

**COMPARATIVE ANALYSIS OF DIARRHOEAL MORBIDITY AND
COMPLEMENTARY FEEDING PRACTICES AMONG CHILDREN 6-59 MONTHS
IN RICE GROWING REGIONS OF KIRINYAGA, KISUMU AND KWALE
COUNTY**

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REQUIREMENTS FOR THE CONFERMENT OF THE DEGREE OF MASTERS OF
SCIENCE IN HUMAN NUTRITION AND DIETETICS FROM KENYA
METHODIST UNIVERSITY**

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DECLARATION.

I declare that this project is my original proposal and to the best of my knowledge it has never been presented to this or any other University.

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DEDICATION

I dedicate this work to my dear family, for their enormous and invaluable support in my studies.

May Allah Bless you abundantly.

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ABSTRACT

Background: Globally, diarrhea remains a significant public health concern, affecting an estimated 2.5 billion children under five annually and contributed to 10% mortality in 2015. In Africa, approximately 696 million under-fives contract diarrhea each year, with Kenya experiencing a high burden, as 25% of deaths in this age group are attributed to diarrhea, in 2011, deaths of under-fives due to diarrhea was 38,822. Proper complementary feeding is essential for child's health, inadequate practices can lead to malnutrition and disease. This study aimed to investigate the prevalence of infectious diarrhea and complementary feeding practices among children aged 6-59 months in rice-growing regions of Kirinyaga, Kisumu, and Kwale. Objectives included assessing morbidity rates of infectious diarrhea, evaluating complementary feeding practices, gathering demographic and socioeconomic data from caregivers, and analyzing sanitation and food hygiene practices. **Method:** Cross-sectional descriptive study design was used. Fichers formular was used to get the sample size which was 384 for each region, Kisumu, Kwale and Kirinyaga respectively. Simple random sampling was used to obtain 30 households with child under five years who were interviewed in each cluster. Semi-structured questionnaire was the tool used for data collection which was administered to the caregiver. Ethical consideration was followed where informed consent was obtained from caregivers before the interview. Data entry and analysis was done using SPSS version 26. Information on diet diversification was collected using a 24-hr recall questionnaire as well as a 1-week food frequency interview questions, these were analyzed by calculating diet diversity score. Descriptive statistic was used to analyze general questionnaire. Chi square was used to compare the findings between the three counties. **Results:** 60.2% of household head in all the three counties had primary level as the highest education level attained, 33.8% were farmers while 24.0% were casual labors, the two making most occupations of the household heads. 61.7% earning monthly income less than KSh 10,000. 42.9% of mothers from Kwale and 36.1% from Kisumu County introduce complementary feeding late after 6 months, compared to Kirinyaga where 36.9% of mothers, start complementary feeding starts at 6 months. Caregivers from Kwale county feeds children once a day at (66.7%) and also twice a day at (56.4%) compared to Kirinyaga and Kisumu where feeding was done more than twice a day at 42.1% and 38.9% respectively, boiling was the predominant method used in preparation of complementary foods across the three counties. On the aspect of diarrhea morbidity, in the last two weeks Kwale County recorded the highest cases of diarrhea in children at 42.5% compared to Kirinyaga (31.8%) and Kisumu (27.5%) and most of these cases did not seek treatment (42.9%) for Kwale. Across the three counties high number of children feed less than normal when they are having diarrhea (59.5%) and they lost weight (62.3%). Tap water was majorly the source of water both during wet and dry season across the three counties at 33.3% and 31.1% respectively. Across the three counties 45.9% of the households did not have a place for hand washing. When asked about hand washing at the five critical times, 64.6% of the respondent from Kwale county did not wash hands after visiting toilet, 40.5%, did not wash hands before handling foods, 41.1%, did not wash hands before feeding children and 48.5% did not wash hands after handling dirt. 95% of the households in Kwale County do open defecation indicating why their diarrhea cases were high. **Conclusion:** The practice on complementary feeding was fair, most of the basic criteria of complementary feeding were adhered to, timely introduction, frequency and amount of feeding. Kwale County reported high cases of diarrhea and was doing very poorly in terms of water and sanitation. The study recommends more health education to be given to pregnant and lactating mothers across the three counties on recommended infant young child feeding and Kwale County to be more sensitized on good hygiene and sanitation practice.

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LIST OF ACRONYMS AND ABBREVIATIONS

ARI	Acute Respiratory Infections
DDS	Dietary Diversity Score (DDS)
HDDS	Household Dietary Diversity Score
GoK	Government of Kenya
IDIs	In- Depth Interviews (IDIs).
KDHS	Kenya Demographic and Health Survey.
KDHIS	Kenya Demographic Health Information System
KNBS	Kenya National Bureau of Statistics
KEMUERC	Kenya Methodist University Ethical Review Committee
MoH	Ministry of Health.
MoPHS	Ministry of Public Health and Sanitation
NACOSTI	National Commission for Science, Technology and Innovation
ORS	Oral Rehydration Salts
RTI	Respiratory Tract infectious
SDGs	Sustainable Development Goals
SMART	Standardized Methodology for Assessment and Relief for Transition
SPSS	Statistical Package for Social Sciences (software)
UNICEF	United Nations Children Emergency Fund
WASH	Water, Sanitation and Hygiene
WHO	World Health Organisation
WI	Wealth Index

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study.

When breast milk is no longer sufficient to meet the child's nutritional needs after six months of age, introducing new other food products to a child while still breastfeeding is known as complementary feeding. This moment is thought of being the most vulnerable to malnutrition, nutritional deficiencies, illnesses, as well as death if the growing child's nutritional needs and essential criteria like hygiene are not met. (Labbok, 2012) Adequate complementary feeding entails the timely start of a sufficient as well as diversified diet, continued breast feeding, giving of at least 4 or more food types per day out of seven food groups, and a recommended daily feeding frequency; frequency is increased as the child grows according to the age of the child. United Nations Children's Fund (UNICEF) and World Health Organization suggest that children breastfeed entirely for the very first six months after birth followed by adequate complementary feeding up to two years and continued breastfeeding for up to 2 years and beyond.

Malnutrition accounts for roughly 10% of all lives lost among kids under the age of five worldwide (Trehan & Manary, 2015). Though the global prevalence of stunting in children fell from 40% in 1990 to 25% in 2013, the WHO in Africa region have seen an increase from 25% to 48% stunting in children worldwide during this time period. In Kenya, inadequate complementary feeding practices cause 10,000 deaths each year among kids under the age of five Sethi et al. (2017). According to global statistics on undernourished children, roughly 161 million children 6-59 months are stunted, 51 million are wasting, and 99 million are underweight. In Africa, there were 13 million stunted children, up from 9.5 million in 1990 (Haddad & Corbett, 2013).

In Kenya, diarrhea in children 6-59 months is a big health problem and has been listed as one of those diseases that causes mortality and morbidity in the children. Kenya Demographic and Health Survey (KDHS) of 2014 reported that diarrhea was number one cause of morbidity among young children in Kenya (Oteri, 2020).

Access to healthcare services, adequate and safe food, improved sanitation, and household assets are all linked to higher socioeconomic status and education (Nyakundi & Ogada, 2020). Gender differences in socioeconomic position are more prominent in East and Southern Africa. Girls suffer 81 percent and 30 percent impediments to enrolment in primary and secondary schools, respectively, as of 2016. World Health Organization, [WHO] (2017). Gender disparities in education and economic status of care givers in rice growing regions of Kisumu, Kwale and Kirinyaga counties contribute to a high rate of morbidity and mortality among children under the age of five years (Kawakatsu et al., 2017). Subsistence agriculture is the main source of income in these regions with women accounting for nearly 80% of the workforce (Kawakatsu et al., 2017).

1.2 Problem Statement.

Major public health problem in Kenya is diarrhea, and it is the leading cause of morbidity among children 6-59 months. It is also responsible for approximately 20% of mortality among children under the age of five, as well as 4.7 percent of outpatient visits among children below 5 years in Kenya. Yearly, roughly 15% of children under five years in each of Kirinyaga, Kisumu and Kwale counties develop diarrhea. Diarrhea hospitalized 1,431 in every 100,000 newborns and 478 of every 100,000 children below 5 years in Kenya in 2007. Each year, estimated 4,500 children below five years die as a result of diarrhea. Yearly, there is 8,800 hospital admissions as well as 1,444,000 outpatient visits among children below five years, with such a cost of approximately \$11 million U.S dollars.

Only a third of breastfed children below 5 years satisfy the criteria of timely introduction of other foods at six months, food diversity, adequate feeding and frequency in many countries (Saaka, 2015). Various factors like caregivers' level of education, household food insecurity, irresponsible caregivers contribute to this, and in return this has contributed to consistent malnutrition among children less than five years despite many efforts to eradicate it.

1.4 Purpose of the study.

The purpose of this study was to make a comparison between complementary feeding practices and morbidity due to infectious diarrhea among children 6-59 months of age in rice growing regions of Kisumu, Kirinyaga and Kwale counties.

1.5 Main Objectives

To find out comparison between diarrhea morbidity and complementary feeding practices among children of 6-59 months of the age in rice growing regions of Kirinyaga, Kisumu and Kwale counties.

1.5.1 Specific Objectives

- i. To determine social demographic information of the care givers of children 6-59 months in the rice growing regions of Kirinyaga, Kisumu and Kwale.
- ii. To determine morbidity due to infectious diarrhea among the children 6-59 months of age in rice growing region of Kirinyaga, Kisumu and Kwale regions.
- iii. To assess complementary feeding practices among the caregivers in rice growing regions in Kirinyaga, Kisumu and Kwale.
- iv. To assess hygiene sanitation practices among caregivers of children aged 6 to 59 months in rice growing regions of Kirinyaga, Kisumu and Kwale.

1.6 Research questions

- i. What are the demographic and social economic information of the caregivers of children 6-59 months in rice growing regions of Kirinyaga, Kisumu and Kwale?
- ii. What is the current morbidity status due to infectious diarrhea among children 6-59 months in rice growing regions of Kirinyaga, Kisumu and Kwale counties?
- iii. What are the complementary feeding practices among the communities in these regions?
- iv. And what is the situation in hygiene and sanitation practices among the care givers in these regions?

1.7 Research Hypothesis

- i. H0: There is no significant association between complementary feeding practices and morbidity due to infectious diarrhea in children 6 months to 59 months of age in rice growing regions within Kirinyaga Kisumu and Kwale counties?
- ii. H0: There is no significant association between caregivers' socio-demographic and socio-economic status and morbidity due to infectious diarrhea in children aged 6 months to 59 months in rice growing regions within Kirinyaga Kisumu and Kwale counties?
- iii. H0: There is no significant relationship between hygiene and sanitation practices among the caregivers and morbidity due to infectious diarrhea in children 6-59 months in rice growing regions of Kirinyaga, Kisumu and Kwale.

1.8 Justification of the study

Diarrhea being major public health problem globally and here at home in Kenya in children under five despite studies done about it and interventions put in place is a subject of question therefore data on its prevalence/trend is important in identifying existing gaps so that improvement in quality of care and resource mobilization can be considered. Poor

complementary feeding practices is also contributing to persistent malnutrition in this age group, so the results will give insight on how the practices are , identifying the gaps/ weak link so that proper interventions can be put in place by policy makers and the devolved unit.

1.9 Delimitations and Limitations

1.9.1 Limitation of the Study.

The study focused on households with children from 6-59 months therefore excluding those households who do not have children of these age bracket. The study relied on recall by caregivers on food given during complementary feeding and 24 hr recall hence the researcher could not rule out recall bias in reporting.

1.9.2 Delimitation of the Study.

The study covered demographic characteristics of the households of children 6-59 months, it also focused on complementary feeding practices among rice growing communities of Kirinyaga, Kisumu and Kwale, their diarrhea prevalence and hygiene and sanitation practices.

1.10 Significance of the Study.

This study aimed at improving the understanding of complementary feeding practices and prevalence of diarrhea morbidity among rice growing communities of Kirinyaga, Kisumu and kwale. It aimed also improve understanding on hygiene and sanitation practices of these communities. it aimed to help policy makers to make informed decisions. It also provide the non-government organizations with information on situations and give chance to make appropriate interventions. It aimed to add on to existing data on complementary feeding practices, diarrhoea morbidity and hygiene and sanitation practices.

1.11 Assumptions.

The study assumed that participants provide true information for questions asked.

1.12 Operational definition of terms

Caregiver: This is a person who is responsible for taking care of a child; the person can be male or female relative of the child or non-relative

Complementary feeding: refers to the period of introducing others foods and liquids when breast milk alone is no longer sufficient to meet the nutrition requirements of a child at 6 months (WHO , 2024).

Complementary food: Any food either liquid, semi-solid or solid introduced to an infant as a complement to breast-milk.

Diarrhea: Diarrhea is defined as the passing of three or more loose or watery stools per day, or more frequently than the child's regular bowel movements. It's frequently a sign of a gastrointestinal illness, which can be caused by a wide range of bacteria, viruses, and parasites.

Household member: A person constituting a household.

Household: A person or a group of people who reside in the same dwelling unit(s) or on the same premises, recognize one adult member as the head of the household, and share joint cooking and eating arrangements.

Hygiene: The practice of keeping oneself and surrounding environment clean.

Minimum acceptable diet: a diet that has the recommended number of dietary diversity and recommended frequency of feeding according to the age of a child.

Minimum dietary diversity: Children under five years who ate 4 or more kinds of food a day before.

Minimum meal frequency: frequency of feeding recommended to a child less than five years which varies according to the age of a child.

Morbidity: Illnesses that occurred within the previous two weeks of the study.

Mortality: An estimate of the total of deaths per unit per time in a given population, adjusted towards that population's size.

Personal hygiene practices: keeping one self clean.

Sanitation: Provision of facilities and services for the safe disposal of human waste at the household level.

Socioeconomic and demographic factor: includes age, gender, occupation, marital status, education level, household size, number of under-fives in household, household residence, number of rooms and income level (wealth index).

Under-fives: Children aged 0-59 month.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction.

This chapter comprises a review of related research on the demographic and socio-economic information, prevalence of diarrheal disease, complementary feeding practices among children 6-59 months and food hygiene and sanitation practice among rice growing communities. Various studies have been carried out all over the world.

2.1 Overview of the Epidemiology of Diarrhea.

The term "diarrhea" refers to passing three or perhaps more watery or loose faeces each day. (Bauleth, et al., 2020.). It also entails loose bowel movement than would be typical for normal bowel ~~movement~~ (Chissaque et al., 2018). In recent years, the epidemiology shift from contagious to non-communicable disorders has moved the focus of public health researchers correspondingly. Nonetheless, communicable diseases, or so-called basic diseases, cause significant morbidity, mortality, and impairment. Even in recent years, Diarrhea is one of the top 10 diseases contributing to worldwide Webb. It is one of the most frequent illnesses in children under the age of five.

In developing countries, annual mortality from diarrhea in children under the age of five was 1.8 million deaths occurred in 2015, a decrease from 4.5 million deaths two decades before. Diarrhea types differ primarily in duration, etiology, and severity of the affected intestinal location, as well as an individual's overall health. A proportion of childhood diarrheal episodes are minor; but, severe cases can result in considerable fluid loss and, as a result, dehydration or mortality (WHO, 2023). Diarrhea also impairs cognitive development, stunts physical growth, and causes weight loss in children aged 6- 59 months because it reduces a child's appetite, causing feeding patterns to change. Diarrhea is the leading risk factor for mortality under age of 5 years all over the world.

Regardless of the fact that there is still a vast literature on diarrheal health problems in children under the age of five, scientific proof of the reasons why diarrheal diseases morbidity in children under the age of five remains high for many countries despite interventions and action plans put in place is quite limited (Thystrup et al., 2024). In Kenya, the leading causes of death among children under the age of five have been preventable illnesses such as diarrhea.

2.2 Etiology of diarrhea in children.

Parasites, viruses and bacteria are the major etiological agents of acute diarrhea mainly in the low and middle income countries with bacterial enteritis bearing the greatest burden among the agents (Kotloff, 2017). According to Platts-Mills et al (2021) on a study conducted in Asia and some parts of Africa, urges that majority of diarrhea burden is attributed to *shigella*, cryptosporidium and rotavirus. Furthermore, re-analysis done on stool specimens by polymerase chain method, revealed that the major pathogens attributing to acute diarrhea were campylobacter spp, *shigella* spp, ST-positive ETEC cryptosporidium spp and rotavirus (Mokomane et al., 2018).

Diarrhea in children may be caused by a number of conditions, including the following: bacterial infection, viral infection, food intolerance or allergies, parasites, reactions to medications, Intestinal diseases, such as inflammatory bowel syndrome and a functional bowel disorder, such as irritable bowel syndrome (Kelly, et al., 2015).

2.3 Prevention, Treatment and Management of Diarrhea.

Oral rehydration salts (ORS) and zinc supplementation are some of the possible treatments, all of which diarrhea episodes are less severe and last less time Omondi (2017). Antibiotics are used in extreme situations of diseases. Prevention measures include educating mothers about observing cleanliness when handling foods and proper sanitation (Karambu et al., 2015).

Viral vaccines only safeguard against rotavirus-caused diarrhea; therefore, additional methods for preventing and treating other types of diarrheas are required. Nonetheless, without considering long-term diarrhea prevention, measures such as hygiene hand washing with soap and sanitation have little effect on the incidence of diarrheal diseases. Water therapeutic approaches and source of water pollution control are two other mechanisms that have been enhanced for diarrheal disease preventive measures in children aged 6 to 59 months.

Intervention to prevent diarrhea would include also Treatment or boiling drinking water, hand washing at all five critical times: Before eating, before food preparation, before child feeding, after child cleaning and after latrine visiting, eating of well cooked food (Watson et al.,2015). It is also important to ensure that children get all the required immunization particularly vaccine that protects children against diarrhea Kotloff (2017) and proper solid waste disposal: It is a proper way of disposing of ordinary domestic wastes which include burning, buried in a composed pit.

Management of diarrhea in children.

It encompasses management of symptoms and also management of dehydration is paramount since if not treated it will result to death of the child. Based on the acuteness of diarrhea, management is made up of: **Oral rehydration therapy (ORT)**: Involves giving the child more water to drink which contain specific amounts of salt and sugar Agbolade et al.(2015), **Use of low-osmolarity oral rehydration solution and zinc supplementation**: This is used when a child has acute diarrhea and has been recommended by WHO Ruchika et al.(2015), **Probiotics**: Effective administering of specific probiotics like *Lactobacillus rhamnosus*, *racecadotril* have resulted to reduction of diarrhea (Vandenplas et al., 2016). **Hypovolemic shock from diarrhea/dehydration**: Treat for shock by giving 20mls of ringers' Lactate (< 15 minutes). Reassess the child and if signs persist, repeat bolus of ringer's Lactate (< 15 minutes)

(Shitemi, 2019), **Severe dehydration:** If signs of shock are not present then the child would be treated for severe dehydration. Intravenous fluid would be started immediately. If the child can drink, oral rehydration solution can be given by mouth while the drip is set up. Reassess every 1-2 hours. If hydration status is not improving, give IV drip more rapidly (Shitemi, 2019). Also give ORS as soon as the child can drink, provide the mother with ORS and show her how to give frequent sips during the trip to a bigger facility for further management, **No dehydration:** Give and food to treat at home, give vitamin A, give ORS and Zinc Sulphate and follow up in 5 days to evaluate the condition of the child, **Persistent diarrhea:** Advise the mother on feeding a child who has persistent diarrhea, give vitamin A, Give ORS and Zinc Sulphate, give multivitamin / mineral supplement and screen for other infections and **Severe persistent diarrhea:** Treat hypovolemic shock and any other form of dehydration before referral unless the child has another severe classification. Give vitamin A, Give ORS and Zinc Sulphate. Give multivitamin / mineral supplement and refer urgently to hospital with mother giving frequent sips of ORS on the way.

2.4 Socio Demographic factors amongst women/caregivers with children under 5 years.

Mothers' (or caregivers') age and occupation, as well as other socioeconomic and demographic characteristics, were found to influence nutrition status among children under the age of five by influencing family behavior and the environment (Shridevi, et al., 2015).

Mothers' employment status was found to be a major predictor in reaching a sufficient dietary diversity score (DDS) in the East Africa area DHS 2008-2011, compared to those with non-working mothers.

Another study also states mothers' education level and employment status assist them with ability to make judgments regarding their own child feeding habits. Only 83 percent of females

aged 15-24 in Nyanza regions, particularly Kisumu County, are literate, with percentages varying by place of residence and age.

2.5 Complementary feeding practices amongst children under 5 years.

What is the significance of complementary feeding? Childhood malnutrition is common in most underdeveloped countries and therefore is associated with poor outcome measures. Malnutrition becomes more prevalent between the ages of 6 and 18 months, after that, there isn't much of a difference. The main cause is poor nutrition, and there is evidence that improving nutrition during this critical age window might have a strong positive influence across both short - term and long- growth, health and development. Appropriate complementary feeding practices is very important for proper children's development and growth.

All mothers should exclusively breastfeed their children for the very first 6 months, then proceed to do so for another 2 years or more while continuing with adequate feeding that's Jama et al. (2020). Child malnutrition is a major global health concern throughout the world. Currently, an approximate 149 million children under the ages of five years are stunted, as well as the lives of over 49 million children are affected by wasting (WHO, 2023). In Kenya, continued breastfeeding after 6 months shows a decreasing trend as the kid gets older, falling from around 99 percent to 61 percent by the time the child is still under five years.

Globally, according to statistics on surviving undernourished children, 171 million children are stunted, 60 million are wasted, and 100 million are underweight (Otim et al. 2020). In East Africa, the prevalence of malnourishment and wasting in children under the age of five was 12.1 percent and 15.6 percent, respectively.

An approximately 14% of child deaths aged 6- 59 months could be avoided if breast - feeding were made applicable, and sufficient nutrition could protect at least 6% of mortalities in children under age of five (Chissaque et al., 2018).

2.6 Hygiene and Sanitation practices among the caregivers of children 6-59 month.

Poor sanitary conditions and personal care (WASH) techniques are prevalent characterized because of the emergence of disease and infections, most particularly in children, severe diarrhea and respiratory tract infectious diseases (RTIs). The purpose of this section of the study is to evaluate the impact of hygiene and sanitation activities on diarrheal disease status in children aged 6–59 months.

According to a study in Indonesia mothers/caregivers classified diarrhea episodes as disease or non-disease. The majority of mothers linked the significance of food handling/hygiene to disease prevention, contaminating agents, and overall health. Caregivers typically wiped the cutting board with a kitchen towel after slicing vegetables, but they cleaned up the board with soapy water after having cut raw meat. Personal hygiene was seen as important by mothers for maintaining health and cleanliness. The majority of these women cleaned their hands without detergent/soap after doing housework and cooking. Boosting caregivers'/mother's understanding while taking into account pre-existing perceptions may result in positive changes. Mothers classified diarrhea episodes as disease or non-disease.

A study in Kenya by Ogutu et al. (2022) found out that poor hygiene practices such as children drinking untreated water, care takers not washing their hands after changing napkins, children not washing hands before eating and after visiting the toilet and children not exclusively breastfed were more likely to suffer from diarrhea.

Association between diarrhea prevalence in children and food hygiene practices has also been suggested in various studies that were done in developing countries like Vietnam, Bangladesh, Nicaragua but the findings were not conclusive enough (United Nations Children's Fund [UNICEF], 2021).

For children under the age of five, contaminated water and poor sanitation are among the top causes of death. Children who do not have access to clean water, sanitation, and hygiene (WASH) are more likely to contract preventable infections and suffer from malnutrition, stunting, and other serious health problems (WHO, 2020)

Other aspects of development, such as education and gender equality, are hampered by a lack of sanitation and cleanliness.

2.8 Summary of Literature.

In conclusion, the literature review revealed that a variety of socioeconomic and demographic factors affect the happening of diarrheal illnesses. According to the reviewed literatures, the majority of children don't really fulfill the complementary feeding guidelines for healthy diets, dietary patterns, and adequate diet i.e. minimum dietary diversity, minimum meal frequency and minimum acceptable diet. There is still a gap in research, nevertheless, since no research has tried to compare these parameters i.e., between the complementary feeding and the children morbidity in the area of rice growing region in Kirinyaga, Kisumu and Kwale counties.

2.9 Conceptual framework

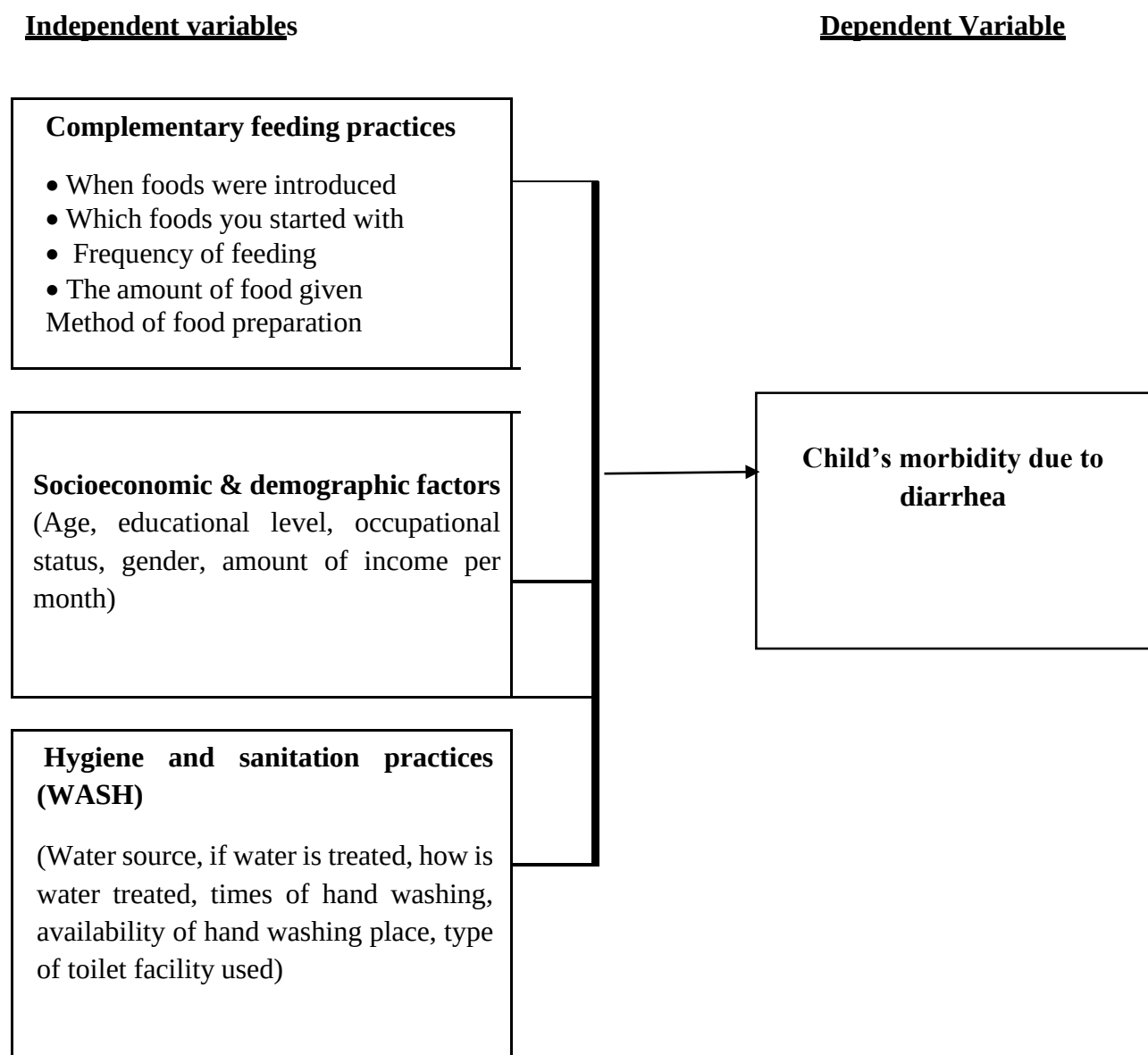
A conceptual framework is a collection of prepositions obtained and supported by data or indications drawn from applicable fields of research (Creswell, 2018). Based on the reviewed literature, this study presents a conceptual framework in which the study independent variables are the caregiver's socio-demographic and socio-economic character traits, complementary feeding practices among the rice growing communities of Kirinyaga, Kisumu and Kwale,

sanitation practices and food hygiene among

the caregivers. Dependent variable is occurrence of diarrhea among children aged under-fives years of age in the rice growing regions of Kirinyaga, Kisumu and Kwale counties. The conceptual framework is used in this study to understand how complementary feeding practice, socioeconomic, and demographic factors, food hygiene and sanitation predispose children who are under-fives years of age to diarrhea in Kirinyaga, Kisumu and Kwale counties.

Figure 2.1

Conceptual frame work



Research Gaps

More research on diarrhea in children under the age of five is needed, especially in Kenya, in which the diarrhea seems to be a leading source of morbidity in kids under the age of 5. This study will address the gap by determining the relationship and comparison between complementary feeding and the children morbidity in the area of rice growing region in Kirinyaga, Kisumu and Kwale counties.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter explains, the research designs, population of the study, data collection methods, procedures and analysis of data.

3.1 Research Design.

The research was conducted in a cross-sectional descriptive design. The design allowed the information collected to represent what was going on at one point in time. This design allowed collection of information at time of data collection and also allowed for collection of quantitative and qualitative data.

3.2 Target Population.

The target population were children aged 6 – 59 months who resides in Nyando sub county (Ahero) in Kisumu, Mwea Sub County in Kirinyaga and Lunga Lunga Sub County in Kwale County which are the rice growing regions.

3.3 Sampling Procedure.

Two stage cluster sampling was used to get to the desired sample. Kirinyaga county, Kisumu and kwale was purposively choosen because they grow rice and the major project was on feeding heat stabilized rice bran to children under five years to find out its effect on diarrhea morbidity in children, Mwea sub county, both east and west, Ahero and Lunga Lunga sub county was purposively choosen because they are the place the rice growing was done in the three counties. Using simple random sampling, a list of random numbers was prepared for all the clusters that practice rice growing in Mwea sub county, Nyando subcounty and Lunga Lunga subcounty and 13 villages/clusters were randomly picked for each sub county. The expected sample size was 384 per sub county of rice growing, therefore, 30 household with children under

five years wererandomly selected from each village, making a a sample size of 390 household per rice growing sub county and a total of 1170 samples for the study.

3.4 Study Area and population

The research was carried out in the rice growing regions of Kirinyaga, Kisumu and Kwale counties. Nyando sub county population in Kisumu County was approximated as 161,501. Mwea sub county in Kirinyaga County has the approximation of 234,898 and Lunga Lunga Sub County in Kwale County was approximated as 198,195 . Ahero

irrigation scheme is situated in Nyanza region, Kenya, its geographical coordinates are 0° 11' 0" South, 34° 55' 0" east and it's in Kisumu County. Mwea Teberre sub-county lies within longitude 37° 21' 14" East and latitude 0° 42' 55" South Lunga Lunga sub county is situated in Coast, Kenya, its geographical coordinates are 4° 33' 0" South 39° 7' 0" East. Subsistence agriculture is the main economic activity in these areas, with women accounting for 80% of the farm labor force. Women, on the other side, influence below 1% of accumulated wealth, and girls are not given opportunities to study (Mukui et al., 2016).

The regions have a poverty index of 60%, the highest in a Kenyan city. Farming, fishing and trading are the main economic activities of the Sub County. According to the Kenya Demographic Health Information System (KDHS) (2014), the prevalence of diarrhea infection in Kisumu county is 15.5%, which is slightly higher as compared to Kwale and Kirinyaga counties with 14.6% and 12.0% respectively. In Kisumu county, only 30% of the region is considered open defecation free area. Kwale has been at the forefront of an effort to eliminate open defecation. According to the Ministry of Health (MoH), 51% of inhabitants were still defecating in the open in 2014.

3.5.1 Inclusion Criteria.

Children 6-59 months who were willing to take part in the study and who live in the ricegrowing region of Kisumu, Kirinyaga and Kwale counties during the study.

3.5.2 Exclusion Criteria.

- i. Children in rice growing region in Kisumu, Kwale and Kirinyaga Counties who are over the age five years.
- ii. Children 6-59 months, match the inclusion criteria but were omitted owing to other compelling circumstances such as refusing to give consent.

3.6 Sample Size Determination.

Fisher et al. (2007) formula was used for the determination of sample size which is recommended for social science research

$$n = \frac{z^2 pq}{d^2}$$

Where;

N was my desired sample size

z was standard deviation (1.96) of required confident level which is given as 95% CI.

p was proportion of the target population (Prevalence of diarrhea occurrence in the counties which in characteristic, for example, every year, roughly 15.5%, of children under the age of five years in each of Kisumu, Kwale and Kirinyaga counties respectively develop diarrhea, according to (KDHS, 2014).

d is the degree of accuracy desired (i.e., 0.05).

q was 1- p

The calculation for Kisumu County computed as:

$$\frac{1.96^2 * 0.15 * 0.845}{0.05^2} = 343 \pm 5$$

$$348 + (10\% \text{ of } 348) = 384$$

$$n = 384 \text{ Sample sizes}$$

The calculation for Kwale County is computed as:

$$\frac{1.96^2 * 0.15 * 0.854}{0.05^2} = 343 \pm 5 =$$

$$n = 348 + (10\% \text{ of } 348) = 384$$

The calculation for Kirinyaga County is computed as:

$$\frac{1.96^2 * 0.15 * 0.88}{0.05^2} = 343 \pm 5 = 348$$

$$348 + (10\% \text{ of } 348) = 384$$

$$n = 384 \text{ sample sizes.}$$

3.7. Data Collection Methods.

3.7.1 Data types and sources.

The study relied on primary and secondary data where desk review of available material was done. Primary data was collected by the use of semi structured questionnaires administered to mothers/caregivers of children 6-59 months;

3.7.2 Data collection procedure.

Two stage cluster sampling was used to get to the desired sample. Kirinyaga county, Kisumu and Kwale was purposively chosen because they grow rice and the major project was on feeding heat stabilized rice bran to children under five years to find out its effect on diarrhoea morbidity in children, Mwea sub county, both east and west, Ahero and Lunga Lunga sub county was purposively chosen because they are the place the rice growing was done in the three counties. Using simple random sampling, a list of random numbers was prepared for all the clusters that practice rice growing in Mwea sub county, Nyando subcounty and Lunga Lunga

sub county and 13 villages/clusters were picked for each sub county. The expected sample size

was 384 per sub county of rice growing, therefore, 30 household with children under five years were randomly selected from each village. 10 research assistant were employed per sub county and trained for 1 day. Each day 15 households were interviewed. When at the households, after greeting the caregiver, then we first confirmed if the household had a child who is in our target group of 6-59 months, if there is a child, we then start the consenting process after the care giver accepted to be interviewed then we go ahead and request for a mother child booklet to confirm the date of birth and the age and then started the interview. The interview took around 30-45 min. after the interview we thank the caregiver for their time and proceeded to the next household. The exercise starts at 8.00 AM every day and went up to 5pm in the evening. The data collection procedure took 10 days for each region.

3.8 Data collection instruments.

Semi structured Questionnaires was developed with open and closed ended questions to gather information on demographics and economic information of caregivers, find out morbidity due to infectious diarrhea, to establish complementary feeding practices among rice growing communities of Kirinyaga, Kisumu and Kwale and to find out hygiene and sanitation practices among these communities.

3.9 Pilot/Pretest.

Pretest was conducted to test the questionnaires. This was done before the actual data collection exercise. It was done in a neighboring area that does fall under the study area but not chosen during random sampling as the village to be studied. In Mwea sub county, pilot test was done in block village, in lunga lunga subcounty it was done in Manda village and in Nyando subcounty pilot was done in kakola ahero village. In order to test the tools, a test sample of 10% of the study sample size was used. This was approximately 38 households with children

6-59 months. Results from the pre-test were used to check for the appropriateness of the questionnaire used and it guided the researcher on any other additional information to be included in the questionnaire in order for it to provide all the required answers to the questions being asked. Corrections and modifications were done to correct any anomalies noted on the data collection instruments before it was administered during the main study.

3.10 Reliability

Reliability refers to how consistently a method measures something, if consistent result is produced by this one method under the same circumstance. In this study reliability testing was done during pre-test when the tool was put to test to see if it was ambiguous or easy to be understood by different respondent, the reliability also checked if this tool was producing similar results from different respondent. The instruments will be considered reliable when they are consistent with attaining consistent results a Cronbach's alpha of 0.70 and above Taber (2018).

3.11 Validity

Validity refers to how accurately a study measures what it is supposed to measure, if research has high validity, it produces results that corresponds to real properties, characteristics in the physical or social world. During discussion of the findings, results were compared to other studies that were done before.

3.12.Variables

3.12.1. Dependent Variables.

Morbidity due to diarrhea was the dependent variable.

3.12.2. Independent Variables.

The socio-demographic and socio-economic characteristics of caregivers or mothers with children aged 6-59 months, as determined by their age, gender, level of education, occupational status, number of dependents and income level, was independent variables (WI wealth index). Complementary feeding practices among the community was another independent variable. This entailed , Introduction of other foods other than breast milk, the types of food introduced, how are these foods prepared, frequency of feeding, the amount to be fed at each feeding time, the diversity of food fed food hygiene and sanitation practices among the care givers of children 6-59 months is another independent variable. This entails, washing hands when handling foods, preparing foods in clean environment, using clean utensils to prepare foods, washing foods

before cooking e.g., lentils and washing vegetables before cutting, serving foods using clean utensils and storing food in clean storage containers and in clean environment.

3.13 Data Analysis Methods.

The Statistical Package for Social Sciences (SPSS) Version 26.0 software was used. In the analysis, descriptive statistics and inferential statistics was used. Descriptive statistics included distribution measures (frequency and percentages) and variation measures (standard deviations). The findings of the analyses was presented in the form of tables.

3.14 Ethical and logical consideration.

The researcher sought clearance from KeMU University ethics committee (KEMUERC). Research permit was sought from the National Commission for Science Technology and Innovation (NACOSTI) Administrative approval was then sought from the ministry of health Kisumu, Kirinyaga and Kwale counties and also the local administration offices i.e., chief, was informed before going to the households. Issues of confidentiality, privacy, voluntariness, and working with various institutional review boards are some of the ethical and logistical challenges that can arise during a research project (Crowther & Lancaster, 2012). In this study, the respondents were provided with information on why the study is been done. They were consented before interview, only after they voluntarily accept to participate was when they were interviewed. Their identity was kept anonymous as the questionnaire was not written their name, instead it was numbered. The finding of the data was not to be shared with any other persons a part from the concerned parties, therefore privacy was be guaranteed.

3.15 Dissemination of findings

The final copy of research report was presented in form of thesis to KeMU School of Health science, department of public health and nutrition. The researcher had published the final work in a peer reviewed journal. Importantly the health authorities in the sub-County of study were furnished with a copy of the same report for any deserving action.

CHAPTER 4

RESULTS AND DISCUSSIONS

This chapter contains detailed presentation and discussion of data analysis and the results of this study. The study investigated Comparative analysis of diarrheal morbidity and complementary feeding practices in children 6-59 months in rice growing regions of Kirinyaga, Kisumu and Kwale. The findings are presented under the following major headings: Social demographic and socioeconomic characteristics; Complementary feeding practices; Diarrhoea morbidity and Hygiene and sanitation practices. The main determining factor of response was if the household had child 6-59 months.

The quantitative data were summarized by descriptive statistics and chi square test of independence to look for any associations between variables using Statistical Package for Social Sciences (SPSS) version 26.0. A p value of less than 0.05 was considered statistically significant.

4.1 Demographic information of the respondent.

Demographic information was collected to bring out better understanding of the respondents. The demographic data was divided into two categories namely: social-demographic characteristics and social economic characteristics.

4.1.1 Social demographic characteristics

4.1.1.1 Age of respondent

A total of 1170 households were included in the study. Socio-demographic characteristics of study participants are shown in Table 4.1. This table indicates that 56.1% of the household heads of the total population are from the age cohort of 31-50 years across the three counties. From those household heads who were 13-30 years, Kirinyaga county had a larger number of the (43.7%) while Kisumu had a higher number of those who were 51-87 years (43.8%) and

Kwale's most household heads were of middle age 31-50 years (32.2%), this was in agreement with previous study done . National Council for Population and Development [NCPD], (2017). where he found out that most respondent in Kwale county were of age 30-45 years (55.9%). The p value is less than 0.05, indicating that there is a significant difference in the ages of household heads across the three counties.

Table 4.1*Age category among household heads across Counties using chi-square*

COUNTY n (%)	13-30	31-50	51-87	TOTAL	Chi-square(p value)
KIRINYAGA	164 (43.7)	213 (31.9)	35 (24.0)	412 (34.7)	27.36 (0.001)
KISUMU	103 (27.5)	216 (32.4)	64 (43.8)	383 (32.2)	
KWALE	108 (27.5)	238 (35.7)	47 (32.2)	393 (33.1)	
TOTAL	375 (31.6)	667 (56.1)	146 (12.3)	1188(100)	

Table 4:2*Gender of house heads across the counties using chi square*

County n (%)	Male	Female	total	Chi-square p(value)
KIRINYAGA	250 (28.1)	173 (40.9)	423 (34.7)	77.92 (0.001)
KISUMU	340 (38.2)	54 (16.5)	394 (32.3)	
KWALE	301 (33.8)	100 (30.6)	401 (32.9)	
TOTAL	891 (73.2)	327 (26.8)	1218 (100)	

The table shows that 73.2% of the household heads were male across the three counties. Among those household heads who were female the higher percentages of (40.9%) were from Kirinyaga. This agrees with findings of census 2019 where 59% of the households in Kirinyaga County were found to be headed by females. While for Kisumu and Kwale 38.2% and 33.8% of the household heads were male respectively. The p value is showing significant difference between gender of household heads among the counties.

Marital status of household heads

Table 4:3

Marital status of household heads using chi-square

County	single	Married	Divorced	widowed	total	Chi-square) p value)
Kirinyaga	63 (50.8)	305 (32.7)	31 (42.5)	12 (25.0)	411 (34.9)	46.66(0.001)
Kisumu	30 (24.2)	325 (34.8)	5 (6.8)	24 (50.0)	384 (32.6)	
Kwale	31 (25.0)	303 (32.5)	37 (50.7)	12 (25.0)	383 (32.8)	
Total	124 (10.5)	933 (79.2)	73 (6.2)	48 (4.1)	1178 (100)	

This table indicates that 79.2% household heads were married. This finding agree with previous study done by Ogutu et al. (2022) where 74.2% of respondent from kirinyaga county found to be married and a previous study by NCPD (2017) where 269/356 of respondent from kwale were found to be married. Among those who were single, more than half (50.8 %) were from Kirinyaga county, among those who were divorced, 50.7% were from Kwale county and 50% of those who were widowed were from Kisumu county.

Marital status may influence the economic status of a family in the event that both the parents are working, pooling of income may be possible. This will result to increase in purchasing power eventually contributing to good nutritional status of the children, family will afford to live in a clean environ ment and eventually good health care. The p value indicates significant difference in marital status of household heads across the three counties.

Religion

Religion has influence on the way of living.e.g. religion influences the type of foods people eat.I.e. Muslims are not allowed to eat pork. Table 4:4, indicates that 76.5% of the respondent were Christian mainly from Kirinyaga and Kisumu county. Muslims which makes 22.2% of

the respondent were mainly from Kwale county. There was just one atheist across all the three counties. And other faith made just 1.2%.

Table 4:4*Religion of the respondents*

	N.	%
Christian	919	76.5
Muslim	267	22.2
Atheist	1	.01
Others	14	1.2
Total	1201	100

Social economic characteristics

These were assessed in order to gauge the purchasing potential of the respondent. The level of education, occupation and monthly income were the main variables studied.

Education level of the respondent**Table 4:5****Education level of the respondent***Education level of household heads across Counties using chi-square*

COUNTY n (%)	No formal schooling	Primary level	Secondary level	tertiary	Chi-square(p value)
KIRINYAGA	10 (2.4)	164(38.8)	116(27.4)	28(6.6)	27.36 (0.001)
KISUMU	12 (3)	182(46.2)	89(22.6)	29(7.3)	
KWALE	64 (16)	266(66.3)	45(11.2)	12(2.9)	
TOTAL	85 (8.5)	612 (60.2)	250 (24.6)	69 (6.8)	

Many studies have shown that education level directly influences the food choices a mother makes for her baby and as well as how hygienically the food is prepared. Table 4:5 shows that the highest population of the respondents (60.2%) reported to have reached std. 8 as the highest level of education, (24.6%) have reached form.4 and (8.5%) have never gone to school. indicating that most respondent may not make good food choices for their children and hygiene level may be low. This finding concur with studies by Shitemi (2019) in Mwea, Kirinyaga county where highest level of education of the most respondent was primary level(59.8%) and study by NCPD (2017) in kwale county where highest level of education attained by most respondent was also primary level(59%)

Occupation of the respondent

This is an important factor in determining income and purchasing power.

Table 4:6
Occupation of household head across the county

County	Formal employ ment	Busines s	Farmin g	Casua l labor	Unemploy ed	other	TOTA L	CHI- SQUAR E (P VALUE)
KIRINYAGA	27 (27.0)	76 (31.4)	159 (38.7)	113 (38.8)	28 (31.8)	20 (24.7)	423 (34.8)	49.60 (0.001)
KISUMU	28 (28.0)	59 (24.4)	145 (35.3)	102 (35.1)	38 (42.2)	22 (27.2)	394 (32.4)	
KWALE	45 (45.0)	107 (44.2)	107 (26.0)	76 (26.1)	24 (26.7)	39 (48.1)	398 (32.8)	
TOTAL	100 (8.2)	242 (19.1)	411 (33.8)	291 (24.0)	90 (7.4)	81 (6.7)	1215 (100)	

The occupation of 33.8% of the household heads from the three counties was farming with

Kirinyaga leading at 38.7%. This finding is in agreement with findings of census 2019, where most population in Kirinyaga County were found to be farmers. 24% of the total population across the counties were casual labourers while only 8.2% were in formal employment. The p value is less 0.05 indicating significance difference between occupations of the household heads across the three counties.

Household monthly income

Table 4:7

Monthly income of the household heads

County N (%)	NONE	<10000	10000- 20000	>20000	total	Chi-square) p value)
Kirinyaga	32 (42.7)	255 (34.3)	106 (32.5)	30 (49.2)	423 (35.1)	17.70(0.007)
Kisumu	16 (21.3)	231 (31.1)	126 (38.7)	18 (29.5)	391 (32.4)	
Kwale	27 (36.0)	257 (34.6)	94 (28.8)	13 (21.3)	391 ((32.4)	
Total	75 (6.2)	743 (61.7)	326(27.1)	61 (5.1)	1205 (100)	

The table 4:7 shows that more than half of the total populations across the three counties (61.7%) earn income of less than ksh 10,000. Among those who earn the highest income of more than ksh 20,000, Kirinyaga County had the highest number of 49.2%. The table indicates low purchasing power of the respondent which will influence food choices, i.e. poor food choices, they will not afford a clean place to live, with good water source and sanitation. The p value is significant.

4.2: COMPLEMENTARY FEEDING PRACTICES OF THE RESPONDENT.

4.2.1 Introduction of complementary feeding.

Table 4:8

Introduction of complementary feeding

Counties n(%)	(before 6 months)	(at 6 months)	(after 6 months)	Total	Chi-square (p value)
Kirinyaga	52(29.9)	338(36.9)	23(21.3)	413(34.5)	14.24(0.007)
Kisumu	65(37.4)	279(30.5)	46 (42.6)	390(32.6)	
Kwale	57(32.8)	298(32.6)	39(36.1)	394(32.9)	
Total	174(14.5)	915(76.4)	108(9.0)	1197(100)	

After the first six months of life, breast milk is no longer enough to be the only diet of a child because of the increased nutritional needs to ensure optimal growth and development WHO (2022). Complementary feeding has to be started at 6 months, giving other foods (complementary foods) in addition to breast milk. During this time growth and development is at its peak stage and if nutrition is not adequate malnutrition (under nutrition) can occur leading to poor growth and development. Early introduction of complementary foods(before 6 months) exposes child to diseases like diarrhoea while late introduction(after 6 months) exposes child to malnutrition WHO (2017).table 4:8, indicates that 76.4% of mothers/caregivers introduce food at 6 months. this finding agreed with finding by Otim et al. (2022) where 68.5% of the respondent introduced complementary feeding timely at 6 months. The p value is less than 0.05, indicating significant difference in time of starting complementary feeding across the three counties.

4.2.2 When complementary feeding is supposed to be started:

Table 4: 9

A cross tabulation of county and at what age are you supposed to introduce otherfoods

COUNTY N(%)	(at 6 months)	(above 6 months)	Total	Chi-square (p value)
Kirinyaga	414 (35.3)	7(21.9)	421(34.9)	6.31(0.043)
Kisumu	382(32.5)	8(25.0)	390(32.3)	
Kwale	375(32.2)	17(53.1)	395(32.8)	
Total	1174(97.3)	32(2.7)	12.6(100)	

This table shows that 97.3% of mothers/caregivers think that food should be introduced at 6 months. Among those who think that it should start after 6 months, Kwale county have a higher percentage of (53.1%) , the finding agree with Otim et al. (2022) where most mothers in Kwale were found to have little knowledge on complementary feeding practices. P value indicate significant difference.

4.2.4 Frequency of feeding

Table 4: 10

Frequency of feeding children during complementary feeding across the counties

County N(%)	(once a day)	(2 times a day)	(more than 2 times a day)	Total	Chi-square
Kirinyaga	8(15.7)	72(21.8)	325(42.1)	405(35.1)	178.47(0.001)
Kisumu	9(17.6)	72(21.8)	300(38.9)	381(33.0)	
Kwale	34(66.7)	186(56.4)	147(19.0)	367(31.8)	
Total	51(4.4)	330(28.6)	772(67.0)	1153(100)	

Frequency of feeding is among the criteria of complementary feeding, recommended feeding frequency according to the age of the child ensures adequacy of diet to ensure optimal growth and development UNICEF (2019). Table 4:10, shows that 67% of mothers across the three counties feed their children more than 2 times a day which is adequate. Among those who feed their children less than the frequency that is recommended, Kwale county has high percentage of 66.7%, they feed their children once a day when starting complementary feeding (66.7) which indicates the frequency of feeding does not meet the recommended feeding frequency of complementary feeding, which recommends that child at 6 months to be fed 2 times a day. This finding concur with Shitemi et al. (2019) where during an FGD many mothers from Kwale reported when starting complementary feeding, they feed children once a day. The p value is significant.

4.2.5 Amount of feeding

Table 4:11.

Amount of feeding at 6 months

County N(%)	(less than 2 tablespoon)	(two tablespoon)	(more than 2 table spoon)	Total
Kirinyaga	9(47.4)	37(25.9)	339(35.9)	385(34.8)
Kisumu	4(21.1)	32(22.4)	326(34.6)	362(32.8)
Kwale	6(31.6)	74(51.7)	278(29.5)	358(32.4)
Total	19(1.7)	143(12.9)	943(85.3)	1105(100)

Amount of feeds is among critical criteria of complementary feeding, it increases according to the age of the child to ensure adequate growth and development. At 6 months of age a child is supposed to eat 2-3 tablespoon per feed WHO (2017). Table 4:11 indicates that 85.3% of the mothers/caregivers across the three counties fed their children adequately at 6 months with more than 2 table spoon per feed. the study finding disagree with Shitemi et al . (2019) where he found out most children were not getting adequate diet in terms of quantity and variety Jama et al. (2020) also agreed that minimum dietary diversity (MDD) and minimum acceptable diet(MAD) were as low as 4.43%. Karambu et al . (2015) (56) and Mukui et al. (2012) (57) went ahead and associated MDD and MAD to household income and in rural set up where household income is commonly low, MAD and MAD are always very low. Among those mothers who fed less than recommended, Kirinyaga County had the highest percentage of 47.4%.

4.2.6 Food preparation method during complementary feeding most of the time

Table 4:12

How complementary food was prepared across the county

County N(%)	(boiling)	(frying)	(stewing)	Total	Chi- square(pvalue)
Kirinyaga	334(35.0)	22(35.5)	3(13.6)	359(34.6)	15.67(0.003)
Kisumu	305(32.0)	17(27.4)	3(13.6)	325(31.3)	
Kwale	314(32.9)	23(37.1)	16(72.7)	353(34.0)	
Total	935(91.9)	62(6.0)	22(2.1)	1037(100)	

We eat food to supply our bodies with energy and to nourish it with vitamins and minerals, the way we prepare foods has significant impact on its nutritional value. Cooking certain foods at high temperature or for extended periods than is necessary can destroy the nutrients they contain, also boiling foods like vegetables in large amount of water can destroy some nutrients. (WHO , 2022). This table indicates that 91.9% of mothers/caregivers across the three counties, boil food fed to children during complementary feeding, indicating nutrients loss. Among those who use alternate method which is stewing, 72.4% of mothers from Kwale County use this method. Indicating less nutrient loss compared to boiling. The p value is less than 0.05, indicating significant difference in method used across the three counties.

4.2.7 Who feeds the child

Table 4:13:

Who feed the child during complementary feeding across the county

County n(%)	(mother)	(others)	Total	Chi-square(pvalue)
Kirinyaga	390(35.5)	24(24.7)	414(34.6)	17.58(0.001)
Kisumu	338(30.8)	50(51.5)	388(32.4)	
Kwale	371(33.8)	23(23.7)	394(32.9)	
Total	1099(91.9)	97(8.1)	1196(100)	

When feeding is done by mothers/caregivers responsive feeding happens, this also include early childhood stimulation as mothers interact with their children. Table 4:13 shows that children are mostly fed by their mothers (91.9%). The p value is significant.

Table 4.14.

Household Dietary Diversity Score Distribution Across the Counties of Kirinyaga, Kisumu, and Kwale

Household Dietary Diversity Score (HDDS)	County % (n)			Total	X (P- value)
	Kirinyaga	Kisumu	Kwale		
Low HDDS (0-4 Food Groups)	14.7 (62)	22.1 (87)	22.9 (91)	19.8 (240)	32.13 (0.001)
Medium HDDS (5-7 Food Groups)	49.9 (211)	45.9 (181)	33.4 (134)	43.2 (526)	
High HDDS (8-10 Food Groups)	35.5 (150)	32.0 (126)	43.6 (175)	37.0 (451)	

Information on different types of food consumed by the child and the households was collected using 7 day food frequency questionnaire, the household dietary diversity score was calculated, therefore this table indicates high number of households across the three counties (526,43.2%) scored medium, in this case indicating that they have consumed,5-7 food groups per day out of the 10 food groups. Among this number, Kirinyaga county top with (211,49.9%) counts of the

household.(451,37.0%) of the households across the three counties scored high, which in this case indicated that, they have consumed 8-10 food groups per day. Among this number, Kwale county tops with (175, 43.6%). 19.8% of the households across the three counties scored low, indicating, they have consumed 0-4 food groups per day. The p value is 0.001; it is less than 0.05, indicating significant difference among the three counties.

4.3 DIARRHOEA MORBIDITY

4.3.1 Has the child experienced diarrhoea in the past two weeks

Table 4:14.

Morbidity of diarrhea/watery/bloody stool across the county

Counties n (%)	Yes	No	Total	Chi-square(p value)
Kirinyaga	110(31.8)	313(35.9)	423(34.7)	21.18(0.001)
Kisumu	89(25.7)	305(35.0)	394(32.3)	
Kwale	147(42.5)	254(29.1)	401(32.9)	
Total	346(28.4)	872(71.6)	1218(100)	

Table 4:14 shows that Kwale County had the highest number of diarrhoea cases in the past 2 weeks at 42.5%, followed by kirinyaga at 31.8% and then Kisumu at 25.7% this finding concurs with report by kwale county government (2021) that diarrhoea makes to top five list of the diseases that children suffer from. Across the three counties 28.4% of children had diarrhoea while 71.6% did not experience diarrhoea. The p value is significant.

4.3.2 Did you seek treatment for diarrhea

Table 4:15

Whether respondent seek treatment for diarrhoea across the county

County N(%)	1(yes)	2(no)	Total	Chi-square(pvalue)
Kirinyaga	115(38.6)	26(26.5)	141(35.6)	5.05(0.80)
Kisumu	69(23.2)	30(30.6)	99(25.0)	
Kwale	114(38.3)	42(42.9)	156(39.4)	
Total	298(75.3)	98(24.7)	396(100)	

Table 4:15 42.9% of mothers/caregivers in Kwale county did not seek treatment for diarrhea indicating poor health care seeking behavior of the county, the study finding agree with report of Diarrhea & Pneumonia Working Group 2013, where they reported that there is not only a high diarrhoea incidence in Kenya, but poor care seeking and un-recommended treatment practices are very prevalent.

However across the three counties, 75.3% of mothers seek for treatment during diarrhea .
The p value is more than 0.05, indicating that there is no significant difference in seeking treatment across the three counties.

4.3.3 Where did you seek treatment

Table 4:16.

Cross tabulation of county and where they seeked treatment

County N(%)	Government	Private	Mission hospital	Pharmacy	total
Kirinyaga	101(36.7)	14(58.3)	5(71.4)	10(29.4)	130(38.2)
Kisumu	59(21.5)	4(16.7)	1(14.3)	10(29.4)	74(21.8)
Kwale	115(41.8)	6(25.0)	1(14.3)	4(41.3)	136(40.0)
Total	275(80.9)	24(7.1)	7(2.1)	34(10.0)	340(100)

Where to seek treatment depends on the affordability and accessibility of the health care services. Table 4:16 indicates that 80.9% of mothers whose children had diarrhoea in the past 2 weeks across the three counties sought treatment from government hospital, this finding agrees with many other studies e.g. WHO and UNICEF (2020) where they found out that most respondents in their studies sought treatment from government facilities. Among the respondents who sought treatment from private and mission hospital, Kirinyaga county has a high percentage of 58.3% and 71.4% respectively. Kisumu County sought also from pharmacy (29.4).

4.3.4 What treatment was the child given?

Table 4:17 indicates that 56.3% of children from Kwale who had diarrhoea were treated with zinc (56.3), those from Kirinyaga were treated with ORS (54.7) while those from Kisumu were treated with antibiotics (29.7). However, across the three counties 64.2% of children were treated with ORS and zinc. The study finding agrees with the report of Diarrhea & Pneumonia Working Group 2013, where the report stated that the use of ORS and zinc as the first line treatment for diarrhea has been implemented by most health facilities in Kenya.

Table 4:17*Cross tabulation of the treatment children were given for diarrhoea across the counties*

County	Zinc	ORS	Zinc&ORS	Antibiotics	Others	Total
n(%)						
Kirinyaga	3(18.8)	29(54.7)	78(37.9)	12(32.4)	0(0.0)	122(38.0)
Kisumu	4(25.0)	6(11.3)	45(21.8)	11(29.7)	2(22.2)	68(21.2)
Kwale	9(56.3)	18(34.0)	83(40.3)	14(37.8)	7(77.8)	131(40.8)
Total	16(5.0)	53(16.5)	206(64.2)	37(11.5)	9(2.8)	321(100)

4.3.5 Did the diarrhoea stopped after treatment**Table 4:18***Whether the diarrhoea stop after treatment across the counties*

County	1(yes)	2(no)	Total	Chi-sqaure (p-value)
N(%)				
Kirinyaga	129(38.1)	8(20.5)	137(36.2)	4.65(0.97)
Kisumu	81(23.9)	12(30.8)	93(24.6)	
Kwale	129(38.1)	19(48.7)	148(39.2)	
Total	339(89.7)	39(10.3)	378(100)	

The table shows that 89.7% of mothers/caregivers across the three counties reported that diarrhea stopped after treatment with ORS and Zinc . Among those who reported that diarrhoea did not stop after treatment Kwale County had high percentage of (48.7%). P value is not significant.

4.3.6 Feeding of the child during diarrhea

Table 4:19.

How was the child feeding during diarrhea

	No.	%
Normally	85	21.9
less than normal	231	59.5
More than normal	4	1.0
Child refused to eat	66	17.0
I did not feed the child	2	0.5
Total	388	100

When asked about the feeding of the child during diarrhoea, 59.5% of the respondent said that, the child was feeding less than normal that is more than a half, 21.9% said the child feed normally while 17.0% said the child refused to eat. This clearly indicated that during diarrhoea children consume less food which contributes to weight loss and eventually malnutrition. This concur with finding by Agbolade, et al. (2015) during diarrhoea, there is decreased dietary intake and malabsorption which can lead to nutrients deficiency and under nutrition.

4.3.7 Did the child loss weight during diarrhoea

Table 4:20

A cross tabulation of county and whether the child loss weight during diarrhoea

County N(%)	YES	NO	Total	Chi-square (pvalue)
Kirinyaga	84(35.0)	52(40.6)	136(37.0)	1.25(0.535)
Kisumu	57(23.8)	26(20.3)	83(22.6)	
Kwale	99(41.3)	50(39.1)	149(40.5)	
Total	240(65.2)	128(34.8)	368(100)	

This table indicates that, 65.25% mothers across the three counties reported that children lost weight after diarrhea. This concurs with Agbolade, et al. (2015) finding where due to decreased nutrient intake and malabsorption children lose weight during diarrhea and eventually malnutrition is likely to occur. This indicates that diarrhea contributes to malnutrition in children. The p value is more than 0.05, there is no significant difference across the three counties.

4.4. HYGIENE AND SANITATION

Table 4:21

Major source of water during dry season

	No.	%
River	343	28.5
Dam	20	1.7
Tap	400	33.3
Well protected	120	10.0
Well not protected	104	8.6
Borehole	207	17.2
Tanker	3	0.2
Rainwater	5	0.4
Others	1	0.1
Total	1203	100

33.3% of respondent uses tap water for household consumption during dry season ,followed by river at 28.5% across the three counties. this finding agrees with (census 2019) where most population in Kirinyaga were found to use piped water (40.5%)

4.4.2 Source of water during wet season.

Table 4:22.

Major Source of water during wet season.

	No.	%
River	315	26.3
Dam	37	3.1
Tap	372	31.1
Well protected	104	8.7
Well not protected	59	4.9
Borehole	189	15.8
Tanker	4	0.3
Rainwater	111	9.3
Others	7	0.6
Total	1198	100

31.1% respondent still continue to use tap water as their major source even during wetseason, followed by river at (26.3) and then borehole at (15.8).

4.4.3 Do you buy water from the source

Table 4:23

Whether the respondents buy water from the source across the counties

County	1(yes) N(%)	2(no)	Total	Chi- square(pvalue)
Kirinyaga	97(25.1)	261(41.8)	358(35.4)	119.12(0.001)
Kisumu	77(19.9)	230(36.8)	307(30.4)	
Kwale	212(54.9)	134(21.4)	346(34.2)	
Total	386(38.2)	625(61.8)	1011(100)	

The table indicates that high number of households in Kwale county buy water for use (54.9), this means that the use of water is limited and would likely to compromise hygiene, because cleaning might not be done as required due to scarcity of water., for instance, hand washing

might not be done as frequent as required. This finding agrees with report by WHO (2022) where it stated that 29 million Kenyans still have challenges in access to basic water services which is inadequate in many parts of the country. Kirinyaga and Kisumu pay water bills at the end of the month but do not do the daily purchase like Kwale. The p value show significant difference across the three counties.

4.4.4 How much per 20lt jerry can

Table 4:24.

How much does 20 litres jerry can cost?

KSH	N.	%
5	450	93.0
10	29	6.0
20	5	1.0
Total	484	100

Table 4:24. indicates that when asked how much they pay for 20lt of water, 93% of the respondent said that they pay ksh 5, 6% pay ksh 10 while 1% pay ksh 20.

4.4.4 Do you treat your water

Table 4:25

Whether the respondent treat water across the county

County N(%)	1(yes)	2(no)	Total	Chi-square)p value)
Kirinyaga	155(30.8)	220(41.1)	375(36.1)	125.58(0.001)
Kisumu	233(46.2)	80(15.0)	313(30.1)	
Kwale	116(23.0)	235(43.9)	351(33.8)	
Total	504(48.5)	535(51.5)	1039(100)	

This table indicates that 46.2% of respondent from Kisumu county (46.2%) treat their drinking water while 43.9% from Kwale county do not treat their drinking water. Across the three counties 51.5% of the household do not treat water and only 48.5% of the households treat. the finding concur with Oteri (2020), he found out that Only 34% of the households treated water commonly using boiling before using it for drinking. The p value shows significant difference across the three counties.

4.4.5 How do you treat your water

Table 4:26.

Method of water treatment across the counties

	No.	%
1(chemical-water guard)	483	73.4
2(filtration)	16	2.4
3(boiling)	137	20.8
4(decanting)	5	0.8
5(standing)	15	2.3
7(others)	2	0.2
Total	658	100

Table 4:26, indicates that among the respondent who treated their drinking water 93.0% used chemical-water guard to do so and 20.8% treat their water by boiling.

4.4.6 Places the household use to wash hand

Table 4:27.

Places the household use to wash hand

	No.	%
1(observed fixed place)	309	28.2
2(observed containers)	277	25.3
3(not observed, not in dwelling)	503	45.9
4(not observed, no permission to see)	3	0.3
5(not observed, no other reason)	5	0.5
Total	1097	100

When asked if to observe the place the household wash hands, 45.9% of the households do not at all have place they can wash hands, 28.2% of the household had a fixed place to wash hands, while 25.3% hand a mobile place to wash hand. This concur with a report by UNICEF (2019), Only 25% have hand-washing facilities with soap and water at home.

4.4.7 Do you use soap to wash hand

Table 4:28.

Whether the household members use soap to wash hand across the counties

County	(yes)	(no)	TOTAL	Chi-square(pvalue)
N(%)				
Kirinyaga	357(43.1)	59(16.4)	416(35.0)	151.20(0.001)
Kisumu	293(35.3)	97(27.0)	390(32.8)	
Kwale	179(21.6)	203(56.5)	382(32.2)	
Total	829(69.8)	359(30.2)	1188(100)	

This table indicates that, 43.1% of respondent from Kirinyaga County , wash hands with soap while Kwale, high percentage of respondent (56.5%) do not use soap to wash hands. Across the three counties high percentage of respondent (69.8%) reported they use soap to wash hands. This finding disagree with report by UNICEF (2019) where it stated that most Kenyans do not usesoap during hand washing. It went ahead and stated that among a total of 5182 critical opportunities for hand washing, hand washing with soap was only at 25%. The p value shows significant difference between the three counties.

4.4.8. Whether soap available at the toilet

Table 4:29:

Whether soap is available at the toilet used by household members across thecounties

County	yes	No	Total	Chi-square(pvalue)
N(%)				
Kirinyaga	147(38.3)	259(32.7)	406(34.5)	6.20(0.45)
Kisumu	130(33.5)	258(32.6)	388(33.0)	
Kwale	107(27.9)	275(34.7)	382(32.5)	
Total	384(32.7)	792(67.3)	1176(100)	

The table shows that high percentage of the household across the three counties (67.3%) do not have soap at the toilet. This indicated poor hand washing behavior among this communities.

Washing hand with soap after visiting toilet is among the five critical times of hand washing WHO (2022). Among those have soap at the toilet, most were from Kirinyaga County at 38.3%. The p value is more than 0.05, indicating there is no significant difference between the three counties.

4.4.9. Whether soap available at the kitchen

Table 4:30.

Whether soap and water is available at the kitchen across the counties

County N(%)	yes	No	Total	Chi- square(pvalue)
Kirinyaga	215(38.8)	191(30.8)	406(34.6)	80.97(0.001)
Kisumu	230(41.5)	158(25.4)	388(33.0)	
Kwale	109(19.7)	272(43.8)	381(32.4)	
Total	554(47.1)	621(52.9)	1175(100)	

The table indicates that Kisumu county have higher number of households (41.5%) that have soap at the kitchen compared to its counterpart Kwale and Kirinyaga. Kwale on the other hand take the lead in high number of households that does not have soap at the kitchen (43.8%). The total across the three counties indicates that high number of household (52.9%) do not have soap at the kitchen yet another indicator of poor hygiene practices among this community. The p value is less 0.05, indicating significant difference among the counties.

4.4.10. When do you wash your hands

4.4.10.1 After visiting toilet

Table 4:31

Whether household members wash hand after visiting the toilet across the counties

County N(%)	Yes	No	total	Chi- square(pvalue)
Kirinyaga	295(35.1)	14(7.2)	309(29.9)	97.11(0.001)
Kisumu	296(35.2)	55(28.2)	351(33.9)	
Kwale	249(29.6)	126(64.6)	375(36.2)	
Total	840(81.2)	195(18.8)	1035(100)	

Hand washing after visiting the toilet is on top of the list of the five critical times of washing hand WHO (2022), table 4:31 shows that high percentage of respondent across the three counties wash hand after visiting toilet (81.2%). Among those who wash hand after visiting

toilet Kirinyaga and Kisumu county were on top list at 35.1% and 35.2% respectively. On the contrary Kwale County was on top list at (64.6%) among those who do not wash hand after visiting toilet. The p value shows significant difference among the counties.

4.4.10.2 Before handling food

Table 4:32.

Whether the household members wash before handling food

County N(%)	Yes	No	Total	Chi- square(pvalue)
Kirinyaga	203(32.3)	106(26.0)	309(29.9)	6.74(0.034)
Kisumu	215(34.2)	136(33.4)	351(33.9)	
Kwale	210(33.4)	165(40.5)	375(36.2)	
Total	628(60.7)	407(39.3)	1035(100)	

Washing hands before handling foods is in the list of critical times to wash hands UNICEF (2019) table 4:32 shows that, 40.5% of the respondent from Kwale County do not wash hands before handling food, this finding agree with Oteri (2020) where he found out that during food handling only (15%) wash hands. He went ahead and found out that In univariate and multivariate analysis, water access, level of education, media exposure and media ownership were associated with hand washing with soap. Only households with very poor access to water and sanitation, and with the lowest levels of education and media exposure, washed their hands markedly less than the majority of the households. 32.3% and 34.2% of the respondent from Kirinyaga and Kisumu County wash hands before handling food respectively. The total across the three counties shows that most respondent wash hands before handling food (60.7%). The p value is significant.

4.4.10.3 Before eating

Table 4:33:

Whether the household members wash your hands, before eating

County N(%)	Yes	No	total	Chi-square(pvalue)
Kirinyaga	224(31.7)	85(25.9)	309(29.2)	4.63(0.099)
Kisumu	240(33.9)	111(33.8)	351(33.9)	
Kwale	243(34.4)	132(40.2)	375(36.2)	
Total	707(68.3)	328(31.7)	1035(100)	

Table 4:33 shows that 68.3% of respondents across the three counties wash hands before eating. Among those who do not wash, still kwale county had most number at 40.2%. The pvalue is more than 0.05 indicating no significant difference among the three counties.

4.4.10.4. Before feeding children

Table 4:34:

Whether the household members wash hand, before feeding children

County N(%)	Yes	No	total	Chi-square(pvalue)
Kirinyaga	185(35.1)	124(24.4)	309(29.9)	16.63(0.001)
Kisumu	176(33.4)	175(34.4)	351(33.9)	
Kwale	166(31.5)	209(41.1)	375(36.2)	
Total	527(50.9)	508(49.1)	1035(100)	

Hygiene is one critical component of complementary feeding, from handling food before cooking, to handling food during preparation, food storage, hygiene of the utensils used and feeding of the child. Table 4:34, indicates that 50.9% of the respondents across the three counties wash hand before feeding children. Among those who do not wash hand, Kwale county a gain take lead with high percentage of (41.1%). The p vale is significant at 0.001.

4.4.10.5 after handling dirt.

Table 4:35

Whether the household members wash hand after handling dirt

County N(%)	Yes	No	Total	Chi-square(pvalue)
Kirinyaga	215(40.0)	94(18.9)	309(29.2)	78.48(0.001)
Kisumu	189(35.1)	162(32.6)	351(33.9)	
Kwale	134(24.9)	241(48.5)	375(36.2)	
Total	538(52.0)	497(48.0)	1035(100)	

Table 4:35, indicates that, 48.5% of the respondents from Kwale county do not wash hands after handling dirt (48.5%) on the contrary 40.0% and 35.1% of those from Kirinyaga and Kisumu wash hands .The total population across the counties shows that 52.0% of the respondents wash hands after handlingd irts. The value shows significant difference.

4.4.11. Type of toilet facilities used by the households

Table 4:36

The toilet facility used by the household members across the county

County N(%)	Flash toilet	Pit latrines	No facility/bush/open defaecation	Total	Chi-square(pvalue)
Kirinyaga	93(42.9)	381(41.4)	1(0.5)	421(34.7)	464.25(0.001)
Kisumu	10(10.8)	343(40.5)	9(4.5)	392(32.3)	
Kwale	44(47.3)	166(18.0)	191(95.0)	401(33.0)	
Total	93(7.7)	920(75.8)	201(16.6)	1214(100)	

Table 4:36 indicates that, among those respondents who do open defecation 95.0% are from kwale county, this and many poor hygiene practices as found out from this study must have contributed to the high diarrhea incidences in kwale county as found out. The finding agree with 2014 Joint Monitoring Program (JMP) report, where by Kenya was ranked to be among countries with inadequate sanitation facilities in the rural areas, where open defecation cases have been reported. Most respondents across the three counties uses pit latrine (75.8%) Kirinyaga County uses flash toilets and pit-latrine, 42.9% and 41.1% respectively. Most respondents from Kisumu county uses pit latrines (40.5%). The p value is significant.

4.4.12 Do you share the facilities

Table 4:37

Whether the household members share toilet facility with others across the county

County N(%)	(yes)	(no)	Total	Chisquare- p value
Kirinyaga	122(38.6)	290(43.7)	412(42.0)	2.48(0.248)
Kisumu	114(36.1)	212(31.9)	326(33.3)	
Kwale	80(25.3)	162(24.4)	242(24.7)	
Total	316(32.2)	664(67.8)	980(100)	

Across the three counties 67.8% of households do not share toilet facilities. The p value is not significant, indicating no significant difference between the three counties in sharing the

facility.

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

SUMMARY

Globally, diarrhea remains a significant public health concern, affecting an estimated 2.5 billion children under five annually and contributed to 10% mortality in 2015. In Africa, approximately 696 million under-fives contract diarrhea each year, with Kenya experiencing a high burden, as 25% of deaths in this age group are attributed to diarrhea, in 2011, deaths of under-fives due to diarrhea was 38,822. Proper complementary feeding is essential for child's health, inadequate practices can lead to malnutrition and disease.

This study aimed to investigate the prevalence of infectious diarrhea and complementary feeding practices among children aged 6-59 months in rice-growing regions of Kirinyaga, Kisumu, and Kwale. Objectives included assessing morbidity rates of infectious diarrhea, evaluating complementary feeding practices, gathering demographic and socioeconomic data from caregivers, and analyzing sanitation and food hygiene practices. Cross-sectional analytical study design was used. Fichers et al formular was used to get the sample size which was 384 for each region, Kisumu, Kwale and Kirinyaga respectively. Simple random sampling was used to obtain the cluster which acted as sample for the whole region, 30 households with child under five years were interviewed in each cluster. Semi-structured questionnaire was the tool used for data collection which was administered to the caregivers. The data collection took 10 days in each region, Kirinyaga, Kisumu and Kwale respectively.

Ethical consideration was followed where informed consent was obtained from caregivers before the interview. Data entry was done using SPSS version 26 and analysis also done using SPSS version 26.. Information on diet diversification was collected using a 24-hr recall questionnaire as well as a 1-week food frequency interview questions, these were analyzed using nutria-survey 2018 and diet diversity score. Descriptive statistic was used to analyze general questionnaire.

The findings of the study were as follows: on social demographic and social economic status of the respondents, most household in Kirinyaga county was headed by young adults at age of 13-30 years and most household heads were female whose marital status were single parents compared to its counterpart Kisumu and Kwale. The education level of household head in all the three counties was mostly primary level, their occupation was mostly casual work while monthly income was less than ksh 10,000. Most mothers from Kwale and Kisumu county introduce complementary feeding after 6 months, 42.6 and 36.1% respectively compared to

Kirinyaga where complementary feeding starts at 6 months. High number of Caregivers from Kirinyaga and Kisumu feed children once a day (66.7) and their method of food preparation was boiling while most caregivers from Kwale feed children twice and they stew food. Across the three counties, mothers are the once who do the feeding of children.

On the aspect of diarrhoeal morbidity, in the last two weeks Kwale county recorded the highest cases of diarrhoea in children at 42.5% compared to Kirinyaga and Kisumu and most of this cases did not seek treatment (42.9%). Higher percentage of those from Kwale county seek treatment from government hospital (41.8) and were treated using zinc. Across the three counties high number of children feed less than normal when they are having diarrhoea (59.5%) and they lost weight (62.3%). Tap water was majorly the source of water both during wet and dry season across the three counties. Most of the households from Kwale county was buying water from the source (54.9%) and do not treat the water they use (43.9%). Across the three counties most households did not have a place for hand washing (45.9%). When asked about hand washing at the five critical times, 64.6% of the respondent from Kwale county do not wash hands after visiting toilet, 40.5%, do not wash hands before handling foods, 41.1%, do not wash hands before feeding children and 48.5% do not wash hands after handling dirt. 95% of the households in Kwale County do open defecation indicating why their diarrhoea cases were high.

In conclusion, the economic status of the respondents across the three counties was poor as most of the respondent income per month was <10000 which meant they earn less than ksh 500 per day indicating their low purchasing power which will intern increase household food and nutrition insecurity. The education level of the respondent across the three counties was low as the highest level of education of the most of respondent was upto std.8. The practice on complementary feeding was fair, some of the basic criteria of complementary feeding was adhered to frequency, amount and hygiene. Kwale County reported high cases of diarrhoea and was doing very poorly in terms of water and sanitation. More health education to be given to pregnant and lactating mothers across the three counties on recommended infant young child feeding and Kwale County to be more sensitized on good hygiene and sanitation practice.

CONCLUSION

In conclusion, the study confirmed that the economic status of the respondents across the three counties was poor as 61.7% of the respondent income per month was <10000 which meant they earn less than ksh 500 per day indicating their low purchasing power. Kirinyaga county had

highest number of those who earned highest income of > ksh 20,000 at 49.2%.

The education level of the respondent across the three counties was low as the highest level of education of 60.2% of respondent was up to std.8 with Kwale county leading with 66.3%, Kirinyaga and Kisumu were better than Kwale as they had those respondents who had attained up to secondary and tertiary. The practice on complementary feeding was fair, some of the basic criteria of complementary feeding was adhered to like timely introduction at six months, frequency and amount given at six months, Kirinyaga county doing better in practice compared to Kisumu and Kwale. The main method of food preparation was boiling, which indicates that the foods given to the children were nutrients inadequate because most nutrients were lost during preparation as boiling some foods destroys nutrients with Kirinyaga and Kisumu county doing more boiling than Kwale where food was also stewed. Dietary diversity score was medium across the three counties, indicating consumption of 5-7 food groups per day and again Kirinyaga county was doing better than Kisumu and Kwale. Hygiene and proper sanitation is essential in reduction and control of diarrhoea in children, Kwale County reported high cases of diarrhoea and was doing very poorly in terms of water, hygiene and sanitation compared to the other two counties. They were doing open defecation, not treating drinking water and they were also doing so poorly in hand washing.

RECOMMENDATIONS ON RESEARCH FINDINGS

Recommendations for training and education.

Health care providers especially nutritionists should give health education to all pregnant and lactating women on maternal infant and young child nutrition (MIYCN) putting emphasis on : basic criteria of complementary feeding(frequency, amount, texture, variety, active feeding and hygiene).Community health promoters(CHP) should be employed by the specified counties under study(Kirinyaga, Kisumu and Kwale) so that more health education to mothers should continue at the community level.

Recommendations for practice.

Public health officials should put more effort in ensuring every household should have toilet and waste to be disposed well to reduce risk of diseases. The importance of water treatment for domestic use should also be shared with the community in an effort to reduce diarrhoea especially in children 6-59 months. This is especially for those public health officials in Kwale county. Children who had diarrhoea episodes should be screened thoroughly for malnutrition and follow ups done on their food intake to reduce risk of malnutrition. Government facilities

should be well equipped with drugs and other facilities such as laboratory and enough health personnel to give adequate service to the community because most communities from the three counties seek treatment mostly from government hospital as per the findings.

Recommendations on further research

These study recommends further research on factors contributing to poor sanitation practices in lunga lunga constituency, Kwale County.

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Appendix I: Consent form

Kenya Methodist University

School of health science

Department of public health and nutrition

Dear Respondent

My names are Halima Godana, a Masters student at *Kenya Methodist University*. Am undertaking a study to analyze the diarrhea morbidity and complementary feeding practices among children 6-59 months in rice growing regions of Kirinyaga, Kisumu and Kwale counties. This research project is critical as it will provide data on morbidity due to diarrhea in the said counties so that the concerned ministries will improvise measures to improve the situation which in turn will protect children from the diarrhea. The study will also provide data on complementary feeding practices which will be used by MOH or other organization to mitigate measures to improve on good complementary feeding practices among children 6-59 months which lead to reduction in malnutrition among this age group.

The interview will take 20-30min during which I will ask you a few questions about how you feed your child and if your child has loose stool in the past two weeks.

Privacy and confidentiality

I will record our conversation using this recorder but your name will not be written in it or anywhere in the questionnaire that am using, what you tell me here will not be heard or read by any person except for those who are concerned with this study, so do not be afraid, the

information will be kept confidential. And the interview will be private, no one will listen to you as you answer questions.

Voluntary participation

For you to answer my questions, to participate in the study is voluntary, you can refuse to participate or stop the interview at any point in time when you feel you can't answer the questions and you will not be punished or victimized.

Benefits

You will not get personal benefit for participating in this study, like payment, but the data from the study may be used by the concerned ministries and other organization to improve policies that will alter benefit the larger community.

Risk/harm

You will not be at any risk or harm for participating in the study, I will just ask you question and that will not harm you in anyway.

In case you have any questions, you are free to contact the following;

	Contacts	
Dr. Mapesa J Department of Public Health, Human Nutrition and Dietetics, Kenya Methodist University	+254 703567768	Supervisor
Mrs Rose Juma Department of Public Health, Human Nutrition and Dietetics, Kenya Methodist University	+254 722788624	Supervisor
Mrs Dorcas Kamunya Department of Public Health, Human Nutrition and Dietetics, Kenya Methodist University		Supervisor

Participant's Statement

The above statement regarding my participation in the study is clear to me. I have been given a chance to ask questions and my questions have been answered to my satisfaction. My participation in this study is entirely voluntary.

Date.....Signature.....

Researcher's Statement

I, the undersigned, have explained to the volunteer in a language s/he understands the procedures to be followed in the study and the risks and the benefits involved.

Halima Godana

Date.....Signature.....

Appendix II: Research questionnaire

a) Demographic Information of the caregiver/child 6-59 months

- A. Sex(observe)
- B. How old are you (in years)
- C. Marital status:
- D. Highest level of education:
- E. Occupation,
- F. What is your house hold monthly income?
- G. Do you own the house you are living in or do you rent it?
- H. Do you have animals for consumption or for commercial purposes, (for example cows, goats, sheep, chickens or pigs)?
- I. What is the age of the child? **(In months)**
- J. What is the Sex of the child?

b) Information on complementary feeding practices

- 1) Up to what age is child supposed to be given only breast milk?
- 2) At what age did you gave your child other foods other than breast milk?
- 3) Are you still breastfeeding?
- 4) If no, why did you stopped?
- 5) Which foods did you started with?
- 6) Which foods are you giving now?
- 7) How many times a day do you feed the child?
- 8) what amount do you give at one feeding time?(ask her to show the amount using the plate/cup she normally use to feed the child)
- 9) How do you prepare the foods you feed to the child?
- 10) Who feed the child?
- 11) Are there any taboos which prohibits from giving this child any types foods?

I. food diversity

12) Now, I would like you to tell me the foods and liquid you have given your child for the last 24 hours? (take the 24 hour recall)

13) Administer the 7 day food frequency table.

c. Information on morbidity due to infectious diarrhea

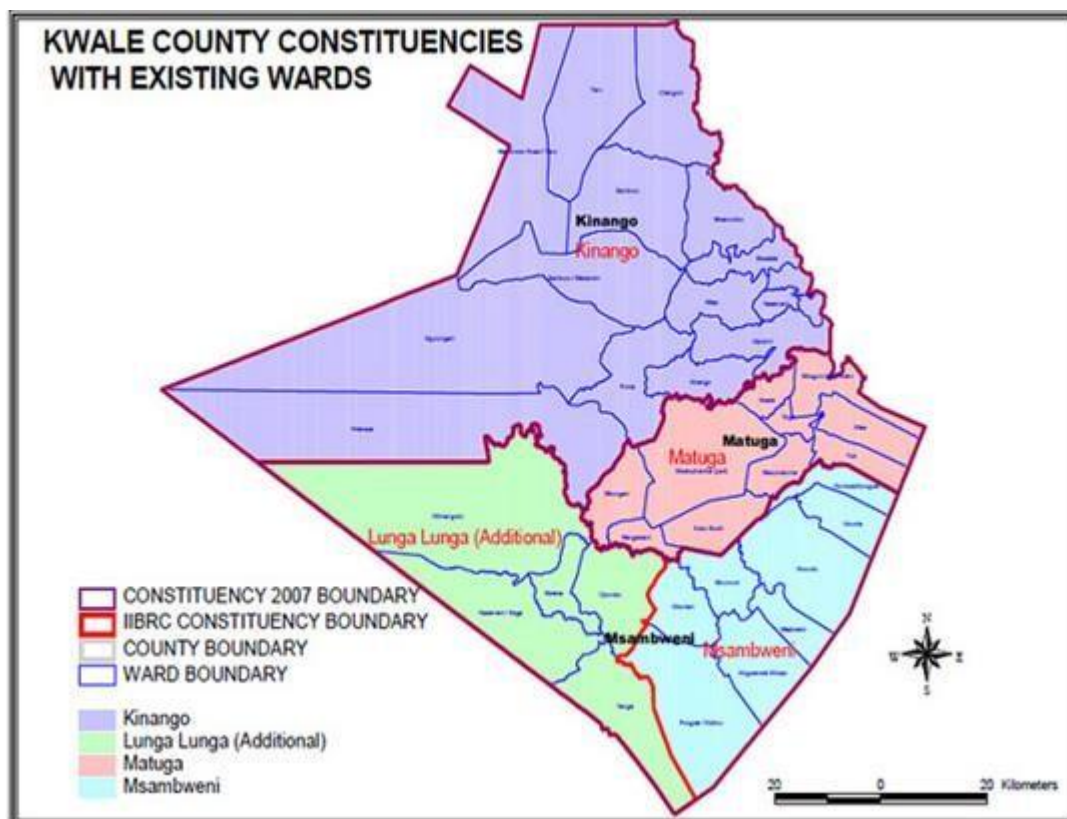
- 1) Has your child fallen ill in the past two weeks?
- 2) If yes, what was the problem?
- 3) If diarrhea not mentioned, has your child had loose stool more than 5 times a day in the past two weeks?
- 4) How many times in the past two weeks?
- 5) Did you seek treatment for diarrhea?
- 6) If no, why
- 7) If yes where did you seek treatment?
- 8) What medication was the child given upon treatment?
- 9) Did the diarrhea stop after treatment?
- 10) How was the child feeding during diarrhea?
- 11) Did the child lost weight during diarrhea?
- 12) If yes, do you know how many grams has the child lost?

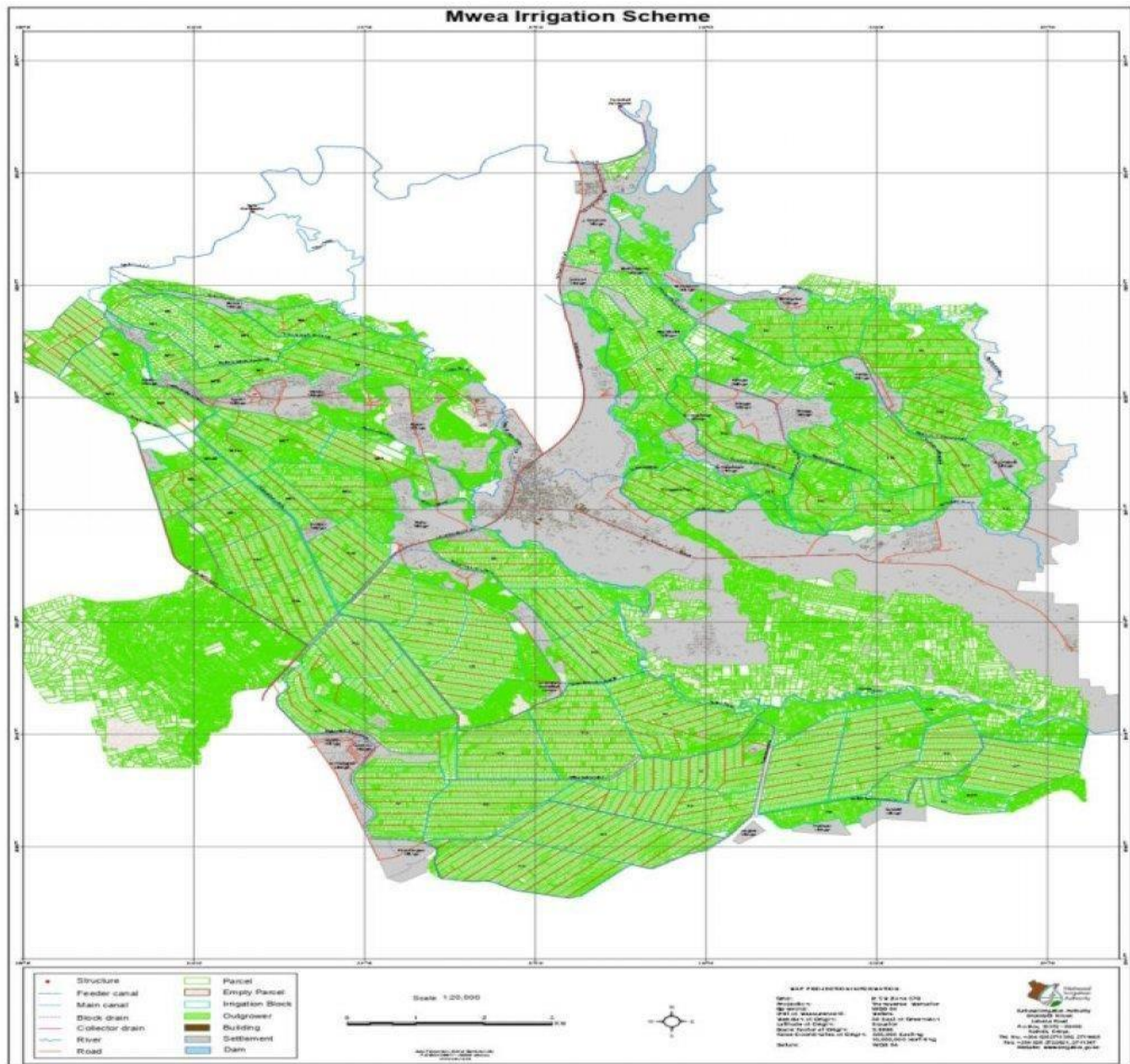
d) Hygiene and sanitation practices

- 1) Do you have hand washing place?
- 2) Do you have soap for hand washing at the toilet/ kitchen?
- 3) Do you wash hand during the five critical time; after visiting toilet, before eating, before cooking, before feeding the child and after handling dirts?
- 4) What kind of toilet facility do you have?
- 5) Do you share with other household?

- 6)** If yes, how many?
- 7)** Where do you get water?/ what is the source ?
- 8)** Do you buy water from the source?
- 9)** Do you treat it? How do you treat? (Ask)
- 10)** How do you store your water? (Ask)

Appendix V: Maps for Mwea, Ahero and Kwale





Licence and permit

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May 31, 2022

KeMU/SERC/INT/1/2022

JOB MAPESA
WANJA TENAMBERGEN
BERNAD OUNA
ROSE JUMA
ANDREW CHEGE

Dear All,

**SUBJECT: RESEARCH AND DEVELOPMENT OF HEAT STABILIZED RICE BRAN FOR
DIARRHEA PREVENTION**

This is to inform you that Kenya Methodist University Scientific Ethics and Review Committee has reviewed and approved your research proposal. Your application approval number is KeMU/SERC/ INT/1 /2022. The approval period is 31st May, 2022 – 31st May, 2023.

This approval is subject to compliance with the following requirements: -

- I. Only approved documents including (informed consents, study instruments, MTA) will be used.
- II. All changes including (amendments, deviations, and violations) are submitted for review and approval by Kenya Methodist University Scientific Ethics and Review committee.
- III. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to KeMU SERC within 72 hours of notification.
- IV. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to KeMU SERC within 72 hours.
- V. Clearance for export of biological specimens must be obtained from relevant institutions.