University of Rwanda

College of medicine and health sciences

School of Public Health

Master's Program in Public Health

Dissertation report:

Factors contributing to Infant and Young Child Feeding (IYCF) practice among children of 6 to 23 months of age; Secondary data analysis of Rwanda, DHS 2014 - 2015.

Dissertation presented to University of Rwanda / CMHS/SPH towards the partial fulfilment of the requirements for the degree of Master of Science in Public Health.

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Kigali, October 2019

ABSTRACT

Nutrition of infant and young child is a Public Health issue in Rwanda. The sufficient quantity and quality of foods is recommended for better growth and development of child. Dietary diversity is a key element for quality diet. Inappropriate feeding practice of infant and young child has negative impact on child health. Among the consequences, under nutrition and increase of susceptibility to infectious diseases are most frequent. The study aimed to identify factors associated with Minimum Accepted Diet (MAD) was performed to the data from mothers and care givers of children aged 6 to 23 months during the fifth Demographic and Health Survey conducted in Rwanda in 2014 - 2015. Total number of study population was 1171. The results were obtained by processing data with STATA Version 13.0. Descriptive analysis was done and presented in proportion. For logistic model, an Odd Ratio (OR) with 95% of Confidence Interval (CI), p. value less than 0.05 were used. The prevalence of MAD was 23.74%. Children of 18 - 23 months were 2,46 times more likely to have MAD (OR = 2,46; CI at 95 % = 1.71 - 3.54; p. value = 0.001) compared to those age of 6 - 11 months. Children from Northern Province were 2,89 times more likely to have MAD (OR = 2,89; CI at 95 % = 1,77 - 4,71; p. value = 0.001) compared to those from Western Province. Children whose mothers had higher education level were 3.12 more likely to have MAD (OR = 3,12; CI at 95% = 1.17 - 8.46; p. value = 0.023) compared to those to children whose mothers were no education. Children from richest family were 4,10 more likely to have MAD (OR = 4,10, CI at 95% = 2.39 - 7.05; p. value = 0.001) compared to those from poorest wealth index.

The consumption of variety foods with recommended times per day increases the chances of growth and development in greater harmony and reduce the risk of malnutrition. Optimum feeding with MAD is important and more effort must be invested to introduction of complementary feeding, promotion of education and development program to assist poorest, for development of family in order to achieve sustainable and optimum feeding for all children of 6 to 23 months in Rwanda.

Key words: malnutrition; complementary feeding, minimum acceptable diet.

Resumé

La nutrition des nourrissons et des jeunes enfants est un problème de santé publique au Rwanda. La quantité et la qualité suffisante des aliments sont recommandées pour une meilleure croissance et le développement de l'enfant. La diversité alimentaire est un élément clé d'un régime alimentaire de qualité. Une pratique alimentaire inappropriée chez le nourrisson et le jeune enfant a un impact négatif sur la santé de l'enfant. Parmi les conséquences, la sous-alimentation et l'augmentation de la vulnérabilité aux maladies infectieuses sont les plus fréquentes. L'étude visait à identifier les facteurs associés au régime minimal accepté (MAD) a été réalisée à partir des données des mères et des personnes en charge d'enfants âgés de 6 à 23 mois lors de la cinquième enquête démographique et de santé menée au Rwanda en 2014 - 2015. La population d'étude était de 1171. Les résultats ont été obtenus en traitant des données avec STATA version 13.0. Une analyse descriptive a été réalisée et présentée en proportion. Pour le modèle logistique, un rapport impair (OR) avec un intervalle de confiance (IC) de 95%, p. valeur inférieure à 0,05 ont été utilisés. La prévalence de MAD était de 23,74%. Les enfants de 18 à 23 mois étaient 2,46 fois plus susceptibles de souffrir de MAD (OR = 2,46; IC à 95% = 1,71 à 3,54; valeur p = 0,001) par rapport à ceux âgés de 6 à 11 mois. Les enfants de la Province du Nord étaient 2,89 fois plus susceptibles de souffrir de MAD (OR = 2,89; IC à 95% = 1,77 - 4,71; valeur p = 0,001) par rapport à ceux de la Province de l'Ouest. Les enfants dont les mères avaient un niveau d'éducation supérieur étaient 3,12 plus susceptibles d'avoir recu MAD (OR = 3,12; IC à 95% = 1,17 - 8,46; valeur de p = 0,023) par rapport aux enfants dont les mères n'étaient pas scolarisées. Les enfants des familles les plus riches avaient 4,10% plus de chances d'avoir MAD (OR = 4,10, IC à 95% = 2,39 - 7,05; valeur p = 0,001) par rapport à ceux de l'indice de richesse le plus pauvre.

La consommation d'aliments variés aux heures recommandées par jour augmente les chances de croissance et de développement de manière plus harmonieuse et réduit les risques de malnutrition. L'alimentation optimale est importante et il faut déployer plus d'efforts pour introduire l'alimentation complémentaire à temps, la promotion de l'éducation et les programmes de développement pour aider les plus pauvres, pour le développement de la famille afin de parvenir à une alimentation durable et optimale pour tous les enfants de 6 à 23 mois au Rwanda. .

Mots-clés: malnutrition; alimentation complémentaire, régime alimentaire minimum acceptable.

DEDICATION

The research project is dedicated to the family members especially my wife MUSABYEYEZU Francoise, children: ISHIMWE Merry Assumpta and GANZA NIYITANGA Louis Bertrand for their support during my study.

ACKNOWLEDGEMENT

I address my thanks to the Government of Rwanda which through the Ministry of Education continue the development of programs to build capacity and enable the researcher to discover new knowledge as response to Rwandan population health problems.

I address my thanks to the team of supervisors Dr RWABUFIGIRI NGABO Bernard and Professor MUNYANSHONGORE Cyprien for their hard working, availability from the beginning to the end of this research project.

I remember all friends, families, classmates and Board of Ruli District Hospital who support moral and material my initiative to study in Public Health till the of end this research project.

I address my appreciations to the University of Rwanda administration and all staff especially the lecturers of Masters in Public Health for their logical and academic support for evening program.

God bless you!

ABBREVIATIONS AND ACRONYMS

ANC: Antenatal care

AOR: Adjusted Odd Ratio

C I: Confidence Interval

CAADP: Comprehensive Africa Agriculture Development Program

DALYs: Disability Adjusted Life Years

EDPRS: economic development and poverty reduction strategies

IYCF: Infant and Young Child Feeding

MAD: Minimum Accepted Diet

MDD: Minimum Diet Diversity

MMF: Minimum Meal Frequency

MND: Micronutrients Deficiencies

MOH: Ministry of Health

NISR: National Institute of Statistics of Rwanda

RDHS: Rwanda Demographic and Health Survey

SDGs: Sustainable Development Goals

SUN: Scaling Up Nutrition

UNICEF: United Nations Children Fund

VUP: The Vision 2020 Umurenge Programme

WHO: World Health Organization

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CHAPTER 1: INTRODUCTION

1.1. Definition of the concepts

Malnutrition is a manifestation of inadequate foods intake in term of deficiency , imbalance or excess either for one as for more nutrients (1).

Complementary food is define as foods given child to increase nutrients intake from breastmilk or its substitutes to ensure growth, health and development based on needs in term of calories , proteins , carbohydrates , vitamins and minerals (2).

The minimum acceptable diet is an indicators for assessing the compliance of mothers or care givers to adequate feeding of children per day considering the foods groups and meals frequency appropriate for age (3).

1.2. Back ground

Feeding practice of infants and young children is a public health issue especially for vulnerable people from most of developing countries (5). The nutrition of children depend on family ability to avail required nutrients at specific stage of development but few children don't meet the criteria of minimum acceptable diet appropriate to their age (6). The quality of food is based on variety and frequency of meal per day. The inappropriate feeding practices of infant and child at 6 to 23 months of age have many consequences on health status of child. Under nutrition is seeing to be a result of socio-economic, physiological determinants and psycho- social and behavior. The optimum feeding of child improves health, growth and development. The mother has limit to apply better nutrition (8). The inadequate foods quality and frequency is responsible of all forms of malnutrition. The increases of infectious diseases and delay of child development are consequences (9).

1.3. Problem statement

Worldwide, food insufficient in quantity and quality is responsible of 800 million of hunger and more than 2 billion suffer from micronutrient deficiency globally in 2013 (10). The 149 million of children under five are stunted in 2018 (1). The period of 1000 first days was identified as an opportunity window to build good health of children. The period of 6 to 23 months is very critical because of shift to ordinary food of children who breastfeed until birth (9).The preparation of foods require serious measures of hand hygiene to avoid food contamination (11) This period is characterized by the increases of foods intake and many children under two years of age fail to satisfy the needs (12).

In 2018, the number of children with malnutrition reduce but the burden remains a barrier for developing countries. The nutrition problem due to food insecurity is frequent in Africa and south Asia (12). The fulfillment of MAD for children and young infant age of 6 to 23 months is less than 25 %. In West Africa region, the prevalence of MAD was between 11% and 29% (2). Lack of adequate complementary foods increase the risk of undernutrition. The 45% of children death are associated to insufficient foods in term of quantity, quality and frequency. Among them 2/3 are associated with feeding practice of under two years children (3). The one over 3 cases of death due to undernutrition can be prevented if adequate feeding is apply to all children (9). The adequate intake of food for children is very important as it provides energy, promotes growth and maintains life of infant and young children. The mothers or care givers feed children not appropriate diet which lack essential nutrients. The inadequate feeding practice is associated with social beliefs and culture even the children from educated and high wealth index of family(14). The World Health Organization (WHO) set strategies need to increase awareness for infants and children feeding practice (15). Better nutrition improve child health and reduce the risk of illness death at early childhood (16). But the introduction of soft foods to breast milk cover the nutritional needs and accelerate growth of child (17).

Foods variety for children is important to meet nutrients intake but the solution for improving nutrition is on the hand of parents who live with child. The diet for developing countries are based on available resources of agriculture which dependent on season (3).The culture and poor counselling on IYCF practice during the prenatal and post-natal care are main factors of inadequate breast feeding and thereafter low diet diversity (14).

The mothers begin mixed feeding at different age , the prevalence of children who initiated for complementary feeding is only 60 percent for infant aged of 6 to 9 months (17). The reasons of malpractice of infant and young feeding are grouped into education background of the parents , foods insecurity at household or in certain regions, routine in agriculture process where the famers focus mainly on tubers , roots and cereals (18). The background characteristics of the mothers, feeding behavior , the culture and socio economic classes are also identified as barrier to optimum feeding practice of mothers / caregivers to children at early stage of live (14).

In Africa, the burden of stunting has an explanation to low compliance to optimum feeding practice less than 30% for children of 6 to 23 months (9). A study conducted in Benin demonstrated that the complementary feeding was a problem in Nigeria, Ghana and Benin. The prevalence of meeting MAD was estimated to 11%, 29.9% and 15% in Nigeria, Ghana and Benin (2).The funding of the study conducted in Ethiopia demonstrate the relationship of malnutrition and feeding practice. The prevalence of MAD of 27. 3 % in 2015 is linked to foods habits at household level, involvement of mother in decision making, birth order, education level and wealth index of household (9). Culture, food insecurity, foods habits , climate issue affect the nutrition of children are also mentioned to be associate with suboptimum feeding of children (19).

In Rwanda , under nutrition remains a health problem among children (20). According to DSH 2019, the prevalence of stunting was 38% (21). The inadequate food preparation of foods to children is identified as cause of undernutrition to children as poverty and food insecurity to household (22). A study conducted to analyze the factors related to stunting issue in Musanze district demonstrated an association of stunting and receiving acceptable food (23). For food variety, only 18 % of children received acceptable foods. This situation is worst in rural than urban area (21).The Government of Rwanda has initiated different interventions to eradicate all forms of malnutrition and hunger (22). Adequate use of foods rich to micronutrients and blended fortified food are among the strategies set by the Government of Rwanda to insure child health (20). Better nutrition of children has great impact when it is initiated at early stage of their development (24).

In Rwanda, the nutrition of children under five is a big health problem. The stunting is a burden for under five children with in 2014 (20).

1.4. Significance of the study

Apply IYCF as elaborated by UNICEF in collaboration with WHO should reduce undernutrition issue in Rwanda. The data gotten for this study helped to identify the factors contributing to inadequate optimum feeding of children. Identified success factors to meet MAD should orient decision making of specific group at high risk and allow adaption of new policy formulation, new guidelines, new protocol and new strategic plan. Then the identified gaps will be analysed and orient health intervention to improve child nutrition. The study will provide useful information to Public Health researchers on specific aspect of Nutrition to children.

1.5. Research question

The children meeting the Minimum Accepted Diet were 18.1 % (21). Reasons for such a situation are not documented. Thus, the research question of this study is as follow: what are the factors associated with low MAD in Rwanda?

1.6. Study objective

1.6.1. General objective

The principal objective of this study is to identify the factors contributing to IYCF practice among children 6 to 23 months of age based on analysis of RDHS 2014 - 2015.

1.6.2. Specific objectives

1. To calculate the prevalence of minimum acceptable diet for the infants and young children of 6 to 23 months of age in Rwanda.
2. To identify contributing factors to Minimum Acceptable Diet in Rwanda.

1.7. Literature review on IYCF

Good practice of breastfeeding and complementary feeding is a key for children growth, development and health. Nutrition is fundamental right of child until his existence according to Geneva Convention of right the child (25). The practice of appropriate infant and child feeding at recommended age (6 – 9 months) give a greater role to child health (26). The complementary

feeding begins to satisfy nutrition requirement of infant (7). If adequate complementary feeding is not done the risk of under nutrition increase for this particular age group. Introduction of liquid and solid foods procure to child the complement of what the breast feeding is not covers in term of energy, protein, mineral and vitamins (14). A period of 18 months is opportunity window for moths and children care givers to fight against under nutrition and its consequences but many children don't receive adequate and safe complementary(25). The malpractice of complementary feeding is responsible of malnutrition of all forms and the consequences lead to high morbidity, mortality, repetitive infectious diseases and later metabolic disorders like hypertension, diabetes and cardiovascular diseases (2).

The breast milk ensure optimum growth, development and health(27). The contribution of breast milk to satisfy child needs vary with age for example 50 % of energy is from breast milk to child of 6 up to 12 months; 30 percent for 12 to 24 months of age. The early wearing leads to growth faltering , low immunity and risk of death (6).

1.7.1. Introduction of complementary foods

Infant and children feeding is a particular area to consider in promotion of health growth and development of child (8). Malpractice of complementary feeding is due to early or late of beginning, inadequacy of foods in terms of quantity and quality and safety in administrating the food to children and the results are malnutrition, repetitive illness and impairment development (28).

The needs of energy and nutrients increase with time and at 6 months of age the needs exceed the nutrients provided to breast milk and the body is ready for metabolism of others foods. The period is real time to introduce the complementary feeding using local foods and family foods habits (29). The beginning of complementary feeding must be accompanied by continuous breast feeding for growth and psychology development of children (17). To be more effective the mother should start by foods and thereafter give the breastmilk. The role of mother caregiver is important in prevention of infectious diseases spread from unsafe hand to month. The practice of hand washing at critical time have greater impact on nutrition status of child (17). The indicators of complementary feeding as set by WHO are classified into to the following categories :

introduction of solid foods, introduction of semi and soft foods, practice of adequate feeding with foods variety and frequency of meal per day according to age of children (14).

Principles of hygiene and diseases prevention for children in IYCF practice

Counselling of mothers and caregivers of children on hygiene is a key for prevention of infectious diseases like diarrhea, pneumonia. The exercise of good hand washing with clean water and soap are recommended at all time but the following conditions are required wash hands for reducing foods contamination: before preparing foods and feeding child, after using the toilet or clean children, after child hygiene. Keeping clean the cups and utensils which can be easy be contaminated and store foods in secure , safe and clean environment (8).

Importance of optimum feeding practice to children

The practice of optimum feeding of children at early age has the greater impact to influence future health. The different strategies and interventions set by the government of Rwanda to increase awareness of people to infant and young child feeding practice lead to reduction of under-five mortality from 76 to 50 deaths per 1000 childbirths between 2010 and 2015 (21).

The practice of exclusive breastfeeding of a child up to 6 months, introduction of complementary feeding has positive impact on children health by preventing diseases and supply nutrients needs for under five children (25). The profits of breastmilk to children were proved for immune and defense system to fight repetitive diseases like diarrhea and respiratory infection which are frequent to children (27).

Impact of good practice of IYCF for growth

Adequate foods intake for the first two years of life has impact on child health. The nutrition needs for rapid growth. This period identified as critical window of opportunity of strategies aimed to prevent growth faltering. The optimum feeding at this specific reduce vulnerability to undernutrition problem as manifested by stunting, underweight and wasting. The acute malnutrition is usually predominant to 6 up to 23 months of age (14).

The window opportunity for preventing undernutrition is matching with period of exclusive breastfeeding, continuous breastfeeding and complementally feeding. But the non-compliance

with optimum feeding is responsible of restrict growth, child development and nutrition problem and their consequences at adulthood (14).

Feeding practice and child development

The period of infancy is characterized by a rapid development (8). Only breastmilk can't respond to nutrients needs (30). The lack of knowledge of foods composition and the frequency to feed a child increase the risk of malnutrition to children(8). Better feeding practice increases affection of mother to children and provides emotional development of child (31). The intelligence test is of higher performance for children who live with the parents (32).

Later benefits of IYCF practice to child

The optimum feeding protects the consequences at adult age to the child undernutrition and overnutrition. the breastfeeding reduces to children the risk of developing the chronic illness like diabetes, heart diseases and cancers comparing to the children who receive other milk and infants formula (16). The burden of undernutrition has negative economic at household (family) level if MAD is provided to child , the result is growth of incomes (33). The benefit of optimum feeding increases access to health care for the family, the out of package for health care is used for promotion activities like health insurance, child education, cost of needs foods for children and all family members. Prevention and reduction of child malnutrition and its consequences increase women capacity of working and human capital development (34).

Updated IYCF indicators

Feeding practice children is classified into two categories: essential and optional indicators

The essential indicators for apply IYCF

The indicators encourage exclusive breastfeeding direct after birth, not more than one hour. The breast feed at 1 up to 2 years continue to help in child development. Start of complementary food with family habits at 6 months; insist on foods variety for each diet; respect of meal frequency per day according to age group of children and prevent anemia by adequate supplement of iron rich food.

Optional condition for better feeding

1. Breast milk is always the first preferable food
2. A child can continue breastfeeding up to 2 years
3. The six first months is for exclusive breastfeeding only, except medical prescription.
4. No bottle to feed children, unless use cup or spoon
5. The preparation of milk to non-breast child requires high quality of hygiene and quantity.

1.7.2. Guidance for child feeding

It is encouraged to continue breast milk till two 24 months.

Family members must adopt positive feeding of children to encourage child to eat without forcing, just put the child into favorable condition and stimulate appetite.

The principle of hygiene for prevention of diseases, proper foods handling and conservation.

The quantity of foods to serve a child increases in quantity with the age of child.

Consider age of child in foods preparation: the varieties and consistency of food.

The meals frequency increase with age of child: the child of 6 to 8 months receives 2 meals per day but the child of 9 to 23 should eat at least 3 time a day.

Provision of Vitamins and Minerals through supplementation and fortified foods increase nutrients intake for breastfeeding and non-breastfeeding children (35).

Foods groups and their purpose in IYCF practice

	Food group	Purpose
1	Root (cassava, potatoes ...) Grains (rice beans, peas,) and tubers	Sources of energies
2	Nuts and legumes, example of groundnuts	Growth, tissue reparation
3	Milk and their products like cheese and yogurt	Growth and bone development
4	Animal foods	Help in growth and development,
5	Eggs	Help child to growth
6	Sources of vitamins A pineapple, avocado, papaya, passion fruit, orange	Prevent blindness and reduce risk of infection
7	Other fruits and vegetables	Sources of micronutrients prevention of infectious diseases
8	Fortified foods: FBF, Ongera, Shisha Kibondo	Enhance the nutritive value of manufactured food

1.7.3. Minimum Acceptable Diet (MAD).

It is an indicator which combine the meal frequency and foods diversity to assess effectiveness of children feeding the last day. The 3 conditions are analyzed to determine the prevalence: breastfeeding status, meal frequency and types of food for each meal that a child consume the previous day of survey.

Importance of determining Minimum Acceptable Diet to population

The MAD is developed to serve as tool of nutrition to population level. It assesses feeding mother practice to their children. It gives a comparison and trends of IYCF over time within the community. It is used during the health survey to identify population at risk, determine the effectiveness of the implemented feeding interventions and support decision making process. The numerator and denominator take into consideration the age range (3).

1.8. Concept Framework for feeding practice of mothers to the children

1.8.1. Immediate determinants of infant and young child feeding (IYCF).

Adequate food intake in term of quality and quantity determine the health status of child. The practice of mothers on complementary feeding depend on food habit and their availability. Not all children have access to regular consumption flesh foods , fruit and vegetables which are rich in minerals and vitamins (36). The relationship between nutritional deficit and diseases is cyclical; nutritional deficiency can make an individual more susceptible to disease, while disease contributes to nutritional deficiency.

1.8.2. Underlying determinants of infants and young child feeding practice

Food security at household level and MAD

The underlying determinants of IYCF are dominated by access to foods security. To survive if there is a problem of foods at community level, the families try to use local foods. The lack of sufficient food in quality as well as in quantity force mother to reduce meal frequency or prepare poor diet for children. The condition affects the family with more children and for poorest wealth index. In Rwanda the production of foods and processing is improving over time. The 71% population of Rwanda are farmers but draught due to climate change affect the production in some region. The fruits and vegetables are avail. The farmers sell their product in exchange of money but the use of money may be a problem if there is family conflict. Empower women in all sector especially education and involvement to decision making are implementing by government to sustain production and development of country (24).

Care of women and children as promotion of IYCF practice

Care of child and woman is a factor of meeting the MAD because the role of woman in household, the children receive adequate food if the mother is participating to decision either at family level as well as in administration according to their expertise. Care of children is not limited to foods but also to social environment and health system. The services to improve health and wellbeing of have been highlight in the law and regulation of Rwanda. In education the percentage of girls attending school increase to all level but the gap remains in rural than in urban while 48% of women using modern contraceptive method according to DHS 2014. Birth interval

is also other determinant of child and mother health particularly for nutrition status, Rwanda has 56% of mother giving a birth after 3 years of interval.

1.8.3. The basic determinants of IYCF

The basic determinants of infants and young children feeding practice at national and international level is leading by Rwanda political commitment to improve nutrition status of all children. The nutrition policy for infants and children is elaborated. The program to reduce poverty among the vulnerable people according to UBUDEHE categories and Vision 2020 Umurenge Program (VUP). The screening and management of children malnutrition are decentralized at village level and the community health workers are trained for pregnant and children health. The government in collaboration with World Bank, Global Fund and others partners set the strategies to fight malnutrition, especially stunting within 13 exposed districts of Rwanda. Multi sectorial activities aim to poverty reduction has been implemented to combat nutritional problems like malnutrition and micronutrient deficiency (24). The government of Rwanda have made efforts through; Scaling up Nutrition (SUN), Multiple Sectorial Strategies and being part of the Comprehensive Africa Agriculture Development Program of 2007 (CAADP), which Rwanda's Feed the Future Multi-Year Strategy rest upon, to limit stunting rate.

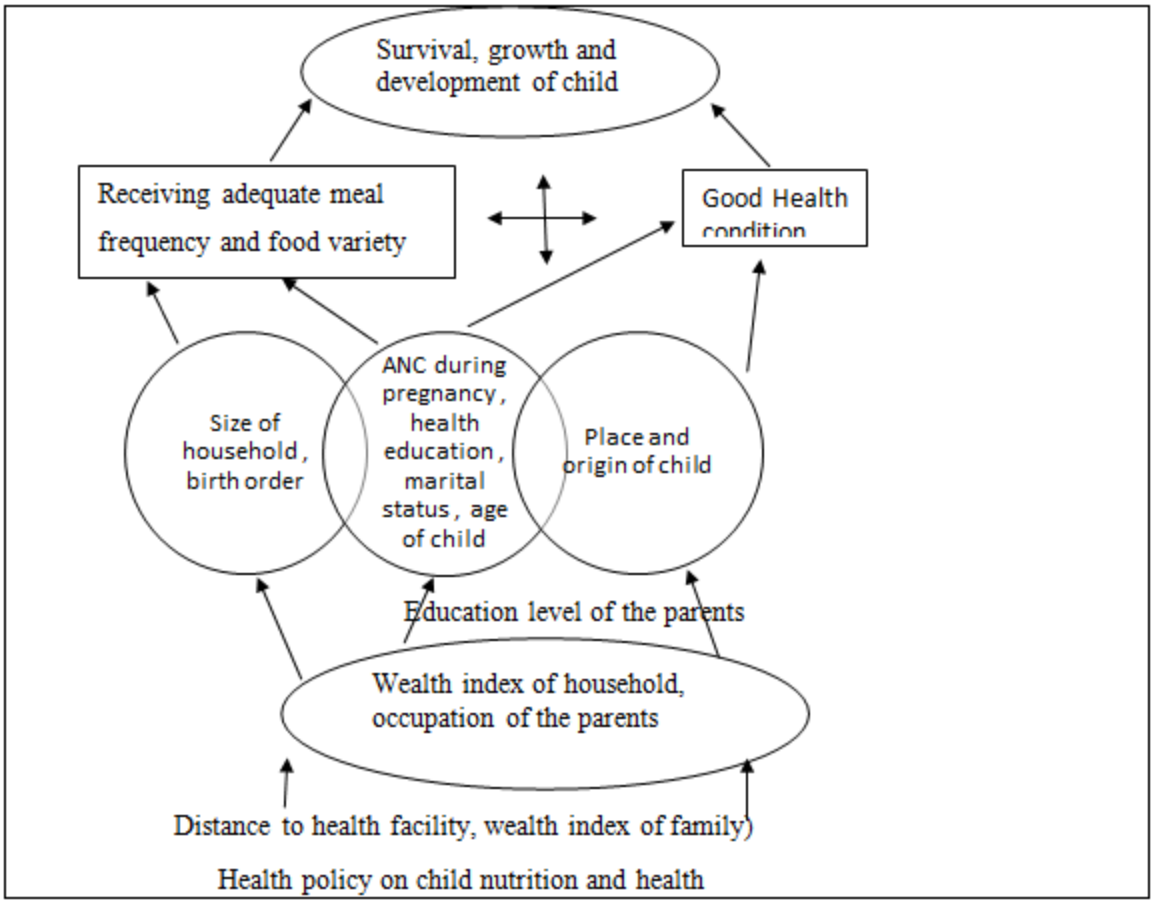

Figure 1: *Adapted concept framework of UNICEF on infants and children feeding practice*

Chapter 2: Methods and materials

2.1. Study area description

Rwanda is a country of central Africa of surface estimated to 23,338 km2. The country shares the borders with Uganda in North, Tanzania to the Eastern, Burundi on South and DRC on the Western. The population of Rwanda growth rapidly at 2.6% and the density was estimated to be 416 people by km2. The people under 15 years of age were 43% of all population according to National Institute of Statistics (NISR) in 2014. The population is estimated to 12 million. The proportion of women account for about 52.6 % of the population. Most of Rwandan populations live in rural according to DHS 2014 at 84% and practice farming at 71%. The most productive crops are potatoes, sweet potatoes, cassava, maize and beans.

2.2. Study design

The study to identify factors associated with IYCF practice among children of 6 to 23 months of age is analytical and cross section study design of RDHS 2014 – 2015.

2.3. Specific objectives achievement

Calculate the prevalence of the Minimum Acceptable Diet for infant and young child 6 to 23 months in Rwanda: the objective was achieved by tabulating a new variable "MDD, MMF and then MAD". For calculating MDD, the foods are categorized into 8 foods groups if the children are breastfeeding: Grains, roots and tubers; Legumes and nuts; milk ; animal foods; Eggs; Vitamin-A rich fruits and vegetables; other fruits and vegetables; Fortified foods, the children who consume at least 4 foods groups are considering to have minimum dietary diversity. The principles are the same for non-breastfeeding but without considering dairy products, so MDD are calculated based on 7 groups of foods that children consume last day. The children of 6 to 23 months are categorized into 2 group named breastfed and not breastfed. Breastfeeding children of 6 to 8 months of age the frequency of meal necessary is 2 times a day while the breastfeeding children of 9 to 23 months of age, the meal frequency is 3 times. Exception is for non-breastfeeding, without considering age of children 4 times are necessary to fulfill the condition of meal frequency per day. The prevalence of infant and children who meet minimum acceptable diet is calculated using the formula of total number of children who ate minimum diet diversity

and minimum meal frequency for last 24 hours of survey. The denominator was a total number of infants and children of 6 to 23 months of age multiply by 100.

Minimum Diet Diversity is calculated based on information of types of foods the child ate 24 hours before. To meet MDD, the child must eat different food at least 4 foods groups.

MMF is obtained by calculating the percentage of infants and young children who were fed according to WHO recommendations on complementary feeding. The infant of 6 to 8 months must eat at least 2 times and at least 3 times for child of 9 to 23 months of age 24 hours preceding the survey.

Identification of the factors associated to MAD among under 24 months children in Rwanda
To achieve the objective, a descriptive analysis of independent variables was done. The bivariate analysis between all independent variables was computed. Then the independent variables with significance were used in multivariable analysis. In multivariable analysis we conformed the association between independent variables with dependent variable, the relationship power was determined by the Odd Ratio (OR).

Study variables

Dependent variables

The outcome variable, MAD is computed based on the proportion of children who receive at least recommended 4 foods group and 2 meal frequency for the infants of 6 to 8 months of age or 3 times a day preceding the survey if a child has 9 to 23 months.

Independent variables

A set of different socio demographic and economic factors was considered to identify the factors associated to MAD among the infants and young children. The list of independent variables was composed by age of child, sex of child, birth order, origin, place of residence, parent's education level, parent's occupation, marital status of the mothers, head of household, antenatal care visits, size of household and access to health education on nutrition.

Data analysis plan

For this study description of variables was performed and the results were in percentages. To identify the association of MAD with independent variables a bivariate was done. The identified factors associated to MAD were computed to full model. To determine the level of significance a simple regression model of p. value < 0.05 was considered. The results of logic regression were in by OR, 95% CI and p. value. The analysis was performed using STATA, version 13.

2.4. Study population

The interested population of this study were mothers / care givers of children aged 6 to 23 months who were eligible to DHS. The analysis was done on DHS 2014- 2015 dataset to provide information feeding practice. The mother was responded to a given interview guide. The condition to participate in survey was to have a child aged between 6 and 23 months who stayed in the household on the night before the interview but children with their mother not listed in the household questionnaire were excluded from the study.

Sample size calculation

All children of 6 up to 23 months with complete information in RDHS (2014 - 2015) dataset were participated to the study, (1171).

Sampling techniques

Sampling techniques used a multistage cluster sampling of Village and households. The DHS 2014 – 2015 used stratified two stage cluster sampling for recruiting study participants. The first stage consisted of selecting clusters from each stratum represented by a district. The second stage was a systematic sampling of households from each cluster selected.

Data collection procedure

The data for this study was from the DHS conducted in Rwanda from November 9, 2014 to April 8, 2015 to obtain current information on demographic and health indicators including feeding practice. The information was provided by mothers of children who was eligible to respond: Being at night of survey and resident of household. Mothers who responded sign first of all the

consent form for using the data recoded to child like height, weight of their children. A registration and application to DHS data were made to use the data and were approved.

2.5. Materials

The material using to obtain result of study were those used during DHS 2014 – 2015: Household questionnaire and an individual 24 hours recall questionnaire for Children under five years and mothers.

The data used to compute IYCF practice was derived from the children's sample whose mothers and care takers participated in the RDHS 2014/2015. Data were analyzed using STATA version 13.0.

2.7. Ethical considerations

During this study, the information on factors contributing to IYCF practice was obtained from RDHS 2014 - 2015. The survey was representative and covered the entire population, using sampling methods till household level, the findings are generalizable to the Rwandan population. The respondents of survey signed informed consent during the data collection. Information to children was provided by parents, guards or others person with the right to present interest of child. Then the authorization to use the data was provided by IRB- DHS Program on 30 August 2019.

CHAPTER 3: RESULTS

3.1: Socio demographic characteristic of infant and child.

The study analyzed the information from 1,171 mothers or cares givers of children aged of 6 to 23months to identify the associated factors of IYCF practice in Rwanda among these children of 6 to 23 months of age. The age group of infants and children was 36.2%, 33.5 % and 30.3% for 6 to 11 months, 12 to 17 and 18 to 23 months age group respectively. Among children 77.28% were residing in the rural. Female children were 50.3 %. Among the mothers, 12% were illiterate and 25.6% were from the poorest households. Among study participants, 59.9% their mothers were self-farmers and 52.4% were married. About 29.5% were aged 25-29 years. Wealth index of the family participating to the survey indicates that 25.62% were poorest. Health education on Nutrition was done for 70.94%. The number of under five children is dominated by the group of 2 and 3 children per family with 90.35%. More than the two thirds of the households (80.3%) were led by the males. About 69.2% were the households composed of 4 to 7 members.

The results indicated that the pregnant women attended the Antenatal Care (ANC) visits at the health facilities. During pregnancy, 98.86% of pregnant women attended the ANC visits at least once and 42.56% received four and more ANC services, 56.3% did 2 to 3 ANC visits.

The results indicated that about 70.9% of the pregnant women whose children were aged 6-23 months received the counselling and health education about Nutrition as detailed in Table 1.

Table 1: Socio - demographic characteristics of the study population.

Variables	**Frequency (n)**	**Percentage (%)**
Age of children (in months)		
6-11	424	36.21
12-17	392	33.48
18-23	355	30.32
Sex of children		
Male	582	49.7
Female	589	50.3
Birth order		
Three or below	803	68.57
Four and above	368	31.43
Number of under five children at household		
None	6	0.51
2 - 3 children	1,058	90.35

4- 7 children	107	9.14
Number of household members		
1-3 members	232	19.81
4 members or above	939	80.19
Region		
Kigali city	135	11.53
Southern Province	289	24.68
Western Province	291	24.85
Northern Province	168	14.35
Eastern Province	288	24.59
Place of residence		
Urban	266	22.72
Rural	905	77.28
Age group of mothers		
15-19	44	3.76
20-24	240	20.5
25-29	345	29.46
30-34	295	25.19
35-39	175	14.94
40-44	64	5.47
44-49	8	0.68
Marital status of mother		
Never living together	129	11.02
Married	614	52.43
Living with partner	348	29.72
Widowed	11	0.94
Divorced	26	2.22
No longer living together/separated	43	3.67
Number of ANC visits during pregnancy		
No visit	13	1.14
1 to 3 visits	643	56.3
4 visits or above	486	42.56
Perception of distance with health facility		
Big problem	261	22.29
Not a problem	910	77.71
Education level of mothers		
No education	140	11.96
Primary	861	73.53
Secondary	144	12.3
Higher	26	2.22
Mother' s occupation		
No occupation	6	0.58
Professional	64	6.15

Home occupation	628	60.33
Other	343	32.95
Education level of husband / partner		
No education	160	15.36
Primary	750	71.98
Secondary	98	9.4
Higher	34	3.26
Occupation of husband / partner		
No occupation	93	7.95
Professional	33	2.82
Home occupation	863	73.76
Other	181	15.47
Sex of household head		
Male	940	80.27
Female	231	19.73
Wealth index family		
Poorest	300	25.62
Poorer	236	20.15
Middle	213	18.19
Richer	197	16.82
Richest	225	19.21
Receiving counseling / Health education on nutrition		
No	331	29.06
Yes	808	70.94

3.2: Prevalence of MAD among children of 6 to 23 months of age.

The prevalence of infant and children who meet minimum acceptable diet was 23.7%.

3.3: Bivariate analysis of factors associated with MAD

The following variables were significant with MAD. Those are age group, region, place of residence, distance to health facility, marital status of the mother, education level of the mother, mother and partner education level, mother and partner occupation, sex of head of household, wealth index and number of under five children in household.

The children of age group of 6 to 11 months are not well fed; only 16.27 % meet the MAD for previous day. The children of Western Province meet MAD at 14.09 % but those from Kigali City consume adequate food at 37.78 %. Low prevalence of MAD is in rural at 20.9 %. The children of mothers who perceive a problem of distance to reach health facilities meet the conditions at 16.86%. The prevalence of MAD based on the marital status of the mothers demonstrates lower level for divorced at 11.54%, the children of widower ate at 36.6% the acceptable foods. The children with mother who didn't attend school ate adequate foods at 12.86 and 54.5% for those with mothers who attendant higher education. For the father the 13.6% for non-education and 50% of father who attendant higher education was the percentage of meeting MAD for their children. Home occupation for mothers, the children ate at 20.1% while the father home occupation contribute to MAD at 18.7%. The children from household headed by the female ate at 20.7% while the 24.4% were from the household headed by the male. The wealth index of household was associated with MAD at 10.6%; 17.8%; 23.4%;32.4% and 40% for the poorest, poor, middle, rich and richest respectively. Table 3 shows also that the prevalence of adequate feeding at lower level for the family with more than 3 under five children at 14.02% and 24.7 for the family with 1 or 2 children.

Table 2: Bivariate analysis: MAD and socio demographic characteristics of the study population

Variables	**Yes**	**No**	**P. value**
Age group of children (in months)	**% (n)**	**% (n)**	
6 - 11	16.27 (69)	83.73 (355)	**0.0001**
12 - 17	25.77 (101)	74.23 (291)	
18-23	30.42(108)	69.58 (247)	
Sex of a child			

Male	23.2 (135)	76.8 (447)	0.663
Female	24.28 (143)	75.72 (446)	
Region			
Kigali city	37.78 (51)	62.22 (84)	**0.0001**
Southern Province	23.88 (69)	76.12 (220)	
Western Province	14.09 (41)	85.91(250)	
Northern Province	32.14 (54)	67.86 (114)	
Eastern Province	21.88 (63)	78.13 (225)	
Place of residence			
Urban	33.08 (88)	66.92 (178)	**0.0001**
Rural	20.99 (190)	79.01 (715)	
Child birth order			
Three or below	24.91 (200)	75.09 (603)	0.166
Four and above	21.2 (78)	78.8 (290)	
Number of antenatal visits			
No visit	30.77 (4)	69.23 (9)	0.127
1 to 3 visits	21.93 (141)	78.07 (502)	
4 visits or above	26.95 (131)	73.05 (355)	
Distance to health facility			
Big problem	16.86 (44)	83.14 (217)	**0.003**
Not a big problem	25.71 (234)	74.29 (676)	
Age groups of mother			
15-19	31.82 (14)	68.18 (30)	0.548
20-24	20 (48)	80 (192)	
25-29	22.32 (77)	77.68 (268)	
30-34	25.76 (76)	74.24 (219)	
35-39	25.14 (44)	74.86 (131)	
40-44	26.56 (17)	73.44 (47)	

44-49	25 (2)	75 (6)	
Current marital status of the mother			
Never living together	17.83 (23)	82.17 (106)	**0.008**
Married	27.85 (171)	72.15 (443)	
Living with partner	20.4 (71)	79.6 (277)	
Widowed	36.36 (4)	63.64 (7)	
Divorced	11.54 (3)	88.46 (23)	
No longer living together	13.95 (6)	86.05 (37)	
Education level of the mothers			
No education	12.86 (18)	87.14 (122)	**0.001**
Primary	21.6 (186)	78.4 (675)	
Secondary	42.36 (61)	57.64 (83)	
Higher	50 (13)	50 (13)	
Partner / husband occupation			
No occupation	50 (3)	3 (50)	**0.001**
Professional	35.94 (3)	64.06 (41)	
Home occupation	18.79 (118)	81.21 (510)	
Other	32.36 (111)	67.64 (232)	
Partner / husband education level			
No education	13.75 (22)	86.25 (138)	**0.001**
Primary	24 (180)	76 (570)	
Secondary	36.73 (36)	63.27 (62)	
Higher	50 (17)	50 (17)	
Mother occupation			
No occupation	23.66 (22)	76.34 (71)	**0.001**
Professional	54.55 (18)	45.45 (15)	
Home occupation	20.16 (174)	78.84 (689)	
Other	35.36 (64)	64.64 (117)	
Sex of head of household			
Male	24.47 (230)	75,53 (710)	**0.0238**
Female	20.78 (48)	79.22 (183)	

Wealth index of family			
Poorest	10.67 (32)	89.33 (268)	**<0.001**
Poorer	17.8 (42)	82.2 (194)	
Middle	23.47 (50)	76.53 (163)	
Richer	32.49 (64)	67.51 (133)	
Richest	40 (90)	60 (135)	
Number of household members			
1-3 members	26.72 (62)	73.28 (170)	0.233
4 members or above	23 (216)	77 (723)	
Number of under five children in H H			
None	16.67 (1)	83.33 (5)	**0.042**
1&2	24.76 (262)	75.24 (796)	
3 -7	14.02 (15)	85.98 (92)	
Receiving health education on nutrition			
No	22.36 (74)	77.64 (257)	0.334
Yes	25 (202)	75 (606)	

3.4: Multivariate analysis: Factors associated with MAD

Table 4 shows that children with age group of 18 - 23 months were 2,46 times more likely to have MAD (OR: 2,46; CI at 95 % = 1.71 - 3.54; p. value = 0.001) compared to those aged 6 - 11 months.

Children from Northern Province and Southern Province were 2,89 and 1,72 times respectively more likely to have MAD (OR = 2,89; CI at 95 % = 1,77 - 4,71; p. value = 0.001; OR = 1,72; CI at 95% = 1,10 - 2,68; p value = 0.017) compared to those from Western Province.

Children whose mothers had higher and secondary education level were 3.12 and 2.71times more likely to have MAD respectively (OR = 3,12; CI at 95% = 1.17 - 8.46; p. value = 0.023; OR = 2.71; CI at 95% = 1.42 - 5.16; p. value = 0.003) compared to children whose mothers were with no education.

Children from richest and richer wealth index were 4,10 and 3,72 times respectively more likely to have MAD (OR = 4,10; CI at 95% = 2.39 - 7.05; p. value = 0.001; OR = 3.72; CI at 95% = 2.28 - 6.09; p. value = 0.001) compared to those from poorest wealth index.

Table 3: Multivariate analysis: Factors associated with MAD

Variable	Full model			Reduced model		
	OR	**95%CI**	**P-value**	**AOR**	**95%CI**	**P-value**
Age (in months)						
6 – 11	1					
12 – 17	1,96	1,33 - 2,89	0,001	2	1,40 - 2,88	**<0,001**
18-23	2,36	1,60 - 3,50	<0,001	2,46	1,71 - 3,54	**<0,001**
Region						
Western Province	1					
Kigali city	1,83	0,99 - 3,36	0,053	1,73	1 - 2,99	0,051
Southern Province	1,75	1,09 - 2,82	0,021	1,72	1,10 - 2,68	**0,017**
Northern Province	2,52	1,50 - 4,25	0,001	2,89	1,77 - 4,71	**<0,001**
Eastern Province	1,26	0,77 - 2,07	0,358	1,36	0,86 - 2,13	0,188
Mother's education						
No education	1					
Primary	1,28	0,73 - 2,25	0,398	1,50	0,87 - 2,57	0,146
Secondary	2.14	1,04 - 4,44	0,04	2,71	1,42 - 5,16	**0,003**
Higher	2,02	0,65 - 6,29	0,227	3,12	1,17 - 8,36	**0,023**
Wealth index						
Poorest	1					
Poorer	1,80	1,03 - 3,13	0.038	1.81	1,09	**0,022**
Middle	2,16	1,24 - 3,76	0,007	2,36	1,43 - 3,89	**0,001**
Richer	3,47	1,98 - 6,07	<0,001	3,72	2,28 - 6,09	**<0,001**
Richest	3,32	1,64 - 6,71	0,001	4,10	2,39 - 7,05	**<0,001**

Chapter 4: DISCUSSION

4.1: Prevalence of MAD

The prevalence of minimum acceptable diet is 23.74% for the children of 6 to 23 months of age. The result is align with the finding of study conducted in Northern Ghana in 2013 to analyze the indicators of complementary feeding and nutrition status of the children where MAD was applied at 27.8% (37). The study conducted in Ethiopia to access the practice of children feeding in fasting season for orthodox religion demonstrates the low prevalence of children who meet MAD of 8.6% (9) but other study for the optimum feeding practice in Malaysia in 2016 for the children of 6 to 23 months shows high prevalence of feeding children at 32.% , 32.6%, 50.6% and 62.2% for the Cambodia, Indonesia , Malaysia and Vietnam respectively (38). The practice of adequate feeding for the children remains a Public Health issue.

4.2: Factors associated with MAD

The age group of 18 to 23 months are more likely to receive MAD (OR = 2.46; CI at 95% = 1.71 – 3.54; p. value = 0.001). Other study conducted in Ethiopia aligned with the result on age factors where the AOR was 2.34, 95% CI (1.33 - 4.11) to be associated with MAD in Dabat District (39). Other study in Haiti showed the low prevalence to age category of 6- 11 months at 17.1% (40).

The difference in prevalence on Western Province may be explained by the climate of the region, low land to cultivate for household and food insecurity. High level of severe and moderate food insecurity at 5.6% and 29.6% respectively as it described by a report of Rwanda comprehensive food security and vulnerability analysis conducted in 2015; average was 2.6% for severe and 16.8 % for moderate food insecurity. The mothers of agrarian region and dwellers in Ethiopia were 5 times more likely to feed their children than mothers from pastoralist (AOR = 5.1; 95% CI = 2 - 13.1; 5.4; 95% CI = 1.9 - 14.8). among the causes of those difference the culture, food habits and foods insecurity were mentioned (19).

Children from mother with higher education level are 3 times more like to have MAD (OR = 3.12; CI at 95% = 1.178 - 36; p. value = 0.03) compared to those whose mothers were with no education.

The results are similar to those of study conducted in Ethiopia by Mulat E at al. demonstrated , mother education as factors associated with meeting the MAD with AOR:0.22; 95% CI = 0.1-

0.48 for education level (9). Other study in Philippine by Months CA demonstrated the OR of 2.0 and 3.19 ; p. value of 0.040 and 0.099 with 95% CI (1.02 - 2.53 and 0.92 - 2.50) for education level secondary and tertiary of mothers to feed the children with acceptable diet (41).

The wealth index of the family determines the feeding practice of infants and young children of 6 to 23 months of age. The results from this study show that the children of richest family are 4.14 times more like to have MAD than those from poorest family. The same for poor and middle classes with p. value of 0.024, 0.001 and OR of 1.78; 2.30 with CI at 95% (1.08 - 2.94) and 1.40 - 3.76) for the poor and middle classes respectively. There is similarity of the results from a study conducted in Ghana, where the children from high wealth index were 51% well fed with AOR of 0.49 at 95 CI (0.26 - 0.94) in rural northern of Ghana (37).

4.3. Study limitations

The study has limitations because the data analyzed using a single recall within the previous day of survey. The collected information may not necessary represent what the families apply for infant and child feeding. Missing information during analysis. It is also a limit to determine the causal inferences between the outcome (MAD) and independent variables for cross section study design.

CONCLUSION AND RECOMMENDATIONS

Conclusion

A large number of children don't receive MAD, the prevalence of the Minimum Acceptable Diet for infant and young child 6 to 23 months in Rwanda is 23.7%.

The identified factors associated with MAD are, age of child, education level of mother, origin and wealth index of household.

Children aged 18 - 23 months were 2,46 times more likely to have MAD (OR: 2,46; CI at 95 % = 1.71 - 3.54; p. value = 0.001) compared to those aged 6 - 11 months. The children receive MAD as well as their age growth up while the malnutrition is severe for the early age of life. This situation can be explained by lack of knowledge on introduction of soft and sold food.

The children from the mothers who attended higher education are 3 times more like to have MAD (OR = 3.12; CI at 95% = 1.17 - 8.36; p. value = 0.023) compared to those with no education. Educated mother have knowledge and are involved in decision making. They are contributing also to the incomes of household.

The children from Western Province don't receive MAD, compared to others Provinces.

The children of richest family are 4.14 times more likely to satisfy the MAD than the poorest households.

Recommendations

1. Mobilize mother during the ANC, immunization and growth monitoring to prepare complementary food for children regarding their age.
2. Enhance the role of Community Health Workers to assist mother for introduction of adequate food to their children especially the 6 to 11 months of age.
3. Continue the promotion of education for girl and train mother for decision making.
4. Reinforce Health education on complementary feeding for Western Province.

For further research a study to identify barriers hindering complementary feeding to infants aged 6 to 11 months is needed.

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