INFLUENCE OF MATERNAL NUTRITION KNOWLEDGE ON INFANT AND YOUNG CHILD FEEDING PRACTICES AND NUTRITION STATUS OF CHILDREN IN MUSANZE DISTRICT, RWANDA

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DECLARATION

I hereby declare that this dissertation is my original work and that it has not been presented for a degree in any other university or institution of higher learning.

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It is with deepest gratitude and warmest affection that I dedicate this dissertation to my beloved mom, Mukantabana Jacqueline and my brother Rugira Janvier. Thank you for your encouragement and endless love during this journey.

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LIST OF ABBREVIATIONS AND ACRONYMS

CARI	Consolidated Approach to Reporting Indicators
CFSVA	Comprehensive Food Security and Vulnerability Analysis
CHWs	Community Health Workers
DHS	Demographic Health Survey
EBF	Exclusive Breastfeeding
ENA	Emergency Nutrition Assessment
FAO	Food and Agriculture Organization of the United Nations
GAM	Global Acute Malnutrition
GoR	Government of Rwanda
HAZ	Height –for- Age Z-score
HH	Household
HHH	Head of Household
HIV	Human Immunodeficiency Virus
ICF	International Coach Federation
IDDS	Individual Dietary Diversity Score
IFPRI	International Food Policy Research Institute
IYCF	Infant and Young Child Feeding
KAP	Knowledge Attitudes and Practices
MAD	Minimum Acceptable Diet
MDD	Minimum Dietary Diversity

MIYCN	Maternal Infant and Young Child Nutrition
MMF	Minimum Meal Frequency
MINALOC	Ministry of Local Government of Rwanda
MINECOM	Ministry of Finance and Economic Planning of Rwanda
MNP	Micronutrient Powder
MoH	Ministry of Health
MUAC	Mid Upper Arm Circumference
NCD	Non-Communicable Disease
NGO	Non- Governmental Organization
NISR	National Institute of Statistics Rwanda
OR	Odds Ratio
PAHO	Pan America Health Organization
RDHS	Rwanda Demographic Health Survey
RWF	Rwandan Franc
SD	Standard Deviation
SPSS	Statistical Package for Social Science
TV	Television
UN	United Nations
UNDP	United Nation Development Programme
UNICEF	United Nations International
USAID	United States Agency for International Development

WAZ Weight- for- Age Z-Score

WFP World Food Programme

WHZ Weight-for-Height Z-Score

WHO World Health Organization

OPERATIONAL TERMS AND DEFINITIONS

Anthropometric measurements: Measurement of weight and height used in determination of nutritional status of under two years old children

Children: in the context of this study refers to children aged between 6 and 23 months

Complementary food: Foods given to a child in addition to breast milk at age of six month

Household: Refers to one person who lives alone or a group of persons living under one house, related or unrelated who share meals or make common provisions for food and other essentials for living.

Infant and young child feeding practices: in the context of this study refers to child meeting recommended minimum dietary diversity, minimum meal frequency and minimum acceptable diet and consumption of iron rich foods.

Maternal nutrition knowledge: Refers to verbalized or demonstrated ability to reproduce from memory theoretical understanding of breastfeeding and complementary feeding practices.

Nutrition Status: in the context of this study refers to whether or not the child is underweight, stunted or wasted.

Underweight: Refers to having low weight for age with a < -2 SD mainly due to chronic under nutrition or acute malnutrition (WAZ)

Wasting: Refers to having low weight for height according to WHO standard with a <-2 SD mainly due to acute malnutrition (WHZ)

Stunting: Deficit in linear growth achieved pre-and post-natal. It refers to the height for age below minus two standard deviations. This indicates long term cumulative effects of inadequate nutrition.

ABSTRACT

Children under five years of age face multiple malnutrition burdens. Under-nutrition causes approximately half of all deaths in young children every year worldwide. Infant and young child feeding (IYCF) practices pose immediate effects on the nutrition status of under-two year aged children and greatly influence the survival of a child. Low maternal nutrition knowledge is one of the key determinants of suboptimal complementary feeding practices. In Rwanda, only 18% children of age between 6 to 23 months adhere to the infant young feeding practices (IYCF) set by WHO in terms of minimum acceptable diet, despite the high stunting prevalence of 38%. However, little is known about the association between IYCF practices, children nutritional status and maternal nutrition knowledge in the country. This study was, therefore, designed to assess the influence of maternal nutrition knowledge on the IYCF practices and nutritional status as well as the factors associated with child feeding practices and nutritional status. Analytical cross section study was carried out in Musanze, a district of Rwanda and involved 241 mothers having children aged between 6 and 23 months, in August 2019. Data were collected using a pre-tested semi-structured questionnaire. Data analysis was done using SSPSS version 20.0 and ENA for SMART 2011. Chi-square test and logistic regressions were used to determine the associations and risk factors of various variables.

The results showed that the majority of mothers (72%) had high nutrition knowledge (≥ 70% score). Minimum meal frequency (MMF) was attained at 83% rate, minimum dietary diversity (MDD) at 57%, minimum acceptable diet (MAD) at 53% and consumption of iron rich foods at 29%. However, younger (6-8 months) children had significantly lower MMD (39%) and MAD (39%). Stunting, wasting and underweight prevalence were 28%, 2% and 5%, respectively. There was an association between MMF (p=0.006) and maternal nutrition knowledge, and the

latter was positively correlated with the individual dietary diversity score of a child (r=0.149, p=0.021). There was no significant association between the maternal nutrition knowledge and the child nutritional status. Factors influencing IYCF practices were mother employment status, consumption of animal sourced foods, community health workers' home visits, community gatherings attendance and income type. The predictors of child nutritional status (stunting) were found to be sex of the child, MAD, consumption of animal sourced foods, child underweight status and income type. Maternal nutrition knowledge should continue to be strengthened through nutrition education done at the community level with a huge focus on child dietary diversity, especially among younger children. The factors influencing IYCF practices and child nutrition status should be taken into consideration by the policy makers and development partners while developing different food and nutrition sensitive programs and interventions.

CHAPTER ONE: INTRODUCTION

1.1 Background

Malnutrition is recognized as a major universal concern that has various forms and it can affect anyone in the world at certain point in life, despite of one's age, sex, wealth or geographical area. Although all people can suffer from malnutrition, young children are among the most affected (Global Nutrition, 2018a). Malnutrition in developing nations is considered as one of the serious public health issues (Gaayeb et al., 2014) and the pre-existing social and economic challenges are aggravated by malnutrition by slowing down worldwide development with adverse human consequences (Global Nutrition, 2018a). Malnutrition is more prominent in the region of Africa to the south of Sahara Desert and in Asia continent (von Grebmer *et al.*, 2018). Malnutrition incorporates three aspects of under-nutrition, micronutrients deficiency and over-nutrition. In the countries of south of Sahara, particularly in countryside regions, undernourishment and micronutrients deficiency are a major challenge (Fanzo, 2012).

The three major groups of malnutrition are under-nutrition (underweight, stunting, and wasting), micronutrient-related malnutrition and overweight, obese conditions and diseases that are non-communicable but related to diets (WHO, 2018). Undernourishment is responsible of approximately 50% of all young children dying, resulting into three million young lives lost every year (UNICEF, 2018b) and according to Dewey and Begum (2011) being stunted is a risk factor for reduced survival, childhood and adult health, and reduces the capacity of learning and production.

Children under five years of age face multiple malnutrition burdens. Globally, in 2017 there were 150.8 million (22.2 %) stunted, 50.5 million (7.5 %) wasted and 38.3 million (5.6 %) overweight children (UNICEF et.al, 2018), while in Africa, the prevalence of wasting, stunting and overweight was 58.7 million, 13.8 million and 9.7 million, respectively. In Rwanda, the prevalence of stunting (38.2%) among under-five children is above the average prevalence of an underdeveloped country (25%) whereas the prevalence of wasting is lower (2.3%) than the wasting average of a developing nation (8.9%) (Global Nutrition, 2019).

Infant and young child feeding (IYCF) practices possess immediate effects on the nutritional status of under-two year aged children and greatly influence the survival of a child. Moreover, appropriate feeding is fundamental among children (6 to 23 months) to be nutritionally healthy resulting in optimal health and development (WHO, 2008a). Proper IYCF practices mainly allude to breastfeed infant in not more than one hour after delivery, exclusively breastfeeding done for the child's first six month of birth and the continuation of breastfeeding until at least two years, and to introduce feeding a child at six month old with other foods other than breastmilk that are safe and age- adequate (UNICEF, 2018a). After analyzing statistics on IYCF practices globally, UNICEF (2018a) emphasized on the urgent development of programs in this area and specially showed considerable need for improving how children in complementary feeding period (6 to 23 months) are fed.

Globally in 2017, only 42 % of children were breastfed not later than one hour after delivery, exclusively breastfeed (0-5 months) was at 41 % and 69% of children aged of six to twenty three months were given complementary food. Feeding children aged 6 to 23 with WHO recommended minimum meal frequency (MMF), minimum dietary diversity (MDD) and

minimum acceptable diet (MAD) were done at 51%, 25% and 16% rate, respectively. Continued breastfeeding at two years was at 45% rate (UNICEF, 2018a).

Rwanda is among the countries struggling with various forms of malnutrition as it has been classified as a country burdened by anemia among women in reproductive period (15-49 years) and stunting (Global Nutrition, 2018c). According to 2014-2015 Rwanda Demographic Health Survey (RDHS), the prevalence of children (under-five years) suffering from stunting was 38 % at national level, a very high prevalence (stunting ≥30%) according WHO threshold (De Onis et al., 2019), whereas wasting and underweight prevalence were 2% and 9% respectively (NISR et al., 2015).

In Rwanda, IYCF practices in terms of breastfeeding are ahead as 81 % of children are breastfed in not later than one hour after birth, 87% exclusively breastfed while breastfeeding continuation at two years is done at 87 % rate. However, poor feeding practices of children of six to twenty months of age exist as only 18 % of children are fed according to recommended IYCF practices (NISR et al., 2015).

Therefore, the present study was designed to find out the mothers' nutrition knowledge potential in determining the IYCF practices and child nutritional status from which appropriate measures can be drown to improve the child feeding practices and ultimately child nutrition.

1.2 Statement of the Problem

In Rwanda, only 18 % children of age 6 to 23 months adhere to infant young child feeding practices set by WHO in terms of minimum acceptable diet, despite a high stunting rate of 38 %. Although, the period of complementary feeding from 6 to 24 months is the critical window of opportunity for the prevention of various forms of malnutrition including stunting, it's clear that

limited efforts have been initiated to use this as means of preventing and reducing the high stunting prevalence in the country. The statistics show that the appropriate feeding in accordance with IYCF practices among children aged between 6 to 23 months has minimally increased during a five year period; it changed only from 17 % in 2010 to 18 % in 2015. Additionally, there are limited documentation on the factors that can be associated to poor child feeding practices in the country as well as the limited data on level of nutrition knowledge among mothers and its impact on feeding practices and nutritional status of children.

1.3 Justification of the study

Rwanda government has shown a lot of commitment to reduce malnutrition and promote maternal, infant and young child nutrition (MIYCN) through Rwanda National Food and Nutrition policy in which many programs have been developed such as National Multi-Sector Strategy to Eliminate Malnutrition (2010), District Plans to Eliminate Malnutrition (2010), Joint Action Plan for the Elimination of Malnutrition (2012), First 1,000 Days Community Based Food and Nutrition Programs (CBFNP), among others (GoR, 2014). Despite all the efforts put in place, the appropriate feeding in accordance with IYCF practices among children aged between 6 to 23 months is still poor (NISR et al., 2015).

In that context, this research carried out in Musanze district plays a part in finding out some of the factors associated with the pre-mentioned inappropriate feeding practices. The study provides a good understanding on whether child's feeding behaviors and nutritional status are influenced by maternal nutrition knowledge. Moreover, it contributes to the body of knowledge on the further factors associated with IYCF practices and child nutritional status. The findings will be very useful in giving insightful information to nutrition and health system in Rwanda on the effectiveness of the existing nutrition education strategies in changing maternal feeding

behaviors. Thus, these findings could be taken into considerations by the government and development partners alike while developing different food and nutrition policies and interventions, which, consequently, can lead to the improvement of nutrition and overall health of young children in the country.

1.4 Aim of the study

The aim of the study was to contribute towards the Rwanda national target of reducing stunting prevalence to 19 % by 2024 and other forms of malnutrition through the improvement of IYCF practices.

1.5 Purpose of the study

The purpose of the study was to generate data for good understanding of the linkage of maternal nutrition knowledge and IYCF practices and child nutritional status that could be used by the government to improve the nutrition education system and child feeding behaviors.

1.6 Objectives

1.6.1 General objective

The main objective of the study was to determine the influence of maternal nutrition knowledge on IYCF practices and nutritional status of children of 6 to 23 months of age in Musanze district, Rwanda.

1.6.2 Specific objectives

1. To determine the sociodemographic and socio-economic characteristics of households

2. To determine maternal knowledge on IYCF practices and assess the current IYCF practices among children aged 6- 23 months

3. To assess nutritional status of children aged 6-23 months of age

4. To assess the nutrition information network and its effects on child food intake

5. To determine the association between maternal nutrition knowledge, IYCF practices and nutritional status of children aged 6-23 t months

1.7 Hypothesis

There is no association between maternal nutrition knowledge, IYCF practices and children nutritional status.

CHAPTER TWO: LITERATURE REVIEW

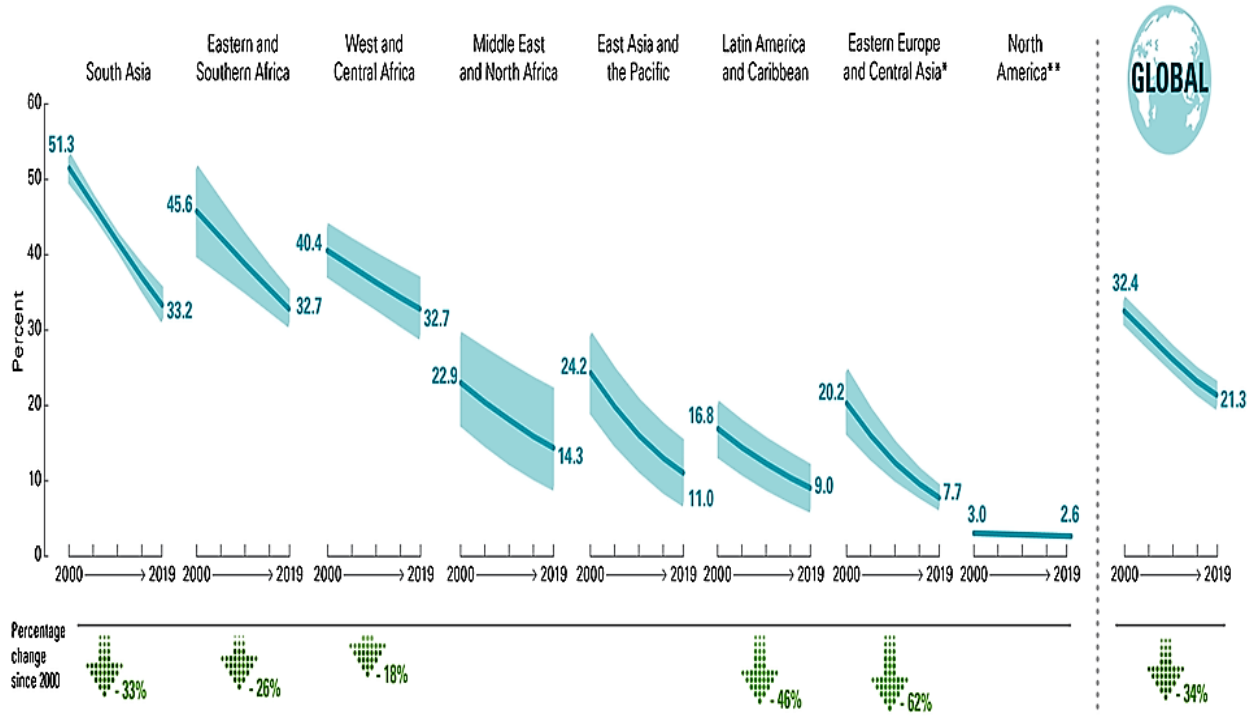
2.1 Overview of malnutrition

Malnutrition is recognized as a major universal concern that has various forms and it can affect anyone in the world at certain point of the life, despite of one's age, sex, wealth or geographical area. Although all people can suffer from malnutrition, the most affected are ones are young children, people in elderly age, girls in adolescence, lactating mothers, pregnant women, ill or immuno-compromised people, indigenous and poor people (Global Nutrition, 2018a). Malnutrition in developing nations is considered as a serious public health issue (Gaayeb *et al.*, 2014) and according to Global Nutrition (2018a) report, the social and economic problem is enhanced by malnutrition which refrains the worldwide development with adverse human consequences. Under-nutrition causes approximately half of all deaths in young children resulting into 3 million young lives lost every year (UNICEF, 2018b).

2.1.1 Global situation of malnutrition in children

Globally, the rates of malnutrition are still too worrying due to stunting that is decreasing very slightly (Figure 1) and a big number of young children being affected by wasting. Moreover, the joint estimates from UNICEF, WHO and World Bank group admitted that the hope of seeing a world free of malnutrition is very small (UNICEF et al., 2018). Global Hunger index (2019) report argued that reporting undernourishment at national levels without highlighting inequalities within country groups favors the underestimation and perseverance of undernutrition and hunger (von Grebmer et al., 2019). According to UNICEF et al. (2018), children of under 5 years of age face multiple malnutrition burdens as in 2017, globally, there were 150.8 million (22.2 %) stunted, 50.5 million (7.5 %) wasted and 38.3 million (5.6 %) overweight, while in Africa, the prevalence of wasting, stunting and overweight was 58.7 million, 13.8 million and 9.7

million, respectively . Although malnutrition is more prominent in sub-Saharan Africa and Asia (von Grebmer *et al.*, 2018), multiple forms of malnutrition are faced by many countries and out of 141 countries inspected worldwide, 123 of them (88%) confront more than one form of malnutrition (Global Nutrition, 2018a).



Source: UNICEF (2020)

Figure 1: Globally, stunting declined from one in three to just over one in five between 2000 and 2019

2.1.2 Malnutrition situation in Rwanda

Rwanda is among the countries struggling with various forms of malnutrition as it has been classified as a country burdened by anemia occurring in women of child-bearing age (22.3%) and stunting (38.2%) (Global Nutrition, 2018c). According to 2014-2015 Rwanda demographic health survey (RDHS), the prevalence of stunting, wasting and underweight in underfive years children is 38%, 2% and 9%, respectively. Furthermore, the children who are overweight or

obese are at 8% rate and 37% of children aged between 6-59 months are anemic (NISR et al., 2015). The major concern in Rwanda is stunting as it is classified as a very high prevalence (stunting ≥30%) according WHO threshold (De Onis et al., 2019).

However, Rwanda is very committed to eradicate malnutrition problem as the prevalence of malnourished children is being reduced year by year as shown by different RDHS reports. The percentage of stunted children reduced from 51% in 2005 to 44% in 2010 and 38% in 2015; the wasting prevalence diminished from 5% in 2005 to 3% in 2010 and to 2% in 2015; and the underweight from 18% in 2005 to 11% in 2010 an to 9% in 2015 (NISR et al., 2015). This success has been attained due to the Rwandan government putting into places multi-sectoral approaches, promoting an increasing the number of the nutrition programs implemented at the community level in all 30 districts of the country (UNICEF, 2013).

2.1.3 Forms of malnutrition

Malnutrition results from the lack or excess of nutrients intake or from a body not being able to balance the nutrients consumed. There are 3 major groups of malnutrition; under-nutrition (stunting, wasting, underweight); micronutrient-related malnutrition (deficiencies or excess of micronutrients); and overweight, obesity and diet-related non-communicable diseases such as heart diseases, stroke, and diabetes (WHO, 2018).

2.1.3.1 Under-nutrition

Children are made more susceptible to disease and death by under-nutrition (WHO, 2018) and undernourished children have a high risk of dying from common infections and are prone to develop frequently such infections with increased severity and recovery period (UNICEF,

2018b).The under-nutrition has 4 main forms; stunting; wasting; underweight and micronutrients deficiencies.

Wasting occurs when a person has low weight compared to the height and it is usually the results from the rapid loss of massive weight due to insufficient food intake or the presence of infectious disease. Although wasting can be treated, the children who suffer from it are at risk of dying (WHO, 2018) and it was found to be highly associated with mortality in underfive years children (Olofin et al., 2013).

According to WHO (2018), stunting is defined as having low height than a person's age and it results from persistently lacking sufficient nutrients over a long period and it is linked with the poor nutrition and health during pregnancy and lactation period, regular illness and fail to appropriately feeding and care for infant an young children in their early stage of life. Stunting is a risk factor for reduced survival, childhood and adult health, and leads to the diminished capacity of learning and production (Dewey and Begum, 2011). On the other hand, underweight stands for low weight as compared to one's age and an underweight person can suffer from stunting, wasting or both concurrently (WHO, 2018).

2.1.3.2 Micronutrient-related malnutrition

Micronutrients are very important in human body as they are involved in many metabolic functions such as regulation of hormones, inflammatory reactions as well as in biochemical pathways, which results in having a healthy body (Van Ommen *et al.*, 2008). Micronutrients refer to minerals and vitamins, and they play a vital role for optimal development and growth (WHO, 2018). Yao et.al, (2020) suggest that an increase of calcium consumption is beneficial to the bone health by increasing the bone mineral density. Micronutrient deficiencies know as

hidden hunger, mostly occur due to the lack of diet diversification which include sufficient amount of vegetables, fruits and foods of animal origin (Kennedy et.al, 2003). The most threatening micronutrient deficiencies are iodine, vitamin A and iron, which mostly affect the life of pregnant women and children in developing countries (WHO, 2018). Globally, iron deficiency is referred as the predominant and universal nutritional disorder and has unfortunate consequences on a great number of preschool children and pregnant women (Darnton-Hill, 2019; WHO, 2019). Malaria, worm infections and other infectious diseases exasperate iron deficiency anemia in numerous developing nations. Adverse effects of anemia include poor pregnancy outcomes, increased deaths among mothers and interfering with child physical and cognitive growth (WHO, 2019).

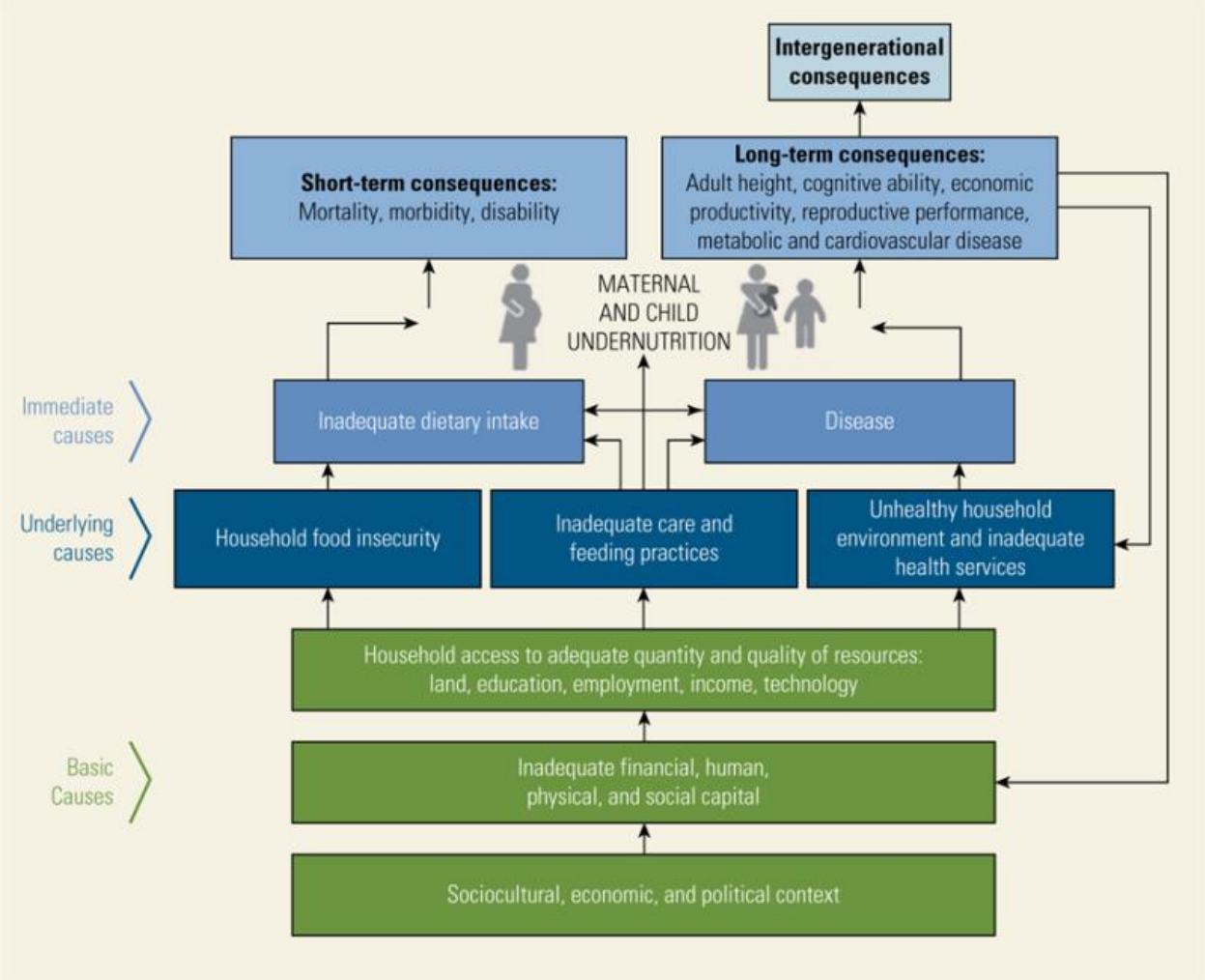
2.1.3.3 Overweight, obesity and Diet-related non-communicable diseases

A condition by which a person has a lot of weight compared to his or her height refers to overweight or obesity and it is due the intake of foods that are energy-dense and the failure to expand them resulting into body fat accumulation (WHO, 2018). Lack of physical activity and eating behaviors such as skipping meals (Hota et al., 2015) and high consumption of fats and sugar sweetened drinks (Caamaño et al., 2015; Hota et al., 2015), have been linked to the weight gain and obesity.

The diet-related non-communicable diseases (NCDs) are usually associated with poor nutrition and the consumption of unhealthy foods. The NCDs refer to certain cancers, cardiovascular diseases and diabetes (WHO, 2018). The four main risk factors of NCDs were reported to be misuse of alcohol, tobacco consumption, lack of healthy diet and physical activity (WHO, 2020).

2.1.4 Determinants of malnutrition in young children

As defined by the UNICEF conceptual framework (Figure 2), the determinants of malnutrition are multidisciplinary, involving food, caring practices and health factors. Influenced by social, political and economic factors, malnutrition causes are categorized as being immediate, underlying and basic. For the children to have a good nutrition, it requires the access to the adequate and nutritious food; appropriate care practices among mothers and children; availability of suitable medical services; and healthy living conditions embracing clean water, proper hygiene practices and sanitation (UNICEF, 2013). Several studies have been conducted in the different places to investigate more about the causes of malnutrition. One of the studies done in Nigeria found that the mothers' education and body mass index, presence of toilet and clean water, the gender of the child are the risk factors of under-nourishment among under five children (Babatunde *et al.*, 2011). The household food insecurity has been identified as a risk factor of stunting by a considerable number of studies. The examples include studies conducted by Tariku et al. (2019), Chandrasekhar et.al (2017) and Ali et al.(2013).



Source: UNICEF, 2013

Figure 2: Conceptual Framework of Determinants of Under-nutrition

2.2 Infant and child young feeding practices

2.2.1 Overview of infant and young child children practices

Promoting proper IYCF practices is rated as one of the most successful interventions in ameliorating the health of a child (WHO, 2009). IYCF practices have immediate effect on the children's nutrition status of less than two years of age and greatly influence the survival of a child (WHO, 2008a). Moreover, potential growth and development are attained by the children fed properly

especially those in the critical window of between 0 and 24 months of age (UNICEF, 2018a). IYCF indicators such as exclusive breastfeeding, minimum meal frequency, minimum dietary diversity and minimum acceptable diet have been largely associated with the outcome of child's nutritional status (Jones et al., 2014; Krasevec et.al, 2017).

The recommended optimal IYCF practices set by UNICEF and WHO are exclusively breastfeed for the first child's six months period and starting the complementary feeding at six month of age together with breastfeeding continuation up to the child's two years of age or beyond (WHO, 2009).

2.2.1.1 Exclusive breastfeeding

According to WHO (2009) exclusive breastfeeding refers to a status when an infant is only fed on breastmilk whether expressed or from a wet nurse. The infant does not receive any other foods, not even water, except prescribed medicines including oral solution for rehydrating purpose and supplement syrups containing minerals and the vitamins.

According to studies, higher morbidity has been observed in the infants exclusively breastfed for only three or four months than those that are fed exclusively on breastmilk for the first six month period (Kramer and Kakuma, 2012). Moreover, less risk of dying from pneumonia and diarrhea is recognizable in the exclusively breastfed infants than the those who are not, and additionally, their immune systems are reinforced and the occurrence of long-standing diseases such as diabetes and obesity in the future is likely to be prevented (UNICEF, 2018a)**.** Furthermore, the exclusive breastfeeding is beneficial for the mothers as it acts as natural contraceptive method for more pronged period (Kramer and Kakuma, 2012) and prevents them from experiencing certain types of cancers (UNICEF, 2018a)**.**

The globally recommended practices during the exclusive breastfeeding period are the early breastfeeding within one hour from birth and six month duration of the exclusive breastfeeding (WHO, 2002).

2.2.1.2 Complementary feeding

At six month of age an infant is not able to meet all his or her nutrient needs by only being breastfed, hence the introduction of other foods and drinks which nutritionally complement the breastmilk called. Although the child may be breastfed even after reaching two years, generally, the complementary feeding period is from 6 to 24 months of age (Dewey, 2002). One of the critical parts of the first 1,000 days of life is the period of complementary feeding from 6 to 24 months, which gives the window of opportunity for the prevention of various types of malnutrition such as acute malnutrition, stunting, overweight and obese conditions. Therefore, improper feeding during that period might adverse growth, organ development and metabolism (Michaelsen et.al, 2017).

As reported by Lutter and Rivera (2003) in the research conducted in some developing countries (Bangladesh, Peru, Guatemala and Ghana), the key challenge during the weaning period (6-23 months) is more about the food quality rather than the food quantity given to children whereby inadequacy in Zinc, vitamin B6, lipids and Iron consumption has been observed in the diets fed to the children, which might be the source of the delayed growth.

WHO (2002) has recommended appropriate practices during the complementary feeding which are;

- Timely introduce the foods other than breastmilk at six month of age

- Provide adequate food in terms of energy, proteins and micronutrients intake for the child to obtain all nutrients required for the optimal growth
- Consider the safety by cleaning hands and washing utensils before feeding the child; food preparation and storage done hygienically; and avoid using bottles as well as teats.
- Properly feeding the child by knowing the satiety and appetite indications, adopting feeding technique and the number of meals in accordance with the child's age
- Continued breastfeeding until at least to child's second birthday.

2.2.2 Global situation on infant and young child feeding practices

After assessing data on IYCF practices, globally, UNICEF emphasized on the emergency of programs development in this area and specially showed a considerable need of improving ways in which children aged between 6 to 23 months are fed. Globally in 2017, only 42% of children were breastfed within one hour after birth, exclusive breastfeeding (0-5 months) was at 41% rate and 69% of children (6-8 months) were introduced to solid, semi-solid or soft foods. Children (6 to 23 months) that were fed with WHO recommended minimum meal frequency (MMF), minimum dietary diversity (MDD) and minimum acceptable diet (MAD) were only 51%, 25% and 16%, respectively. Breastfeeding continuation up to a child's second year was at 45% rate (UNICEF, 2018a).

2.2.3 Infant and young child feeding practices in Rwanda

According to 2014-2015 Rwanda Demographic Health Survey (RDHS) report, some of the practices are widely practiced and others are still poorly followed. The 2014-2015 RDHS findings show that 81% children were breastfed within one hour after birth, exclusive breastfeeding done at 87% rate and 87% rate of continued breastfeeding at two years. However, the complementary feeding practices of children aged between 6 to 23 months are poorly carried

out as only 18 % of children receive the MAD with 30% and 47% rates of meeting the MDD and MMF, respectively. Therefore, overall IYCF standards in accordance with MAD remains a big challenge as it has minimally increased during a five year period; it only changed from 17 % in 2010 to 18 % 2015 (NISR et al., 2015).

2.3 Nutrition education and maternal nutrition knowledge

One of major causes of malnutrition is inappropriate feeding behaviors that may due to the lack of knowledge and practices on responsive feeding among caregivers. Several studies have linked the nutrition knowledge among caregivers with child' feeding practices and nutritional status. For example, in one of the studies done in Ghana, the nutrition status of the children was found to be associated with nutritional knowledge of their mothers and additionally, the maternal economic situation and school education had lesser effect on the children's nutrition status than the maternal nutritional knowledge had (Appoh and Krekling, 2005). Another study conducted in Ethiopia showed that maternal knowledge on complementary feeding is one of the key determinants of suboptimal complementary feeding practices (6 to 23 months) and was positively associated with children meeting the MMF and MAD (Berra and Yang, 2017).

For caregivers to acquire the necessary knowledge and skills on appropriate feeding, WHO (2002) suggest the assistance from professionals and community-based workers. Moreover, in order to improve IYCF practices, messages that are consistent should be provided at all levels in public and private health system, the media and in communities (WHO, 2002).

Numerous studies have found that nutrition education interventions improve nutritional knowledge of caregivers and increase the child (6-23 months) dietary diversity as well as in food insecure area (Waswa *et al.*, 2015; Kuchenbecker *et al.*, 2017). In one of the studies conducted in

Kenya, nutrition knowledge level among children caregivers has improved after being enrolled in the nutrition education program for six months (Mbogori and Murimi, 2019). Another study conducted in Malawi demonstrated a positive change in infant and young child feeding practices after exposing caregivers to a nutrition education intervention (Chiutsi-Phiri et al., 2017).

2.4 Nutritional status assessment of under- five children

Four techniques can be used assessing the nutritional status of individuals namely; anthropometric methods, dietary assessment, clinical observation and laboratory tests. The anthropometric methods embrace the measurements taken physically and with these methods it is easier to know the past information regarding the person's nutrition (Gibson, 2005). The anthropometry method is defined by WHO as the most convenient, cheaper and globally relevant for determining the mass and content of human body (WHO, 1995). The anthropometric measurements are useful in assessing the occurrence of chronic malnutrition due to protein and energy deficiencies and help to classify the levels of malnutrition such as severe and moderate stages (Gibson, 2005).

The only one measurement that ideally describe the nutrition status and health conditions of children is the growth assessment, and the anthropometric indices usually used for growth monitoring are; mid-upper arm circumference (MUAC); weight –for- height; weight- for -age and height –for- age (De Onis and Habicht, 1996). The confirmation of malnutrition is done with the help of one or both of those anthropometric indices (WHO, 1995).

Height-for-age index is used to measure the rate at which the linear growth has been attained and its deficit refers to stunting. While wasting or thinness as well as obesity among children are measured by using height-for-weight index, the underweight is measured by weight-for-age

index. Although the MUAC has been recommended as substitute index for assessing wasting in emergency conditions where to measure height and weight seems difficult, it is also used as an additional index during community screening (WHO, 1995).

2.5 Assessment of infant and young child feeding Practices

The assessment of IYCF practices is done by using the indicators which are divided into two groups; core indicators and optional indicators (Table 2.1). The core indicators are eight while optional indicators are seven (WHO, 2008a).

Table 2.1: Indicators for infant and young child feeding practices

Core indicators	Optional indicators
Early initiation of breastfeeding	Children ever breastfed
Exclusive breastfeeding under 6 months	Continued breastfeeding at 2 years
Continued breastfeeding at 1 year	Age-appropriate breastfeeding
Introduction of solid, semi-solid or soft foods	Predominant breastfeeding under 6 months
Minimum dietary diversity	Duration of breastfeeding
Minimum meal frequency	Bottle-feeding
Minimum acceptable diet	Milk feeding frequency for non-breastfed children
Consumption of iron-rich or iron-fortified foods	-

Source: WHO (2008a)

According to WHO (2008a) recommendation while assessing IYCF practices, it is very important to make a report at least on four core indicators of IYCF practices, in case it seems impracticable to report on all indicators. Those main indicators:

- Exclusively breastfeed for the first six months and early introduction to breastfeeding while assessing feeding practices among 0 to 6 months old infants

- Minimum acceptable diet and consumption of iron-rich or iron-fortified foods while determining IYCF practices among children aged between 6 to 23 months

2.6 Gaps in knowledge

Although several interventions are being put in place to fight against the major concern of stunting in Rwanda, there are still gaps in researches investigating deeper on the factors behind high stunting prevalence in the country, especially among male children and in food secure households. Furthermore, there are no or very few studies in nutrition knowledge, attitude and practices among mothers as well as the factors influencing eating behaviors in Rwandan population. There is also a need to assess the effectiveness of nutrition related interventions in order to learn and expand the successful ones.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.1 Study design

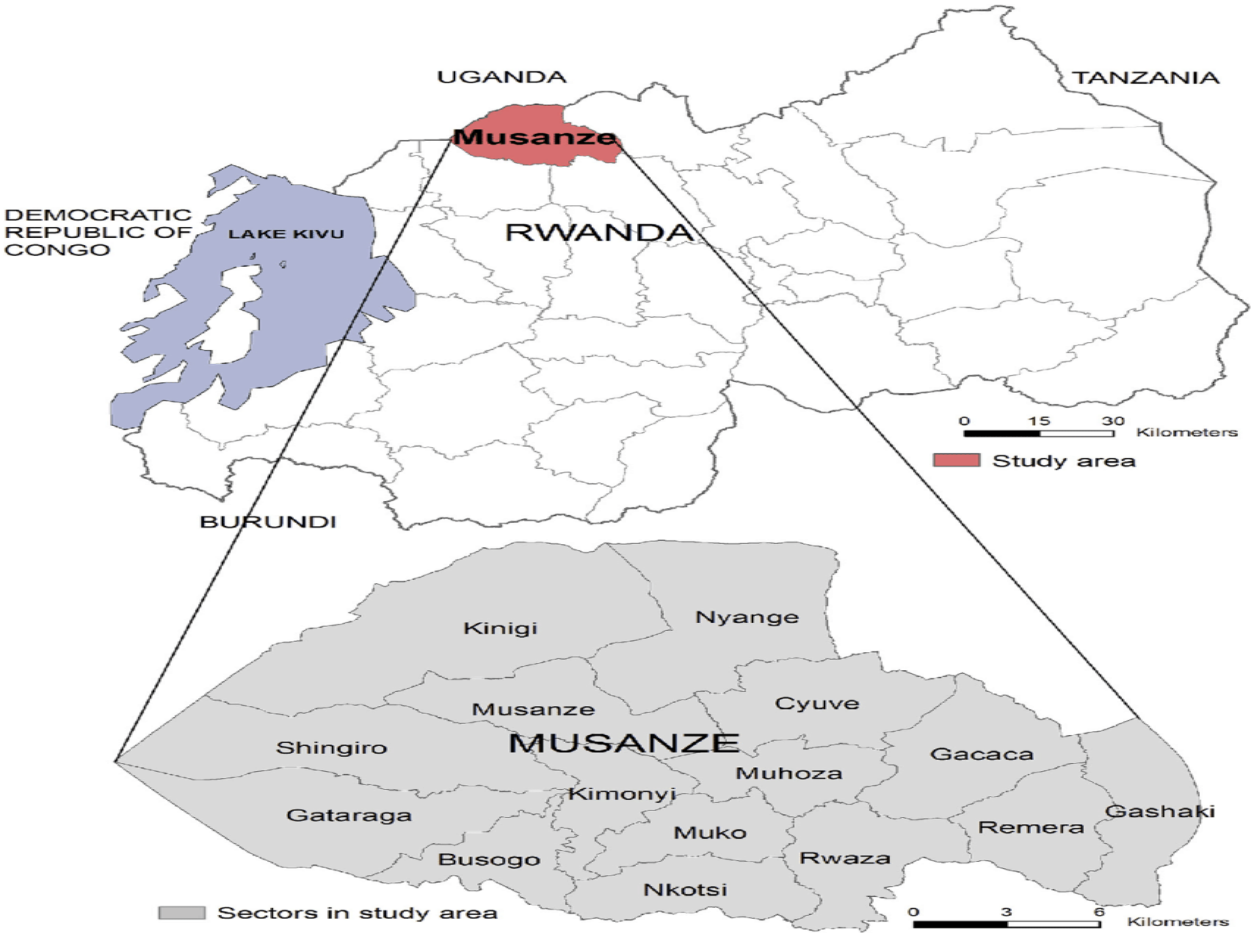
An analytical cross-sectional study design was carried out by using quantitative and qualitative research methods.

3.1.1 Study setting

The study took place in Northern Province of Rwanda, in the district of called Musanze. The district was purposely chosen since it is food secure district and yet has a high stunting prevalence of 38%.

3.1.2 Geographical Location

Musanze district constitutes five districts composing the Northern Province of Rwanda and it was set by Rwandan organic law n°29/2005 of 12/23/2005 regarding administrative entities (Figure 3). Musanze district is split into 15 sectors, which in their turn divided into 68 cells and then 432 villages. In the North, Musanze borders Democratic Republic of Congo (DRC) and Uganda via Virunga National Park, Gakenke district in the South, in the West Nyabihu district, Virunga Park and Ruhondo Lake, and in the East it borders the district of Burera. Musanze district is 530.4 km^2 of total area and within the district boundaries, it has five out of eight volcanoes constituting Virunga Park, namely Kalisimbi, Muhabura, Bisoke, Sabyinyo, and Gahinga volcano (GoR, 2013).



Source: Akinyemi (2017)

Figure 3: Map of Musanze district

3.1.3 Climate and Topography

Musanze is the most mountainous district in the country. Its landscape is composed of two parts having different types of soils; namely the volcanic zone, slightly slopped with volcanic ash soils and it extends over North and central part of the district, and the mountain range zone with sharp hills covering the East -South part and counting the two third of the district area. The altitude in volcanic zone is 1,860 m and the one of the mountain zone varies between 1,900 m and 2000. With the altitude of 1850 m and the average temperature of 20 ^{o}C, the district of most Musanze is ranked the first to have a pleasant climate in the country. The rain can be abundant in Rwanda

depending on the season. While in April to May, it rains heavily, October and November are marked by raining in moderate way. In rainy seasons, the rainfall amount is 1,000 m to 2,000 m per month averagely (GoR, 2013).

3.1.4 Demography

The population of Musanze district is 368,267 and it has a highest density among Northern districts with 694 habitants per Km^2 (2012). The female population counts 52.6% whereas the male percentage is 47.4%. Most of the population lives rural area (72.3%) against 27.7% residing in the urban part. The children aged below under five years are 50,613 with 25,247 males and 25,366 females (NISR and MINECOFIN, 2012).

3.1.5 Economic activity and Agriculture

In Rwanda, the official working age is 16 years and above. In Musanze district, the labor force is 76.4% with the residents either working or searching for a job. The unemployment rate is estimated to 2.3% (NISR and MINECOFIN, 2012). The dominant job among residents aged of 16 years and above, is independent farming (57%) followed by wage non-farm work performed by 21.6% of Musanze habitants. The major sources of households' income are agriculture, wage, business, rent, and the income from transfers (NISR, 2011).

Agriculture is the predominant activity in the district as it is performed by 91% of the population. Although the district is known to be the first producer of Irish potatoes in the country, it has also other main crops such as are maize, beans, fruits and vegetables. Some of cash crops are also cultivated in Musanze such as tea, coffee, pyrethrum and wheat. The percentage of households raising livestock is at 69 % with cattle and chickens mainly raised (GoR, 2013).

3.1.6 Health and Nutrition

Musanze district has one referral hospital and 16 health centers. One of the big challenges of the district is the under-five child mortality rate of 67 deaths per 1,000 livebirths, higher compared to the national rate of 50 deaths per 1,000 livebirths (NISR et al., 2015). In this district, stunting in under-five children is as serious as the one at national level as stunted children are 37.8% against 38% of national prevalence. Wasting and underweight prevalence are 1% and 6.7%, respectively while at national level wasting is at 2 % and 9 % of underweight (NISR et al., 2015).

3.2 Research methodology

3.2.1 Study population

The population of the study was constituted of mothers having children aged between 6 to 23 months in Musanze district.

3.2.2 Sample size determination

The sample size was calculated using formula of Fischer et al., (1991) as follows:

$$n=z^2pq/d^2$$

Where

n= the desired sample size when population is greater than 10,000

z= the standard normal deviation which is 1.96 at 95 % confidence interval

p= prevalence of IYCF practices 18 %, (2014-2015 RDHS)

q=1-p=1-0.18=0.82

d= the degree of accuracy desired set at 5 % (0.05)

Therefore;

$n=\frac{1.96^2*0.18*0.82}{0.05^2}=227$

5.5 % attrition=227/0.945=241 (attrition = 14)

Therefore, the total sample size =241

3.2.3 Sampling procedure

The sampling schema is shown in Figure 4. Musanze district was sampled purposely for the study as it has a high stunting prevalence of 37.8 % (NISR et al., 2015)., despite being 80% food secure according to CARI index (WFP, 2016). The district is divided in 15 sectors with 16 health centers. The data were collected in 9 health centers purposively selected based on the ones having higher cases of acute malnutrition. The health centers were Nyakinama, Nyange, Kimonyi, Kinigi, Rwaza, Karwasa, Muhoza, Gataraga and Musanze. The study participants were the mothers having children aged between 6 to 23 months who had visited the health center at the time of data collection. The systematic random sampling was used to select twenty six mothers from each of the nine health centers.

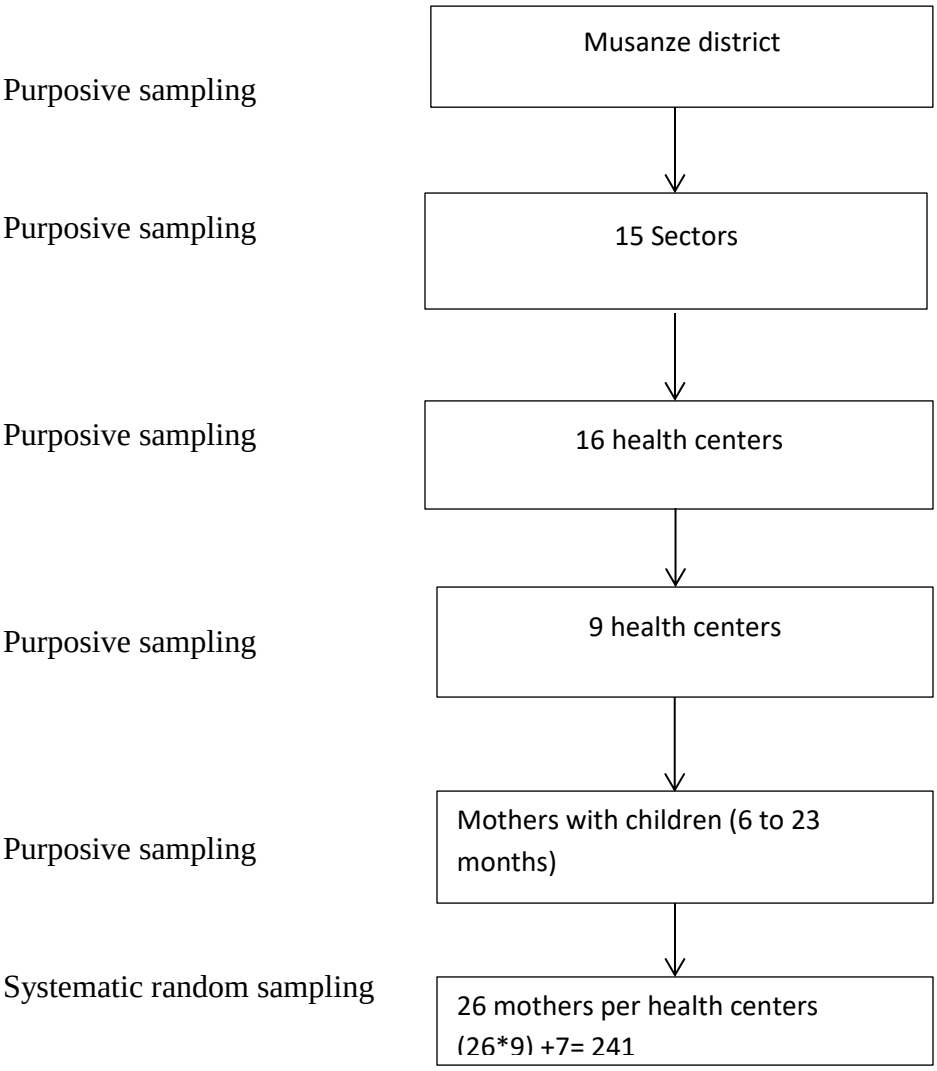


Figure 4: Sampling schema of the study

3.2.4 Inclusion criteria

All mothers having children of 6 to 23 months old who had attended the selected nine Health Centers and who gave consent. They were interviewed and anthropometric measurements of their children were taken.

3.2.5 Exclusion criteria

The mothers that declined to participate as well as the children who had severe or critical illness or referral cases.

3.2.6 Specific study methods for each objective

3.2.6.1 Determination of sociodemographic and socio- economic characteristics of households in Musanze District, Rwanda

By using a semi-structured questionnaire the information on the following socio demographic and socioeconomic characteristics were collected; age, sex, education level of the mothers, household size, marital status, household occupation, income, land ownership, wealth category (Appendix 2). The information was obtained by face to face interviews with the mothers of the child under and data were analyzed using the descriptive statistics.

3.2.6.2 Determination of maternal nutrition knowledge and assess infant and young child feeding practices among children aged between 6- 23 months

3.2.6.2.1 Maternal knowledge on infant and young child feeding practices

A semi-structured questionnaire (appendix 2) was used to obtain data on maternal nutrition knowledge. The questions were developed from FAO guidelines for assessing nutrition- related knowledge, attitudes and practices (KAP) (Macias & Glasauer, 2014). The total questions asked to the mothers were ten (six on complementary feeding and four on breastfeeding practices) (Appendix 2). For each question correctly answered, 1 point was scored whereas a wrong or an "I don't know" answer was scored 0. To standardize the results, the overall points on knowledge of each respondent were computed out of 100%.

In order to carry out the statistical analysis by testing the association of knowledge with different study variables the scores were graded into two categories, namely, low (score < 70%) and high (score ≥70 %) knowledge categories.

3.2.6.2.2 Current infant and young child feeding practices among children aged between 6-23 months

In order to assess on how the mothers feed their children (aged of 6 to 23 months), four core indicators of IYCF practices (WHO, 2010) were assessed in this study, namely; Minimum dietary diversity (MDD); Minimum meal frequency (MMF), Minimum acceptable diet (MAD) and consumption of iron-rich or iron-fortified foods. The tools used, to assess the late indicators, were developed following the guidelines recommended by FAO while conducting nutrition-related Knowledge, Attitude and Practices (KAP) surveys (Macias & Glasauer, 2014). The tools included a semi-structured questionnaire composed of questions reflecting on the pre-mentioned indicators; a seven food-groups dietary diversity checklist as well as a 24-hour dietary recall questionnaire where the mothers indicated all foods and drinks the child consumed 24 hours before the start of the survey (Appendix 2).

The MMF was calculated based on the number of meals (solid, semi-solid or soft foods) fed to the child during the 24 hours preceding the interview. The criteria for meeting the MMF recommended by WHO vary depending on the age and the breastfeeding status of the child (WHO et al., 2010) . Among the breastfed children, receiving at least two meals (when aged of 6 to 8 months) or at least three meals (when aged of 9 to 23 months) were the conditions to achieve the MMF. Regardless of the age, the non-breastfed children had to be fed at least four times the previous day to be classified as having met the MMF.

The recommended MDD was calculated referring to WHO et al. (2010) guidelines. A seven food groups checklist (appendix 2) was used to determine the individual dietary diversity score (IDDS) reflecting the number of food groups a child was fed from one day before the interview. The food groups on the checklist were grains, roots and tubers; legumes and nuts; dairy products;

flesh foods; eggs; vitamin A fruits and vegetables and other vegetables and fruits. The conditions for meeting MDD differ for breastfed children and non-breastfed children (WHO et al., 2010). Consequently, being fed from four food groups or more was a criterion to achieve the MMD among breastfed children whereas the consumption of at least four food groups, without including the milk feeds, was a condition for non-breastfed children.

Children met the MAD when they had achieved at the same time the MMF and MDD 24 hours before the survey. The consumption of at least 2 milk feeds was an added condition to non-breastfed children for them to achieve the MAD (WHO et al., 2010)

In order to measure the indicator of consumption of iron-rich or fortified foods among the children; a short food intake checklist (appendix 2) was used. The list was assessing whether in the 24 hours before the survey a child had consumed one or more of the following types of foods; flesh foods; commercially iron fortified foods specially designed for infant and young children and foods in which iron containing Micronutrient Powder (MNP) was added (Macias & Glasauer, 2014).

3.2.6.3 Assessment of nutritional status of children aged 6 to 23 months

Referring to WHO guidelines, two anthropometric data were taken, namely height (length) and weight (WHO, 2008b). Three nutrition indicators (stunting, wasting and underweight) were determined for the assessment of the nutritional status and the indicators' rate in the children. The tools used for the anthropometric measurements were height/ length boards and electronic SECA scales.

3.2.6.4 Assessment of nutrition information network and its relationship with food intake of children

A pretested semi-structured questionnaire (Appendix 2) was used and administered to the mothers with children aged between 6 to 23 months to assess the characteristics of the nutrition information network in Musanze district. The study sought to determine the sources of nutrition information received by mothers, periods of receiving nutrition information, means of accessing information and types (topics) of the messages learnt.

3.3 Research tools

3.3.1 Questionnaire

A pre-tested semi-structured questionnaire (Appendix 2) was used to collect data and was divided into sections of sociodemographic and socio-economic characteristics, maternal nutrition knowledge, IYCF practices, nutrition information network and anthropometric measurements. The questionnaire was administered to the mothers and each response given was filled well in its respective section. The questionnaire had the parts for quantitative data and qualitative data.

3.3.2 Dietary diversity assessment

The individual dietary diversity score of the child was calculated by using a seven-food group dietary diversity checklist (appendix2) developed by FAO (2014). The foods fed to the child were classified into food groups to gauge whether the child had at least eaten foods within four food groups, the cut-off point to meet the MDD for 6 to 23 months old children.

3.3.3 24hour dietary recall questionnaire

In order to capture all the foods, beverages and the frequency at which children were fed in 24 hours preceding the interview, a 24- hour dietary recall questionnaire was developed and it displayed the time of the food consumption, the name and ingredients of the dish (appendix3).

3.3.4 Anthropometric measurements

The anthropometric measurements were taken referring to WHO (2014) recommended guidelines for measuring weight and height (length) of under two years children.

Height – The UNICEF height board was used to measure the length of the child and read to the nearest 0.1 cm. In the first place, the mother helped to take off the excess clothes and shoes of the child prior to measuring. Then, the height board was horizontally placed on a flat and leveled surface and the height (length) was obtained by the child lying on it straight with feet together, knees straight, heels and buttocks in contact with the board, the shoulders relaxed, arms straight at the sides and the shoulder blades touching the length board. The measurements were taken twice from which an average length was calculated.

Weight: An electronic SECA scale was used to measure the weight of the child. The scale was placed on flat and stable surface and checked for accuracy and verified using an object of known weight before every weighing session. Children only remained with lightweight clothes (without jackets, socks and shoes). The measurements were taken twice from which an average weight was calculated and reported to the nearest 0.1 kg.

3.4 Pretesting of study tools

The questionnaire was pre-tested on 20 mothers in a selected pilot health facility before commencing actual data collection to ensure familiarization of the field assistants with the

questionnaire, equipment, obtaining consent, checking on its validity and find out if it would respond to objectives of the study.

3.5 Recruitment and training of field assistants

The recruitment of field assistants was advertised verbally with in the study district. The criteria for recruitment consisted of good conduct and reliability, attainment of college education, having basic nutritional knowledge, experience in data collection, and preferably being a resident of the study area. The shortlisted candidates were interviewed.

The training took two days (Appendix 3) and the covered subjects were; study objectives, the use of survey equipment, interviewing techniques, anthropometric measurements, and filling the questionnaire. The whole team went through the questionnaire to understand its contents for uniformity in interpretation of the questions. They were trained as well on good behavior and courtesy while interacting with and interviewing the participants.

3.6 Ethical considerations

Ethical clearance certificate was sought from Rwanda National Ethics Committee (appendix4) as well as a written approval from Musanze district administration (appendix 5). The informed consent was also sought from health centers administration in the District. The study participants were clearly explained about the purpose of the study by giving the former the opportunity to inquire clarifications and any concern about the study. After a thorough explanation and good understanding of the study, the participants, who voluntarily accepted to take part in the study, signed an informed consent form (appendix1).

3.7 Data quality assurance

To ensure the quality of the collected data, different strategies were taken such as adequate training of the field assistants, pre-testing of questionnaire and tools, calibration of scales every morning with standard known weights, taking two measurements for each subject and calculate the average to minimize the errors and examine the completed questionnaires while still being at the field to verify on the completeness of information provided as well as the consistency of measurements taken and answers given. The principal investigator had to meet with the field assistants on daily basis for work review and to deal with any issue that would be arisen. Data from closed-ended questions were pre-coded during questionnaire designing whereas open-ended questions were coded after data collection.

3.8 Statistical analysis

Statistical Package for Social Science (SPSS) software version 20.0 was used for data entry, cleaning and analysis with different statistical tests. The data analysis of anthropometric measurements was done using Emergency Nutrition Assessment software (ENA for Smart 2011) to determine different nutritional status (wasting, stunting and underweight) of children.

Descriptive statistics such as percentages, frequency distribution, mean and standard deviation were used for socio-demographic and economic, feeding practices, maternal knowledge and nutrition information network data analysis. Chi-square test and odds ratio were used to determine the associations and their strengths between different variables such as nutrition knowledge, feeding practices and nutrition status. The independent t-test and Pearson's correlation were as used to compare means of and determine the associations between variables, respectively. Microsoft excel was used for the graphical presentation and the analysis of

qualitative data on nutrition information network. Binary logistics regression models were used to determine factors influencing stunting and the minimum acceptable diet among the children.

CHAPTER FOUR: RESULTS

4.1 Socio demographic and socio-economic profile of households in Musanze District

4.1.1 Socio-demographic characteristics of households

Table 4.1 shows the means of socio-demographic characteristics of the study participants. The mean household size of 241 respondents was 4.7 (SD =1.8) with a minimum of two (2) members. The mean age of the index children was 11.8 months (SD=4.5). The mean age of the mothers was 29.1 years with the oldest interviewed mother being 50 years old.

Table 4.1: Means of socio-demographic characteristics of households

Variable	Mean	Standard deviation	Minimum	Maximum
Age of the mother (years)	29.1	6.8	18	50
HH Size	4.7	1.8	2	12
Age of children (months)	11.8	4.5	6	23

The study revealed that majority (46%) of the mothers was aged between 20 and 29 years. It was noted that only less than 10% were above 40 years (Figure 5).

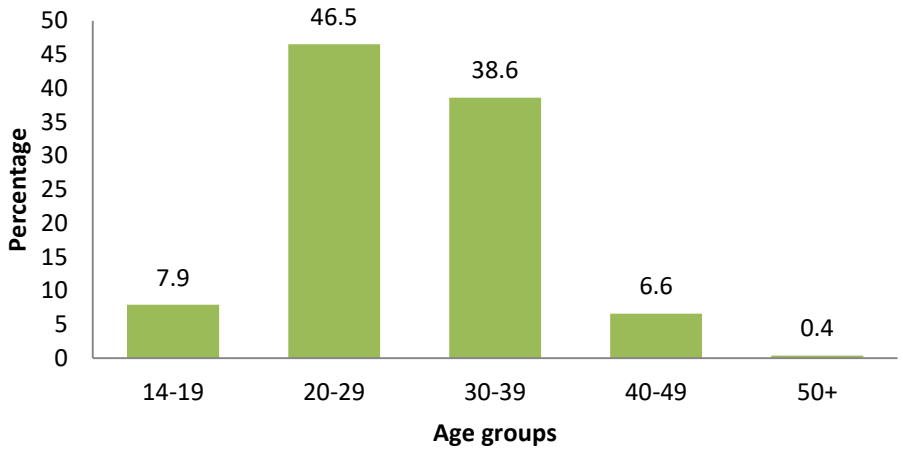


Figure 5: Distribution of mothers by the age groups

The results in Figure 6 show the households classification into wealth categories[1] where majority of the respondent households were in the second wealth category (54%). The study found that only a few respondents (17%) were in the first wealth category whereas 30% were in the third wealth category. It is noteworthy that no household was found to be in the fourth wealth category, the richest category.

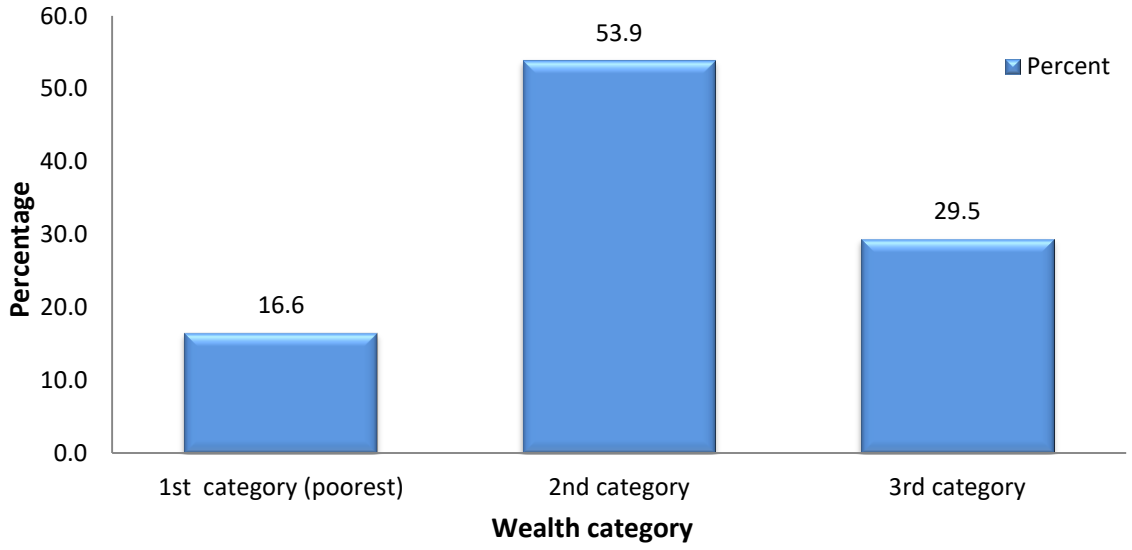


Figure 6: Distribution of respondents by wealth categories

The selected socio-demographic characteristics of the sample households were assessed across their respective wealth categories (Table 4.2). The results revealed that out of 241 mothers under the study, 85.5% were married, 9.1% single, 4.2% widowed and 1.2 separated. The majority of the mothers have attained primary school education (56.4%), 27% have been at least in the secondary school, only 4.1 % attended the University and 12.4% of mothers had no formal

[1] In Rwanda, households are classified into Ubudehe categories, which reflect their economic status. The recent classification was done into 2015 and the population was put into 4 Ubudehe categories (referred as wealth categories in this study) based on the resources and assets owned by households as well as the ability of sustaining their livelihoods. The categories are the first (poorest), second, third and fourth (richest) ubudehe categories (Ministry of Local Government (MONALOC), 2015).

education. Out of 75 mothers who had at least attained secondary education, 73% of them were from the higher (third) wealth category whereas no mother from the first category had completed the secondary school or attained the university education. The dominant religion of the participant households is Christianity where 53% are Catholic and 46% Protestant while only 1% is Muslims.

The study revealed that most of the sample households (67%) had only one child under-five years of age and few households (1.7%) had more than two under-five year's old children. The maximum number of under-five year old children found in the households was three. The dominant gender of children who participated in the study was male comprising 52% (Table 4.2).

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Table 4.2: Sociodemographic characteristics of household members across their wealth categories

Variable	Pooled n = 241		1st wealth category n = 40		2nd wealth category n = 130		3rd wealth category n = 71		Chi2	p-value
	Freq	%	Freq	%	Freq	%	Freq	%		
Marital status of mothers									18.33	0.005***
Married	206	85.5	29	72.5	113	87	64	90		
Single	22	9.1	5	12.5	12	9	5	7		
Separated	3	1.2	3	7.5	0		0			
Widowed	10	4.2	3	7.5	5	4	2	3		
Education of mothers									49.31	0.000***
No formal education	30	12.4	12	30	12	9.2	6	8.5		
Some primary	69	28.6	21	52.5	32	24.6	16	22.5		
Completed primary	67	27.8	2	5	44	33.8	21	29.6		
some secondary	37	15.4	22	12.5	10	16.9	37	14.1		
Completed secondary	28	11.6	0		18	13.8	10	14.1		
University/college	10	4.1	0		2	1.5	8	11.3		
Number of underfive children per HH									4.745	0.314
1	161	66.8	23	57.5	91	70.0	47	66.2		
2	76	31.5	15	37.5	38	29.2	23	32.4		
3	4	1.7	2	5.0	1	0.8	1	1.4		
Sex of index child									1.227	0.541
Male	115	47.7	16	40	65	50	34	47.9		
Female	126	52.3	24	60	65	50	37	52.1		
Religion of HH									19.85	0.001***
Catholic	127	52.7	10	25	82	63.1	35	49.3		
Protestant	112	46.5	29	72.5	48	36.9	35	49.3		
Muslim	2	0.8	1	2.5	0	0.0	1	1.4		

Notes: *** represent significance at 1% level

4.1.2 Socio-economics characteristics of households

Majority (49%) of the mothers were farmers, 21% casual labors, 9% business women while 17% were unemployed (Table 4.3). On the other hand, the predominant occupation of the heads of households was casual labor (39%), followed by farming (37%), salaried job (13%) and business (9%). Out 32 the salaried households head, 72% were from the third wealth category. Furthermore, the study revealed that farming and casual labor were the two predominant sources of income of the households, 38% and 37%, respectively. The households that were found to possess land for food production were 68% whereas 32% of the households did not produce food (Table 4.3). The total household income for the month preceding the survey was below ten thousand Rwandan francs for the majority of the households (46%). Out of households which earned more than fifty thousand Rwandan francs, 61% were from third wealth category and only 2% from first wealth category.

Table 4.3: Socio-economic characteristics of household members across their wealth categories

Variable	Pooled n = 241		1st category n = 40		2nd category n = 130		3rd category n = 71		Chi2	p-value
	Freq	%	Freq	%	Freq	%	Freq	%		
Occupation of mothers									37.601	0.000***
Salaried job	9	3.7	0		1	0.8	8	11.3		
Farmer	117	48.5	15	37.5	70	53.8	32	45.1		
Business	21	8.7	2	5	9	6.9	10	14.1		
Casual labor	50	20.7	18	45	24	18.5	8	11.3		
Crop/animal sales	2	0.8	0	0	1	0.8	1	1.4		
Housewife	1	0.4	0	0	1	0.8	0			
Unemployed	41	17	5	12.5	24	18.5	12	16.9		
Occupation of HHH									43.537	0.000***
Salaried job	32	13.3	1	2.5	8	6.2	23	32.4		
Farmer	89	36.9	13	32.5	53	40.8	23	32.4		
Business	21	8.7	1	2.5	13	10.0	7	9.9		
Casual labor	94	39	24	60	54	41.5	16	22.5		
Crop/animal sales	1	0.4	0	0.0	0	0.0	1	1.4		
Unemployed	4	1.7	1	2.5	2	1.5	1	1.4		
Major source of income of the HH									47.030	0.000***
Salaried job	30	12.4	1.0	2.5	6	4.6	23	32.4		
Farmer	92	38.2	13.0	32.5	55	42.3	24	33.8		
Business	21	8.7	3.0	7.5	11	8.5	7	9.9		
Casual labor	89	36.9	22.0	55.0	53	40.8	14	19.7		
casual trade	7	2.9	0.0	0.0	4	3.1	3	4.2		
Remittance/gift	2	0.8	1.0	2.5	1	0.8	0	0.0		
Total HH income in the last month (Rwf)									29.415	0.000***
Less than 10,000	110	45.6	25	62.5	63	48.5	22	31.0		
10,000 - 20,000	45	18.7	7	17.5	28	21.5	10	14.1		
20,000 - 30,000	18	7.5	4	10.0	9	6.9	5	7.0		
30,000 - 50,000	29	12.0	3	7.5	16	12.3	10	14.1		
50,000 and above	39	16.2	1	2.5	14	10.8	24	33.8		
HH access to the land for food production									0.584	0.747
Yes	163	67.6	25	62.5	89	68.5	49	69		
No	78	32.4	15	37.5	41	31.5	22	31		

4.1.3 Household crop production characteristics

The results in Table 4.4 show the various types of crops produced by households that own land. The most and least crops cultivated are legume (67%) and cash crops (tea, coffee and pyrethrum) (2%), respectively. The greater percentage of the food produced (more than 75%) is consumed within the majority of households (62%). Only 2.5% of the households consume less than 25% of the food they produce (Table 4.4).

Table 4.4: Types of the crops produced by households owning the land

Variable	Frequency n = 241	Percentage
Type of Crop produced		
Cereal	97	59.5
Root crops	84	51.5
Legumes	109	66.9
Vegetables	77	47.2
Fruits	8	4.9
Cash crops	3	1.8
% of food production consumed in the HH		
Below 25%	4	2.5
25 -50 %	28	17.2
50-75 %	30	18.4
Above 75%	101	62.0

4.2 Maternal nutrition knowledge and infant and young child feeding practices

4.2.1 Maternal nutrition knowledge

While assessing the overall nutrition knowledge of the mothers, the scores were classified as low (< 70%) and high (≥ 70%). The study revealed that a large proportion (83%) of the mothers were able to answer correctly to half of the questions. The mean knowledge score was found to be 71.03 (15.06 SD), whereas the minimum and maximum scores were 20% and 100% respectively.

Figure 7 demonstrates that the majority (72%) of the mothers had a high knowledge score whereas 28% had a low knowledge score.

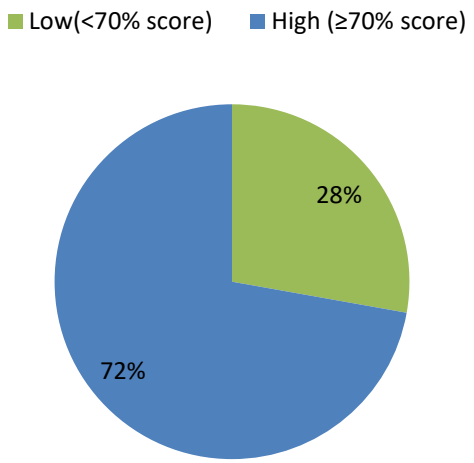

Figure 7: Distribution of mothers by low and high knowledge score

The details on the types of questions asked to the mothers and the percentage of correct responses are indicated in Table 4.5. About 60% of the questions were based on complementary feeding whereas 40% were on breastfeeding practices. The question on the recommended period of exclusive breastfeeding was the most answered correctly by the majority of the respondents (96%). Poor knowledge was observed on the question about food diversity where 91% failed to get it right by not being able to mention at least three types of food (food groups) to feed a child of 6 to 23 months of age.

Table 4.5: Percentages of correct responses to nutrition knowledge questionnaire

Questions to assess knowledge	Correct answer	
	Freq	%
When should breastfeeding be initiated after delivery?	209	86.7
What does exclusive breastfeeding mean?	200	83
Recommended length of exclusive breastfeeding	232	96.3
How long is it recommended that a woman breastfeeds her child?	224	92.9
At what age should babies start eating foods in addition to breastmilk?	227	94.2
Why is it important to give foods in addition to breastmilk to babies from the age of 6 months?	181	75.1
Food diversity: which foods or types of food can be added to porridge making it more nutritious (or other types of foods to give to child other than porridge)?	21	9
Please look at these two pictures of porridges. Which porridge (thick or watery/thin) do you think should be given to a young child?	94	39.0
How many times per day should a baby should be fed (liquids not included)?	161	66.8
Responsive feeding	163	67.6

4.2.1.1 Linking socio-demographic and economic characteristics with maternal nutrition knowledge

This study used the chi-square test, to establish the linkage between selected socio-demographic and socio-economic profiles and the maternal nutrition knowledge categorized into low (< 70% score) and high (≥70% score) knowledge (Table 4.6). The results showed that nutrition knowledge was not statistically significantly associated with most of the selected characteristics. This is despite the fact that, 68% of the youngest (14-19 years) mother group had high nutrition knowledge against 75% of the older group (40-49 years). The mothers who attained secondary education had the highest (≥ 80%) rate of high nutrition knowledge as compared to the mothers with other levels of educational attainment. The mothers having 3 underfive years old children had low knowledge at the rate of 25% against 27% of those with only 1 underfive child. The mothers that were salaried workers and those doing business as their main occupation had the lowest rate of low knowledge, 22% and 14%, respectively. Mothers in the 3rd wealth category had the highest (80%) rate of high nutrition knowledge whereas those in the 2nd wealth category

had the lowest rate (67%). However, a statistically significant difference was found when the mothers were classified into two groups based on their educational levels, lower (primary school and less) and higher (secondary and above) education. As expected, the mothers in the latter category had higher (81%) rate of high nutrition knowledge than those in lower education category (68%).

Table 4.6: Linkage of nutrition knowledge and sociodemographic and socio-economic characteristics

Variable		**Knowledge level**			
	Pooled n = 241	**Low (%)**	**High (%)**	χ^2	**P-value**
Mother age groups				3.068	0.547
14-19	19	31.6	68.4		
20-29	112	25.9	74.1		
30-39	93	29	71		
40-49	16	25	75		
50+	1	100	0		
Mother education				5.041	0.169
No formal education	30	26.7	73.3		
Primary	136	33.1	66.9		
Secondary	65	18.5	81.5		
University/college	10	20	80		
Number of under5 children				0.341	0.843
1	161	26.7	73.3		
2	76	30.3	69.7		
3	4	25	75		
Occupation of mothers				9.395	0.153
Salaried	9	22.2	77.8		
Farmer	177	24.8	75.2		
Business	21	14.3	85.7		
Casual	50	40	60		
Crop/animal sales	2	50	50		
Housewife	1	100			
Unemployed	41	26.8	73.2		
Wealth Categories				4.270	0.118
1st	40	25	75		
2nd	130	33.1	66.9		
3rd	70	19.7	80.3		
Land access for food production				1.038	0.308
No	78	32.1	67.9		
Yes	163	25.8	74.2		
Mother education classification				4.526	**0.033**
Lower education	166	32	68		
Higher education	75	19	81		

4.2.2 Infant and young child feeding practices among children of 6 to 23 months old

The results showed that 84% of children were initiated to breastfeeding within one hour after delivery, 93% continued to be breasted after turning one year old and nearly all the children (96%) were still being breastfed at the time of the study (Table 4.7). While the majority of the children (79%) were fed at least 3 times the day before the survey, 2.5% of children did not consume any solid or semi solid food one day before the survey. The majority of children had the medium dietary diversity score (4-6 score), followed by the low dietary score (43%) (≤3 score).

Table 4.7: Feeding practices of children between 6 and 23 months

Practices	Frequency	Percent
Early initiation of breastfeeding		
Within an hour of birth	203	84.2
Few hours and more after birth	38	15.8
Total	241	100
Continued breastfeeding at one year		
Yes	107	93
No	8	7
Total	115	100
Children being breastfed at time of survey		
Yes	231	95.8
No	10	4.2
Total	241	100
Dietary diversity Score		
High dietary diversity(≥6)	9	3.7
Medium dietary diversity(4-5)	128	53.1
Low dietary diversity (≤3)	104	43.2
Total	241	100
Meal frequency (number of meals)		
0	6	2.5
1	11	4.6
2	34	14.1
3+	190	78.8
Total	241	100

4.2.2.1 Food groups and types of foods consumed by children

WHO has classified foods into seven food groups as guidelines to determine the dietary diversity score (DDS) for the children aged between 6 and 23 months (WHO et al., 2010). The study findings showed that the two main food groups that were largely consumed were starchy (96%) and legumes and nuts (85%) food groups. The vitamin A rich food group came to the third place (72%), followed by other fruits and vegetables group (69%). The least foods consumed by children were of animal origin namely, eggs (5%), dairy products (12%) and flesh foods (16%) (Table 4.8).

Table 4.8: Types of foods consumed by children in 24 hours preceding the survey

n=241	Grains, roots, tubers (%)	Legumes and nuts (%)	Dairy products (%)	Flesh foods (%)	Eggs (%)	Vit A fruits & vegetable (%)	Other fruits& vegetables (%)
Age (months)							
6-8	86.6	70.1	14.9	13.4	4.5	44.8	64.2
9-11	100	91.5	10.2	16.9	8.5	81.4	74.6
12-23	99.1	90.4	11.3	16.5	4.3	82.6	64.3
Total	95.9	85.1	12	15.8	5.4	71.8	66.8

4.2.2.2 Minimum Meal Frequency

Figure 8 illustrates the proportions of the children who achieved the Minimum Meal Frequency (MMF) recommended by WHO (2010) for children aged between 6 and 23 months. MMF was calculated based on the age and breastfeeding status of a child referring to WHO guidelines. Out of 241 children who participated in the study, 231 were still being breastfed and only 10 were no longer receiving breastmilk. Overall, almost 83% of the children had met the MMF.

The proportion of non-breastfed children who achieved MMF is 30%, while 85% of breastfed children met the MMF as well.

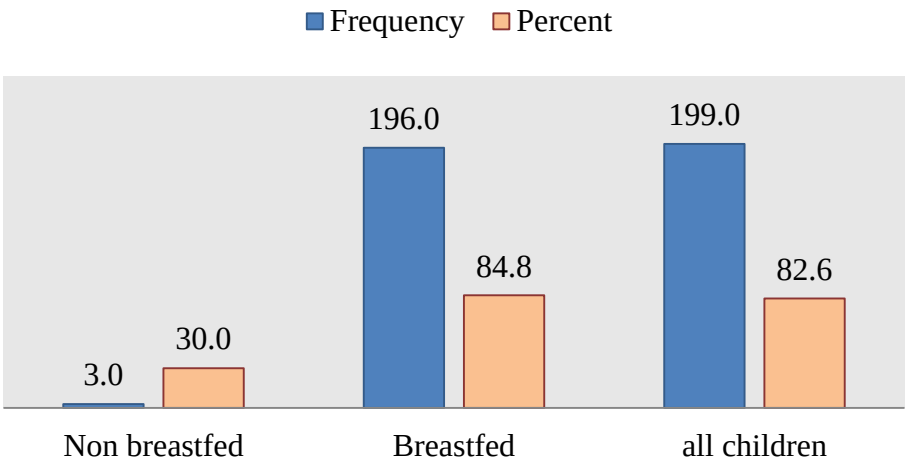

Figure 8: Distribution of children achieving the recommended MMF

4.2.2.3 Minimum Dietary Diversity

The Individual Dietary Diversity score (IDDD) was calculated based on the number of foods within pre-mentioned seven food groups a child had consumed the day before the interview. The criteria for meeting the recommended minimum dietary diversity (MDD) differs for the breast and non- breastfed children (WHO et al., 2010). Therefore, consuming from four different food groups are the minimum acceptable number of food groups for breastfed children, whereas achieving the MDD for non-breastfed require the consumption from four food groups without including the milk feeds. The mean IDDS score for all children was found to be 3.5 (1.25 SD).

Out of 241 under the study, almost 57% met the MDD. Among the breastfed children 57% have achieved the MDD against 60% of non-breastfed children (Figure 9).

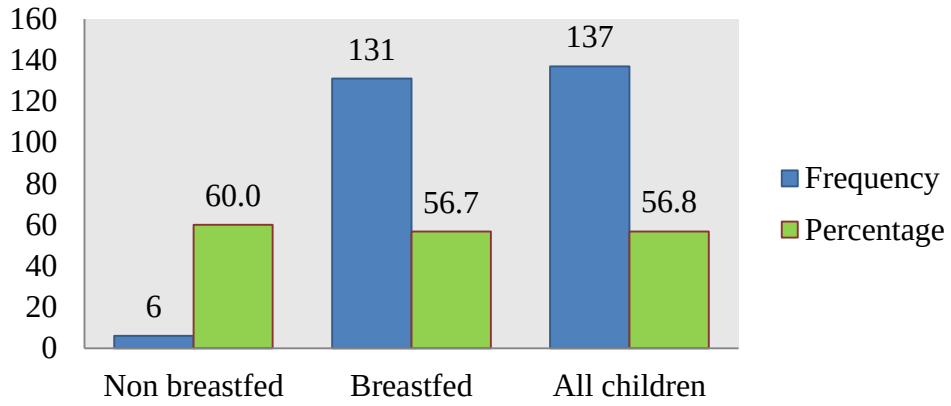

Figure 9: Distribution of children who met the recommended MDD

4.2.2.4 Minimum Acceptable Diet

Children (6 to 23 months) achieve the minimum acceptable diet (MAD) when they have met the MMF together with the MDD during the day before the survey. The consumption of at least 2 milk feedings is added to the previous conditions for non-breastfed children to achieve the MAD (WHO et al., 2010). The study findings in the Figure 10 indicate that out of 241 children participants, slightly more than half (53%) met the MAD. Only 10% among non-breastfed children achieved the recommended MAD.

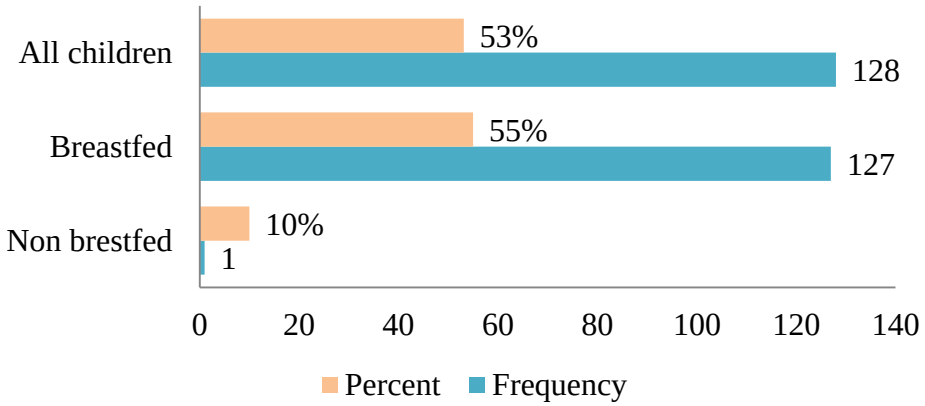

Figure 10: Children aged of 6 to 23 months who met Minimum Acceptable Diet

4.2.2.5 Consumption of iron-rich or fortified foods

This indicator is measured by assessing whether in the 24 hours before the survey a child has consumed at least flesh food, commercially iron fortified food specially designed for infant and young children or foods in which iron containing Micronutrient Powder (MNP) was added (WHO et al., 2010).

Out of 241 children, only 29% had consumed the iron rich or fortified foods. Among those who consumed, majority (12%) got their source of iron from only flesh foods (meat, poultry, fish), 8% from only iron-fortified foods and 4% consumed food in which MNP was added. The proportion of children who received the iron-rich foods from more than one source is 4.1% (Table 4.9).

Table 4.9: Sources of iron consumed by the children

Source of iron	Frequency	Percent
Flesh food only	30	12.4
Iron fortified-food only	20	8.3
MNP only	10	4.1
Flesh food + iron-fortified food	4	1.7
Flesh food +MNP	3	1.2
Iron fortified-food +MNP	2	0.8
Flesh food +Iron fortified-food +MNP	1	0.4
Total	70	29.0

***MNP:** Micronutrient Powder

4.2.2.6 Linking sociodemographic and socio-economic characteristics with IYCF practices

Some selected socio-demographics characteristics and IYCF practices were linked in this study using chi-square test (Table 4.10). The findings showed a non-significant association between the socio-demographic characteristics and meeting the WHO recommended minimum meal

frequency (MMF), minimum dietary diversity (MDD) and minimum acceptable diet (MAD) among children. However, this study classified the child's age and the mother's age into younger and older groups and found statistical significant associations between these variables and IYCF practices. The findings reveal that older (9-23months) children achieved the MDD and MAD at a significantly higher rate (MDD =64%, MAD =57%) as compared to younger (6-8months) children (MDD =39%, MAD =39%). Moreover, younger children were three and two times less likely to meet MDD and MAD, respectively, than older children. Also, children whose mothers were older (p=0.004) met the MAD at a higher (64%) rate as compared to those with younger mothers (49%).

Unexpectedly, the mothers without formal education had the highest (87%) percentage of children achieving the MMF, and together with the mothers with secondary school level had the children the highest rate of achieving the MDD (60%) and MAD (57%). The households with only one underfive year child had the highest rate of children meeting the MDD (59%) and MAD (55%).

Table 4.10: Linkage of selected socio-demographic characteristics and IYCF practices

Variable	Pooled n = 241	IYCF practices											
		MMF				MDD				MAD			
		Yes (%)	χ^2	Sig.	OR	Yes (%)	χ^2	Sig.	OR	Yes (%)	χ^2	Sig.	OR
Mother age groups			6.363	0.714	-		2.810	0.590	-		1.959	0.743	-
14-19	19	89.5				63.5				57.9			
20-29	112	84.8				54.5				51.8			
30-39	93	79.6				57				52.7			
40-49	16	81.2				68.8				62.5			
50+	1	0				0				0			
Mother education			1.531	0.675	-		1.594	0.661	-		1.369	0.713	-
No formal education	30	86.7				60				56.7			
Primary	136	80.1				55.9				51.5			
Secondary	65	86.2				60				56.9			
University	10	80				40				40			
Number of under5 children in HH			0.897	0.639	-		0.933	0.627	-		0.466	0.792	-
1	161	82.6				59				54.7			
2	76	81.6				52.6				50			
3	4	100				50				50			
Child age (months)			0.015	0.902	1.04		12.312	**0.000**	2.2		7.627	**0.006**	2.8
Younger (6-8)	67	82.1				38.8				38.8			
Older (9-23)	174	82.8				63.8				58.6			
Mother age classification			0.256	0.613	1.2		2.728	0.099	1.6		4.002	**0.04**	1.9
Younger(<35 years)	182	82				54				49			
Older (≥35 years)	59	85				66				64			

Notes: OR: Odds ratio

Moreover, a relationship was established between individual dietary diversity score (IDDS) of a child and the age of the child. Table 4.11 shows a significant positive correlation between the two variables. This implies that as the age (months) of the child increases, his or her IDDS does increase as well.

Table 4.11: Relationship between child age (months) s and IDDS of a child

Variable	Correlation coefficient	P-value
IDDS	0.186	0.004*

Note: IDDS: Individual Dietary Diversity Score

Table 4.12 presents the results of associations between selected socio-economic characteristics of households and IYCF practices using a chi-square test. The only statistically significant (P=0.014) association was found between the total household income in the month preceding the survey and the MAD. The households with the highest income (≥ Rwf 50,000) had the highest (74%) rate of children who achieved the MAD. Nevertheless, the households doing business as a major source of income had the highest rate of children meeting the MDD (71%) and MAD (67%), followed by salaried households (MDD= 63% and MAD= 67%). The children with the highest (87%) rate in meeting the MMF were from the second wealth category households whereas the highest rate in achieving the MDD (58%) and MAD (54%) were observed among children belonging to the households within the third wealth category. Although the households possessing the land for crops production had a higher (83%) number of children meeting the MMF, they had a lower rate of children meeting the MMD (56%) and MAD (51%) as compared to households which do not have access to the land (MDD= 58% and MAD=56%).

Table 4.12: Linkage of selected socio-economic characteristics and IYCF practices

Variable	Pooled n = 241	IYCF practices								
		MMF			MDD			MAD		
		Yes (%)	χ^2	Sig.	Yes (%)	χ^2	Sig.	Yes (%)	χ^2	Sig.
HH major income source			1.317	0.933		2.916	0.713		3.966	0.554
Salaried job	30	83.3			63.3			63.3		
Farm	92	84.8			54.3			47.8		
Business	21	81			71.4			66.7		
Casual labor	89	79.8			53.9			51.7		
Casual trade	7	85.7			57.1			57.1		
Remittance/gift	2	100			50			50		
Total HH income in the last month (Rwf)			6.591	0.159		9.065	.059			
Less than 10,000	110	80.9			51.8			47.3	12.533	**0.014**
10,000 - 20,000	45	88.9			64.4			60		
20,000 - 30,000	18	83.3			44.4			33.3		
30,000 - 50,000	29	69			48.3			48.3		
50,000 and above	39	89.7			74.4			74.4		
HH Wealth Categories			3.979	0.137		0.056	0.972		0.250	0.883
1st	40	75			57.5			50		
2nd	130	86.9			56.2			53.1		
3rd	70	78.9			57.7			54.1		
Land access for food production			0.261	0.610		0.034	0.854		0.504	0.478
No	78	80.8			57.7			56.4		
Yes	163	83.4			56.4			51.4		

4.3 Nutritional status of children aged of 6-23 months

4.3.1 Stunting

Stunting is defined as having low height compared to a person's age. It is assessed by determining the Height-for-age Z-score (HAZ) of a child. A HAZ falling under -2 standard deviation (SD) indicates the state of stunting, whereas HAZ below -3 SD shows severe stunting (WHO, 2008b). Almost 28% of 241 children measured were stunted where 9% and 19% were severely and moderately stunted, respectively (Table 4.13). The male children were more stunted than their female counterparts, 40% and 17%, respectively. By using the chi-square test, the results revealed a statistically significant difference ($P<0.05$) in the prevalence of stunting between male and female children. Overall, 174 children (72%) had HAZ ≥ -2, i.e., were not stunted (Table 4.13).

Table 4.13: Distribution of children by stunting across their gender

Stunting category	Males (%)	Females (%)	All (%)	χ^2	Sig.
	n=115	n=126	n=241	18.162	0.000*
Stunting	40	16.7	27.8		
Moderate	25.2	13.5	19.1		
Severe	14.8	3.2	8.7		

Notes: Stunting= <-2 Z score; Moderate=<-2 and <-3 Z score; Severe=< -3 Z score
* represents ($p < 0.05$)

4.3.2 Wasting

A child is wasted when his/her weight is low compared to the height. Wasting occurs when the weigh-for-height Z-score (WHZ) falls below -2 standard deviations of the WHO Child Growth Standards median (WHO, 2008b). Global acute malnutrition (wasting) prevalence was 2 % in all 241 children as their weight-for-height Z-scores were below -2 SD. Among male children almost 1% was wasted against 2% of female children (Table 4.14).

Table 4.14: Distribution of children by wasting

Wasting category	Males (%)	Females (%)	All (%)
Global	0.9	2.4	1.7
Moderate	0.9	1.6	1.2
Severe	0	0.8	0.4

Notes: Global= <-2 Z score; Moderate=<-2 and <-3 Z score; Severe=< -3 Z score and/or oedema

4.3.3 Underweight

Underweight is indicated by low weight for age index. An underweight child has a weight-for-age Z-score (WAZ) which is below -2 SD of the reference population (WHO, 2008b). Out of 241 children under this study, 95% had a good nutrition status in terms of underweight, whereas the prevalence of moderate and severe underweight was found to be 4% and 1%, respectively (Table 4.15).

Table 4.15: Distribution of children by Underweight

Underweight category	Males (%)	Females (%)	All (%)
Underweight	8.7	2.4	5.4
Moderate	6.1	2.4	4.1
Severe	2.6	0	1.2

Notes: Underweight= <-2 Z score; Moderate=<-2 and <-3 Z score; Severe=< -3 Z score

4.4 Nutrition information network and its relationship with child food intake

4.4.1. Characteristics of nutrition information network among mothers

The current study sought to elucidate if the mothers had ever received the nutrition information whether before or after giving birth to the study index child. The results revealed that 95% of mothers confirmed having been exposed, at least once, to the nutrition education either in a formal or an informal way. Of those who got the nutrition information, a large proportion (55%) received the education during pregnancy, 34% during the exclusive breastfeeding period, 12% during complementary feeding time and 6% of the mothers acquired the information before they got pregnant (Figure 11).

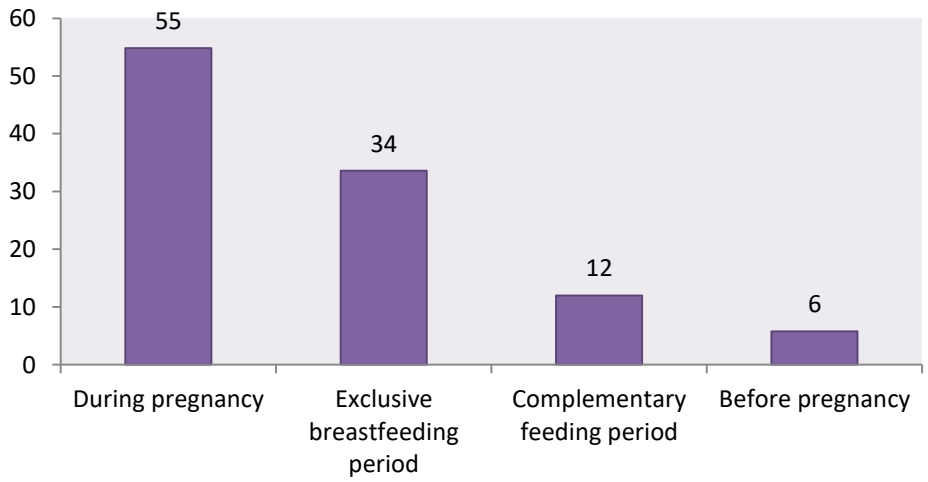

Figure 11: Distribution of mothers by the period of receiving the message

When asked where they got the nutrition information from, two sources were mentioned by the majority of the mothers, namely, health centers (57%) and Community Health Workers (CHWs) (35%) (Figure 12). The study indicates that 17%, 12%, 11% of the respondents had mass media (radio and TV), friends and community groups (mother-to-mother support groups

or parent evenings), respectively, as their sources of nutrition education. About 8% of mothers acquired the information from other sources, such as local NGO, school, flyers and church**.**

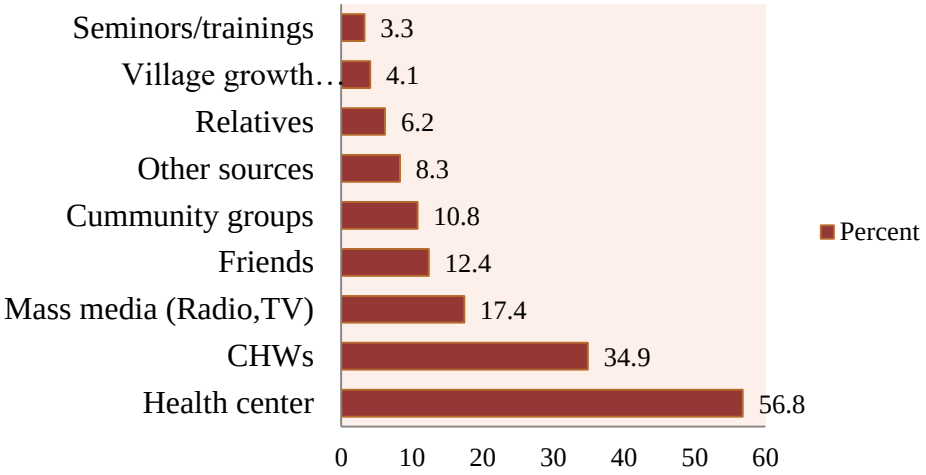

Figure 12: Distribution of mothers by the source of nutrition Information

The study sought as well to find out which sources of information mothers trust the most (Figure 13). Information trusted by majority (69%) is from the health centers, followed by CHWs (38%), mass media (radio and TV) (15%), relatives (3%) and friends (3%).

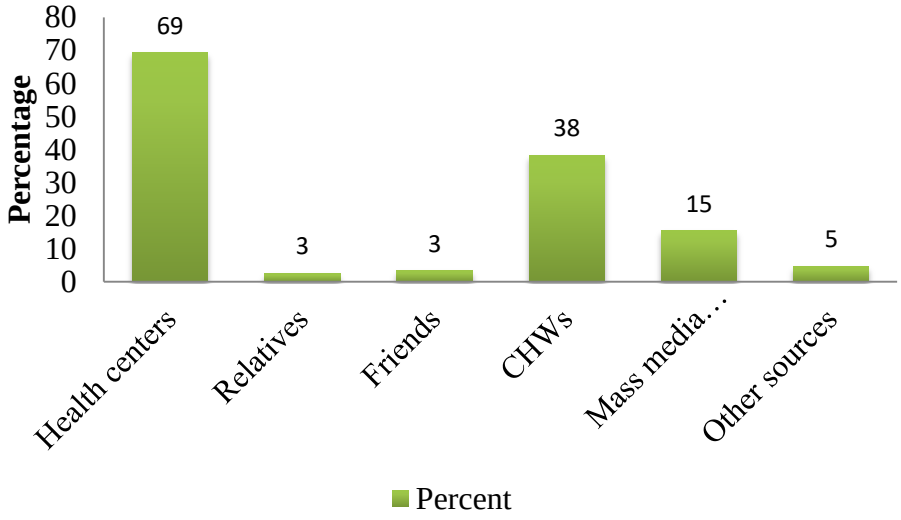

Figure 13: Distribution of mothers by the most trusted source of nutrition information

Further, the study looked at the types (topics) of nutrition messages being shared to the mothers and the results show that 77% were educated on a balanced diet, 17% learnt about the diet to be consumed during the pregnancy, 16% about complementary feeding and 9%, exclusive breastfeeding (Figure 14).

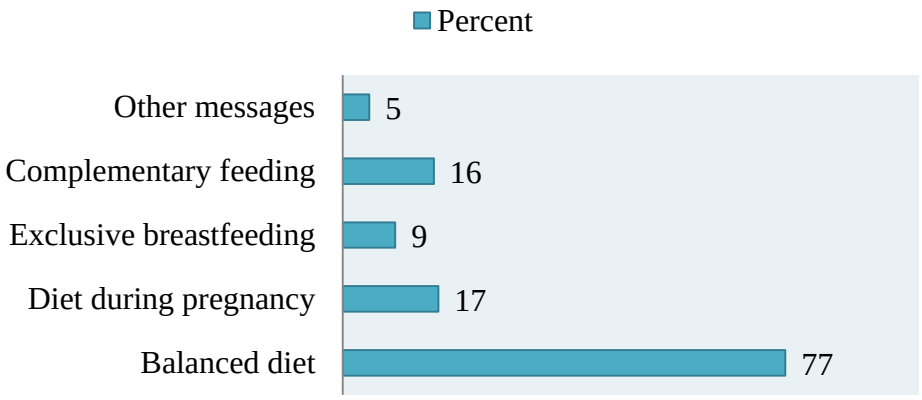

Figure 14: Distribution of the types of the message given to the mothers

4.4.2 Relationship between means of accessing nutrition information and child food intake

When the Chi-square test was conducted to assess the relationship between the feeding practices (MMF, MDD and MAD) and nutrition information network in terms of means by which the mothers access the information, it was found that home visits by CHWs were significantly (P=0.04) associated with children meeting the MAD where 70% of children whose household had been visited by CHWs achieved the MAD (Table 4.16). Furthermore, 51%, 60%, 57%, 62% of children whose mothers go to clinics, attend community gatherings (mother-to-mother support groups, parent evenings, cooking demonstrations and growth monitoring), listen to the radio or TV and visit friends met the MAD, respectively, though it was not statistically significant.

Table 4.16: Association between means of accessing information and IYCF practices

Means of access	Pooled n = 241	Feeding practices								
		MMF			MDD			MAD		
		Yes	χ^2	Sig.	Yes	χ^2	Sig.	Yes	χ^2	Sig.
Going to clinic (yes)	124	87%	3.63	0.057	53%	1.36	0.24	51%	0.54	0.46
Attend community gatherings (yes)	78	86%	0.88	0.34	63%	1.67	0.19	60%	2.37	0.12
Home visits by CHWs(yes)	33	91%	1.84	0.17	70%	2.57	0.11	70%	4.22	**0.04**
Listen to the radio/TV (yes)	35	80%	0.18	0.66	60%	0.16	0.68	57%	0.26	0.61
Friend visits (yes)	21	86%	0.15	0.69	71%	1.99	0.15	62%	0.71	0.34

4.4.3 Preferred ways of easily accessing nutrition information

After identifying the different characteristics of the nutrition information network, the study endeavored to know mothers' wishes and suggestions on how they can easily access the nutrition information as well as the appropriate ways of message delivery for better nutritional knowledge and practices. The results are displayed in table 4.17 where 241 study participants indicated their wishes by proposing the different channels through which nutrition messages should pass. The two most proposed channels were CHWs (53%), and the village gatherings (52%).

Table 4.17: List of the preferred channels for Nutrition Information by the mothers

Channels	Frequency	Percentage
CHWs	128	53.1
Village gatherings	125	51.9
Health center (clinics)	51	21.2
Radio	38	15.8
Church	20	8.3
Mobile phone	11	4.6
Distribution of flyers/pamphlets in the community	4	1.7
TV	3	1.2
Nutrition education at the cell level	3	1.2

Under the CHWs channel, 25% of the mothers suggested that CHWs should deliver the nutrition education in the community, whereas 14% recommended a household-to-household visit by the CHWs. Intensification of capacity buildings (trainings) and motivation of the CHWs to frequently educate in the community, were the 2 other ways of improving nutrition education proposed by the mothers (Table 4.18).

Concerning the village gatherings as a channel of nutrition education, the suggested ways of delivering the education included regular parent evening sessions (10%), educating in the community (public) meetings (23%), scheduling and communicating to the population fixed nutrition education sessions (8%), increasing the frequency of nutrition education sessions to at least twice a month (3%) and the community outreach by the nutritionists or nurses to educate the mothers (2.5%).

Table 4.18: Stated modes of nutrition information delivery through most preferred channels

Mode of Nutrition Information delivery	Percentage	Channel
Nutrition education in the community by CHWs	25.3	CHWs
Home visits by CHWs to every household	14.5	
Increase the capacity building of CHWs and motivate them to frequently educate the mothers	10.4	
Increase the number of CHWs in the villages to reach more households	2.9	
Nutrition education during community meetings	23.6	Village gatherings
Nutrition education in the parent evening sessions	10.4	
Schedule fixed nutrition education sessions in the village, sensitize and communicate the population	7.9	
Increase the frequency of Nutrition Education sessions at least twice a month	2.9	
Community outreach by Nutritionists/nurses for education	2.5	
Meeting to be led by village chiefs	1.7	
Assign to each village a Nutrition educator	0.8	
Schedule Nutrition education after working hours	0.4	
Nutrition education during growth monitoring sessions	0.4	
Establish the mother-to-mother support groups in the villages	0.4	
Frequent culinary demonstrations in the village	0.4	
Educate men about Nutrition	0.4	
Nutrition education at health centers and the health posts	16.2	Health center
Nutrition education at health centers before the vaccination	4.6	
Establish a health center in each cell	0.4	

4.5 Association between maternal nutrition knowledge, IYCF practices and child nutritional status

4.5.1 Association between maternal nutrition knowledge and IYCF practices

As presented in Table 4.19, the Chi-square test was used to assess the association between maternal nutrition knowledge and four IYCF Practices (MMF, MDD, MAD and Consumption of iron- rich foods). The results show that there is a statistically significant (p=0.006) association between maternal nutrition knowledge and a child meeting the MMF. The odds ratio of 2.6 shows that mothers with high nutrition knowledge are almost three times more likely to have their children meeting MMF compared to the mothers with low nutrition knowledge. However, the MDD, MAD and the consumption of iron-rich foods were not significantly associated with maternal knowledge (Table 4.19). Although no statistically significant association was found between maternal knowledge and the farmer variables, it was generally revealed that more mothers who had high nutrition knowledge had children who met MDD, MAD and consumed iron-rich food when compared with those who had low nutrition knowledge.

Table 4.19: Association of IYF practices with maternal nutrition knowledge

		Maternal knowledge				
	Pooled n = 241	**Low (%)**	**High (%)**	χ^2	**P-value**	**OR**
MMF				7.705	0.006*	2.6
No	42	7.9	9.5			
Yes	199	19.9	62.7			
MDD				3.122	.077	1.6
No	104	14.5	28.6			
Yes	137	13.3	43.6			
MAD				2.589	.108	1.6
No	113	15.4	31.5			
Yes	128	12.4	40.7			
Consumption of iron-rich foods				1.996	.158	1.6
No	171	21.6	49.4			
Yes	70	6.2	22.8			

Note: * represents significance ($p < 0.05$)

Pearson correlation was used to assess the relationship between individual dietary diversity score (IDDS) of a child and maternal nutrition knowledge, and the results indicated a significant (p=0.021) positive correlation between those variables (Table 4.20).

Table 4.20: Relationship between maternal knowledge score and IDDS of a child

Variable	Correlation coefficient	P-value
Knowledge score	0.149	0.021*

Note: * represents $p < 0.05$

In addition, an independent sample t-test was conducted to compare the IDDS of children in terms of low and high maternal nutrition knowledge as presented in Table 4.21. The results showed that the difference in means of IDD score between the mothers with low (3.18) and high (3.66) knowledge was statistically significant (P-value= 0.007).

Table 4.21: Independent t-test between IDDS and maternal nutrition knowledge

	Maternal Knowledge				
Variable	low	high	Std.Error difference	t-value	p-value
IDDS	3.1791	3.6609	.17813	-2.705	.007*

Note: * represents $p < 0.05$

4.5.2 Association between maternal nutrition knowledge and nutritional status of children

By using the chi-square test, the results indicated no significant difference in the prevalence of stunting, wasting or underweight between children whose mothers have low nutrition knowledge and those with high nutrition knowledge (Table 4.22). However, the results show that the majority of children whose mothers had high nutrition knowledge had good (normal) nutrition status. Categorically, 72%, 98% and 95% of those children are not stunted, wasted nor underweight, respectively.

Table 4.22: Association between maternal nutrition knowledge and child nutritional status

		Stunting (%)				Wasting (%)				Underweight (%)			
	Pooled n = 241	Yes	No	χ^2	p-value	Yes	No	χ^2	p-value	Yes	No	χ^2	p-value
High knowledge	174	28	72	0.04	0.8	2	98	0.01	0.9	5	95	0.8	0.4

Note: * represents $p < 0.05$

4.5.3 Association between IYCF practices and nutritional Status of children

Using Chi-square test, the study revealed that the majority of children who met the IYCF practices had a good nutritional status (Table 4.23). The results show that 74%, 73%, 76% and 69% of children who met MMF, MDD, MAD and consumption of iron-rich foods, respectively, were not stunted. Moreover, 2%, 3%, 3% and 1% of children with recommended MMF, MDD, MAD and iron-rich food consumption, respectively, were wasted. Lastly, 6%, 3%, 8% and 9% who achieved MMF, MDD, MAD and consumption of iron-rich foods respectively, were underweight. However, when the significance tests were conducted between the above IYCF practices and different forms of malnutrition, the associations were found to be no significant at 95% Confidence Interval (Table 4.23).

Table 4.23: Association of IYCF practices with nutritional status of children

IYCF practices	Pooled n = 241	Stunting			Wasting			Underweight		
		Yes	No	χ^2	Yes	No	χ^2	Yes	No	χ^2
MMF(yes)	199	26%	74%	0.20	2%	98%	0.35	6%	94%	0.34
MDD(yes)	137	28%	73%	0.98	3%	97%	0.07	3%	97%	0.13
MAD(yes)	128	24%	76%	0.18	3%	97%	0.05	8%	92%	0.08
Consumption of iron-rich foods (yes)	70	31%	69%	0.64	1%	99%	0.03	9%	91%	0.16

Nevertheless, the study revealed that the MAD has a statistically significant (p=0.021) association with height-for-age Z-score (HAZ) of a child. The results of an independent sample t-test show a significant difference between the HAZ mean (-1 SD) of children who met the MAD and the HAZ mean (-1.5 SD) of those who did not (Table 4.24).

Table 4. 24: Independent t-test between HAZ score and MAD

	Did the child meet MAD?				
Variable	No	Yes	Std.Error difference	t-value	p-value
HAZ score	-1.49331	-1.05326	.189599	-2.321	0.021*

Note: * represents $p < 0.05$

4.5.4 Factors influencing stunting of children of 6-23 months

The determinants of stunting were identified by using the multiple logistic regression analysis. The results showed that the factors that predict stunting are MAD, income type, sex of the child, consumption of animal sourced foods and underweight status as detailed in Table 4. 25.

The findings revealed that there was a significant (p=0.009) negative relationship between the child meeting the MAD and stunting. The household income type (farming) (p=0.021), child underweight (p=0.000) were found to have as well a significant negative relationship with stunting whereas the sex (male) of a child (p=0.003) and consumption of animal sourced foods (p=0.047) had a significant positive relationship with stunting.

Table 4.25: Determinants of stunting among children aged of 6-23 months

Variable	Coefficient (B)	Standard error	Sig.
Income type (Farming HH =1)	-0.946	0.411	0.021*
MAD (yes=1)	-1.385	0.527	0.009*
Higher Education of the mother (yes=1)	-0.659	0.426	0.122
Iron-rich foods consumption (yes =1)	0.787	0.472	0.095
Age of the mother (above 35 years=1)	-0.017	0.400	0.967
Consumption of animal sourced food (yes=1)	-1.109	0.558	0.047*
HH Wealth category (2ndor higher = 1)	-0.165	0.462	0.721
Maternal nutrition knowledge (high=1)	0.194	0.388	0.617
Meal frequency of a child	-0.005	0.195	0.982
IDDS of a child	0.468	0.258	0.070
Access to land (yes = 1)	0.752	0.423	0.075
Sex of a child (male=1)	1.026	0.346	0.003*
Underweight status (yes=1)	3.184	0.870	0.000*
Constant	-2.590	0.862	0.003

Dependent variable: Stunting
Note:*Prediction is significant; HH: Household; MAD: Minimum Acceptable Diet; IDDS: Individual Dietary Diversity Score

4.5.5 Factors influencing minimum acceptable diet of children

The determinants of meeting the MAD were identified by using the multiple logistic regression analysis. The findings showed that the factors that predict the MAD are employed mother, income type, consumption of animal sourced foods, community gatherings attendance and HH home visit by CHWs as detailed in Table 4. 26.

The results indicate that all the found predictors influence significantly and positively a child to meet the MAD. The p-values were found to be 0.034 (employed mother), 0.023 (income type: salary-business), 0.000 (consumption of animal sourced foods), 0.038 (community gatherings attendance) and 0.023 (HH home visit by CHWs).

Table 4.26: Determinants of Minimum Acceptable Diet

Variable	Coefficient (B)	Standard error	Sig.
Nutrition knowledge score	0.017	0.011	0.099
Higher Education of the mother (yes=1)	-0.335	0.396	0.398
Consumption of animal sourced foods (yes=1)	3.154	0.503	0.000*
Age of the child	0.040	0.037	0.275
Employed mother (yes=1)	1.109	0.524	0.034*
HH number of underfive children (over 1=1)	-0.130	0.343	0.704
Access to land (yes = 1)	-0.255	0.358	0.476
Married mothers (yes=1)	-0.562	0.486	0.247
Home visit by CHWs (yes=1)	1.074	0.479	0.025*
HH Income (business/salary =1)	1.089	0.480	0.023*
Attend community gatherings (yes=1)	0.728	0.352	0.038*
HH Wealth category (2ndor higher = 1)	-0.113	0.432	0.793
Constant	-2.862	1.086	0.008

Dependent variable: Minimum Acceptable Diet (MAD)

Note: *Prediction is significant; HH: Household; CHWs: Community Health Workers

CHAPTER FIVE: DISCUSSION

5.1 Sociodemographic and socio-economic profile of households in Musanze District

The mean household size (4.7) found is in consistence with the mean household size of Rwandan population (4.3) reported by the 2014-2015 Rwanda Demographic Health Survey (RDHS) (NISRet al., 2015). This is also comparable with 2014 Kenya and 2015-2016 Tanzania Demographic Health Surveys that found a household size mean of 4.2 and 4.8 respectively (KNBS, 2014; MoHCDGEC et.al, 2016). The majority of the mothers who participated in this study were in their twenties. This corresponds to a study conducted in Kenya where most of primary caregivers of children aged 6 to 23 months were 20 to 29 years old (Cherop, 2017). In addition, this is in line with the 2014-2015 RDHS report showing that among the survey female respondents, the predominant age group ranged between 20 to 29 years old (NISR et al., 2015).

The primary school education was the highest level of education that was attained by majority of the mothers which corresponds to the findings from 2014-2015 RDHS (NISR et.al, 2015). A study conducted in Kenya demonstrated the same tendency of having the primary school as the highest level of education hold predominantly by mothers (Cherop, 2017). A non-negligible proportion of mothers (12.4%) had no level of literacy, findings that are comparable with a study conducted in Democratic Republic of Congo (DRC) and Ghana where 12.6 % and 15% of mothers (of under five years children), respectively, had no formal education (Amugsi et.al, 2020). In this study, mothers who had attained college education were less than 5% which could be explained by socio-cultural and economic factors including low household income resulting to lack of tuition fees and early marriages among young women in rural areas.

Further, the study compared the level of education among mothers within the wealth categories. As expected, the mothers belonging to highest wealth category had higher level of education compared to those in lowest wealth category. This corresponds to the 2014-2015 RDHS report showing that majority of the women belonging in the lowest wealth quantile had only primary education whereas their counterparts in the highest wealth quantile predominantly attained at least the secondary school education (NISR et.al, 2015). Birchall (2018) pointed out family poverty as one of social-economic factors responsible for school dropout in girl child in low and middle income countries.

Regarding the occupation, the findings indicated that a high percentage of mothers were employed with majority being farmers whereas 17% of the mothers were unemployed. This is comparable with Dickson et.al (2017) study that found the rate of employment to be 77% among mothers with underfive year children in both DRC and Ghana. Also, this is similar with RDHS (2014-2015) findings showing an elevated rate of employment among women aged of 15 to 49 years of Northern Province of Rwanda (NISR et.al, 2015).

5.2 Maternal nutrition knowledge and infant and young child feeding practices

5.2.1 Maternal nutrition knowledge

The knowledge of the mothers was assessed on infant and young child feeding practices. The findings showed that the largest proportion of mothers (72%) had high nutrition knowledge level which could be attributed to the fact that nearly all the mothers (95%) had been exposed, at least once, to nutrition education either in a formal or an informal way. This is in line with the findings of Waswa et al. (2015) and Kuchenbecker et al. (2017) who revealed that nutrition education interventions improve nutritional knowledge of caregivers.

The questions on breastfeeding practices were correctly answered by a large number of the mothers where the least correctly responded question was at 83% rate. This could explain why the breastfeeding practices in Rwanda are advanced where 87%, 81 % and 87% of children are exclusively breastfeed, breastfed within one hour after delivery and continued to be breastfed up to two years, respectively (National Institute of Statistics of Rwanda (NISR) et al., 2015).

5.2.1.1 Linking sociodemographic and socio- economic characteristics and maternal nutrition knowledge

As expected, the maternal nutrition knowledge was found to be significantly associated to the mother's education status where mothers who had attended at least the secondary school had higher rate of high nutrition knowledge as compared to those with the education level lower to secondary school. This is in consistence with the study done by De Vriendt et.al (2009) where women with higher educational level were found to have significantly higher nutrition knowledge score as compared to those with lower education level. Another study that was assessing the nutrition knowledge level among pregnant women showed that women who had graduated from high school had higher knowledge scores than those with the primary education level (Aktaç, 2018). According to Bulirani (2018) poor nutritional knowledge is three times more likely to be observed among women with no formal education than their counterpart with formal education.

5.2.2 Infant and young child feeding practices among children of 6 to 23 months old

The study focused mainly on assessing four IYCF practices: minimum meal frequency, minimum dietary diversity, minimum acceptable diet and consumption of iron-rich or fortified foods. However, other IYCF practices were evaluated where the breastfeeding practices, such as initiation of breastfeeding within one hour after delivery, continued breastfeeding at one year

and children breastfed at the time of data collection, were highly advanced. This compares with the finding of RDHS (2014-2015) report indicating that nationally, 81% and 96% of children are breastfed within one hour of birth and being breastfed at one year of age, respectively, whereas 94% of children aged between 6 and 23 months were still breastfed at the time of survey (NISR et al., 2015). Furthermore, this study revealed that the most food groups fed to children were grains, roots and tubers and legumes and nuts. This could be due to the fact that starchy foods and legumes are generally the two predominant crops produced and consumed in the country (WFP, 2018). In addition, cereal and tuber based foods such as the porridge are mostly used as weaning foods in the country. On the other hand, the least consumed food groups were of animal source (eggs and dairy products). This could be due explained by the higher cost of animal sourced foods as compared to price of plant based foods. The findings are comparable to 2018 Rwanda Comprehensive Food Security and Vulnerability Analysis (CFSVA) report that demonstrated the major food group fed to children (6-23 months) to be grains, roots and tubers at 91% rate whereas the least consumed were eggs (4%) (WFP, 2018).

The proportion of children who met the IYCF indicators are higher compared to the 2014-2015 RDHS report showing that in Northern Province, the rate of meeting the MMF, MDD and MAD was is 54%, 34% and 22%, respectively. This could be attributed to two main factors which are food security and maternal nutrition knowledge level in Musanze district. The 2018 Rwanda CFSVA report indicates that in Musanze district, food security rate (by CARI index) has increased from 80% in 2015 to 88.5% in 2018. Additionally, a large number of mothers (72%) demonstrated to have a high level of knowledge on feeding practices and 95% of respondents have been exposed to the nutrition education from different sources such as health centers, CHWs and community gatherings (groups). This is supported by a study conducted in

Indonesia where the diet of children whose mothers had been exposed to nutrition information improved in terms of meeting MAD (Crookston et al., 2018). Similar findings were observed in one of the studies done in Ethiopia where Berra and young (2017) found that maternal knowledge on complementary feeding is one of the key determinants of suboptimal complementary feeding practices and is positively associated with meeting MMF and MAD among children aged between 6 to 23 months. Moreover, nutrition education interventions improve nutritional knowledge of caregivers and increase the child (6-23 months) dietary diversity even in the food insecure areas (Waswa *et al.*, 2015; Kuchenbecker *et al.*, 2017).

5.2.2.1 Linking sociodemographic and socio-economic characteristics with IYCF practices

Age of the mother, age of the child and the household income were the three characteristics found to be significantly associated with the child feeding indicators. Thus, the results revealed that children whose mothers are older met the MAD at higher rate as compared to those with younger mothers. This could be due to the fact that older mothers tend to have more children than the young mothers, thus resulting in older mothers having more knowledge and experience in child care and feeding practice. This is comparable with a study conducted in Kenya where younger mothers were found to have less odds of practicing IYCF practices in terms of exclusive breastfeeding than their older counterpart (Andare et al., 2019).

The findings indicated that younger children are 2 and 3 times less likely to meet the MDD and MAD respectively, than older children. Moreover, Individual Dietary Diversity Score (IDDS) of a child was found to increase as the child's age increases, amplifying those younger children are likely to have lower IDDS as compared to their older counterpart. This could be attributed to that in Rwandan community, children in early complementary food period are most likely to be fed with porridge or other soft foods that are cereal or tuber-based which make it harder for

those children to meet the adequate diversified food. The similar feeding behavior is observed in West African countries where the weaning foods are mostly cereal gruel (Onofiok and Nnanyelugo, 1998). The study findings are consistent with a study conducted in four West Africa countries that revealed young children to be at risk of having inadequate dietary diversity (Issaka et al., 2015).

As expected, the households that gained the highest income in the month preceding the survey had the highest (74%) rate of children who achieved the MAD. This is could be attributed to the fact that high household income increases the household accessibility to various and adequate foods due the elevated purchasing power. This is comparable with the study done in Ghana, Liberia, Nigeria and Sierra Leone where the poor households were associated with inadequate MMF and MDD (Issaka et al., 2015).

5.3 Nutritional status of children

Stunting, wasting and underweight were the three indicators used to assess the nutritional status of children (6 to 23 months) in Musanze district. However, the main focus was on stunting since its prevalence in Rwanda is classified as very high according WHO threshold (De Onis et al., 2019). The study prevalence on wasting and underweight are comparable to the national prevalence by 2014-2015 RDHS report where wasting and underweight among under-five children stood at 2% and 9%, respectively.

However, stunting rate is lower as compared to 38% rate reported in 2014-2015 RDHS report. This decrease could be explained by the time factor where the prevalence might have decreased as the years passed. The RDHS (2014-2015) report indicates the trend of malnutrition decreasing over the years where the stunting rate dropped from 51% in 2005 to 44% in 2010, then to 38% in 2015. Those improvements may be attributable to the great effort done by the

government of Rwanda through different strategies and programmes such as multisector participation and consensus around Rwanda's First National Nutrition Summit(2009), and Second National Nutrition Summit (2011), National Multi-Sector Strategy to Eliminate Malnutrition (2010), behavior change communication (including mass media), and home food fortification by using micronutrient powders and First 1,000 Days Community Based Food and Nutrition Programs (GoR, 2014; NISR et al., 2015) among many others.

In addition, the reduced stunting prevalence in the present study could be due to the fact that larger proportion of the study children met the MMF, MDD and MAD as compared to the children in 2014-2015 RDHS report as elaborated in the preceding paragraphs. This is supported by several researches that linked the nutritional status of children and child feeding practices. While assessing the association of IYCF indicators and stunting by reviewing the DHS data of different countries, Jones et al. (2014) found that the odds of being stunted were significantly lower among the children (6-23 months) who had achieved the MAD (in Zimbabwe) and those who had met the MDD (in India). In Bangladesh, India, Zambia and Ethiopia, meeting the MAD was found to be associated with a higher Height-for-age Z-Score and there was a positive association between MDD and HAZ in those same countries except Ethiopia (Jones et al., 2014).

Male children under this study were more stunted than their female counterparts, and the difference was statistically significant. This is in consistence with 2014-2015 RDHS that showed higher stunting prevalence among underfive boys than girls. According to Saaka et al. (2015) male children (6-23months) have 1.5 more likelihood of suffering from stunting than female children. Moreover, a study conducted in Bangladesh indicated that girls had 11% less likelihood of being stunted than boys, among underfive year children (Sultana et al., 2019). A

cause of sex differences in stunting rate was revealed in the study conducted in rural Senegal where it was found that male children are introduced to early complementary feedings (before age of 6 months) which might be detrimental to their height status, probably resulting in having poorer nutritional status as compared to female children (Bork & Diallo, 2017).

5.4 Nutrition information network and its relationship to child food intake

The current study sought to elucidate mothers' access to nutrition information prior to before or after giving birth to the children under study. Nearly all the mothers (95%) confirmed having been exposed, at least once, to the nutrition education either in a formal or an informal way. This could explain why the majority of the mothers were knowledgeable on nutrition topics. The findings revealed that the nutrition information are delivered to the mothers predominantly during pregnancy, then diminish during exclusive breastfeeding period and become lesser in the period of complementary feeding (6 to 23 months). This indicated that as the child grows, the mothers became less exposed to nutrition information which might affect the quality of the complementary feeding practices subjected to the child. Hence, there is a need to increase nutrition education activities among the caregivers having children aged 6 to 23 months. This is supported by Berra and Yang (2017) who showed that lack of maternal knowledge on complementary feeding, which is in its turn enhanced by nutrition education interventions (Waswa *et al.*, 2015; Kuchenbecker *et al.*, 2017), was found to be one of the key determinants of suboptimal complementary feeding practices.

As expected, the predominant source of nutrition information was the health center, which could be attributed to the fact that most of the providers of this information were based in the health centers. Other sources identified included CHWs, radio and TV, friends and mother-to-

mother support groups and/or parent evenings. Having access to several sources is beneficial as it can help in the spread of nutrition information to a greater number of the population. Several nutrition education-based interventions use similar sources (channels) as social and behavior change communication strategies. The examples are the interventions implemented in Ethiopia (Kim et al., 2016) and Bangladesh (Ruel et al., 2018). This is supported by WHO (2002) recommending that consistent messages should be provided at all levels in public and private health system, in the media and communities in order to improve IYCF practices.

Furthermore, the present study demonstrated that the two major sources of information trusted by a large number of respondents were health centers and CHWs, which is a positive finding since WHO (2002) recommend the assistance from professionals and community-based workers for caregivers to acquire the necessary knowledge and skills on appropriate feeding.

5.4.1 Relationship between nutrition information network and child food intake

The current study assessed the relationship between the feeding practices and nutrition information network in terms of the means by which the mothers access the information. The results indicated that home visits by CHWs were significantly associated with meeting the MAD where 70% of children whose households had been visited by CHWs achieved the MAD. This might due to the fact that visits by CHWs are characterized with interpersonal (face-to-face) communication with the child caregivers (or mothers) which creates a harmonious relationship and trust between them. This kind of relationship was referred as rapport by (GoK, 2010) and said to be very effective during communication process because the clients or counselees are able to express their ideas freely. Hence the transmitted information is well comprehended and the chance of clients obeying to advice being given becomes higher.

The present study finding is in line with a study done in Ethiopia which revealed that the nutrition education through numerous home visits by community volunteers improved the MMF, MDD and MAD of children (Kim et al., 2016). Another research done in Bangladesh showed that one-on-one (individual) counselling was found to be more effective in increasing the rate of exclusive breastfeeding compared to group counselling method, specifically when undertaken while the mothers are still pregnant and continue five months after delivery (Faruque et al., 2008).

5.4.2 Preferred ways of easily accessing nutrition information

After identifying the different characteristics of the nutrition information network, the study endeavored to know if the mothers would wish to give their suggestions on how they can easily access the nutrition information as well as the appropriate ways of message delivery for better nutritional knowledge and practices. The results indicated that the proposed channels included CHWs, village gatherings, health centers, radio, churches and mobile phones with the majority of the mothers preferring the CHWs, followed by the village gatherings. Since the health center was revealed to be trusted by the majority of the respondents, it was unexpected to realize that the former coming at the third place as a proposed channel with 21% respondent votes. This indicates that the physical distance might have played an important factor in influencing mothers to choose their preferred channel, since the average walking distance to health centers is 44 minutes with 71% of households walking for an hour to reach the health facilities in Musanze district (National Institute of Statistics of Rwanda (NISR), 2011). Moreover, in Rwanda most of the CHW activities including home visits take place within their respective villages (Condo et al., 2014), thus, the two channels suggested by the majority of mothers share the same criteria of being easily accessed in term of physical distance.

5.5 Association between maternal nutrition knowledge, IYCF practices and children nutritional status

5.5.1 Association between maternal nutrition knowledge and IYCF practices

Previous studies have linked the maternal nutrition knowledge with child feeding practices. For example, in one of the studies conducted in Ethiopia, maternal nutrition knowledge was found to be one of the key determinants of suboptimal feeding practices among children aged 6 to 23 months and was positively associated with meeting minimum meal frequency and minimum acceptable diet (Berra and Yang, 2017). In this study, 4 feeding practices (MMF, MDD, MAD and Consumption of iron- rich foods) were tested against the nutrition knowledge of the mothers. The results indicated that meeting MMF was significantly associated with the nutrition knowledge of the mothers where mothers with high nutrition knowledge were almost 3 times more likely to have their children meeting MMF as compared to the mothers with low nutrition knowledge.

On the other hand, meeting MDD, MAD and iron- rich foods consumption were independent of maternal nutrition knowledge. However, it was generally revealed that more mothers who had high nutrition knowledge had children who met MDD, MAD and consumed iron-rich food when compared with those who had low nutrition knowledge. Moreover, the study found that maternal nutrition knowledge was positively correlated with the IDDS of a child, implying that the IDDS of a child increases with the increase of maternal nutrition knowledge score. The results showed a significant difference in the means of child IDDS between mothers with low knowledge (3.18) and high knowledge (3.66). This is reflected in the fact that more mothers who possessed high nutrition knowledge had children who met the MDD as compared with those with low nutrition knowledge. This is comparable with a study done in Uganda that

compared caregivers and children that had been enrolled in a nutrition education-based program with those who had not in terms of nutrition knowledge and IYC practices. Though the differences were not significant, the study showed that the caregivers enrolled in the program had greater nutrition knowledge and their children met MMF, MDD, MAD and consumed iron-rich foods at higher rates as compared to the control group (Ickes et al., 2017). Another study done by Nankumbi and Muliira (2015) demonstrated that a barrier to appropriate feeding practices in under 2 years children is the caregivers' lack of knowledge on complementary feeding practices. Also, a study conducted in Japan found an association between dietary (vegetables) intake in children and the nutrition knowledge their guardians (Asakura et al., 2017).

5.5.2 Association between maternal nutrition knowledge and nutritional status of children

The study findings indicated no significant difference in the prevalence of stunting, wasting or underweight between children whose mothers had high nutrition knowledge and those with low nutrition knowledge. Though Kim et al. (2016) found an association between IYCF practices and nutrition education, the latter was not found to be significantly associated with child nutrition status (wasting, underweight and stunting). These findings are in line as well with the study conducted in Burkina Faso by Nikièma et al.(2017).

5.5.3 Association between IYCF practices and nutritional Status of children

Using the Chi-square test, the current study sought to determine the association between IYCF practices (MMF, MDD, MAD and consumption of iron- rich foods) and nutrition status indicators (wasting, underweight and stunting). The results showed that none of the above feeding practices was significantly associated to any of the indicators. This is in accordance with the study conducted in Myanmar where no association existed between MMF, MDD,

MAD and consumption of iron- rich foods and stunting among children aged 6 to 23 months (Mya et al., 2019). The same results were found in the study conducted in Ghana for the first three IYCF practices (Saaka et al., 2015). However, the results of the present study revealed that MAD has an association with height-for-age Z-score (HAZ) of children by demonstrating a significant difference between the HAZ mean (-1 SD) of children who met the MAD and the HAZ mean (-1.5 SD) of those who did not, implying that children who meet the WHO recommended MAD are likely to have greater HAZ compared those who do not meet the MAD. This is supported by the studies done in Bangladesh, India, Zambia and Ethiopia by Disha et al., (2012) and Jones et al., (2014) where they designated that meeting the MAD is associated with a higher HAZ.

5.5.4 Factors influencing stunting of children

The study applied multiple logistic regressions to determine the factors that influence stunting among children in Musanze district. The results showed that the determinants of stunting were the sex of the child, meeting MAD, the consumption of animal sourced foods, the child underweight status of a child and income type.

Though the root causes have not yet been clearly established, a considerable number of studies have asserted that male children are more likely to be undernourished than female children. The examples of these studies include Medhin et al., (2010), Wamani et al., (2007), Bork & Diallo, (2017), (Mya et al., 2019) and Sultana et al., (2019). Also, this study linked stunting with the child's sex by finding that being a male child is associated with a higher chance of being stunted than a female child. Though, the reason behind this finding was not in the scope of this study, some researchers, such as Wells (2000), claim that natural selection might be the cause of male children being more prone to infectious diseases and malnutrition in early stage of life

as compared to girls. Moreover, Bork and Diallo (2017) while conducting a study in rural Senegal, found that male children are introduced to early complementary feedings (before age of 6 months) which might be detrimental to their height status, probably resulting in having poorer nutrition status as compared to female children. According to Michaelsen et al. (2003), introducing the complementary food before age of six months results in increased child morbidity and interferes with the bioavailability of breastmilk nutrients, hence gaining the potential weight and height by a child is likely reduced.

As expected the MAD was found to negatively and significantly influence stunting, implying that children who achieve the MAD are less likely to be stunted. Since meeting the MAD reflects the consumption of a significant number of meals and more diversified foods, children who meet this IYCF indicator are more likely to meet adequate nutrients required for child optimal development and growth (WHO, 2002), hence the prevention of stunting. This study is consistent with Jones et al. (2014) who found that in Zimbabwe, the odds of being stunted were significantly lower among the children (6-23 months) who had achieved the MAD.

The consumption of animal sourced foods was another factor revealed by this study to negatively influence the stunting, implying that children who consume animal sourced foods are less likely to be stunted. This could be attributed to the fact that animal sourced foods such as meat, fish, eggs and dairy products are scientifically proven to contain high quality protein which according to Headey et al. (2018), has been linked to the child growth by several nutritional researchers. Consequently, Dewey (2003) recommend the daily inclusion of animal sourced foods in the complementary food for the child's insurance of meeting all nutrient needs. The present study finding is in line with the research conducted in 46 countries (Asia, Africa and Latino America) that came to a conclusion that the consumption of foods from

animal origin is strongly associated with child growth, especially the milk products and fish (Headey et al., 2018). The similar results were found by Krasevec et.al (2017) in study conducted in low- and middle-income countries.

Underweight was found to be significantly and positively associated to stunting. This implies that a child who is underweight has a bigger chance to become stunted. This finding was not surprising because stunting is defined as low height for age whereas underweight stands for low weight for age (WHO, 2018). Therefore, factors that can interfere with the child's optimal growth by affecting the weight, can easily affect the height as well. This is upheld by (WHO, 2018) stating that an underweight person can suffer from stunting, wasting or both concurrently. The present finding is in consistent with Ngwira et al. (2017) who found a significant association between underweight and stunting among underfive children in Malawi.

Farming as major source of household income was found to be negatively associated with stunting, implying that in Musanze district, children belonging to households that farm as their main source of income are less likely to be stunted. This could be due to the fact that farming increases the availability of and access to food items which in turn improves food and nutrition security of the households, thus the likelihood to reduce malnutrition. In the present study, 100% of households farming as major source of income own the land for crops production, and 77%, 57% of these households reported consuming more than 50% and 75% of the harvest within their households, respectively. According to 2018 Rwanda CFSVA report, land ownership among the agricultural households contributed to food security and more severe food insecurity was observed in households who did not own land as compared to those who owned land (WFP, 2018). A study done in India asserted a relationship between household food security and child undernutrition by finding that children from severely food insecure

households have higher chances of suffering from severe stunting and underweight (Chandrasekhar et al., 2017). The similar findings were as well found by (Ali et al., 2013).

5.5.5 Factors influencing Minimum Acceptable Diet of children

This study sought to know the factors that influence children to achieve the minimum acceptable diet (MAD) in Musanze district. Employed mother, consumption of animal sourced foods, home visits by CHWs, community gatherings attendance and income type were revealed to be the five MAD determinants.

Being an employed mother was found to positively and significantly affect the MAD. This implies that the children whose mothers have an occupation are more likely to meet the MAD than children with mothers without occupation. This might be explained by the fact that in Rwanda, particularly in rural areas, most of the needs of young children are provided by their mothers. Thus, mothers who are able to generate some income have a higher propensity of taking care of their children by providing them with sufficient food in quantity and quality. This is reinforced when the mothers have been nutritionally educated like those in Musanze district who demonstrated high nutrition knowledge at 72% rate. Hence, there is higher chance of meeting the MAD among children with employed mothers. Moreover, a working mother (spouse) increases the household income when married to as well an employed husband, thus improving the household food security. This relationship between the employment status of mothers and child nutrition reinforces the need for women empowerment. Chandrasekhar et al.(2017) have linked household food security with child dietary intake by revealing that the lower dietary diversity score is likely to be observed among children from the severely and moderately food insecure households.

Home visits by CHWs and attending the community gatherings (groups) were found to be significant and positive determinants of MAD, meaning that children whose households have been visited by CWHs (for nutrition education purpose) or whose mothers attend the nutrition education sessions in the community are likely to meet the MAD. This could be because, since CHWs in Rwanda are elected by the community in their respective villages (Condo et al., 2014), the mothers or caregivers have the chance to interact with or being educated by the people they know, respect and trust, whether during home visits or community gatherings. This might create a harmonious relationship, referred as rapport by GoK (2010), between the CHWs and the community. The rapport is said to be very effective during the communication (education) process because the clients or counselees are able to express their ideas freely, hence the transmitted information is well comprehended and there is a higher chance of clients obeying to advice being given (GoK, 2010). In addition to the rapport establishment between the mothers and CHWs, the individual counselling applied during home visits take into consideration the socioeconomics situation of each mother and each child-specific needs (Nikièma et al., 2017). Thus, enabling the CHWs to give better advice on proper way of feeding the child accordingly, hence the higher chances of meeting the MAD among children whose households are visited by the CHWs. This is in line with Kim et al. (2016) who revealed that the nutrition education through numerous home visits by community volunteers improved the MMF, MDD and MAD of children in Ethiopia.

As expected, having salary or business, as main income generating activity was positively associated with MAD, implying that children belonging to households living on business or salary as major source of income are more likely to be fed with the MAD recommended by WHO. This is due to the fact that households that are salaried or having their own business are

likely to earn more income as compared to the other income generating activities. For example in this study, 77% of salaried or business-based households reported having earned higher income (above Rwf 30,000) the month preceding the survey, against only 15% of non-business or salary-based households that earned the same amount, and it was statistically significant. With a higher income, those households are more likely to afford quantitatively and qualitatively sufficient foods, giving the child higher chance of meeting the MAD. This is supported by Rwanda CFSVA (2018) report which indicated that among all livelihood groups (classified based on main income activity), the business owners and salaried workers were the most food secure (WFP, 2018). Also, according to MacHaria et al. (2018) in a study done in Kenya, children from food secure households have 135% more odds to meet the MAD as compared to children living in food insecure households.

The consumption of animal sourced foods was found to positively influence the MAD, meaning that including an animal sourced food in a child's diet gives him or her more chances to achieve the MAD. In the present study, meeting the MAD was found to be strongly and significantly dependent on dietary diversity where 93% of children who achieved the MDD also met the MAD. As mentioned in the above paragraphs, the consumption rate of the food groups within plant origin was higher and common among children in Musanze district, where 96%, 85% and 72% consumed legumes, starchy foods and vitamin A rich fruits and vegetables, respectively, whereas the consumption rate of animal foods is still low (28%). Therefore, including at least one animal sourced food such as flesh, eggs or dairy product in the child's daily diet will increase the number of food groups consumed and therefore, higher chance of achieving the MDD. Hence, children consuming the animal sourced foods are more likely to achieve the MAD as compared to those who do not.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The mothers in Musanze district possess good nutrition knowledge level which is chiefly driven by the mother's education. One in two children in Musanze district is fed according to WHO recommended Infant and Young Child Feeding (IYCF) practices. The ability of a mother to feed a child according to the recommended IYCF practices is associated with the maternal nutrition knowledge and sociodemographic and socio-economic factors such as age of the mother, household income and age of the child. Younger children are less likely to meet minimum dietary diversity and minimum acceptable diet as compared to older children and there is a low consumption of animal based foods among overall children. Nutrition education through CHWs home visits is effective towards children meeting proper IYCF practices.

Mother's employment status, consumption of animal sourced foods, nutrition education through CHWs' home visits, community gatherings attendance and income type are the five factors that encourage the IYCF practices. Nutritional status (stunting) was found to be influenced by different factors, namely, sex of the child, MAD, consumption of animal sourced foods, child underweight status and income type.

6.2 Recommendations

Nutrition education conducted at the community level should be enhanced, especially the CHWs' visits to households with young children. This can be done by motivating and increasing the number of CHWs as well as nutrition education sessions at the village level.

Since the dietary diversity was found to be highly associated with the child meeting proper IYCF practices, there is a need to continuously emphasize on dietary diversity while delivering

nutrition messages to the community especially to mothers with younger (6-8 months) children. Moreover, availability of and access to fortified porridge flours should be greatly increased among mothers having young children.

Livelihood programmes that promote animal rearing as well as increase in household income should be emphasized. This can promote the consumption of animal sourced foods and consequently, improve the overall IYCF practices and nutrition status of children.

Stunting identified risk factors (sex of the child, MAD, consumption of animal sourced foods, child underweight status and income type) should be taken into considerations by the Rwandan government and development partners alike while developing different food and nutrition policies and interventions.

Further researches should be conducted on more factors associated with feeding practices and nutrition status of children, with the main focus on male children and the population in urban settlement.

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APPENDICES

Appendix 1: Study introduction and consent seeking

<u>TITLE OF THE STUDY</u>: Influence of maternal nutritional knowledge on Infant and young child feeding practices and nutrition status of children in Musanze district, Rwanda

Introduction

Hello, my name is _____and I am carrying out a research on how **maternal nutritional knowledge can influence the Infant and young child feeding practices and nutrition status of children in Musanze district, Rwanda.** The study is for partial fulfillment of a Master's of Science in Applied Human nutrition, from University of Nairobi.

Purpose

The purpose of this study is to generate information that will be used to improve the child feeding practices as well as the nutritional status of young children in Rwanda.

Confidentiality

Please be assured that all your responses will be treated confidentially and anonymity of your responses in the final report is guaranteed. I assure you that all responses received will be only be used for scientific purposes within the framework of this survey. Also note that participation is voluntary, there is no monetary gain and that you may withdraw your permission to participate at any stage without any negative consequences

However, I hope that you will participate in the survey since your views are very important. For any enquire about any aspect of this study, please contact the principal investigator on **Telephone Number: +250788593008.**

By signing or approving this consent indicates that you understand what will be expected of you and you are willing to participate in the survey.

Name and Signature of respondent. _____ Date:

Signature of interviewer_____Date:

Appendix 2: Questionnaire

<u>TITLE OF THE STUDY</u>: Influence of maternal nutritional knowledge on Infant and young child feeding practices and nutrition status of children in Musanze district, Rwanda

Identification

Sector..... Cell.....Village.....

Health center name: …….. Date of interview...../...../2019

Name of Interviewer.....

Respondent's name..... Sex: FEMALE ……MALE……

SECTION 1	**Socio-Demographic, Economic characteristics**	**Write all appropriate codes in this Colum**
1.1	Age of the mother years	
1.2	Number of household members	
1.3	Number of children underfive	
1.4	Marital Status of the Mother 1.Married ☐ 2. Single☐ 3. Separated☐ 4. Divorced☐ 5.Windowed☐	
1.5	Relationship to the Head of household 1. Head☐ 2.spouse ☐ 3. Daughter ☐ 4. Daughter in law☐ 5. Grandchild ☐ 6. Others (specify) ☐	
1.6	Level of Education of the Mother 1. Some primary☐ 2. Primary completed☐ 3. Some Secondary☐ 4. Completed secondary ☐ 5. university/college ☐ 6.Vocational school☐ 7.No education ☐	

1.7	Level of Education of Head of household 1 Some primary☐ 2. Primary completed☐ 3. Some Secondary☐ 4. Completed secondary ☐ 5. university/college ☐ 6.Vocational school ☐ 7.No education ☐	
1.8	What is the main religion of the household? 1. Catholic ☐ 2. Protestant ☐ 3. Muslim Others ☐	
1.10	Occupation of Mother 1. Salaried Job☐ 2. Farmer☐ 3. business☐ 4. Casual Labor☐ 5. Crop/animal sales 6. Housewife☐ 99 Unemployed☐	
1.11	Occupation of head of household 1 .Salaried Job☐ 2.Farmer☐ 3. business☐ 4. Casual Labor☐ 5. Crop/animal sales 99. Unemployed☐	
1.12	What is the main source of income in the household? 1 .Salaried Job☐ 2.Farmer☐ 3. Business☐ 4. Casual Labor☐ 5. Remittance/gift ☐ 6. Casual trade ☐ 7.Others ☐ specify	
1.13	What was the total household income last month (in Rwandan franc)? 1. Less than 10,000 ☐ 2. 10,000-20,000 ☐ 3. 20,000-30,000 ☐ 4. 30,000 – 50,000 ☐ 5. 50,000 and above ☐	
1.14	Does the household have access to the land for food production? 1.Yes ☐ 2.No ☐	
1.14.1	What are the types of crops produced in that land? 1. Cereals ☐ 2.Root crops ☐ 3. Legumes ☐ 4.Vegetables ☐ 5. Fruits ☐ 6. Cash crops (tea, coffee, etc.) ☐	
1.14.2	What is the percentage of food production consumed in the household?	

	1. Below 25 % ☐ 2. 25-50 % ☐ 3. 50-75 % ☐ 4. Above 75% ☐	
1.14.3	What is the percentage of food production sold? 1. Below 25 % ☐ 2. 25-50 % ☐ 3. 50-75 % ☐ 4. Above 75% ☐	
1.15	What is the wealth category (ubudehe) of your household? 1.1st category (poorest) ☐ 2. 2nd category ☐ 3. 3rd category ☐ 4. 4th category(richest) ☐,	
SECTION 2	**Information About the Index Child**	
2.1	Name of the Child Date of Birth: Age of the child in Months	
2.2	Gender of the Child: 1. Male☐ 0. Female☐	
2.3	Where was the child Born? 1.Health Facility☐ 2. At Home☐ 3. TBA home☐ 4. Others Specify	
SECTION 3	**Infant And Young Child Feeding Practices(adopted from FAO, 2014)**	
3.1	Has ***(****name of the child****)*** ever been breastfed? 1.Yes ☐ 2.No ☐	
3.2	How long after birth did you first put ***(NAME)*** to the breast? 1. Within an hour of birth☐ 2. Few hours after birth☐ 3. 1-2 days after birth☐ 4. Cannot remember☐ 6. Others Specify☐	
3.3	In the first six months after delivery, was [NAME] given anything to drink or other food other than breast milk? 1.Yes ☐ 2.No ☐	
3.4	**Question on Continued breastfeeding** Was (*name of the baby*) breastfed or did he or she consume breastmilk yesterday during the day or at night**?** 1.Yes ☐ 2.No ☐	

3.2	**Dietary Diversity for the Index Child** Now I would like to ask you about (other) liquids or foods that (*name of the baby*) ate yesterday during the day or at night. I am interested in whether your child had the item even if it was combined with other foods.	
3.2.1	**Grains, roots and tubers** **e.g**. Porridge, bread, rice, maize, spaghetti or other foods made from grain, white potatoes, white yams, manioc, cassava or any other foods made from roots 1.Yes ☐ 2.No ☐	
3.2.2	**Legumes and nuts** Any foods made from beans, peas, lentils, nuts or seeds 1. Yes☐ 2. No☐	
3.2.3	**Dairy products** **e.g.** Infant formula**,** milk, such as tinned, powdered or fresh animal milk ,Yogurt , fermented, cheese 1. Yes☐ 2. No☐ **How many times the child consumed milk products (fresh or powdered)?**	
3.2.4	**Flesh foods** **e.g** Liver, kidney, or other organ meats, such as beef, pork, lamb, goat, chicken, duck, fresh or dried fish, shellfish or seafood or insects 1. Yes☐ 2. No ☐	
3.2.5	**Eggs** 1. Yes☐ 2. No ☐	
3.2.6	**Vitamin A fruits and vegetables** Pumpkin, carrots, squash or yellow or orange sweet potatoes Any dark green vegetables (cassava leaves, amaranths, bean leaves, sukuma wiki, spinach, pumpkin leaves) Ripe mangoes, ripe papayas, musk melon Foods made with red palm oil, 1. Yes☐ 2. No ☐	
3.2.7	**Other fruits and vegetables** **E.g.** tomato, cabbage, eggplant, onions. Passion fruit, tree tomato, pineapple 1. Yes☐ 2. No ☐	

3.2.8	**Preliminary analysis** Number of food groups consumed the previous day _____/7	
3.3	**Minimum meal frequency**	
3.3.1	How many times did (*name of the baby*) eat foods, which is meals and snacks other than liquids yesterday during the day or at night? Number of times Don't know/no answer	
3.4	**Consumption of iron-rich or iron-fortified foods**	
3.4.1	Yesterday, during the day or night, did ***(NAME)*** consume any iron fortified solid, semi-solid or soft foods **E.g.** Shishakibondo flour, etc. 1. Yes☐ 2. No ☐	
3.4.2	Did ***(NAME)*** consume any food to which you added a [**powder or sprinkles**] like this? *Show common types of micronutrient powders available in survey area.* 1. Yes☐ 2. No ☐	
3.5	**Food frequency questionnaire**	

	Frequency										Amount				
Food Group Food items **(#103 food items)**	Never or less than 1 per month	1-3 per month	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4-6 per day	+6 per day	2-3 per day	Standard Portion	S	E	B	Seasonal
Cereals and Grain Products (17 food items)															
Breakfast Cereals	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Bread, white/rolls Chapati/Roti	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Bread, Brown/rolls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Maize porridge soft	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Maize porridge stiff	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Maize, roasted	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐

Millet, porridge soft	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Millet, porridge stiff	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Sorghum, porridge soft/mabele soft	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Sorghum, porridge stiff/mabele stiff	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Oats	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Potato, (boiled/roasted/stew)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Potato (sweet)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Rice (white, brown)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Rice bun	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☒
Cassava	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Spaghetti and pasta	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
VEGETABLES (14 food items)															
Broccoli	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Spinach	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Cabbage, Kale	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Pumpkin, Butternut squash, Gem squash	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Green Beans, Okra	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Onion	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Tomato	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Garlic	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Mushrooms	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐

Carrots	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Cucumber	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Salad vegetables (lettuce, watercress)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Processed Vegetables	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Vegetable juices	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
LEGUMES, PULSES, SEEDS, AND NUTS (3 food items)															
Beans, Lentils	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Peas	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Nuts, groundnuts and seeds	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
FRUITS (18 food items)															
Apple, Pears	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Avocado	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Banana/Plantain, Boiled plantain	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Berries	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Baobab, pulp	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Mango	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Pawpaw	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Guava	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Lime/Lemon	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Grapes	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Melon	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Orange, Tangerine/Naartjie	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐

Peaches	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Plums	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Pineapple	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Dry fruits (raisins, dates, prunes, figs, etc.)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Processed Fruits	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Juice fruits	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
MEAT, FISH AND EGGS (13 food items)															
Beef, Pork	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Chicken	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Goat meat	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Lamb meat	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Bush meat	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Sausages	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Offals	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Batter dipped fried chicken (e.g. KFC)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Canned fish	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Fat fish: sardines/pilchard, swordfish/marlin, mackerel, salmon, herring, etc	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Slim fish: Tuna, horse mackerel, carp, hake, etc.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Seafood	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Eggs(boiled, fried,	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐

scrambled)															
DAIRY PRODUCTS (8 food items)															
Fat Milk (cow)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Semi-Skim milk	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Skim milk (cow)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Other types of milk	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Soft Cheese: Cottage,Brie, etc.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Semi-hard and Hard Cheese: Cheddar, Emmental and Gruyere, etc.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Yogurt	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Cremora (milk substitute)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
FATS AND OILS (6 food items)															
Butter	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
lard	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Margarine (brick, tube)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Olive Oil	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Soybean Oil	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Sunflower oil	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
SAUCES, SEASONINGS AND FLAVOURINGS (7 food items)															
Meat Extracts	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Savoury Spreads	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Sweet spreads (honey, jam, atchar)															
Tomato sauce	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Mayonese, Salad	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐

Dressing															
Spices and herbs	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Peanut Butter	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
SUGAR, SYRUPS AND SWEETS (9 food items)															
Low sugar cookies, Rusks	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
High-sugar cookies and biscuits	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Cakes, Tarts, Pudding	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Muffins/Scones, Pancakes/Waffles	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Doughnuts/Eclairs, African (mandazi)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Crisps, Popcorn	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Ice cream	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Chocolates	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Sugar (white, Brown)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
BEVERAGES (8 food items)															
Carbonated Cold Drinks	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Diet cold drinks	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Energy drinks	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Coffee	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		☐	☐	☐	☐
Tea	☐	☐	☐	☐	☐	☐	☐	☐				☐	☐	☐	☐
Water	☐	☐	☐	☐	☐	☐	☐	☐				☐	☐	☐	☐
Wine	☐	☐	☐	☐	☐	☐	☐	☐				☐	☐	☐	☐
Other alcoholic beverages	☐	☐	☐	☐	☐	☐	☐	☐				☐	☐	☐	☐

SECTION 4	Maternal knowledge on IYCF practices	
4.1	**Breastmilk at birth.** When should breastfeeding be initiated after delivery 1. Within one hour ☐ 2.Dont know/others ☐	
4.2	**Meaning of exclusive breastfeeding** What does exclusive breastfeeding mean? 1.☐ Exclusive breastfeeding means that the infant gets only breastmilk and no other liquids or foods 2. ☐ Other/ Don't know	
4.3	**Recommended length of exclusive breastfeeding** How long should a baby receive nothing more than breastmilk? 1. ☐ From birth to six months 2. ☐ Other/Don't know	
4.4	**Continued breastfeeding** How long is it recommended that a woman breastfeeds her child? 1. ☐ 24 months and more 2. ☐ Other/Don't know	
4.5	**Age of start of complementary foods** At what age should babies start eating foods in addition to breastmilk? 1. ☐ At six months 2. ☐ Other/Don't know	
4.6	**Reason for giving complementary foods at six months** Why is it important to give foods in addition to breastmilk to babies from the age of 6 months? 1.☐ Breastmilk alone is not sufficient (enough)/cannot supply all the nutrients needed for growth/from six months, baby needs more food in addition to breastmilk 2. ☐ Other/Don't know	
4.7	**Dietary diversity and ways of enriching porridge**	

	To feed their children, many mothers give them sorghum, maize porridge or other cereals. Which foods or types of food can be added to porridge makes it more nutritious (or other types of foods to give to child other than porridge? ☐ Animal-source foods (meat, poultry, fish, liver/organ meat, eggs, etc.) ☐ Pulses and nuts: flours of groundnut and other legumes (peas, beans, lentils, etc.), sunflower seed, peanuts, soybeans ☐ Vitamin-A-rich fruits and vegetables (carrot, orange-fleshed sweet potato, mango, yellow pumpkin, mango, papaya, etc.) ☐ Green leafy vegetables (e.g. spinach) ☐ Energy-rich foods (e.g. oil, butter/ghee) ☐Other/Don't know	
4.8	**Consistency of meals** Please look at these two pictures of porridges. Which one do you think should be given to a young child? *(Show the images/pictures of thick and watery/thin porridges*) ☐ Shows the thick porridge ☐ Shows the watery ☐ Does not know	
4.9	**Meal frequency** How many tirnes per day a baby should be fed (liquids not included)? 1.☐ 2-3 times (6-8 months) 2.☐3-4 times(9-23 months) 3.☐Other/Don't know	
4.10	**Responsive feeding** ☐Giving them attention during meals, talk to them, make meal times happy times ☐ clap hands ☐ make funny faces/play/laugh ☐demonstrate opening your own mouth very wide/modelling how to eat ☐say encouraging words ☐draw the child's attention ☐Other ☐Don't know	
SECTION 5	**NUTRITION INFORMATION NETWORK**	
5.1	Have you ever received nutrition information on good child feeding	

	practices? 1. Yes☐ 2. No☐	
5.2	If yes, where did you receive the nutrition information (source of information)? 1. Clinic ☐ 2.Relatives ☐ 3.friends ☐ 4. CHWs ☐ 5.Radio/Mass media 6.Mother –to-mother support groups ☐ 7. Seminar/workshop ☐ 8.others(specify)	
5.3	Which source of information do you value or trust the most? 1. Clinic ☐ 2.Relatives ☐ 3.friends ☐ 4. CHWs ☐ 5.Radio/Mass media ☐ 8.others(specify) ☐	
5.4	How do you access those sources of information? (channels such as, meetings, radio/ mass media, mothers to mother support groups, visiting friends)	
5.5	What kind of information did you receive (what was the message about)?	
5.6	When did you receive the nutrition information? (**E.g**. during pregnancy, exclusive breastfeeding, complementary feeding period, etc.)	
5.7	How can mothers be helped to get easily information on child feeding practices (channels of information)?	
SECTION 6	**Anthropometric measurements of the index child(6 to 23month)**	
6.1	**Weight** Weight measured to the nearest 0.1kg Weight measured to the nearest 0.1kg Average weight measure to the nearest 0.1kg	
6.2	**Height** Height measured to the nearest 0.1cm Height measured to the nearest 0.1cm Average Height to the nearest 0.1cm	
Thank the mother for the participation		

Appendix 3: 24-hour questionnaire

INDIVIDUAL 24-HOUR RECALL QUESTIONNAIRE

Interviewer……..... ***Health center……....***

Interview date…….... ***Subject ID……....***

Age…….... ***Subject Name……....***

Time	**Place eaten**	**Name of the dish**	**Ingredients**
A. Was yesterday a celebration or a feast day where you ate unusual foods? YES / No			
B. Was the child sick yesterday? Yes / No i. If yes did sickness affect the appetite of the child? Yes / No ii. If yes, how? Decreased or increased?			

Appendix 4: Ethical approval

REPUBLIC OF RWANDA/REPUBLIQUE DU RWANDA

NATIONAL ETHICS COMMITTEE / COMITE NATIONAL D'ETHIQUE

Telephone: (250) 2 55 10 78 84
E-mail: info@rnecrwanda.org
Web site: www.rnecrwanda.org

Ministry of Health
P.O. Box. 84
Kigali, Rwanda.

FWA Assurance No. 00001973
IRB 00001497 of IORG0001100

August 27, 2019
No.681/RNEC/2019

Principal Investigator: Nadine UMWALI
A student at the University of Nairobi

Your research project: **"Influence of Maternal Nutrition Knowledge on Infant and Young Child Feeding Practices and Nutrition Status of Children in Musanze District, Rwanda."** has been evaluated by the Rwanda National Ethics committee.

		Involved in the decision		
			No (Reason)	
Name	Institute	Yes	Absent	Withdrawn from the proceeding
Dr.Jean-Baptiste MAZARATI	Biomedical Services (BIOS)	X		
Prof. Jean Paul RWABIHAMA	Kigali Teaching Hospital	X		
Prof.Laetitia NYIRAZINYOYE	University of Rwanda	X		
Ass .prof. Egide KAYITARE	University of Rwanda	X		
Mr. Spencer BUGINGO	Lawyer	X		
Dr. David K. TUMUSIIME	University of Rwanda	X		
Ass. Prof. Lisine TUYISENGE	Kigali Teaching Hospital	X		
Dr. Darius GISHOMA	University of Rwanda	X		
Sr Epiphanie MUKABARANGA	Rwamagana Nursing and Midwife school		X	
Dr. Vedaste NDAHINDWA	University of Rwanda	X		

Prof. Claude MUVUNYI	Biomedical Services (BIOS)		X	

After review of the protocol and the progress report, during the RNEC meeting of august 10, 2019 where quorum was met, and revisions made on the advice of the RNEC submitted on 26 August 2019, **we hereby provide approval for the above-mentioned protocol**.

Please note that approval of the protocol and consent form both English and Kinyarwanda version is valid for **12 months**.

You are responsible for fulfilling the following requirements:

1. Changes, amendments, and addenda to the protocol or consent form must be submitted to the committee for review and approval, prior to activation of the changes.
2. Only approved consent forms are to be used in the enrollment of participants
3. All consent forms signed by subjects should be retained on file. The RNEC may conduct audits of all study records, and consent documentation may be part of such audits.
4. A continuing review application must be submitted to the RNEC in a timely fashion and before expiry of this approval.
5. Failure to submit a continuing review application will result in termination of the study.
6. Notify the Rwanda National Ethics committee once the study is finished.

Sincerely, P.O. Dr. Vedaste Ndahindwa
Vice Chair

Date of Approval: August 27,2019
Expiration date: August 26,2020

R.N.E.C

Dr. Jean- Baptiste MAZARATI
Chairperson, Rwanda National Ethics Committee.

C.C.
- Hon. Minister of Health.
- The Permanent Secretary, Ministry of Health.

Appendix 5: Musanze district research approval

REPUBLIC OF RWANDA

Musanze, on 01/08/2019

NORTHERN PROVINCE
MUSANZE DISTRICT
Website: www.musanze.gov.rw
Email: musanzedistrict@musanze.gov.rw
Po. Box 03 Musanze
Ref: *Health*

Ref N° 1209/07/04.03

Mrs. UMWALI Nadine

Kicukiro District.

Tel : 0788593008

Email: nadumwali@gmail.com

RE: Approval to conduct research study in Musanze District for Academic Purpose

Dear Mrs,

Reference is made to your letter received on 20th June, 2019 requesting the Permission to conduct a study among mothers attending the Health Centers in Musanze District for your Master's Dissertation on "Influence of Maternal Nutrition Knowledge on Infant and Young Child Feeding Practices and Nutrition Status of Child in Musanze District ".

I am glad to inform you that you are allowed to conduct research study, for academic purpose only, respecting the Ethics related to Research, and upon completion of the Study, we look forward to receiving your report on the findings.

Yours Sincerely,

HABYARIMANA Jean Damascène

Mayor of Musanze District

CC:

Governor of Northern Province / Musanze