdens of infectious diseases, and other biological and social determinants(18).

1.4.2. Classification of malnutrition

a) Undernutrition

The pathological state resulting from the consumption of an inadequate quantity of food over an extended period of (*3*)

b) Over nutrition

It is the pathological state resulting from the consumption of an excessive quantity of food, and hence a calorie excess, over an extended period of time(21).

c) Specific deficiency

It is pathological state resulting from relative or absolute lack of an individual nutrient(22)**.**

d) Imbalance

This state results from a disproportionate consumption of essential nutrients with or without the absolute deficiency of any nutrients as determined by the requirements of a balanced diet(23)**.**

1.4.3. Protein energy malnutrition

Protein energy malnutrition, also known as starvation, means a diet with insufficient amounts of all necessary nutrients like proteins, carbohydrates and fats. A starving person is characterized by thin skeletal and weak and is susceptible to death. Protein energy malnutrition usually is seen during famines in Third-World countries and in eating disorders especially in Western societies.
PEM is a health problem arising out of lack of protein and energy in varying proportion; it occurs mostly in infants and young children and usually associated with infections (28).

1.4.3.1. Classification of PEM

a) Kwashiorkor: It is derived from African word meaning first child, second child. It refers to the observation that the first child develops PEM when the second child is born and replaces the first child at the breast. Symptoms include oedema, diarrhea, apathy, dermatitis, old man face, failure to thrive, fatty liver etc. There is predominant deficiency of calorie than protein.

b) Marasmus: It occurs due to the deficiency of protein. It is most predominant form of PEM in developing countries.

c) Marasmic kwashiorkor: Children suffering from this type PEM exhibit a mixture of some of the features of both marasmus and Kwashiorkor

1.4.4. Nutritional status of children U5

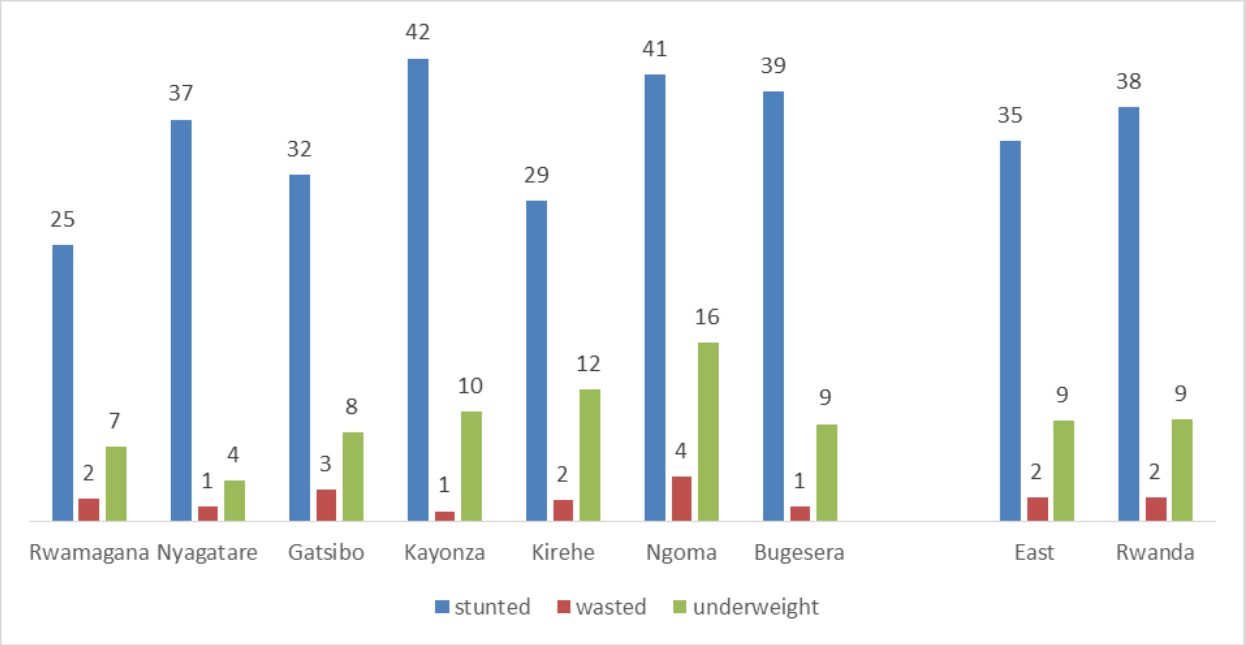
Nutritional status of children U5 is important measure of children's health and growth.
Malnutrition can take the form of stunting (height-for-age and/or weight-for-height) and underweight (weight-for-age); however, stunting is the primary form of malnutrition seen throughout the world.

Stunting is one of the most commonly used indicators of child nutrition and health status. Stunting in early life is associated with adverse functional consequences, including poor cognition and educational performance, low adult wages, lost productivity, and chronic disease when accompanied by excessive weight gain later in childhood.

Literature regarding determinants of all three indices of childhood malnutrition includes; direct factors contributing to malnutrition that are poor maternal health and nutrition, inadequate infant and young child feeding practices, micronutrient deficiencies, and infections. In addition, Literature highlights different determinants of stunting including; household wealth status, age of child, size of child at time of birth, and child anemia (13).

The anthropometric data on height and weight collected in the 2014-15RDHS permit the measurement and evaluation of the nutritional status of young children in Rwanda. In East province, 35 percent of children under age 5 are stunted (too short for their age), compared to 38 percent at the national level. Variation in children's nutritional status by district is quite evident, with stunting being highest in Kayonza (42%) and lowest in Rwamagana (33%).Two percent of U5 are wasted (too thin for their height) in East Province, and at the national level. The wasting prevalence is highest among children in Ngoma (4%) and lowest in Nyagatare, Kayonza and Bugesera (1%, each).Figure below shows also that nine percent of children U5 in the East Province are underweight (low weight-for-age), the same percentage as at national level. Variation in children's underweight by district shows that Ngoma has the highest percentage of underweight children (16%) while Nyagatare has the lowest one (4%).

Figure 1: Percentage of children under five years by nutrition status(12)



1.4.5. Food availability and nutritional status

Food is not everything we eat; it is an integral part of culture of a community, region, or nation. Good health depends on an adequate food supply and this in turn on sound agricultural policy and accurate system of food distribution. The one of the most important measures for the achievement of nutrition adequacy is to increase food production groups making the national balanced diet. The unexpected consequences are manifested themselves if the national diet are deficient nutrients like Vitamin A deficiency followed by iron deficiency, blindness among children, PEM and so on which could be overcome by supplying or consuming diets rich in these nutrients(24)

1.4.6. Nutritional requirements

Nutritional requirement refers to amount of energy, food and nutrients needed by specific group and sex categories on average per day in order to meet the needs of healthy individuals for normal functioning of the body for work and growth.

The energy supplies is important especially in developing countries where the stable commodities are either very low in protein content or the protein is of poor quality. Most of the people of developing countries depend upon starchy food and 80% of the total calories derived from them. they are able to obtain at least 87% of calories intake and 79% of gross protein intake and they receive only 6.4% of their 8 calories and 8.9 % of their protein are from the consumption of meat, egg, milk and milk fats combined(24).

Table 1: Recommended daily allowance (RDA) of nutrients for preschool children (1-5 years)(24).

NUTRIENTS	**YEARS**	
	1-3	**4-6**
Calories (Kcal)	1240	1690
Protein (g)	22	30
Fats (g)	25	25
Calcium (mg)	400	400
Iron (mg)	12	18
Vitamin A(µg)	400	400
Thiamin(mg)	0.6	0.9
Riboflavin(mg)	0.7	1.0
Nicotinic acid(mg)	8	11
Pyridoxine(mg)	0.9	0.9
Ascorbic acid(mg)	40	40
Folic acid(µg)	30	40

1.4.7. Assessment of nutritional status

Assessment of nutritional status of the community is one step in the formulation of any public health strategy to overcome malnutrition.

The primary aim of such assessment is to determine the magnitude, type and distribution if malnutrition in various geographic areas to identify really groups which is at risk and to determine the contributory factors. In addition this assessment is essential to sensitize administrators and politicians to obtain allocation of materials and human resources and to plan accurately. The nutritional assessment may require encompassing nations, communities, vulnerable segments of communities or individuals.

1.4.7.1. Direct method

a) Anthropometric measurement

Nutritional anthropometry refers to measure the variations of physical dimensions and gross composition of human body at different age levels and degrees of nutrition. This method has most commonly been conducted on preschool children where in this age group the PEM is usually most prevalent and most severe.

The commonly used anthropometric measurements or indicators of nutritional status for preschool children are explained here below:

Weight for height: weight and height of child is measured using standard Seca digital balance and stadiometer respectively and index is expressed in standard deviation units from the median of WHO child growth standards adopted in 2006. Children whose weight-for-height is below minus one standard deviations is considered mildly wasted similarly below minus 2 and 3 standard deviations are considered moderately and severely wasted respectively.

Weight for age: Children whose weight-for-age is below minus two standard deviations from the median of the reference population are considered underweight. The measure reflects the effects of both acute and chronic under nutrition.

Height for age: Children whose height-for-age is below minus two standard deviations from the median of the reference population are considered stunted or short for their age. Stunting is the outcome of failure to receive adequate nutrition over an extended period and is also affected by recurrent or chronic illness.

MUAC: children whose mid upper arm circumference is below 12.5cm are considered malnourished. Hence it is significant during the diagnosis of protein energy malnutrition. Measurement should be taken by flexible, non-stretch tape made of fiber glass or steel.

Oedema: Accumulation of fluid in interstitial is called as oedema it also reflects PEM.

Head and chest circumference: Measurement of head circumference is important because it is closely related to rain size.

b) Biochemical methods:

This is a test used primarily to detect subclinical deficiency states or to confirm a clinical diagnosis. Some of its examples include hemoglobin estimation, serum protein, urine creatinine, serum retinol etc.

c) Clinical examinations:

Nutritional status can also assessed by observing certain sign and symptoms which are associated with deficiencies of different nutrients in various organs of the body like skin, hair, mouth, tongue etc.

d) Dietary survey:

Dietary assessment protocol is designed to assess nutrient intakes after implying questionnaire, records, and recall methods.

1.4.7.2. Indirect methods

a) Vital statistics

Several of vital statistics such as maternal, infant and childhood mortality rates, prevalence rates have been considered in community as indirect indicators of nutritional status

b) Information

The nutritional status of an individual or a society is affected by socioeconomic and ecological factors. Therefore these parameters are likely to serve useful indirect indicators.

1.4.8. Role of government in malnutrition eradication/alleviation

According to the result of Survey launched on April 05, 2016 in Kigali, report a reduction of % of stunting among U5 children from 43% to 36% over past three years (2012-2015). The Government of Rwanda with its concerned efforts of relevant stakeholders has a target of meeting 18% of reduced stunting prevalence by 2018.

The survey indicates that the percent of malnutrition prevalence in rural area is high compared to urban area with 40% and 27% respectively. The districts of Western Province are mostly

affected, and include Rutsiro, Nyamagabe, Nyabihu, Nyaruguru, Rusizi, Karongi and Nyamasheke. In Rwanda the causes poverty, illiteracy and insufficient land for farming are among the identified factors linked to food insecurity, and are the most likely cause of stunting, especially among rural people. According to this report, children of mothers with low education are more often stunted.

A number of national strategies and programs have been put in place to fight malnutrition and food insecurity in Rwanda. These include the 3rd Strategic Plan for the Transformation of Agriculture (PSTA3), the Health Sector Strategic Plan, the National Food and Nutrition Strategic Plan (NFNSP), and the Social Protection Sector Strategic Plan.

Key strategies to combat malnutrition and food insecurity in Rwanda's agricultural sector include efforts to increase the capacity of food and nutrition insecure households to improve their diet via associations of annual and perennial crops; to increase production of animal protein by food and nutrition insecure households; to increase the affordability of dairy products; and to increase access of school and pre-school children to nutritious food. Different programs such as the Crop Intensification Program (CIP), the One Cow per Poor Family program (Girinka), and the One Cup of Milk per Child Program and the Home Grown School Feeding initiated by the agricultural sector have contributed significantly to the fight against hunger and malnutrition in Rwanda (27).

Moreover, the One Cow per Poor Family program has helped to improve consistency of class attendance for school children contributed to improved child health and reduced the number of school drop-outs. 85, 448 children benefited from this program in fiscal year 2014/15 and received 1,545,814 liters of milk(25).

1.5. Conceptual framework

According to the UNICEF conceptual framework for causes of malnutrition in society, there are immediate, underlying, or intermediate, and basic, or root, causes of malnutrition as shown in Figure 2. Poor social and care environment often consists largely of poor infant feeding practices, poor home care for ill children, and poor health care seeking behavior. Poor access to health care and unhealthy environment; the environment includes standard indicators of sanitation and water supply (26).

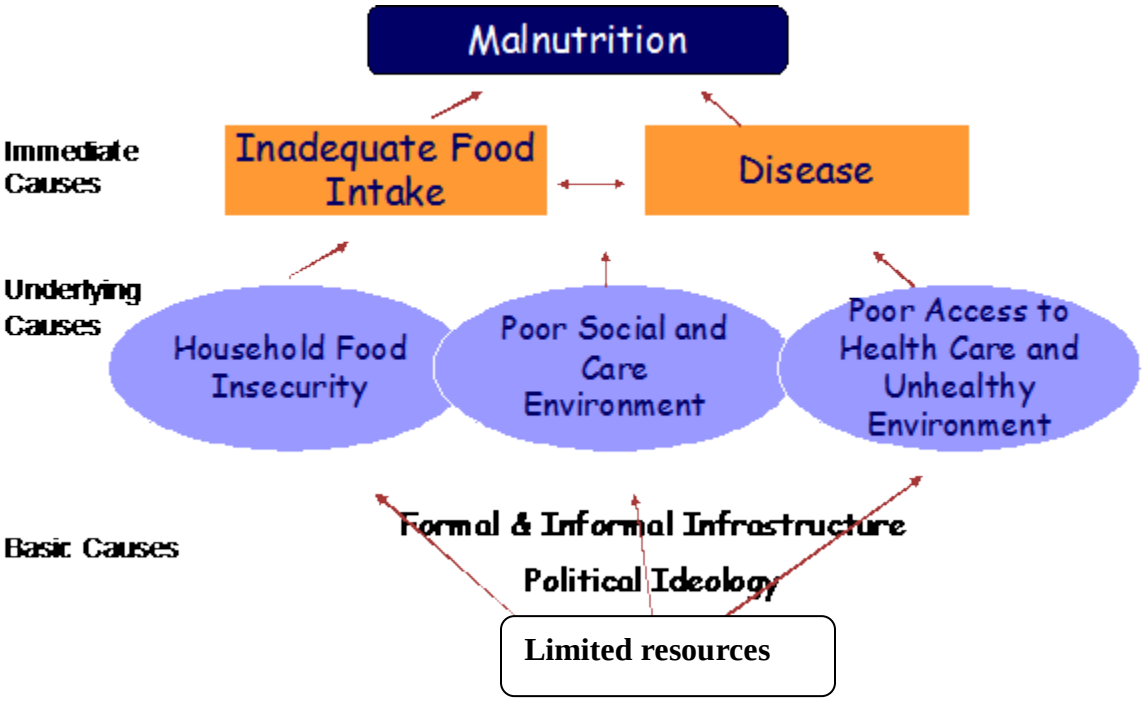


Figure 2: **Conceptual frame of factors of malnutrition adopted from UNICEF 2008(26).**

CHAPTER II.METHODS AND MATERIALS

2.1. Description of the study area

The District of Rwamagana is characterized mainly by low undulating hills separated by valleys some of which are swampy and boggy where this kind of topographical layout constitutes an important potentiality for modern irrigation system and mechanized agriculture in this District

The District of Rwamagana is situated between 1°57'2, 7''of south latitude and 30°26'8''of longitude, it experiences a moderate tropical climate with four seasons of which: two are cold and the rest dry (EDPRS self-assessment District report). Rwamagana District has very fertile soils almost in all its sectors. In the economic front, the EICV3 report reveals that, land use consolidation is at 7.4% compared to the national average of 11.5%, hillside irrigation is at 6.1% compared to national average of 3.0%, Land under erosion control 88.3% compared to 78.1% national average. Through GIRINKA program, the district has distributed 6,168 cows to 14.3% vulnerable families (EICV3 report).Agriculture and livestock are the principal economic activity that employees over 80% of the population in rural areas of whom, at least 85% use traditional agriculture practices.

Rwamagana district is divided into 14 sectors: Fumbwe, Gahengeri, Gishari, Karenge, Kigabiro, Muhazi, Munyaga, Munyiginya, Musha, Muyumbu, Mwulire, Nyakariro, Nzige and Rubona as shown in Figure 3.

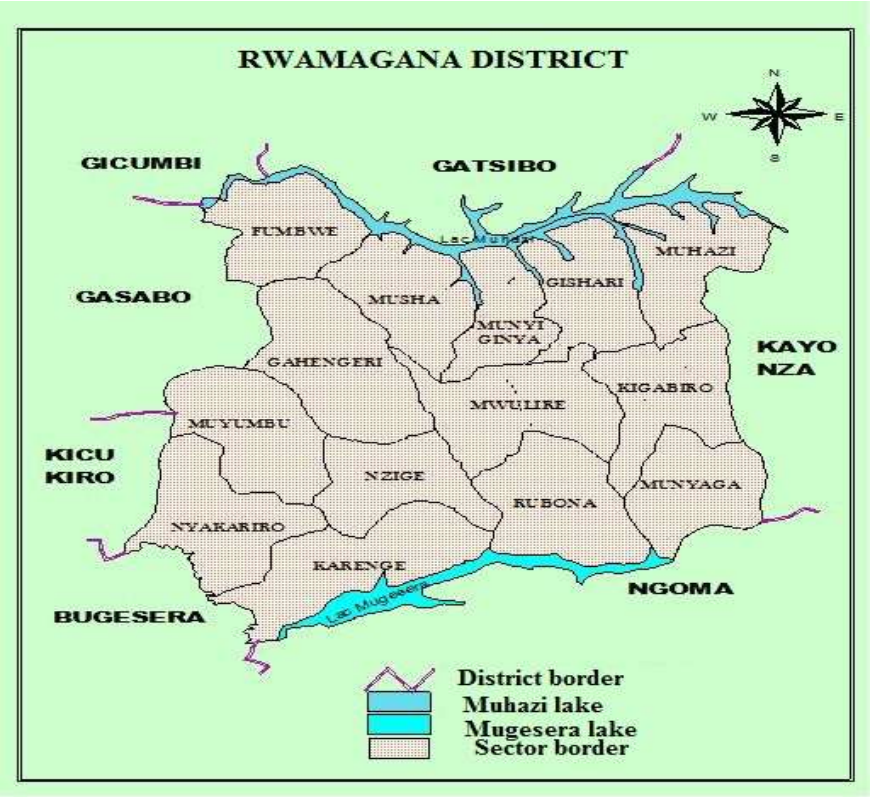


Figure 3: Map of Rwamagana District.

2.2. Study design

An analytical cross sectional study was used to assess the nutritional status of the children under five years of age in Rwamagana District.

2.3. Specific objectives achievement

The specific objectives of this study were achieved as follows:

To assess nutrition status of the children under five years old in Rwamagana District:

The outcome variables were constructed according to WHO standards for malnutrition indicators.

The three study outcomes of stunting, wasting and underweight were defined on the basis of -2 SD levels of the standard corresponding Z-scores for age of children. STATA 10.0 software was used for measurements of final dataset of 397 children.

Stunting: stunting reflects low height for age z scores (standard deviation). The cut off level of -2.0 Z score was used for stunting in this study.

Wasting: Wasting which is based on low weight for height z scores (standard deviation) level. A cutoff level of -2.0 was considered as wasted child.

Underweight: Underweight which is defined as low weight for age Z scores (standard deviation). It was based on cutoff value of -2.0 standard deviation Z score.

The cutoff for stunting, wasting and underweight was based on child growth standard published by World Health Organization. Z-scores for stunting was defined as the difference of a child's height and the age- and sex-specific median height of the WHO reference population over the standard deviation of their age group within the reference population.

The outcome anthropometric variables were constructed on height-for-age (HAZ), weight for age (WAZ) and weight-for-height (WHZ). Each z-score shows deviation from the reference median height or weight of a child of the same age and sex.

To identify factors contributing to malnutrition among under 5 years children of Rwamagana District:

Data analysis was performed to test any statistical strength in terms of proportion between dependent and explanatory variables. Only variables, which were significant, were sent to the final logistic regression model to identify factors associated with malnutrition.

Study variables

Two types of variables were used in the study, namely dependent and independent variables.

Dependent variable

The study has one dependent variable, which is malnutrition; is a pathological state resulting from a relative or absolute deficiency or excess of one or more essential nutrients.

Independent variables

The independent variables in the study were regarded as immediate causes(inadequate food intake and diseases mainly infectious diseases and diarrhea), underlying causes including household food insecurity, poor social and care environment, poor access to health care and

unhealthy environment and basic causes including cultural factors, education, political ideology, conflicts and limited resources.

Analysis plan

Raw data from questionnaires were entered in MS Excel and analyzed using STATA v10.Frequency tables and/or charts used to summarize data. Bivariate and multivariate analyses were performed to identify factors associated with malnutrition by calculating the Odds Ratio (OR) and 95 % Confidence Interval, with the statistical significance that is set at the level $p < 0.05$. Multivariate analysis was used to find out whether or not the factors, which were significantly identified in bivariate analysis, remain independently associated with the risk of malnutrition.

2.4. Study population

The subjects were all under-five years' children completing the criteria considered by Early Childhood Development Program.

Sample size calculation

The target population for this study is consisted of all caregivers/mothers of the children who met criteria considered by National Early Childhood Development Program (NECDP) in its study conducted in Rwamagana District. The sample was chosen using Taro YAMANE method to set the sample size and the Rwanda Population and Housing Census done in 2012. Data were used where it indicated that the number of under five years children was 48098. Based on the formula below, sample size was calculated:

$$n = \frac{N}{1 + N\left(e^2\right)}$$

N is total number of U5 in district

e: is error of sampling

n: is sample size

According to the National Institute of Statistic of Rwanda (NISR), the number of the children under five years was 48,098 children in 2015

Therefore, from the formula above the sample size n can be calculated as follow:

$$n = \frac{48{,}098}{1 + 48{,}098\left(0.05^2\right)} = 397 children$$

Sampling techniques

A multi stage sampling method was used to select a representative sample for the study. First, all Sectors of Rwamagana District were selected to participate in the study. Randomly two Cells from each Sector and one Village from each Cell selected; hence, 30 Villages were selected and represent the whole Rwamagana District. At the household level, a simple random sampling was used to select a representative sample from each Village selected.

Data collection procedures

Data collection procedures for this study follow the ones for the Early Child Development survey.

Early Child Development Survey its data collection has in four phases:

Survey preparation and questionnaire design: This stage includes sample design and survey questionnaires development to meet study target.

Training and fieldwork: It consists of training field staff and conducting fieldwork, identification of eligible households to participate in the survey.

Data processing: This is the third stage involving data editing, coding, and entering and verifying the data and checking them for consistency.

Final report, data preparation and dissemination: This is the final stage involving the analysis of the data, preparation of the final report, and dissemination of the survey.

2.5. Materials

Early Child Development survey collected data using different tools and techniques, namely questionnaires, anthropometry measurement of children.

These questionnaires were translated from English into Kinyarwanda. And also anthropometric components in which children under age 5 were measured for height and weight.

2.6. Policy implication

Due to high morbidity associated with malnutrition in under five years children, it is very significant to undertake this research work so as to determine socio-demographic, environmental and economic risk factors contributing to malnutrition among underfive years children in Rwamagana District. The establishment of the abovementioned factors associated with malnutrition in under five years children will be beneficial for the Ministry of Health, Rwamagana District and stakeholders to provide the necessary interventions to minimize the burden of malnutrition within all Sectors of Rwamagana District.

In addition the study will provide also knowledge base information on how the intervention towards good nutrition, sanitation and hygiene improvement could be tailored especially in Rwamagana District.

2.7. Ethical considerations

The analyses in this study were based on secondary data obtained with permission from National Early Childhood Development Program. Early Child Development survey has been approved by Rwanda National Ethics Committee which guarantees that the survey abide the regulations to protect human subjects.

CHAPTER 3: RESULTS

3.1. Socio-demographic characteristics of respondents

Half of the under-five children (50.6%) in the study were females and majority (46.3%) were aged 24-59 months and followed by those aged 6-23 months (30.2%) respectively.

More than half of the children (54.9%) were of birth order 1-2 with a few (38%) in the birth order of 3-4 and 5+ order (7.1%) respectively. Most of the children (48.4%) were of birth intervals equal or less than two years. There was also quite a large number of children (47.6%) born in the birth interval of 3-4 years. On the age of the mother at birth, majority of the children (53.1%) had their mothers aged 30-39 years while quite a significant proportion (33.9%) was also from children whose mothers at birth were aged 20-29 years. Few children (4%) and (9.1%) were from mothers aged less than 20 years and 40-49 years at birth respectively. The immunization status of the under-five years children that were involved in the study reveals that majority of the children (82.9%) were fully immunized up to date according to the Expanded Programme of Immunization.

The percentage distribution of under-five children according to the education level of the mother indicates that majority of the mothers (71%) had received primary level education and quite a few (2%) had never been to school. Findings further reveal that 27% of the children had mothers with secondary education and above.

The distribution of under-five years children according to the marital status of their mother indicates that majority of the children (80%) were born to mothers who were married/cohabiting and another proportion of the under five children were born to never married (7%), divorced (5%) and widowed mothers (8%).

The findings also indicate that majority of the under-five children (76%) had their mothers who were farmers as their occupation. Children whose mothers (14%) were civil servants, whose mothers were doing business (8%) and the pastoralists (2%). There were also a few children (2%) whose mothers did handcrafts as their occupation as detailed in Table 3.1.

Table 3.1 Socio-demographic characteristics of respondents

Child factors (n=397)	Frequency	Percentage (%)
Variables		
Sex		
Male	196	49.4
Female	201	50.6
Age (months)		
<6	93	23.4
6_23	120	30.2
24-59	184	46.3
Birth order		
1_2	218	54.9
3_4	151	38.0
5+	28	7.1
Birth interval(years)		
≤2	192	48.4
3_4	189	47.6
5_6	16	4.0
Fully immunized according to WHO standards		0.0
Yes	329	82.9
No	68	17.1
Age of mother at birth (years)		
<20	16	4.0
20-29	134	33.8
30-39	211	53.1
40-49	36	9.1
Education level		
No education	9	2
Primary	281	71
Secondary and above	107	27
Marital status of the mother		
Never married	27	7
Married/Cohabitating	316	80
Widowed	33	8
Divorced	21	5
Maternal occupation		
Farmer	301	76
Pastoralist	8	2

Civil servant	54	14
Business	30	8
Handcrafts	6	2

3.2. Level of malnutrition among under-five years children

Results indicate that stunting was the most common malnutrition problem (37.8%) among under five years' children in Rwamagana District. There was also quite a high prevalence of wasting (7.1%) and underweight (3%) among under five years' children as shown in Table 3.2.

Table 2. 3.2. Level of malnutrition among under-five years children

Malnutrition Index	**Overall status**	
(n=397)	Frequency	Percentage
Stunting	150	37.8
Wasting	28	7.1
Underweight	12	3

3.3. Bivariate analysis: Malnutrition among under-five years children with child and maternal factors

A comparison of stuntedness between males and females showed almost an equal proportion of stunting among females; (83.5%) compared to 73.5% of the males. For wasting females and males were equally wasted and for underweight males were almost more underweight than girls.

However, there were few children underweight from 6-23 months (1.9%) unlike those aged 24-59 (8.7%). For birth order, the proportion of stunting is higher among children of birth order 3-4 (41.8%) than those of order 1 to 2 (35.4%).

On the birth interval, the proportion of stunting is higher among underfive years children with birth interval of 2 years and below (41.4 %) than those of 3-4 or even 5-6 years (39.3%-16.7%).

For mothers occupation the proportion of stunting was higher in children whose mothers were from peasant farmers (37.5%) than other occupation of mothers.

Regarding economic status, findings showed a high proportion of all three indices among children born to mothers found in first category (poorest).

In relation to low birth weight, a proportion of 11.3% children born with low weight were stunted, while 4.1% children were wasted and 2% of children born with low weight were underweight.

Regarding small number of daily meals taken by the child, study findings revealed a high proportion of stunted (35.7%), wasted (4.3%) and underweight children (1.7%) who experienced small number of daily meals than those who did not have small number of daily meals taken.

Concerning child illness, results indicated a high proportion of stunted children (28.6%) who have experienced illness in their childhood, 5.8% with wasting, and 2.9% with underweight.

Children who were delivered at home, study results highlighted a high proportion of stunted children (51.7%) compared to those born in a health facility 26.4%, a high proportion of underweight children (27.5%) born at home compared to 19.5% born in health facility.

Furthermore, a remarkable fraction of wasted children (15.4%) was found in children not vaccinated while 10% of wasted children were found in vaccinated children.

Source of drinking water showed a significant proportion52.7% to those using protected water sources and 47.3% to those who use unprotected water sources with stunting (p-value=0.049) as detailed in Table 3.3.

Table 3.3.3. Bivariate analysis: Malnutrition among under five years children and different sociodemographic factors.

Explanatory Variable	Stunting		Wasting		Underweight	
	Stunted		Wasted		Underweight	
	(%)	p-value	(%)	p-value	(%)	p-value
Sex of the child						
Male	73.5	0.546	9.7	0.069	8	0.159
Female	83.5		20.6		4.8	
Age of child (months)						
<6	45.2	0.737	17.2	0.94	7.5	0.041
6_23	37.3		7.8		1.9	
24-59	36.9		13		8.7	
Birth order						
1_2	35.4	0.023	6.9	0.232	7.2	0.068
3_4	41.8		22.2		19.2	
5+	28.6		17.6		0	
Birth interval (years)						
≤2	41.4	0.039	16.4	0.926	10.5	0.672
3_4	39.3		12.8		11.2	
5_6	16.7		16.3		0	
Age of mother at birth						
<20	37.4	0.371	13.5	0.717	13.5	0.681
20-29	37.6		15.1		7.2	
30-39	54.6		13		12.3	
40-49	27.3		0		0	
Education level						
No education	24	0.769	24	0.317	17.2	0.413
Primary	45.1		10.2		6	
Secondary and above	39.7		16.2		0	
Marital status of the mother						
Never married	31.4	0.275	9.4	0.362	9.4	0.584
Married/Cohabitating	45.3		18.5		10.7	
Widowed	32		11		7.1	
Divorced	9		5.7		2.6	
Maternal occupation						
Peasant farmer	37.5	0.047	14.6	0.684	9.4	0.636
Pastoralist	5.1		19.1		0	

Civil servant	32.7		22.4		0	
Handcrafts	7.3		0		0	
Economic status						
Category 1(Poorest)	21.19	0.01	20.19	0.01	21	0.01
Category 2(Poorer)	21.05		20.11		20.6	
Category 3(Middle)	20.14		19.01		19.8	
Category 4(Richer)	19.72		18.34		19.72	
Low birth weight						
Yes	11.3	0.04	4.1	0.02	2	0.04
No	26.5		3		1	
Not breastfed in the first six months						
Yes	4.07	0.7	2	0.08	1.07	0.19
No	33.73		5.1		1.93	
Small number of daily meals taken						
Yes	35.7	<0.01	4.3	<0.01	1.7	<0.01
No	2.1		2.8		1.3	
Child illness						
Yes	28.6	0.03	5.8	0.02	2.9	0.04
No	9.2		1.3		1	
Place of delivery						
Home	51.7	<0.01	9.2	0.15	27.5	<0.01
Health facility	26.4		8.4		19.5	
Vaccination						
No	55.7	0.18	15.4	0.02	34.6	0.24
Yes	49.3		10		27.8	
Source of drinking water						
Unprotected source	47.3	0.049	45.9	0.073	61.4	1.8
Protected source	52.7		44.1		38.6	

3.4. Multivariate analysis: Stunting among under-five years children in Rwamagana District

The multivariate analysis was performed to find out the associated factors with stunting prevalence in under five years children in Rwamagana District. Logistic regression was used, and full and reduced models were analyzed to disclose the persistent factors associated with stunting prevalence in under five years children in Rwamagana District. Variables considered in the bivariate analysis were considered in the full and reduced models.

Children whose mothers were peasant farmers were 1.5 times more likely to be stunted than those whose mothers were pastoralists [(OR=1.5; CI= (1.54-5.44)].

Concerning economic status, first category was highlighted positively associated with stunting [(OR=1.68; CI= (1.62-3.11)] and was 1.68 times more likely to be stunted compared to those of the fourth category.

Low birth weight was found positively associated with stunting [(OR=4.2; CI= (1.16-6.86)] and was found to be 4.2 times more likely to be stunted than those born with no low birth weight (normal weight).

Small number of daily meals taken was found positively associated with stunting was found to be 8.11 times more likely to be stunted than those who take sufficient number of daily meals [(OR=8.11; CI= (1.926-81.587)].

Child illness was found positively associated with stunting was found to be 5.11 times more likely to be stunted than those who did not have illness [(OR=5.11; CI= (3.001-8.051)].

Home delivery was found positively associated with stunting was found to be 1.81 times more likely to stunted than those delivered at health facility [(OR=1.81; CI= (1.200-12.817)].

Source of drinking water showed statistically significant association with stunting. Children whose family use drinking water from unprotected source were 4 times more likely to have stunting compared to children whose family use drinking water from protected source[(OR=4;CI=(1.05-7.27)].

Table 4.3.4: Multivariate analysis: Stunting among under-five years children in Rwamagana District

	Stunting			
	Full model		Reduced model	
Factors	**OR (CI at 95%)**	**p-value**	**OR (CI at 95%)**	**p-value**
Age of child (months)				
24-59	1		1	
6-23	2.38(0.65–3.42)	0.16	2.1(0.91-3.34)	0.17
≤6	0.65(0.30–1.6)	0.54	2.03(0.64-1.59)	0.09
Birth interval (years)				
3_4	1		1	
≤2	1.33(0.30–2.98)	0.17	0.52(0.82-2.4)	0.09
5_6	1.86(0.37–2.94)	0.59	0.4(0.90-5.01)	0.2
Maternal occupation				
Pastoralist	1		1	
Peasant farmer	2 (1.19–6.40)	0.14	1.5(1.54–5.44)	0.01
Civil servant	1.94(0.33–7.21)	0.14	0.35(0.06-4.41)	0.45
Handcrafts	1.23(0.22–5.69)	0.92	1.11(0.70-1.44)	0.29
Economic status				
Category 4(Richer)	1		1	
Category 3(Middle)	1.22(1.75–3.41)	<0.01	1.04(0.94-2.01)	<0.01
Category 2(Poorer)	1.43(2.13–5.08)	<0.01	0.83(1.39-3.37)	<0.01
Category 1(Poorest)	2.06(1.91–3.34)	<0.01	1.68(1.62-3.11)	<0.01
Low birth weight				
No	1		1	
Yes	4.7(0.66–3.59)	0.06	4.2(1.16-6.86)	0.04
Small number of daily meals taken				
No	1		1	
Yes	9.38(2.39- 4.20)	<0.01	8.11(1.926-81.587)	<0.01
Child illness				
No	1		1	
Yes	7.95((3.74- 6.58)	0.03	5.11(3.001-8.051)	0.03
Place of delivery				
Health facility	1		1	
Home	1.93(1.30-2.96)	0.01	1.81(1.200-12.817)	0.01
Vaccination				

Yes	1		1	
No	2.04(0.31-1.70)	0.09	1.9(0.53-1.20)	0.11
Source of drinking water				
Protected source	1		1	
Unprotected source	4.89(0.86–2.56)	0.072	4(1.05-7.27)	0.038

3.5. Multivariate analysis: Wasting among under-five years children in Rwamagana District

The multivariate analysis was performed to find out the associated factors with wasting prevalence in under five years children in Rwamagana District. Logistic regression was used, and full and reduced models were analyzed to disclose the persistent factors associated with wasting prevalence in under five years children in Rwamagana District. Variables considered in the bivariate analysis were considered in the full and reduced models.

Children born from poorest (category 1), poorer (category 2) families were 1.64 times and 1.37 times more likely to be wasted than those born from the richer (category 4) families respectively [(OR=1.64; CI= (1.31-1.82)] and [(OR=1.37; CI= (0.69-80)].

Low birth weight was found positively associated with wasting found to be 3.14 times more likely to be wasted than those born with no low birth weight (normal weight)[(OR=3.14; CI=(1.15-7.36)].

Small number of daily meals taken was found positively associated with wasting found to be 9.3 times more likely to be wasted than those who take sufficient number of daily meals[(OR=9.3 CI=(1.36-18.90)].

Child illness was found positively associated with wasting found to be 6.4 times more likely to be wasted than those who did not have illness [(OR=6.4; CI=(1.02-12.10)].

Vaccination was found positively associated with wasting; children who were not vaccinated were 2.6 times more likely to be wasted than vaccinated children [(OR=2.6; CI= (0.78-6.81)].

Source of drinking water showed statistically significant association with wasting. Children whose family use drinking water from unprotected source were 2.7 times more likely to have wasting compared to children whose family use drinking water from protected source[(OR=2.7; CI= (1.18-3.35)].

Table 5.3.5: Multivariate analysis: Wasting among under-five years children in Rwamagana District

	Wasting			
	Full model		Reduced model	
Factors	**OR (CI at 95%)**	**p-value**	**OR (CI at 95%)**	**p-value**
Age of child (months)				
6_23	1		1	
≤6	0.79(0.29-20)	0.78	0.83(0.18-1.28)	0.72
24-59	1.72(0.96-2.05)	0.78	1.09(0.47-1.23)	0.87
Birth interval (years)				
3_4	1		1	
≤2	0.71(0.81-1.75)	0.7	0.62(0.39-1.04)	0.06
5_6	0.72(0.72-1.51)	0.72	0.51(0.48-1.39)	0.57
Maternal occupation				
Peasant farmer	1		1	
Pastoralist	2.53(1.72-2.77)	0.33	1.41(0.44-1.49)	0.21
Civil servant	1.58(0.36-0.59)	0.21	1.36(0.47-1.42)	0.44
Handcrafts	0.24(0.79-1.1)	0.48	0.12(0.17-1.23)	0.16
Economic status				
Category 4(Richer)	1		1	
Category 3(Middle)	1.17(1.19-2.26)	<0.01	0.83(0.52-0.64)	<0.01
Category 2(Poorer)	1.5(1.52-3.24)	<0.01	1.37(0.69-80)	<0.01
Category 1(Poorest)	1.67(0.35-4.70)	<0.01	1.64(1.31-1.82)	<0.01
Low birth weight				
No	1		1	
Yes	5.53(1.85-3.07)	0.02	3.14(1.15-7.36)	<0.01
Small number of daily meals taken				
No	1		1	
Yes	11.6(1.21-2.1)	<0.01	9.3(1.36-18.90)	<0.01
Child illness				

No	1		1	
Yes	9.13(0.76-1.68)	0.02	6.4(1.02-12.10)	0.01
Place of delivery				
Health facility	1		1	
Home	2.22(0.60-3.04)	0.08	0.72(0.70-0.78)	0.01
Vaccination				
Yes	1		1	
No	2.9(0.99-1.83)	0.13	2.6(0.78-6.81)	0.02
Source of drinking water				
Protected source	1		1	
Unprotected source	3.1(0.9-1.79)	0.15	2.7(1.18-3.35)	0.014

3.6. Multivariate analysis: Underweight among under-five years children in Rwamagana District

The multivariate analysis was performed to find out the associated factors with underweight prevalence in under five years children in Rwamagana District. Logistic regression was used, and full and reduced models were analyzed to disclose the persistent factors associated with underweight prevalence in under five years children in Rwamagana District. Variables considered in the bivariate analysis were considered in the full and reduced models.

Results from the reduced model displayed in Table 3.6 show that children aged between 24 and 59 months of age were 1.7 times more likely to be underweight than those aged between 6 and 23 months [(OR=1.7; CI= (4.247-7.174)].

Children born from poorest (category 1) were 1.49 times more likely to be underweight than those born from the richer (category 4) families [(OR=1.49; CI= (0.26-6.82)].

Low birth weight was found positively associated with underweight found to be 2.8 times more likely to be underweight than those born with no low birth weight (normal weight)[(OR=2.8; CI= (1.023-2.94)].

Small number of daily meals taken was found positively associated with underweight found to be 9.18 times more likely to be underweight than those who take sufficient number of daily meals [(OR=9.18CI= (0.62-9.65)].

Child illness was found positively associated with underweight found to be 6.32 times more likely to be underweight than those who did not have illness [(OR=6.32; CI= (1.18-26.20)].

Home delivery was found positively associated with underweight found to be 1.37 times more likely to be underweight than those delivered at health facility [(OR=1.37; CI= (1.12-2.47)].

Source of drinking water showed statistically significant association with underweight. Children whose family use drinking water from unprotected source were 2.48 times more likely to have underweight compared to children whose family use drinking water from protected source[(OR=2.48; CI=(1.91-3.06)].

Table 6.3.6: Multivariate analysis: Underweight among under-five years children in Rwamagana District

	Underweight			
	Full model		**Reduced model**	
Factors	**OR (CI at 95%)**	**p-value**	**OR (CI at 95%)**	**p-value**
Age of child (months)				
6_23	1		1	
≤6	3.14(2.56-1.39)	0.07	1.3(0.85-1.16)	0.03
24-59	0.67(0.44-1.19)	0.65	1.7(4.247-7.174)	0.04
Birth interval (years)				
≤2	1		1	
3_4	0.61(0.74-2.51)	0.37	0.29(0.71-1.19)	0.31
5_6	1.09(0.82-1.61)	0.96	0.16(0.71-1.65)	0.74
Maternal occupation				
Peasant farmer	1		1	
Pastoralist	2.11(0.80-1.09)	0.55	1.58(0.38-2.10)	0.07
Civil servant	1.15(0.07-3.09)	0.91	0.13(0.73-1.94)	0.83
Handcrafts	1.15(0.08-4.61)	0.9	0.8(0.91-1.69)	0.16
Economic status				
Category 4(Richer)	1		1	
Category 3(Middle)	1.14(2.11-3.77)	<0.01	1.03(1.72-4.01)	<0.01
Category 2(Poorer)	1.04(1.13-2.91)	<0.01	0.53(0.37-0.98)	<0.01
Category 1(Poorest)	1.69(1.81-4.13)	<0.01	1.49(0.26-6.82)	<0.01
Low birth weight				

No	1		1	
Yes	3.09(1.20-2.75)	0.04	2.8(1.023-2.94)	0.02
Small number of daily meals taken				
No	1		1	
Yes	11.94(0.45-0.95)	<0.01	9.18(0.62-9.65)	<0.01
Child illness				
No	1		1	
Yes	11.61(1.68-3.41)	0.04	6.32(1.18-26.20)	0.01
Place of delivery				
Health facility	1		1	
Home	1.5(0.27-0.52)	0.01	1.37(1.12-2.47)	0.01
Vaccination				
Yes	1		1	
No	1.4(0.47-0.72)	0.06	2.6(0.93-2.04)	0.17
Source of drinking water				
Protected source	1		1	
Unprotected source	2.94(1.83-3.29)	0.05	2.48(1.91-3.06)	0.02

Summary: Factors associated with malnutrition

Table 3.7 summarizes the trends of common risk factors associated with malnutrition in Rwamagana District. The child's age group below 6 months and between 24 and 59 months was associated with underweight in the final model. In addition, being a child from peasant farmer was found as a risk factor for stunting among children under five years. Children born to mother from the third, second and first category of economic status was associated with stunting and wasting. Children born with low birth weight, children who took small number of daily meals, children with illness, children born at home, as a place of delivery and children who used unprotected water sources of drinking water were at a high risk of getting all three indices of malnutrition. Furthermore, children who were not vaccinated were at high risk of wasting.

Table 3.7: Factors associated with malnutrition

Variables included in the final model	Stunting	Wasting	Underweight
Age of child (months)			
6_23			Ref
≤6			X
24-59			X
Maternal occupation			
Pastoralist	Ref		
Peasant farmer	X		
Civil servant			
Handcrafts			
Economic status			
Category 4(Richer)	Ref	Ref	
Category 3(Middle)	X	X	
Category 2(Poorer)	X	X	
Category 1(Poorest)	X	X	
Low birth weight			
No	Ref	Ref	Ref
Yes	X	X	X
Small number of daily meals taken			
No	Ref	Ref	Ref
Yes	X	X	X
Child illness			
No	Ref	Ref	Ref
Yes	X	X	X
Place of delivery			
Health facility	Ref	Ref	Ref
Home	X	X	X
Vaccination			
Yes		Ref	
No		X	
Source of drinking water			
Protected source	Ref	Ref	Ref
Unprotected source	X	X	X

X=Significance predictor, $p<0.05$

Ref=Reference value for the logistic regression model.

4. DISCUSSION

1. Prevalence of malnutrition in Rwamagana District

The study reveals that prevalence of malnutrition in Rwamagana District is 37.8% closely to the one reported by 2014-2015, Rwanda, Demographic and Health Survey at 36.7 %. This prevalence is less than the whole prevalence of Eastern Province 43.9% and 38% of the whole country.

2. Factors associated with malnutrition in under five years children in Rwamagana District

Results from this study indicated that children aged 24-59 months were underweight since the statistical significance the p-value (p=0.04) was less than the critical value of 0.05 at 95% confidence interval. Moreover, this fact has been witnessed by many previous trials from African region and South Asia (30). The above findings agree with similar findings at national level that the percentage of children who are underweight increases steadily from 4 percent among those less than age 6 months to 9 percent among those age 6-11 months and 11 percent among those age 12-17 months, after which it decreases slightly to 9 percent among children age 18-23 months before once again increasing to 11 percent among children age 24-35 months (13). Similar findings have been observed by several researchers in Uganda, Kenya, Nigeria and Ghana (7)(8)(16).

Findings indicate that there is a significant relationship between mother's occupation and stunting among under five children (p=0.03) in Rwamagana District.

Children whose mothers were civil servant were less likely to be underweight unlike their counterparts whose mothers were peasant farmers. However, the findings contrary to a study done in Vietnam found out that children from mothers who were civil servants had an increased risk of stunting because they rarely get time to care for their children hence end up leaving them under the care of elder siblings or inexperienced maids (10).This might be caused to the time limited that civil servant spend with their children.

Moreover, low birth weight was found significantly associated with all three domains of malnutrition. In a study conducted in Nigeria on identifying risk factors associated with

malnutrition, a higher proportion of cases with malnutrition were of children born with low birth weight compared to their controls (31). Nutritionally compromised mothers are prone to prematurity and intra growth retardation, which translates into low birth weight (32). Study analysis also measured relation of health indicators like vaccination and common child illness and living conditions of families with malnutrition. Not fully immunized status was found associated with wasting, similarly child illness was also found significantly related to stunting, wasting and underweight status. In a descriptive study conducted in India on identifying key predictors of under nutrition, it was highlighted that incomplete immunization status was significantly associated (OR=19.51, $p<0.001$) in development of underweight or severely underweight (33). Child illness impairs children's growth and that underlying malnutrition is a major risk factor for these conditions. Episodes of diarrhea may predispose to pneumonia in undernourished children. Additional studies support breastfeeding and micronutrient supplementation for the prevention and control of diarrhea and pneumonia (34).

Small number of daily meals taken by the child (p-value=<0.01) and child illness p-value=0.03 with stunting, p-value=0.01 with wasting, p-value=0.01 with underweight were significantly associated with all three types of malnutrition. Similar studies done in Ghana revealed that a well-nourished child is one whose weight and height measurements compare very well with the standard normal distribution of heights and weights of healthy children with same age and sex categories. Nutritional status is primarily measured by a child's growth in height and weight and is directly influenced by food intake and the occurrence of infections (35).Source of drinking water was showed statistically significant association with outcome variable.

Those children whose families use drinking water from unprotected source were 4 times more likely to have stunting, 2.7 times more likely to have wasting, 2.48 times more likely to have underweight as compared to those children whose family uses drinking water from protected source with stunting.

Study limitations

Data collection about weighing foods to be taken whether it is small or not it was not well detailed.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study aimed at assessing the prevalence and associated factors with malnutrition among under five years children in Rwamagana District has concluded that the prevalence of malnutrition in Rwamagana District is 37.8%, which is less than the prevalence of Eastern Province 43.9% and 38% of the whole country.

Regarding factors associated with malnutrition in under five years children in Rwamagana District, this study came up with the following factors; Age of the child; results revealed that children between 6 and 59 months of age were the most exposed to stunting than their counterparts of 6 to 23 months old, birth weight; children born with a low weight than average weight at birth were the most exposed to be stunted than children born with a normal birth weight, place of delivery and child being born in the poorest or poorer households were found to be highly associated with child stunting.

In addition, feeding practices such as using unprotected source of water for drinking and frequency of child illness episode, child vaccination status and small number of daily meals taken this study underscores the above mentioned factors that could be prone to malnutrition challenges as well as the particular occupations among women that could pose a risk of malnutrition to the under five year's children.

Recommendations

Based on the findings of the study, the following recommendations are made:

According to the findings, the main associated factors with malnutrition among children under five years in Rwamagana were age of the child, maternal occupation, economic status of households, low birth weight, small number of daily meals taken, child illness, place of delivery, vaccination and source of drinking water.

To the Ministry of Health:

Low birth weight being an associated factor with malnutrition among children under five years, mothers should be provided with a series of trainings about the provision of adequate

micronutrients before and during pregnancy and how they can promote optimal infant and young child feeding (IYCF) and care practices in their households. There is a need to improve adequate infant and young child feeding practices.

To the community and local leaders:

Given that socioeconomic status has an impact on child nutrition, raising household income is highly recommended so that mothers with low income can afford adequate food that will provide a nutritious and diverse diet to children within the households.

To the research institutions:

Similar research should be conducted on a large sample of under-five children to detect the effects of some of the factors that could not be observed by the current study.

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