FACTORS ASSOCIATED WITH LOW MINIMUM ACCEPTABLE DIET AMONG 6-23 MONTHS OLD CHILDREN IN RWANDA, USING THE DATA OF CFSVA 2015.

A Dissertation submitted to the School of Public Health in partial fulfillment of the requirements for the award of the degree of Master of Science in Epidemiology at University of Rwanda

By: Gaga Rukorera Didier

Supervisor: Prof. MUNYANSHONGORE Cyprien

Kigali, September 2019

2019

DECLARATION

This project report is my original work and has not been presented for a degree in any other University.

Signature: ……Date: ……

Didier GAGA RUKORERA
REG N$^{O:}$ 217292445

This project report has been submitted for examination with our approval as University

Supervisors

Signature: …… Date: /03/2019

Prof. Cyprien MUNYANSHONGORE
University of Rwanda, School of Public Health

ACKNOWLEDGEMENT

This research could not have been successfully completed without the support I received from different people .I would like to express my sincere thanks to all those peoples.

I am very grateful for the cooperation and opinions offered, first and foremost by my family (Mugisha Mariam, Gaga A.Quadil, Gaga Rugamba Isaac, Gaga Mugisha Shemsa), supervisors, Prof. Cyprien MUNYANSHONGORE and Dr. Bernard Rwabufigiri. I highly appreciate the invaluable guidance offered to me by them, their constructive instructions and suggestions provided a basis of the completion of this research.

My thanks go also to different Lecturers who accepted to facilitate different courses during this training. Without the support of my work mates, it would not be easy to finish my studies and well conducting this research. Warm thanks go to DHS team and especially to NISR's DG MURANGWA Yusuf, Former Director of SMRP HABIMANA Dominique, DHS Analyst Dr. Shireen Assaf, PhD | The Demographic and Health Surveys (DHS) Program, Dr. Ruilin Ren, PhD The Demographic and Health Surveys (DHS) Sampling Program manager , my job colleagues Kambogo francois, Ntambara juvenal. Bonus Kagarama.

I would finally like to acknowledge all my friends who have always been there for me during my studies. My thanks go to my classmates for their direct or indirect support.

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LIST OF ABBREVIATIONS

ANC: Antenatal care

CAADP: Comprehensive Africa Agriculture Development Programme

CFSVA: Comprehensive Food Security and Vulnerability Analysis and Nutrition Survey 2015, Rwanda.

DG: Director General

DHS: Demographic and Health Survey

HH: Household Head

HSDP: Health Sector Development Plan

IYC: Infant and Young Child

IYCF: Infant and Young Child Feeding

IYCMAD: Infant and Young Child Minimum Acceptable Diet

IYCMDD: Infant and Young Child Minimum Dietary Diversity

MAD: Minimum Acceptable Diet

MDD: Minimum Dietary Diversity

MDG: Millennium Development Goal

MMF: Minimum Meal Frequency

NGO: Non-Governmental Organization

NISR: National Institute of Statistics of Rwanda

PNC: Post Natal Care

RDHS: Rwanda Demographic and Health Survey

U/R: Urban/Rural

WFP: World Food Program

WHO: World Health Organization

RESUME

Les pratiques d'alimentation complémentaire inappropriées sont l'une des principales causes de retard de croissance chez l'enfant au cours des deux premières années de la vie. Cette étude est réalisée pour accéder aux facteurs associés à un régime alimentaire minimum acceptable et faible chez les enfants âgés de 6 à 23 mois au Rwanda, en utilisant les données de (CFSVA 2015) et pour estimer la prévalence des indicateurs nutritionnels complémentaires de l'OMS. d'alimentation complémentaire, de diversité alimentaire minimale, de fréquence minimale de repas et de régime alimentaire minimal acceptable chez les enfants âgés de 6 à 23 mois au Rwanda, à l'aide des données de L'Analyse Approfondie de la Sécurité Alimentaire et de la Vulnérabilité et Enquête sur la Nutrition 2015.

Les données transversales sur 2393 enfants âgés de 6 à 23 mois ont été obtenues à partir de l'enquête sur la démographie et la santé au Rwanda de 2010. Les modèles de risque proportionnel de Cox ont été utilisés pour évaluer l'association entre les indicateurs de l'OMS et la croissance linéaire de l'enfant et pour identifier les déterminants les plus importants de pratiques des alimentation innappropriées. Cette analyse secondaire a montré que la plupart des pratiques d'alimentation complémentaire étaient inappropriées pour les enfants âgés de 6 à 23 mois au Rwanda. La diversité alimentaire minimale atteint un pourcentage de 29%, la fréquence minimale des repas est atteinte par 32% des enfants et le régime minimum acceptable par 15%, ce qui signifie que moins de deux enfants sur six âgés de 6 à 23 mois consommé un régime acceptable.

Près de 32,4% de l'échantillon a atteint l'introduction ponctuelle d'aliments solides, semi-solides et mous et le taux d'allaitement au sein à un an était plutôt élevé (92,1%). Une analyse multivariée a montré que l'âge de l'enfant, l'éducation de la mère, l'âge de la mère et l'indice de richesse du ménage étaient des déterminants importants des pratiques inappropriées d'alimentation complémentaire. Les enfants plus jeunes (de 6 à 11 mois), les enfants de l'ouest du Rwanda et les enfants vivant aux altitudes les plus élevées doivent être ciblés par des interventions en matière d'alimentation du nourrisson et du jeune enfant. Des recherches plus approfondies sont nécessaires sur la quantité et la qualité alimentaires pour pouvoir comprendre les lacunes spécifiques en nutriments dans le régime alimentaire de ces enfants.

Mots-clés: Alimentation Complémentaire, Nutrition du Nourrisson et du jeune enfant, indicateurs de l'OMS, croissance linéaire de l'enfant, retard de croissance, Analyse Approfondie de la Sécurité Alimentaire et de la Vulnérabilité et Enquête sur la Nutrition 2015, Rwanda.

EXECUTIVE SUMMARY

The Inappropriate complementary feeding practices are one of the major causes of child growth retardation in the first two years of life. This study is done to access the factors associated with low minimum acceptable diet among 6-23 months old children in Rwanda, using the data of (CFSVA 2015) and estimate the prevalence of the WHO complementary feeding indicators continued breastfeeding at one year, timely introduction of complementary feeding, minimum dietary diversity, minimum meal frequency and minimal acceptable diet among 6-23 months old children in Rwanda using the data of Comprehensive Food Security and Vulnerability Analysis and Nutrition Survey 2015.

Cross-sectional data on 2393 children aged 6-23 months was obtained from the 2010 Rwanda Demographic and Health Survey. Cox Proportional Hazard models were used to assess the association of the WHO indicators and linear child growth and to identify the most important determinants of inappropriate complementary feeding practices. This secondary analysis showed that most of the complementary feeding practices were inappropriate for children of 6-23 months in Rwanda. The minimum dietary diversity reached a percentage of 29%, the minimum meal frequency was reached by 32% of the children and the minimal acceptable diet by 15%, which means that less than two in ten children of 6-23 months consumed an acceptable diet.

Timely introduction of solid, semi-solid and soft foods was reached by almost 32.4% of the sample and the continued breastfeeding rate at 1 year was rather high (92.1%). Multivariate analysis showed that age of the child, maternal education, maternal age and household wealth index were important determinants of inappropriate complementary feeding practices. Especially younger children (6-11 months), children from the Western region of Rwanda and children living on the highest altitudes need to be targeted with infant and young child feeding interventions. Further in-depth research is needed on dietary quantity and quality to be able to understand specific nutrient gaps in the diet of these children.

Keywords: Complementary feeding, infant and young child nutrition, WHO indicators, linear child growth, stunting, Comprehensive Food Security and Vulnerability Analysis and Nutrition Survey 2015, Rwanda.

I. INTRODUCTION

I.1 Definition of key terms

Acceptable meal frequency: Refers to the proportion of children 6-23 months old who met the recommended meal frequency; 2 times for breastfed children 6-8 months old, 3 times for breastfed children 9-23 months old and 4 times for non-breastfed children 6-23 months old based on a 24 hours recall.

Exclusive breastfeeding: Refers to feeding a child below six months with breast milk only, be it directly from breast or expressed, with no addition of any liquid or solids apart from drops or syrups consisting of vitamins, mineral supplements or medicine, and nothing else 24 hours preceding the study (WHO/UNICEF, 2010).

Feeding practices: These refer to practices (both breastfeeding and complementary feeding) in feeding infants and young children based on WHO/UNICEF recommendations (WHO/UNICEF, 2011).

Minimum dietary diversity: Refers to the proportion of children 6-23 months old who received food from 4 or more food groups based on a 24 hours' recall period.

Minimum acceptable diet: Refers to the proportion of children who met the recommended minimum dietary diversity and meal frequency of based on a 24 hours recall period (WHO/UNICEF, 2010).

Stunting: The relationship between observed height to the expected height for the specific age and sex of the child (H/A).

Underweight: The relationship between observed weight to the expected weight for the specific age and sex of the child (W/A).

Wasting: This phrase refers to the relationship between body mass and body stature of the child (W/H).

Z-scores: Measure of the degree of dispersion of the series of observations (H/A, W/A, W/H) with reference to the median of the series.

Community Health Workers Program

Community Health Workers (CHWs) around the world are men and women who work to improve the health outcomes and general well-being of their fellow community members. The 1978 Declaration of Alma-Ata described CHWs as a major vehicle for the advancement of Primary Health Care in areas with limited resources, starting, "The people have the right and duty to participate individually and collectively in the planning and implementation of health care. CHWs provide a vital link between community members and health centers and hospitals; they extend the reach of the clinic by supporting disease prevention, treatment, and case-finding effort. They also amplify the voice of the community to the medical establishment by informing doctors, nurses, and other health professionals of the needs and conditions in the community that affect health.

I.2 Background

The prevalence of stunting worldwide declined between 2000 and 2013 from 33% to 25% (UNICEF/WHO/ WorldBank 2013) [1]. This decrease in stunting has a positive impact on achieving the 4th Millennium Development Goal of reducing the mortality of children under 5 by two-thirds, between 1990 and 2015. However, in Rwanda the number of under-five stunted children is still very high, with a prevalence of 38%.

Inappropriate feeding practice of infant and young child leads to malnutrition, this exposes the children to under nutrition, increasing morbidity and mortality, and chronic stunting that will be continuing to next generations [1]. By improving the quality and frequency of complementary feeding practice it is possible to improve health, reducing morbidity and mortality of young children. Nearly one third of children deaths could be prevented by appropriate complementary feeding practices [2]. Early initiation of breastfeeding, exclusive breastfeeding, implementing complementary feeding, consumption of diversified diet, adequate meal frequency, and consumption of iron fortified foods are core indicators for monitoring feeding practices of infants and children. Minimum Acceptable diet defined by WHO as is the proportion of children 6–23 months of age who receive a minimum acceptable diet, (both, minimum dietary diversity and the minimum meal frequency) during the previous 24 h [3].In developing countries including Rwanda, feeding infants and children with diversified diet is practiced inappropriately. In Africa less than one-third and one-half of children aged between 6 and 23 months met the minimum criteria for dietary diversity and meal frequency, respectively. That is why the prevalence of stunting in African countries increases threefold during the first 2 years of life [4].

The period of 6-23 months is important because as the child grows and becomes more active, breast milk alone is no longer sufficient to meet the child's nutritional needs. Complementary feeding needs to be introduced to fill this energy and nutrient gap and prevent the child from becoming stunted. In the transition to participating in the family diet children of the age of 6 months and older should be fed small quantities of adequate and safe solid and semi-solid foods throughout the day (WHO 2003) [5].

Despite these recommendations and the health benefits of appropriate complementary feeding, inappropriate complementary feeding is commonly practiced in many low- and middle-income countries. This is partly due to the fact that complementary feeding consists of a complex set of behaviors, comprising timing of introduction, food choices to ensure dietary diversity, preparation methods, food quantity, feeding frequencies, responsiveness to infant cues, and safe

preparation and storage of foods Each behavior, in turn, may have context-specific determinants that influence these complementary feeding practices (WHO 2003) [5].

Previous studies on complementary feeding practices show that younger maternal age, lower maternal education, , young infant age, male sex of the infant, poor household wealth status, inadequate maternal exposure to mass media (newspaper, television, radio) and geographical differences are the main risk factors associated with inappropriate complementary feeding practices among children aged 6-23 months in developing countries (Patel et al. 2010; Kimani-Murage et al. 2011; Hazir et al. 2012; Joshi et al. 2012; Kabir et al. 2012; Senarath et al. 2012; Victor et al. 2012; Aemro et al. 2013) [6].

However, these determinants were not consistent between countries and specific areas, suggesting that the context is important when trying to determine factors that will be targeted in interventions. To effectively influence complementary feeding behaviour in a specific country through the development and strengthening of intervention programs, you need to have comprehensive knowledge about the risk factors associated with this behaviour in that particular local context.

I.2.1 Problem formulation

Malnutrition is on the rise in every country in the world and is a leading global driver of disease. Globally, an estimated of 5.4 million children under the age of five died in 2017 (UNICEF, WHO, World Bank Group and United Nations, 2018). Nutrition-related factors contribute to about 45% of deaths in children under-5 years of age. These mostly occur in low- and middle-income countries (World Health Organization [WHO], 2018) [7]. In 2017, globally about 151 million, or 22.2 per cent, of children under 5 suffer from stunting, nearly 51 million, or 7.5 per cent, children under 5 were wasted and 38 million, or 5.6 per cent, of children under age 5 were overweight (UNICEF, WHO and the World Bank Group, 2018) [8].

Malnutrition is still a major health problem in developing countries and particularly in sub-Saharan Africa. In 2017, more than half of all stunted children under 5 lived in Asia (55%) and more than one third lived in Africa (39%), almost half of all overweight children under 5 lived in Asia (46%) and one quarter lived in Africa (25%), more than two thirds of all wasted children

under 5 lived in Asia (69%) and more than one quarter lived in Africa (27%) (UNICEF, WHO and the World Bank Group, 2018) [9]. .

A comparison of regional trends in the number of children affected by stunting, overweight and wasting in Africa shows a difference. Eastern and Middle Africa had the highest stunting prevalence in 2017 with 35.6 percent and 32.1 percent affected respectively, followed by Western Africa at 29.9 percent and Southern Africa at 29.1 percent. The lowest stunting prevalence in 2017 was seen in Northern Africa, at 17.3 percent. In 2017, 13.7 percent of overweight children lived in Southern Africa, 10.3 percent in Northern Africa and about 5 percent in Middle Africa. Eastern and Western Africa had the lowest prevalence estimates of overweight children with 4.4 percent and 2.4 percent respectively. Northern and Western Africa had the highest prevalence of wasting in children under five in 2017 with 8.1 percent affected, followed by Middle Africa at 7.1 percent and Eastern Africa at 6.0 percent. The lowest prevalence of wasted in 2017 was seen in Southern Africa, at 4.0 percent.

Malnutrition in East Africa manifests itself most clearly in stunted and underweight children. Among countries, there is a difference between those with the highest prevalence and those with the largest numbers of people affected by stunting and underweight. According to the 2016–2017 Burundi Demographic and Health Survey (BDHS), Burundi has one of the highest rates of chronic malnutrition (stunting or low height-for-age) globally (56 percent), affecting over 1 million children under 5 years. Prevalence of underweight among children under 5 years (0–59 months) is at 29% (USAID, 2018). In Tanzania, 34 percent or 3.3 million children under 5 years suffer from chronic malnutrition (stunting or low height-for-age) and 14% suffer from underweight (USAID, 2018). Almost one-third of children under 5 years in Uganda (29%) are stunted. The prevalence of underweight among Ugandan children is at 11% (USAID, 2018). In Kenya, out of a total under-5 populations of 7 million, 1.82 million children (26 percent) are suffering from chronic malnutrition (stunting or low height-for-age). Prevalence of underweight among children under 5 years (0–59 months) is at 11% (USAID, 2018).

Even though Rwanda has achieved significant progress in reducing the proportion of under-five children suffering from malnutrition, the magnitude of the problem still is of great concern. Based on recent survey of the 2014-15 Rwanda Demographic and Health Survey (2014-15 RDHS) 38 % of children under age 5 were stunted and 14 % were severely stunted.

Two percent were wasted, and less than 1 % was severely wasted. Nine percent of children under age 5 were underweight (low weight-for-age), and 2 % were severely underweight. Considering two other forms of malnutrition, overall, 8 % of children below age 5 were overweight or obese (National Institute of Statistics of Rwanda (NISR) [Rwanda]; Ministry of Health (MOH) [Rwanda] and ICF International, 2015) [10].

Until now, there has been no scientific literature published on determinants that influence complementary feeding practices in Rwanda. Solely, the 2010 Rwanda Demographic and Health Survey provide some information about infant and young child feeding practices. The DHS collected information about the number of times a child is fed (feeding frequency) and from how many food groups this food was consumed (food diversity). According to the results 25% of breastfed children age 6-23 months was given foods from four or more food groups in the 24 hours preceding the survey, and 51% were fed the minimum number of times in the preceding 24 hours.

Only one in five breastfed children fell into both categories; that is, their feeding practices met minimum standards with respect to food diversity as well as feeding frequency (RDHS 2014/2015).

Malnutrition remains one of the major obstacles to human well-being affecting all areas of a child's growth and development ,and malnutrition during childhood can lead not only to long-term health problems but also to educational challenges and limited work opportunities in the future. Malnourished children often have smaller babies when they grow up. It can also slow

recovery from wounds and illnesses, and it can complicate diseases such as measles, pneumonia, malaria, and diarrhea. It can leave the body more susceptible to disease (Christian, 2017). The immediate consequences of poor nutrition during the early formative years include significant morbidity and mortality and delayed mental and motor developments. Malnutrition at the early stages of life can lower child resistance to infections. (Kudzai, 2014)[11]. Malnourished children often have smaller babies when they grow up. It can also slow recovery from wounds and illnesses, and it can complicate diseases such as measles, pneumonia, malaria, and diarrhea. It can leave the body more susceptible to disease (Christian, 2017). Moreover, the potential negative impact of child malnutrition goes beyond the individual, affecting society and future generations (Kudzai, 2014) [11].

In this research, we aim to identify associated factors of the inappropriate complementary feeding practices among 6-23 months old children in Rwanda, using the data of (CFSVA 2015). That may be useful for informing policy and indicator-specific programming to resolve the Feeding practices problem in order to close this gap and further reduce the prevalence of malnutrition in Rwanda.

Therefore, this study has the following research questions:

- What is the prevalence rate of Minimum Acceptable Diet in Rwanda?
- What are the associated factors with the Minimum Acceptable Diet in Rwanda?

I.3 Study objectives

Overall objective

To determine the status of the minimum acceptable diet among 6-23 months old children in Rwanda and explore the association between maternal socio- economic and demographic characteristics and the nutritional status of their children, using the Food Security and Vulnerability Analysis and Nutrition Survey 2015.

Specific objectives

1. To establish the Prevalence rate of Minimum Acceptable Diet among 6-23 months' old children in Rwanda.
2. To identify the associated factors of Minimum Acceptable Diet in Rwanda.

I.4 Literature review

Introduction

This section contains literature that has written on the nutritional status of children aged below 2 years and the various factors associated with it. These studies are valuable documents and information to build on because they enrich the understanding of this study as it takes on the analysis of the case study. Literature on household's socio-economic factors, socio-demographic characteristics of household, health and environmental characteristics, and how they influence health status of children under-to years will be covered, extensively, here.

Theoretical review

The Government of Rwanda has demonstrated its commitment to improving nutrition through the institution of various national policies and initiatives. The Ministry of Health (MOH) implemented the National Multi sector Strategy to Eliminate Malnutrition (2010-2013) and a comprehensive joint action plan to fight malnutrition under the Office of the Prime Minister, which provides a common results framework for nutrition. Multi sector nutrition committees were established at central and local levels, bringing together mayors, and district directors of health, nutritionists, agronomists, and officers from social protection, veterinary, hygiene and sanitation sectors (USAID Rwanda, 2014).

In 2012, the U.S. Government provided support for the implementation of the national nutrition strategy at the district level. USAID supported nutrition activities at health facilities and in communities, including supporting the scale-up of the GOR's Community-Based Nutrition Program. Furthermore, a national multi sectorial Food and Nutrition Policy and Strategic Plan for 2013-2018 was completed in October 2013 to guide the GOR and development partners in the implementation of nutrition activities with a multi sectoral approach to address stunting. The policy and the strategic plan is aligned to the five-year (2013-2018) Economic Development and Poverty Reduction Strategy (EDPRS II) that aims to propel Rwanda's economic growth to a middle-income-status country by 2020.

To give nutrition a visible platform for advocacy, a nutrition indicator to reduce chronic malnutrition among children less than 2 years of age was introduced in the EDPRS II. Further, in September 2013, the GOR together with development partners launched a 1,000 day's campaign that will be implemented in three phases to increase awareness of improved maternal, infant and young child feeding practices (USAID Rwanda, 2014). In December 2011, Rwanda joined Scaling up Nutrition (SUN), a global movement that unites national leaders, civil society, bilateral and multilateral organizations, donors, businesses and researchers in a collective effort to improve nutrition. The Director of Maternal and Child Health in the MOH is the SUN focal

point person, while USAID is the donor convener for SUN in Rwanda, and together with the U.N. coordinates the support of nutrition-specific and nutrition sensitive programs (USAID Rwanda, 2014).

The first two years of life are critical stages for a child‟s growth and development. Any damage caused by nutritional deficiencies during this period could lead to impaired cognitive development, compromised educational achievement and low economic productivity (Victoria *et al*; 2008 & Grantham *et al*; 2007). Poor breastfeeding and complementary feeding practices, together with high rates of morbidity from infectious diseases are the prime proximate causes of malnutrition in the first two years of life (Murage *et al*, 2011).

Appropriate Feeding Practice among children 0-23 months

Child feeding practices are multidimensional and they change rapidly within short age- intervals in the first years of life. Unlike exclusive breastfeeding, which can be summarized in a single indicator, the measurement of feeding practices in children aged 6 months and older involves assessing various dimensions of feeding simultaneously. These dimensions include continued breastfeeding, appropriate timing of introduction of complementary foods, and optimum quantity and quality of the foods consumed (WHO/ UNICEF/ USAID, 2010).

Appropriate feeding practices are essential for the nutrition, growth, development and survival of infants and young children, (Kumar *et al*., 2007.) Results of studies on infant and child feeding have indicated that inappropriate feeding practices can have profound consequences for the growth, development, and survival of infants and children, particularly in developing countries (Mamiro *et al*., 2005; Bloss, Wainaina & Bailey,2004). The most recent estimates of the global burden of malnutrition in under 5 children are that 178 million (one-third of all children) are stunted, 112 million are underweight, 55 million are wasted (19 million having severe acute malnutrition) and 13 million children are born each year with intrauterine growth retardation (Ramji, 2009).

Breastfeeding Practice

The WHO and the UNICEF recommend that all mothers should breastfeed their children exclusively for the first 6 months and thereafter they should continue to breastfeed for 2 years or longer (UNICEF, 2011). Breastfeeding alone with no water provides the ideal nourishment for infants for the first six months of life as it provides all the nutrients, antibodies, hormones,

immune factors and antioxidants an infant needs to thrive. It protects babies from diarrhoea and acute respiratory infections and stimulates their immune systems (WHO/UNICEF, 2003).
The indicators of appropriate breastfeeding practices include: early initiation of breastfeeding, exclusive breastfeeding for children under six months and continued breastfeeding at 1 year and for 2 years or beyond (UNICEF, 2011).

Status and Benefits of Exclusive Breastfeeding

For almost all infants, breastfeeding remains the simplest, healthiest and least expensive feeding method that fulfils the infants‟ nutrition needs (Oche, 2011). The numerous benefits of breast-feeding are of public health relevance for developing countries as well as for industrialized nations. Exclusive breastfeeding, which is giving breast milk only and no other liquids, except drops or syrups with vitamins, mineral supplements or Medicines, is superior to non-exclusive breastfeeding with a protective effect against both morbidity and mortality (Kramar & Kakuma,2014.) Currently, exclusive breastfeeding for the first 6 months of life is recommended under Global Infant and Young Child Feeding Practices (Chudasama *et al*., 2009). Worldwide, only 37% of children between birth and their sixth month are breastfed exclusively (UNICEF, 2010). In Rwanda, 23.2% of infants 0-6 months are exclusively breastfed (RDHS 2014 compared to 13%.Scientific evidence indicates that infants not exclusively breastfed are at increased risk of death from diarrhea, pneumonia and neonatal sepsis (Jones et al., 2003).
A study carried out in Casa di reclusione di Roma Rebibbia, the main prison of Rome, on health status of 150 children in prison found that, 70% of mothers breastfed their children (Senanayake *et al*., 2009). A prospective observational study carried out in Welikata prison, Colombia, Sri Lanka, established that 70% of children accompanying imprisoned mothers were breastfed (Senanayake *et al*., 2009). However exclusive breastfeeding status was not established in these studies. Mothers serving prison sentences may not have adequate time to breastfeed their children on demand and exclusively owing to the fact that most of the time the mother is separated from the child (Bastick & Townhead, 2008).

Exclusive breast-feeding provides low cost and complete nutrition for the infant. It protects him/ her against infections including infant diarrhoea and prolongs lactation amenorrhea, thereby increasing birth spacing (Oche, 2011).

Status of Early Initiation of Breastfeeding

The (WHO) and UNICEF recommend initiation of breastfeeding within the first hour after birth (WHO/UNICEF, 2003). Early mother-infant bonding induces a series of changes in the brain cells with the release of chemical neurotransmitters triggering the hormones of lactation. The subsequent rise in prolactin hormone causes a state of tranquility in the mother and enables her to sustain the stress of childcare and the additional burden of transition to parental role (Abdul *et al.*, 2005). This is an important factor to imprisoned mothers as a way of reducing mental stress associated with incarceration.

Early initiation of exclusive breastfeeding serves as the starting point for a continuum of care for mother and newborn that can have long-lasting effects on health and development (WHO, 2010). Despite these recommendations, only 39 percent of newborns in the developing world are put to the breast within one hour of birth (UNICEF, 2009).

In Rwanda, according to the Rwanda Demographic Health Survey (RDHS) practically all of the children (99 percent) born in the two years preceding the survey were breastfed at some point in time. Because breast feeding is nearly universal, variations according to background characteristics are minimal. Eighty-one percent of children are breastfed within one hour of birth, an increase from the figure of 71 percent reported in the 2010 RDHS. Ninety-six percent are breastfed within one day of birth. About 5 percent of children receive a pre lacteal feed, that is, something other than breast milk during the first three days of life. Studies carried out in rural Ghana and Southern Nepal found out that, initiation of breastfeeding after the first 24 hours was associated with a 2.4-fold increased risk of mortality in Ghana and a 1.4-fold increased risk in Nepal when compared to initiation before 24 hours (WHO *et al*., 2010)

Status and Benefits of Continued Breastfeeding at One Year and Two years or beyond

The first two years of life are critical stages for a child's growth and development. Any damage caused by nutritional deficiencies during this period could lead to impaired cognitive development, compromised educational achievement and low economic productivity (Victoria et al., 2008; Mc-Gregor *et al*., 2007). Poor breastfeeding and Complementary feeding practices, together with high rates of morbidity from infectious diseases are the prime proximate causes of malnutrition in the first two years of life. Breastfeeding confers both short-term and long-term benefits to the child. It reduces infections and mortality among infants, improves mental and motor development, and protects against obesity and metabolic diseases later in the life course (Murage *et al*., 2011).

Based on the RDHS (2014/2015) findings, the statements on median duration of breastfeeding among the general population in Rwanda is that Rwanda is among the leading countries globally adhere to the recommended practices regarding breastfeeding: 99 percent of children are breastfed for at least some time, the median duration of breastfeeding is 28 months, and almost 9 in 10 children under age 6 months are being exclusively breastfed. Breast milk supplies higher quality nutrients and protective factors than complementary foods. It is therefore recommended that breastfeeding on demand continues with adequate complementary feeding up to 2 years or beyond (WHO/UNICEF/USAID, 2008).

Status and Benefits of Complementary Feeding Practice

The WHO recommends exclusive breastfeeding for the first six months of life with early initiation and continuation of breastfeeding for two years or more. It also recommends nutritionally-adequate, safe, age-appropriate complementary feeding starting at six months (WHO, 2003). From six months onwards, when breast milk alone is no longer sufficient to meet all nutritional requirements, infants enter a particularly vulnerable period of complementary feeding during which they make a gradual transition to eating family foods (Bhan, 2010).
Inappropriate timing of introduction of complementary foods deprives the infant of optimum nutrition, leading to under-nutrition, and increased mortality and morbidity (Hazir et al., 2011).

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Inappropriate timing of introduction of complementary foods deprives the infant of optimum nutrition, leading to under-nutrition, and increased mortality and morbidity (Hazir *et al*., 2011). According to the new WHO indicators, the timeliness is assessed by whether infants aged 6 to 8 months are receiving solid, semi-solid or soft food irrespective of being breastfed or not (WHO

et al., 2010). The WHO recommended meal frequency is, initially 2-3 times a day for infants between 6-8 months old, increasing to 3-4 times daily between 9-11 months old and 12-23 months old with additional nutritious snacks offered 1-2 times per day, as desired (WHO, 2010). Studies in Malawi have revealed that children who are given foods according to the

Timing set by the WHO are well-nourished as compared with children who were introduced to solids too early (Matthew *et al*., 2009). In achieving dietary diversity, meals should include adequate quantities of meat, poultry, fish or eggs, as well as vitamin A-rich fruits and vegetables every day.

However, six sub-Saharan countries in Africa have shown reductions in stunting among children less than 3 years over the past two decades in Demographic and Health Surveys. The six countries are Senegal, Namibia, Togo, Uganda, Eritrea, and Tanzania. Senegal has had the most dramatic reduction in stunting, from 22 percent in 1993 to only 14 percent in 2005. Other three countries (Botswana, Gabon, and Gambia) do not have DHS trend data, but the WHO and UNICEF indicates they already have low or moderate levels of stunting (WHO, 2008).

A study by Anganwari (2007) on association between feeding practices and under- nutrition in areas of urban Allahabad established that; delayed initiation of breast-feeding, deprivation from colostrum, and improper complementary feeding are significant risk

Furthering its investment in improving nutrition, Rwanda was the first country to sign a CAADP (Comprehensive Africa Agriculture Development Programme) Compact, in 2007. CAADP is an African-led program bringing together governments and diverse stakeholders to reduce hunger and poverty and promote economic growth in African countries through agricultural development. Today Rwanda is one of the few African countries to meet the CAADP-recommended target of 10 percent of agricultural expenditure in the national budget (USAID Rwanda)

Determinants of Inappropriate Complementary Feeding Practice

Selection of factors that were included to investigate determinants for inappropriate complementary feeding practices were based on previous published evidence and divided into three groups of factors. The individual factors of the child included whether the child was currently breastfed and whether the child had diarrhea episodes. The maternal/ household factors, maternal education, maternal literacy, wealth index. The community factors included residence (urban/rural), geographical region, and the access to safe drinking water and proper sanitation where used in the thesis.

Socioeconomic characteristics

Socioeconomic characteristics such as household economic status, maternal socioeconomic characteristics (mothers' education, mothers, wealth index etc are important in child nutrition status. Maternal education regularly emerges as a key element of an overall strategy to address malnutrition. Children born to educated women suffer less from malnutrition which manifests as underweight, wasting and stunting in children. Maternal education has been associated with nutrition outcomes among children in studies in various settings (Handa, 1999). The education level of mothers was positively related to the better nutritional status of children. Educated mother are more conscious about their children's health; they tend to look after their children in a better way (Rayha & Sekander Hayat, 2006)**.**

Numerous studies show that there is a strong linkage between maternal education and children's health. For example, in studies based in Bangladesh found from a case control study on 250 children, aged <36 months that maternal education was significantly associated with severe malnutrition. These study findings also suggest that mother's education played as significant role in reducing prevalence of stunting. Chronic malnutrition was highest among children of illiterate mothers (Rayha & Sekander Hayat, 2006).

Another large scale study in Bolivia indicate that maternal education accounts for almost 60 percent of the behaviours determining child health and nutritional status, with each additional level of schooling decreasing the likelihood of child stunting by approximately 44 percent (Anuska, 2006).

I.5 Conceptual framework

The interplay between the two most significant immediate causes of malnutrition, inadequate dietary intake and illness tends to create a vicious circle: A malnourished child, whose resistance to illness is compromised, is likely to fall ill worsening malnutrition. Prevailing conditions in Rwanda predispose children to increased prevalence of malnutrition and infectious diseases like diarrhea, coughs and colds. Infections cause loss of appetite, mal-absorption and metabolic and behavioral changes. These infections, in turn, increase the body's requirements for nutrients, which further affect young children's eating patterns and how they are cared for. Unavailability of safe and nutritious foods in Rwanda set up and access to safe water are likely to lead to increase levels of malnutrition among children.

Maternal level of education, marital status, economic activity, access to safe drinking water and sanitation availability was assessed to evaluate their effect on nutritional status outcome as basic determinants of malnutrition in children.

According to this framework, developed by UNICEF, malnutrition occurs when dietary intake is inadequate and health is unsatisfactory, being the two immediate causes of malnutrition. In developing countries, infectious diseases, such as diarrheal diseases (DD) and acute respiratory diseases (ARI) are responsible for most nutrition-related health problems (Lioba, 2004).

Readily available food, appropriate health systems and a "healthy" environment are ineffective unless these resources are used effectively. As a result, the absence of proper care in households and communities is the third necessary element of the underlying causes of malnutrition (Lioba, 2004).

Finally, this conceptual framework recognizes that human and environmental resources, economic systems and political and ideological factors are basic causes that contribute to malnutrition (Lioba, 2004).

This model relates the causal factors for under-nutrition with different social-organizational levels. The immediate causes affect individuals, the underlying causes relate to families, and the basic causes are related to the community and the nation. As a result, the more indirect are the causes, the wider the population whose nutritional status is affected. The framework is used at national, district and local levels, to help plan effective actions to improve nutrition. It serves as a guide in assessing and analyzing the causes of the nutrition problem and helps in identifying the most appropriate mixture of actions (Lioba, 2004).

Figure 1 Adopted Conceptual Framework of Malnutrition (UNICEF 1991)

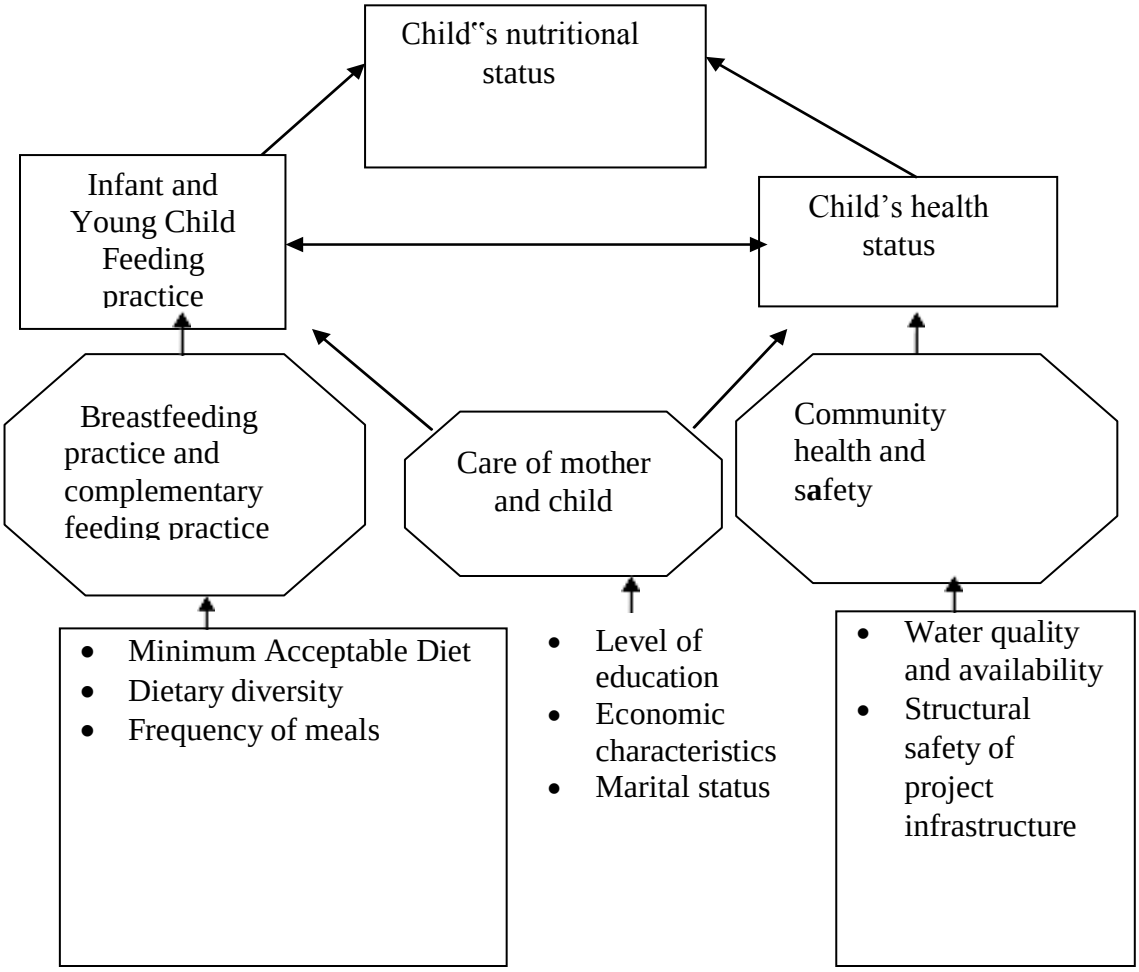


Figure 1.1: Adapted from: UNICEF & Engle *et al.*, (1990, 1998, and 1999). Conceptual framework on the causes of malnutrition among children.

II. METHODS AND MATERIALS

II.1 Study area description

The study unit consisted data from the Comprehensive Food Security and Vulnerability Analysis and Nutrition Survey 2015 where some indicators related to the infant child feeding practices was not captured as it's represented in RDHS 2014/2015. Also this was a nationally representative set of data.

II.2 Study design

This chapter sets out the methodology that was used to achieve the objectives of the study. According to the Petit Larousse dictionary (1982, p. 650), methodology is ''the systematic study by observation of the scientific practice, the basic principles and methods of research that it uses''. The methodology includes the general approach of the study (research design), the population of interest, the sample, data collection instruments and the data analysis technique that were used. To facilitate comparison with existing studies, the CFSVA 2015 was designed to provide statistically representative and precise information at the district level. In this survey, two-stage cluster sampling was used to generate a nationally representative sample of households.

In this study the secondary data analysis were used to achieve the specific objective of this study therefore some analysis like descriptive, binary and multivariate analysis was used to achieve. In addition, for CFSVA 2015 the design was decided to include both urban and rural households and not to exclude the capital province Kigali. The sampling frame was organized according to the 30 districts, a cross-sectional survey was used to conduct in all 30 districts using a two -stage cluster sampling approach was applied.

In the first stage, 25 villages per district were randomly selected with probability to be selected proportional to the population size. In the second stage, ten households in each of the 25 villages in the 30 provinces were selected for participation in the survey. A systematic random sampling technique was chosen for this stage. Households were eligible for participation in the assessment if living in one of the selected villages at the time of the interviews. The first stage sample of villages for CFSVA 2015 in each district was selected systematically with PPS, where the measure of size was based on the number of households in the frame for each village.

II.3 Specific objectives achievements

As mention in study design the secondary data analysis study was used to get more data analysis that was not included in the CFSVA 2015 final report, the process Is that, the dataset was sorted by province and the descriptive statistics were used to get the prevalence rate of Minimum Acceptable Diet among 6-23 months‟ old children in Rwanda using the variable M013 from the dataset. The list of all children (6-59 months old) was dividing into 2 parts and remained with only the 6-23 months‟ old children.

The socio demographic and other community health and safety variables were used in the bivariate analysis of this study. Chi-square tests were performed to establish the relationship between Minimum Acceptable Diet and those variables. The multivariate analysis was explored to the logistic regression analysis only to the variables presenting the significance level in bivariate analysis, Chi-square test was set at ≤ 0.05.

Study variables

The dependent variable for this study was the Minimum Acceptable Diet status among 6-23 months' old children in Rwanda. Nutritional status of children less than six months of age was not established in this study since it is not standard practice to measure nutritional status of this age of children since they are not at high risk of developing under nutrition because of the protection provided by breastfeeding. The independent variables included the IYCF practices which were assessed using the WHO (2010) recommended 8 core indicators and social-demographic status of the mother.

Data analysis plan

This was for cross analysis with variable like nutrition status, diarrhea and other practices. Descriptive statistics (mean, maximum, minimum, frequencies and percentages) were used to describe data on nutritional status, feeding practices and maternal socio-demographic characteristics. The bivariate analysis and multiple regression analysis were used to show relationship between dependent variables such as MAD of child. Chi-square tests were performed to establish the relationship between the socio- demographic, and the nutritional status of the children. Significance level was set at <0.05.

Data was downloaded directly from the NISR website and exported to SPSS for analysis. Each participating household, child, and woman had a unique identification number made up of the cluster number and household number and, for individuals, an individual number, all analyses were done using SPSS and Stata. Three designs were used for this dissertation analysis such are: descriptive statistics, binary logistic regression and multiple logistic regression.

Design Weight Weighting

The Design weight of the sample is merely the inverse of the selection probability.

$$W = \frac{1}{P_\alpha * P_\beta}$$

Where W is the weight.

For adjusting the Weight a listing of all households in the sampled village was done for updating the frame for second stage selection.

$$W_{adj} = \frac{1}{P_\alpha * P_\beta} * \frac{MOS1}{MOS2}$$

Where W_{adj} is adjusted sample weight, $MOS1$ is total number of households in the sample village from census and $MOS2$ is total number of households listed in the sample village.

Estimation methodology

As the stratified random sampling techniques have been adopted for the survey, below are the formula used to estimate various statistical parameters.

Population weight

Assuming that a CFSVA 2015 sample is drawn with two-stage, stratified cluster sampling, design weights was calculated based on the separate sampling probabilities for each sampling stage and for each cluster. We use the following notations:

P1hi: first-stage sampling probability of the i^{th} cluster in stratum *h*

P2hi: second-stage sampling probability within the i^{th} cluster (household selection)

The calculation of the design weight is not complicated; however, difficulties often result from not having of all the design parameters involved in the above calculation because they are not well documented, especially when the sampling frame is a master sample.

$$W = \frac{1}{\frac{nMOS_\alpha}{\sum_\alpha MOS_\alpha} * \frac{\gamma}{MOS_\alpha}} = \frac{\sum_\alpha MOS_\alpha}{n * \gamma} = \frac{N}{N_i}$$

Where:

N= Total number of Households in the stratum

N_i= the total number of households sampled in the stratum i.

n= the sample size (villages) of the concerned district

γ= the sample size (households) of the concerned Village

Variance estimate

The average of variable is Y_i in the stratum i; variance estimate of Y is equal to

$$S_i^2 = \frac{1}{N_i - 1}\sum_{i=1}^{N_i}(Y_{\alpha i} - \bar{Y}_i)^2$$

c. Sample Mean of a stratum i

$$\bar{Y}_i = \frac{1}{n_i}\sum_{ji}^{n_i} y_{ji}$$

d. Sample variance of the stratum i

$$S_i^2 = \frac{1}{n_i - 1}\sum_{ji=1}^{n_i}(y_{ji} - \bar{y}_i)^2$$

e. Population mean

$\bar{Y} = \sum_k W_k \bar{Y}_k$, where k is strata, numbered from 1 to k sub-populations

f. The estimator of the population mean

$$\bar{y}_{st} = \sum_{i=1}^{k} W_i \bar{y}_i$$

g. Estimation of Total for stratum i

$$\hat{Y} = N_i y_i$$

h. The total of overall population

$$\hat{T}(Y) = \Sigma_{i=1}^{k} N_i \bar{Y}_i$$

i. Variance of the mean estimator

$$Var\left[\bar{Y}_{st}\right] = \sum_{i=1}^{k} w_i^2 (1 - f_i) \frac{S_i^2}{n_i}$$

j. Variance of Total estimator

$$\text{var}\left[\hat{T}(Y)\right] = \sum_{i=1}^{k} N_i^2 (1 - f_i) \frac{S_i^2}{n_i}$$

k. Stand deviation estimator

The standard deviation estimator is the square root of the variance.

l. Mean estimator

$$\partial = \sqrt{\text{var}[\bar{Y}_{st}]}$$

m. Total estimator

$$\partial = \sqrt{\text{var}\left[\hat{Y}(Y)\right]}$$

Where ∂ : standard deviation

II.4 Study population

This study is limited by the analysis of Feeding Practices of Children under two old using secondary data of the Comprehensive Food Security and Vulnerability Analysis and Nutrition Survey 2015, because we are only interested nutritional status of children under two years, we only considered 1,379 children for the analysis.

Sample size calculation

A sample size calculator usually asks the required survey precision, a reference indicator, and its design effect from the previously surveys.

$$n = Deft^2 * \frac{\left(\frac{1}{p} - 1\right)}{\alpha^2}$$

Where:

N= Net sample size;

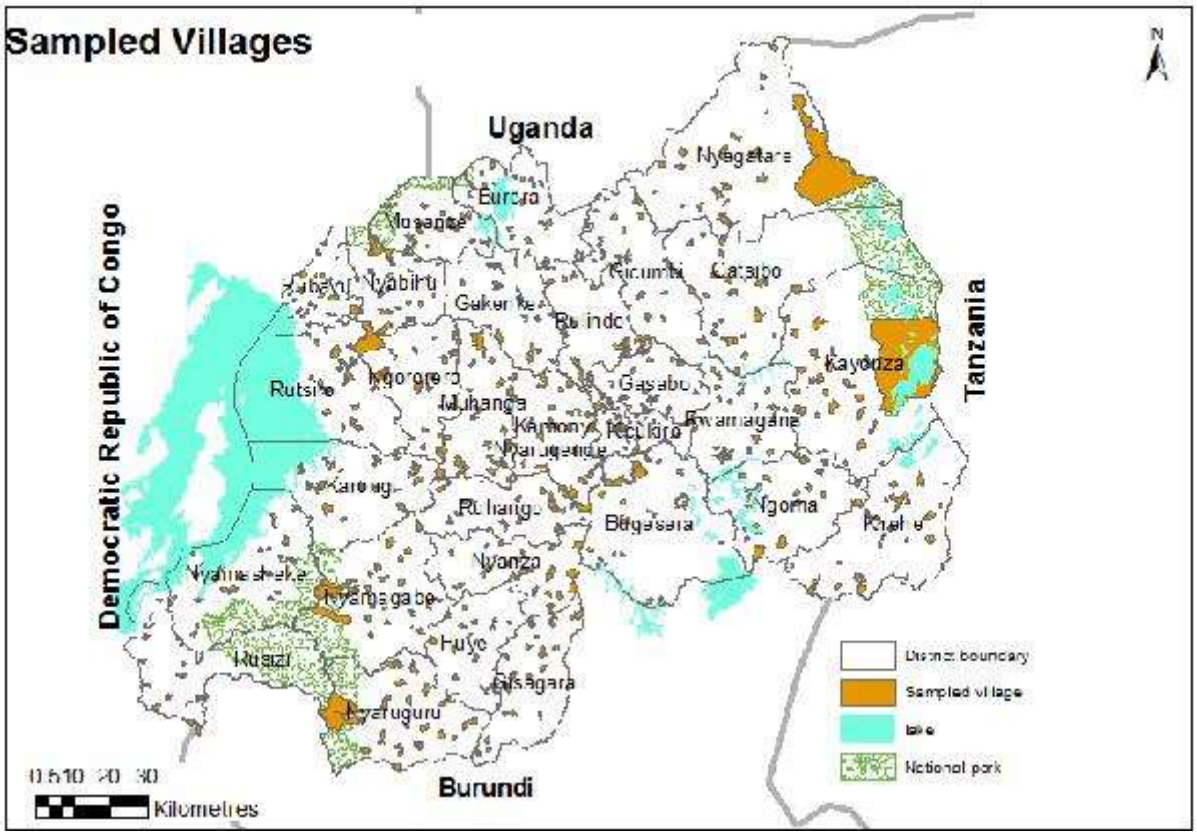
P=proportional of poor population;

α= Relative standard error (RSE) and

Deft= Square root of design effect

For this survey the above formulas were used to get the final minimum sample size in this survey was supposed to cover a total number of 1400 HHs. The reference indicator was 38% on stunting and the design effect was 1.5 and relative standard error was 10%.

Figure 2 Study Coverage



Thus, ten households, from 25 villages, from 30 provinces were chosen to participate in the survey, amounting up to 7,500 households.

Sampling techniques

The first stage sample of villages for CFSVA 2015 in each district was selected systematically with PPS, where the measure of size was based on the number of households in the frame for each village.

According to PPS, the probability of selecting a certain PSU (p_α) is:

$$P_\alpha = \frac{nMOS_\alpha}{\sum MOS_\alpha}$$

Where 'n' is the sample size (Villages) to be selected from the district, and MOS_α is the census number of households in the α^{th} PSU.

At the second sampling stage the households within each sample village were selected with equal probability using systematic random sampling.

According to the SRS, the probability of selecting household in PSU (P_β) is:

$P_\beta = \frac{\gamma}{MOS_\alpha}$ Where 'γ' is the sample size (households) to be selected from the district, and MOS_α is the census number of households in the α^{th} PSU.

Data collection procedures

Primary data collection took place over six weeks from mid-April to the end of May 2015 which coincides with the minor lean season, before season B harvest.

Survey Quality assurance

Quality assurance measures were taken at all steps, from the selection of the enumerators until the data cleaning and analysis.

Selection of enumerators and team leaders:

Survey team members all had previous experience in similar food security and nutrition surveys. The training included 20-30% more personnel than finally recruited for the actual data collection, this allowed the coordination team to select the best enumerators based on their performance during the training. Also reserve enumerators could be called upon if any selected enumerators defaulted. The training consisted of 6 full days of classroom instruction and practice and 1 day of pre-testing of all survey procedures. The assessment managers ensured that all enumerators were fully aware of the enrolment and consent process as well as of inclusion and exclusion criteria for households.

During data collection:

For each selected village, Team leaders recorded the following information, 1) number of households in the village, reasons (if any) for skipping the households, contact details of village authorities and number of women/children measured in each household. These data will allow calculation of response rates and the determination of reasons for non-response.

A mobile phone communication system was put in place between each team leader, survey supervisor and the survey coordination team. Tips and revised procedures were communicated immediately to all survey teams by sms.

A listing form was given to enumerators to collect information of total number of households in each village sampled with the purpose of updating the sampling frame for second stage and to select households in the village. This was used to design a final probability for selection household in a village and the final weights which used to estimate the population parameters.

II.5 Materials

Three instruments were used for primary data collection: a community survey administered to key informants, a household survey administered to randomly selected households and a mother and child questionnaire administered to women of reproductive age in the households.
The instruments were first developed in English and subsequently translated into Kinyarwanda. Tablets programmed with the questionnaires using the Open Data Kit (ODK) were used for the data collection.

Village questionnaire

For each visited village, key informants were gathered in a group and interviewed with a structured questionnaire. The participants normally consisted of village leaders, members of local government, teachers, health workers and farmers. In total, 749 village interviews were conducted. Topics covered included community infrastructure, market information, agricultural crop calendar, and shocks and received assistance. This information was used to contextualize the results from the household questionnaire.

Household questionnaire

The study gathered information through household questionnaires that included sections on demographics, housing and facilities, assets and access to credit, agriculture, livelihoods, expenditures, food consumption and sources, shocks, coping strategies and assistance.
In total, 7500 households participated in the survey.

Women and child questionnaire

A questionnaire was administered to women of reproductive age (15-49 years old) including questions regarding pregnancy, health, hygiene and food consumption. In total, 6768 women were interviewed.
Questions asked regarding children under 5 years covered the topics of breastfeeding, health and supplements. In addition, for children between 6 and 24 months a section on infant and young child feeding practices (IYCF) was included.

II.6 Policy implication

This study first of all is design in the purpose of obtaining award of the degree of Master of Science in Epidemiology from University of Rwanda and it will be used by different people such are: It can help the government to know, the sector where to allocate resources in mostly influencing the development of Child Nutrition Status in Rwanda.

It can help other researchers to understand the methodology used in Rwanda to compute the Comprehensive Food Security and Vulnerability Analysis and Nutrition Survey 2015.This can help in developing a community new intervention to address community risk factors for nutrition status On the other hand the decision makers are aware of the prevalence of MAD among 6-23 years' children. Lastly, the results from the study establish the baseline information that can be used for further researches.

II.7 Ethical consideration

The survey protocol was cleared by the National Ethics Committee, and a visa request was approved by the National Institute of Statistics for my side this study it's available and its public from NISR website.

III. RESULTS

III.1 Socio-demographic characteristics of participants

As it is indicated in Table 1, the results showed that majority of the participants (26.7%) reported that they have completed primary education. and 37.2% did not yet finish the primary school. For wealth index, those who reported to be the poorest households were 21.6% and the poorer households were 17.8%. For age of mothers, results showed that majority of mothers (69%) participated in the survey aged between 19 and 34 years. Concerning the type of place of residence, results showed that the higher proportion of participants (72.2%) were in the rural areas. According to the age of children in months, a high proportion of participants (34.4%) were ranged between 12-17 months. For the sex of the children, results showed that male sex was 50.9% nearly equal to female sex 49.1%.About diarrhea ,11% of children had diarrhea during the last two weeks.

Table 1 Socio-demographic characteristics of participants

		Count	Column N %
The level of education of the woman	**No school**	112	16.50
	Some/still primary	252	37.20
	Completed primary	181	26.70
	Vocational school	6	0.90
	Some/still secondary	59	8.70
	Completed secondary	43	6.30
	Some/still university	4	0.60
	Completed university	21	3.10
Wealth Index groups	**Poorest**	166	21.60
	Poor	137	17.80
	Medium	115	14.9
	Wealth	170	22.10
	Wealthies	182	23.60
Mother's age new	**<18**	3	0.40
	19-34	468	69.00
	35+	207	30.50
Urban status	**Urban**	214	27.80
	Rural	556	72.20
Child sex	**Male**	392	50.90
	Female	378	49.10
Child_age_Categ11	**6-8**	37	14.1
	9-11	50	19.10
	12-17	90	34.40
	18-23	85	32.40
The current main source of water	**Public tap/ piped water**	199	25.80
	Water tap at home	150	19.50

	Pond, lake, river or stream	138	17.90
	Borehole with pump	213	27.70
	Rain water	10	1.30
	Protected dug well or spring	4	0.50
	Unprotected well or spring	34	4.4
	Vendor	9	1.20
	Other	13	1.70
Province	**Kigali city**	226	29.4
	Southern	0	0.00
	Western	137	17.80
	Northern	0	0.00
	Eastern	407	52.90
Diarrhea during last two weeks	**No**	686	89.10
	Yes	84	10.90

III.2 Prevalence of MAD in the survey among 6-23 moths children

Table 2 indicates the prevalence of Minimum Acceptable Diet in the survey among 6-23 moths' children, the results showed that the reported prevalence of Minimum Acceptable diet with weighted cases is 15.2%.

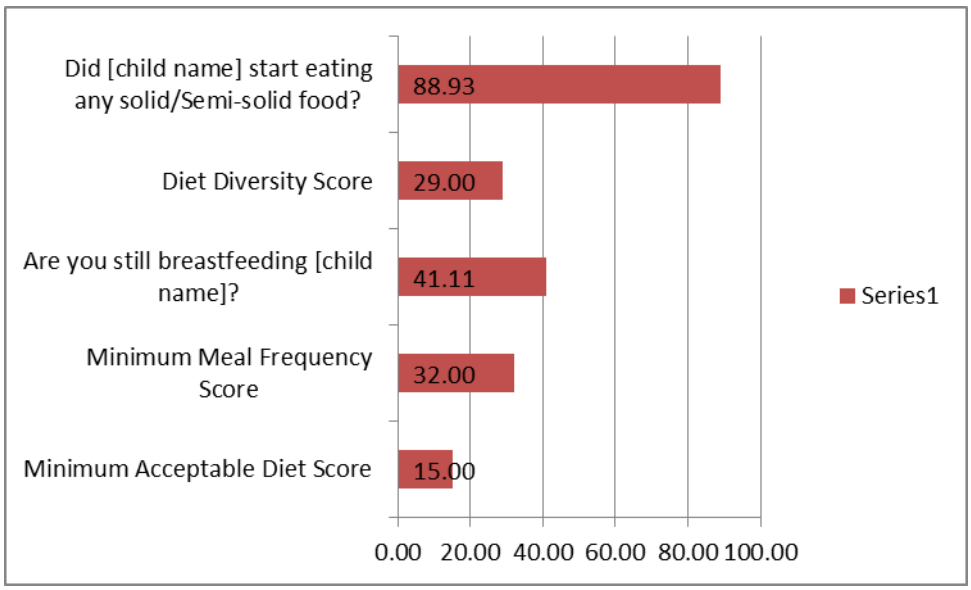
Table 2 Prevalence of MAD in the survey among 6-23 moths' children

Characteristics	Frequency	Percentage
Had the minimum acceptable diet		
Yes	190	15.2
No	1182	84.8

Complementary Feeding Indicators

Figure 3 shows the prevalence of the indicators in CFSVA 2015. It shows the 88.93% with children stated eating any solid/semi-solid food; the minimum dietary diversity has a prevalence of 29% for all children of 6-23 months. The minimum meal frequency rate is 32% for all children of 6-23 months and the Minimum Acceptable Diet could only be calculated for breastfed children and has a prevalence of 15% for all children between 6-23 months.

Figure 3 Complementary Feeding Indicators



Consumption of food groups by age of children

The consumption of food groups by children that did receive solid, semi-solid or soft foods is presented in Table 3. This table presents the types of foods given during the day preceding the interview for the different age groups. The age category 6-11 months is split into two categories of 6- 8 months and 9-11 months because of the introduction of complementary feeding at this stage and the difference between the diet of a 6-8 months old infant and a 9-11 months old infant. The results show that almost 8.3% of the group of the children with 6- 8 months received foods made from grains, roots, and tubers, including porridge and fortified baby food from grains.

The group of 6- 8 months represent only 5% of the children consumed vitamin-A rich fruits and vegetables, but 1.8% received other fruits and vegetables the previous day. 4.4% of the children consumed legumes and nuts and 1.2% consumed fresh food. Consumption of infant formula, milk other than breast milk, cheese, yogurt or other milk products was rather similar in all age groups. All foods were less consumed by children of 6-8 months, but consumption became

higher with increasing age. Dairy products were an exception, children of 12-17 months received a relatively larger proportion of dairy product (45.3%) compared to the other age groups.

Table 3 Consumption of food groups by age of children

		Child_age_Categ11			
	%	6-8	9-11	12-17	18-23
Grains, Roots, and Tubers	Lower CI	5.20	13.00	31.70	29.90
	Upper CI	12.60	23.10	44.60	42.70
	Total	8.30	17.60	38.00	36.10
Legumes and Nuts	Lower CI	2.00	12.30	29.30	34.10
	Upper CI	8.40	24.10	44.10	49.30
	Total	4.40	17.60	36.50	41.50
Dairy Products	Lower CI	5.00	7.20	33.50	19.60
	Upper CI	20.30	24.10	57.50	41.60
	Total	10.90	14.10	45.30	29.70
Flesh Foods	Lower CI	0.10	12.40	27.60	31.80
	Upper CI	5.30	29.10	47.70	52.40
	Total	1.20	19.80	37.20	41.90
Eggs	Lower CI	.	5.60	2.70	44.40
	Upper CI	.	42.10	34.40	86.90
	Total	0.00	18.80	12.50	68.80
Vitamin-A Rich Fruits and Vegetables	Lower CI	2.50	12.80	29.50	33.80
	Upper CI	9.00	24.00	43.50	48.10
	Total	5.00	17.90	36.30	40.80
Other Fruits and Vegetables	Lower CI	0.20	4.60	33.80	28.90
	Upper CI	8.00	20.80	59.40	54.10
	Total	1.80	10.70	46.40	41.10
Fortified Foods	Lower CI	0.70	16.30	17.70	29.90
	Upper CI	10.80	38.70	40.60	55.00
	Total	3.50	26.30	28.10	42.10

III.3 Bivariate analysis

Bivariate analysis on MAD and household characteristics

As summarized in Table 4, results show a list of the variables such as: he education level, wealth index of family 'age categories among 6-23 months, source of water, residence of participants (Provinces), and diarrhea in the last two weeks. The above variables were significant with MAD ($p<0.05$)

Table 4 Bivariate analysis on MAD and household characteristics

Minimum Acceptable Diet		Count	Column N %	P value
The level of education of the woman	No school	112	16.5	0.019
	Some/still primary	252	37.2	
	Completed primary	181	26.7	
	Vocational school	6	0.9	
	Some/still secondary	59	8.7	
	Completed secondary	43	6.3	
	Some/still university	4	0.6	
	Completed university	21	3.1	
Wealth Index groups	Poorest	166	21.6	0.000
	Poor	137	17.8	
	Medium	115	14.9	
	Wealth	170	22.1	
	Wealthies	182	23.6	
Mother's age new	<18	3	0.4	0.637
	19-34	468	69	
	35+	207	30.5	
Urban status	Urban	214	27.8	0.160
	Rural	556	72.2	
Child sex	Male	392	50.9	0.84
	Female	378	49.1	

Child_age_Categ11	**6-8**	37	14.1	0.001
	9-11	50	19.1	
	12-17	90	34.4	
	18-23	85	32.4	
The current main source of water	**Public tap/ piped water**	199	25.8	0.001
	Water tap at home	150	19.5	
	Pond, lake, river or stream	138	17.9	
	Borehole with pump	213	27.7	
	Rain water	10	1.3	
	Protected dug well or spring	4	0.5	
	Unprotected well or spring	34	4.4	
	Vendor	9	1.2	
	Other	13	1.7	
Province	**Kigali city**	226	29.4	0.003
	Southern	0	0	
	Western	137	17.8	
	Northern	0	0	
	Eastern	407	52.9	
Diarrhea during last two weeks	**No**	686	89.1	0.012
	Yes	84	10.9	

III.4 Multivariate analysis

Factor Associated with Minimum Acceptable Diet

Variables considered in the bivariate analysis were considered in the full and the reduced models. Concerning education, children whose mothers were some primary education levels means without complete the primary level found to be 3 times more likely for not having the minimum acceptable diet (OR=2.605; CI=2.134-3.74; p<0.009) than whose mothers were secondary and above educated.

With regard to old wealth index, the poor household category was two times risk for not having the minimum acceptable diet to their children (OR=2.43; CI=1.068-2.954; p<0.004) compared to the richest families.

The researcher found that some factors are significantly associated with MAD. According to the Age categories among 6-23 months old, results showed that a child who was in range of 6-8 and 9-11 months old are more likely for not having the minimum acceptable diet (OR=2.61; CI= 1.156-2.876; p<0.001) compare to those other 2 highest age categories.

Those children whose staying in western province were 1.607 times more likely for not having the minimum acceptable diet (OR=1.607; CI=1.03-2.13; p<0.004) than children from other provinces.

With regard to those children that having the illness of diarrhea during the last two weeks was two times risk for not having the minimum acceptable diet (OR=1.537; CI=1.187-1.990; p<0.001) compared to those having not the illness of diarrhea during the last two weeks.

Table 5 multivariate analysis on MAD and household characteristics

		Full model		Reduced model	
		OR (CI at 95%)	p-value	OR (CI at 95%)	p-value
Education of Mother	No school	1		1	
	Some primary	1.3(0.85-1.16)	0.07	2.605 (2.134-3.742)	0.009
	Completed primary and or vocational training	0.67(0.44-1.19)	0.65	0.77 (0.241-2.465)	0.031
	Some secondary and above	1.09(0.82-1.61)	0.96	1.226 (0.461-3.262)	0.085
Wealth Index groups	Poorest	1		1	
	Poor	0.61(0.74-2.51)	0.45	2.431 (1.068-2.954)	0.004
	Medium	1.09(0.82-1.61)	0.32	1.319 (0.307-5.66)	0.101
	Wealth	1.15(0.07-3.09)	0.07	0.977 (0.232-4.119)	0.37
	Wealthies	1.15(0.08-4.61)	0.01	2.087 (0.772-5.646)	-
Child age	6-8	1		1	
	9-11	5.18(0.62-9.65)	0.01	0.088 (0.015-0.505)	0.006
	12-17	6.32 (1.18-26.20)	0.01	0.671 (0.257-1.752)	0.458
	18-23			0.334 (0.133-0.843)	0.067
The current main source of water	Pond, lake, river or stream	1		1	
	Public tap/ piped water				
	Water tap at home	1.14(0.11-3.77)	0.07	0.518 (0.027-9.911)	0.109
	Borehole with pump	1.69(1.01-2.13)	0.16	0.184 (0.006--5.345)	0.004
	Rain water	1.3(0.85-1.16)	0.03	0.856 (0.041-17.684)	0.683
	Protected dug well or spring	1.7(4.247-7.174)	0.04	0.923 (0.016-52.24)	0.925
	Unprotected well or spring	0.29(0.71-1.19)	0.31	0	0.583
	Vendor	0.16(0.71-1.65)	0.74	1.568 (0.049-50.513)	0.725
	Other	9.18(0.62-9.65)	0.17	55.0 (0.799-3790.86)	0.002
Region	Western	1		1	0.002
	Southern	1.49(0.26-6.82)	0.91	0.929	0.008
	Kigali city	1.03(1.72-4.01)	0.9	1.607 (1.038-2.133)	0.004
Diarrhea during last two weeks	No	1		1	
	Yes	0.53(0.37-0.98)	0.55	1.53 (1.187-1.99)	0.001
	Constant	1		1.376	0

IV.DISCUSSION

4.1 Introduction

Results from this study revealed that minimum acceptable diet among 6-23 month old children were associated with some independent socio and demographic factors. Low minimum acceptable diet is prevalent worldwide although high prevalence is in the developing countries due to their low socio-economic status, and poor living conditions such as mothers low education, family poverty, poor sanitation, unsafe water [12]. This study is done to access the factors associated with low minimum acceptable diet among 6-23 months old children in Rwanda, the probable environmental health factors behind the low minimum acceptable prevalence rates observed. This is unique due to the behavior pattern; knowledge and source of basic needs such as food and other nutrient needs all affect the infection status of the study participants.

This analysis of the CSFVA survey 2015 indicates that most of the complementary feeding practices were inappropriate for children of 6-23 months in Rwanda. The minimum dietary diversity (MDD) present a percentage of 29.0%, the minimum meal frequency (MMF) was reached by 32% of the children and the minimal acceptable diet (MAD) by 15%, which means that more four in five children of 6-23 months don't consumed an acceptable diet as recommended by the WHO (WHO 2003).

4.2 Demographic and socio-economic characteristics

The results of this study showed that most of the respondents were young married women of primary level of education. Most of the families are in age of youth 19-34 years old. The majority of mothers in Rwanda could be classified as of low socio-economic backgrounds. The socio- economic backgrounds are based on the highest level of education attained before incarceration and economic status activities.

4.3 Prevalence of MAD in the survey among 6-23 moths' children

The study reveals that prevalence of MAD in Rwanda is 15.2% the same as the prevalence reported in the 2014-2015, Rwanda, Demographic and Health Survey the similar result was found in Rwanda demographic survey or INWA survey done by USAID Gikuriro Program. For more details, this studies have the intention of helping the government of Rwanda to get some result related to MAD without waiting the RDHS which takes along of 5 years.

More than half of the breastfed children 6-23 months old having met the WHO recommended minimum dietary diversity, however consumption of iron rich foods and fruits was very low thus exposing the children to the risk of micro- nutrient deficiencies that take long to manifest.

4.4 (Multivariate analysis) MAD and household characteristics

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The study revealed that about 15.2% of children received minimum acceptable diet. This result is lower than findings of studies conducted in Gikuriro program as the current figures in Rwanda which was 22%, for sure there is a difference in data collection period and the above studies and this include a real meaning of that difference.

Finding of this study is not compatible with other results from Africa, i.e.,7.3 and 7% obtained from studies conducted in Nigeria and Ethiopian Demographic and health survey respectively [13,14]. The study showed that minimum acceptable diet among 6-23 month old children showed no statistically significant difference between male and female children $p<0.84$. This means that sex was not influential in the prevalence of minimum acceptable diet changes among 6-23 children in Rwanda. Variables considered in the bivariate analysis were considered in the full and the reduced models.

Concerning education, children whose mothers were some primary education, children whose mothers were some primary education levels means without complete the primary level found to be 3 times more likely for not having the minimum acceptable diet (OR=2.605; CI=2.134-3.74; p<0.009) than whose mothers were secondary and above educated. Some indicators were not including in questionnaire that's why we were not able to analyze and take more independent variables. The last special thinks but kwon by different surveys through stunting as indicator is that The children from Those families whose staying in western province were 1.607 times more likely for not having the minimum acceptable diet (OR=1.607; CI=1.03-2.13; p<0.004) than children from other provinces.

As the wealth index its some think that could be the measurement of livelihood, even in this study the poorer family or household category was two times risk for not having the minimum acceptable diet to their child (OR=2.43; CI=1.068-2.954; p<0.004) compared to the richest families.

CONCLUSION AND RECOMMENDATIONS

From our result the minimum Acceptable dietary rate of 15% might be not satisfied level of the estimation from the Rwandan population where less than one in five children they don't consume the minimum acceptable diet, Also, there is no big difference from different age groups and the consumed food groups only that the trend is there, where the group of 6-11 is less likely to consume at least four groups compare to the other age groups.

While the Ministry of Health since 2012 has a policy that that every household in the country should have kitchen garden ("Akarima k' igikoni")[15] to fight malnutrition. Efforts are needed to educate motivate and support mothers or caregivers to adapt optimal complimentary feeding practices.

Further in-depth research is needed on dietary quantity and quality to be able to understand specific nutrient gaps in the diet of these children. Additionally, it is important to keep in mind that child growth is determined by multiple factors.

It is firstly recommended that the capacity of CHWs be increase in order to measure children's height or length through the provision of height and boards for growth monitoring and promotion. Secondarily, the distribution of MNPs should be initiated and the number of children receiving Vitamin A supplement increased. Thirdly, to ensure long-term adequate food intake, improved agriculture production coupled with effective nutrition education for mothers deserve a special attention for improving child feeding practices. Recurrent diarrhea and inappropriate feeding practice are likely to limit effective use of nutrients by the child's body. As this is three years' survey, the WFP cloud insert some variable such as, Unemployment, non-marital status of the mother, inadequate antenatal clinic visits, lack of post-natal care visits, infant delivered at home, in their questionnaire to help Rwanda for some related decision.

Therefore, improved hygiene and use of clean water must be supported in these communities. Early diagnosis and appropriate treatment can be improved through health services seeking behavior change. For this to happen, community health insurance scheme need to be boosted to achieve universal coverage. Husbands or partners need to be informed about the special health needs of mothers and children so that they can provide needed support.

To conduct study with strong study design in wide area to determine minimum acceptable diet and factor associated with minimum acceptable diet practice will give better evidences.

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