Lydiah M. Waswa

Improving dietary diversity and nutritional health of women and children under two years through increased utilization of local agrobiodiversity and enhanced nutrition knowledge in Kenya

DISSERTATION
submitted to the Faculty of Agricultural,
Nutritional Sciences and Environmental Management,
Justus-Liebig-University Giessen, Germany
for the degree of Dr. oec.troph.

édition scientifique
VVB LAUFERSWEILER VERLAG

1. Auflage 2016

1st Edition 2016

© 2016 by VVB LAUFERSWEILER VERLAG, Giessen
Printed in Germany

édition scientifique
VVB LAUFERSWEILER VERLAG

STAUFENBERGRING 15, D-35396 GIESSEN
Tel: 0641-5599888 Fax: 0641-5599890
email: redaktion@doktorverlag.de

www.doktorverlag.de

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INAUGURAL- DISSERTATION

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By

Lydiah M. Waswa

Born in Kakamega, Kenya

Giessen, October 2015

Mit Genehmigung des Fachbereichs Agrarwissenschaften,
Ökotrophologie und Umweltmanagement der
Justus-Liebig-Universität Gießen

Examination Committee:

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Date of examination: 15th December 2015

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Abbreviations

AEZ	Agro-Ecological Zone
CDDS	Children's Dietary Diversity Score
BMI	Body Mass Index
DD	Dietary Diversity
DDS	Dietary Diversity Score
DID	Differences-in- Differences
EAR	Estimated Average Requirements
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization of the United Nations
GEE	Generalized Estimating Equations
GENLINMIXED	Generalized Linear Mixed Models
HAZ	Height-for-age *Z*-score
HDDS	Household Dietary Diversity Score
HFI	Household Food Insecurity
HFIAS	Household Food Insecurity Access Scale
HHS	Household Hunger Scale
IFAD	International Fund for Agricultural Development
IOM	Institute of Medicine
IRR	Incidence Rate Ration
IYCF	Infant and Young Child Feeding
KDHS	Kenya Demographic and Health Survey
KEMRI	Kenya Medical Research Institute
KNBS	Kenya National Bureau of Statistics
LSD	Least Significant Difference
MAD	Minimum Acceptable Diet
MDD	Minimum Dietary Diversity
MDD-W	Minimum Dietary Diversity-Women
MDG	Millennium Development Goal
MMF	Minimum Meal Frequency
OR	Odds Ratio
PAHO	Pan American Health Organization
SD	Standard Deviation
SE	Standard Error

SEM	Standard Error Mean
UNIANOVA	Univariate Analysis of Variance
UNICEF	United Nation's Children Emergency Fund
VAD	Vitamin A Deficiency
WAZ	Weight-for-Age *Z*-score
WDDS	Women's Dietary Diversity Score
WFP	World Food Programme
WHZ	Weight-for-Height *Z*-score
WHO	World Health Organization

Preamble

This thesis consists of two main papers presented as separate pieces of research, with various specific objectives and explicit findings intended for publication. **Chapter 1** provides an overview of the problem of malnutrition in the world, and in Kenya where the study was conducted. Focus is given to lack of dietary diversity, as one key factor contributing to malnutrition in developing countries. Lack of dietary diversity, especially among young children during the complementary feeding period in resource-poor settings has been highlighted. Seasonal variations and its influence on dietary patterns of rural household, as well as the effectiveness of nutrition education interventions on nutrition knowledge of caregivers, child feeding practices and nutritional status have been demonstrated from several studies. The introductory concludes end by outlining the rationale and main objectives of the study, and the model of nutrition security that guided this study. **Chapter 2** includes the description of the methodologies applied during the study including: i) the procedures followed during the repeated cross-sectional surveys conducted during two different seasons, and ii) the implementation of the nutrition education intervention study. The main results, discussions and conclusions of this thesis are presented in **chapters 3 and 4**. The results and discussions with regard to seasonal variations in dietary patterns, food (g/day) and nutrient intakes of women and children 6-23 months are presented in chapter 3. The results on the effect of seasonality and other factors on dietary diversity, the factors influencing nutrient intakes among the women, and the relationship between maternal and child dietary diversity are also presented in this chapter. **Chapter 4** focuses on the nutrition education intervention that promoted the utilization of local agro-biodiversity and its effect on nutrition knowledge of caregivers and children's dietary diversity. Presented in **chapter 5** is the general discussion highlighting the main findings from the repeated cross-sectional surveys conducted during two different seasons and the nutrition education intervention study. The conclusions and recommendations are presented in **chapter 6**. The summary is presented in both English and German in chapters 7 and 8. This is followed by the acknowledgements and the list of references cited in chapters 1, 2, 5 and 6. Lastly are the appendix and the statutory declaration.

1 General Introduction

The global burden of malnutrition

Considerable effort has been made towards meeting the first Millennium Development Goal (MDG), which calls for the eradication of extreme poverty and hunger by 2015[1]. While the latest findings from FAO indicate that there had been a decline in the number of people suffering from food insecurity over the last decade, there were still an estimated 805 million chronically hungry people in the world in 2014[2]. The sub-Saharan region with an estimated 791 million undernourished people accounted for the highest number of hungry people in the world. To add to these numbers of hungry people, there are also 161 million, 99 million and 51 million under-five year old children estimated to be stunted, underweight and wasted, respectively, with a majority of them living in South Asia and Africa[3].

These figures however, do not capture the other wide spread dimensions of malnutrition, including micronutrient deficiencies and overweight/ obesity which are now found occurring along the problems of undernutrition in the world. Micronutrient deficiencies, often referred to as hidden hunger, remains a public health problem, and undermines the growth, development, health and productivity of over two billion people worldwide[4]. Iron deficiency anaemia (IDA), the most common micronutrient deficiency affects an estimated 1.62 billion people worldwide, with the highest prevalence among children below five years (47.4%), pregnant women (41.8%) and non-pregnant women (30.2%)[5]. Vitamin A deficiency (VAD) affects an estimated 190 million pre-school children and 19.1 million pregnant women in the world[6].Simultaneously, the prevalence of overweight and obesity in the world has also been on the rise, not only in developed but also in developing countries[7,8]; with an estimated 39% of adults aged 18 years and above being overweight, and more women (15%) compared to men (11%) being obese in 2014[9]. The problems of overweight and obesity have also been on the increase among children aged below five years, with a global increase from 32 million in 2000 to 42 million in 2013[3].

The burden of malnutrition in Kenya

An analysis of trends in the prevalence of chronic and acute malnutrition over three decades revealed a slow decline in the prevalence undernutrition among young children in Kenya[10]. According to the 2008-09 Kenya Demographic and Health Survey (KDHS), 35%, 16% and 7% of children aged below five years were stunted,

underweight and wasted, respectively. The prevalence of stunting was higher among children residing in rural areas (37.1%) compared with those living in urban areas (26.4%), a trend similar to that found in many developing countries[11]. Evidence from the 2008-09 KDHS also showed an increase in the cases of overweight and obesity occurring in tandem to undernourishment. An analysis of Body Mass Index (BMI) showed that 12% of women aged 15-49 years in Kenya were thin (BMI<18.5 kg/m^2), while the proportion of overweight (BMI≥25 kg/m^2) and obese (BMI≥30 kg/m^2) women increased from 23% in 2003 to 25% in 2008-09. Approximately 18% and 4% under five year old children in Kenya are estimated to be overweight and obese, respectively[11].

While the current estimates of micronutrient deficiencies in Kenya are not clear, estimates from the 1999 National Micronutrient Survey, indicate that micronutrient malnutrition is a public health problem in Kenya, affecting mostly children under the age of five years and women in their reproductive years[12]. According to this survey, IDA was estimated to affect 74% children under five years, 48% women aged 15-45 years and 55% of the pregnant women. The prevalence of acute and moderate VAD was 14.7% and 61.2% among under five year old children, while 10% and 60% of women were estimated to suffer from severe and moderate VAD. Zinc deficiency was also found to be common in Kenya, affecting approximately half of children under five years and women.

Consequences and causes of malnutrition

Malnutrition is the most important risk factor contributing directly or indirectly to morbidity and mortality, particularly in the developing countries[13]. In addition to increasing the risk of suffering from infections, malnutrition increases the frequency and severity of infections and also contributes to delayed recovery[14]. Thus, malnutrition is recognized as the underlying cause of nearly half (45%) of all deaths and 35% of disease burden among children aged below five years in the world[15,16].Women of reproductive age and children aged below five years are at an increased risk of suffering from malnutrition due to their increased nutrient requirements[17–20]. Malnutrition in childhood is associated with adverse short and long- term consequences on growth, cognitive and behavioral development, survival, educational attainment, earning potential and ultimately economic productivity[21–24]. Undernutrition in early childhood is also associated with an increased risk of chronic

diseases in adulthood[25]. Low maternal BMI and micronutrient deficiencies, particularly during pregnancy are reflected in the high prevalence of low birth weight (LBW), which is a major contributing factor to the high rates of infant morbidity, mortality, disability, mental retardation and continued undernutrition in children, in addition to maternal deaths[15,26].

Malnutrition arises from a combination of complex, multiple and interrelated factors. Poverty is one of the main factors contributing to malnutrition and its determinants in the developing world[27]. The prevalence of malnutrition in a given population depends on many other factors including, the season and climatic conditions, food security status, infectious diseases, level of education and nutrition knowledge, access to health and sanitation facilities, cultural practices and beliefs, infant feeding and caring practices and workload[13,28–30]. Even when households have access to adequate food, lack of dietary diversity has been identified as a key underlying factor contributing to malnutrition, particularly micronutrient deficiencies[31] in the developing countries.

Dietary diversity, diet quality and nutritional status

Dietary diversity (DD) is defined as the number of individual food items or food groups consumed over a given period of time[32]. DD is an essential element of diet quality, and consuming a variety of foods across and within food groups, and across different varieties of specific foods is associated with adequate intake of essential nutrients and other important non-nutrient factors such as dietary fiber[33,34]. The relationship between DD and diet quality, nutritional status and food security has been demonstrated in several studies in low and middle income countries. DD has been shown to have a strong association with diet quality among young children[35–37], adolescents[38], adult women[39–42], and the elderly[43]. Other studies have also provided evidence on the association between DD and nutritional status among young children[44–46] and BMI status among adults[47]. Assessed at household level, DD was found to be a good proxy indicator of household food security and socio-economic status[48,49].

Lack of diversity is a major problem, especially among smallholder farm households in rural areas in developing countries. Most of these households depend on food from annual harvest of the staple crop after the main rainy season, and thus often experience seasonal food insecurity during the pre-harvest season[29,50]. Seasonal

variations in temperature and rainfall affect food production, availability, accessibility and pricing, which is a challenge for many rural households with limited financial resources[29,51,52]. Consequently, seasonality contributes to changes in dietary patterns with households adapting to such situations by modifying the types and quality of foods they consume, their meal frequencies, as well as the quantities of foods consumed[29,53,54]. The net result of seasonal food insecurity is the consumption of poor quality diets that contribute to inadequate intake of energy and nutrients, particularly micronutrients which are linked to poor health and nutritional status[50,55–58].

Decline in DD has also been attributed to the rapid socio-economic development, globalization of food markets, industrialization of agriculture, population pressures and urbanization which are being experienced in many developing countries[59]. Alongside this transition, are changes in food production and consumption patterns, which have contributed to increased consumption of diets based on a limited number of energy-rich staple grain foods. These diets are low in variety and thus lack micronutrients and other important dietary factors[60] This simplification of diets is a major contributing factor to the escalating problems of obesity and chronic diseases, which are now increasingly found in tandem to micronutrient deficiencies and undernourishment in the developing world[61].

Dietary diversity during complementary feeding

Lack of DD is a challenge, particularly for young children during the complementary feeding period in many low-income countries[14]. From six months onwards, breast milk alone is not sufficient to meet the increasing nutritional requirements of infants. Therefore, during this period, infants enter a particularly vulnerable period during which they transit from exclusive breastfeeding to gradual consumption of family foods. To fill this nutrient gap, WHO recommends timely initiation of solid and semi-solid foods from 6 months, an increase in the amounts and variety of foods fed, and an increase in feeding frequency with maintenance of breastfeeding[62]. However, the diets of older infants and young children in developing countries rarely meets this criterion, as they consist mainly of starchy staples with less access to nutrient rich sources of food such as animal proteins, fruits and vegetables[63,64]. These poor quality diets, which are often fed infrequently, result in inadequate nutrient intakes,

contributing significantly to an increase in the incidences of growth faltering and micronutrient deficiencies during the complementary feeding period[65,66].

The complementary feeding period accounts for the largest part of the "window of opportunity" phase, that encompassing the first 1000 days of a child's life from conception to the first two years of life[67]. Many interventions seeking to improve Infant and Young Child Feeding (IYCF) practices, as a means of preventing malnutrition and its associated adverse effects have focused their attention on this critical period. This is because nutritional setbacks during this time can result in irreversible effects[21,22]. Therefore, children should be fed on a variety of nutrient-dense foods during the complementary feeding period in order to receive adequate amounts of essential nutrients for normal physical and mental development[68]. The increased recognition of the importance of DD on the nutrition and health of young children, lead to the inclusion of DD as a specific indicator in the guidelines for complementary feeding for children aged 6-23 months. This indicator recommends that children should be fed foods from a minimum of four out of seven food groups each day[69].

Household access to a variety of foods is a key factor for ensuring adequate nutrition among young children, particularly during the complementary feeding period. However, cost and affordability are major issues for many poor households. In many cases households may have access to adequate food resources that they can draw upon to improve the quality of diets they consume. However, lack of knowledge among the caregivers on how best to utilize these foods while feeding young children, particularly during the complementary period is a major challenge[70–72]. Additionally, cultural beliefs and practices, inappropriate advice, and lack of time due to heavy work have been recognized as major contributing factors to inappropriate child feeding practices[30,73,74].

Effectiveness of nutrition education interventions on nutrition knowledge of caregivers, child feeding practices and nutritional status

Nutrition education is defined as "any combination of educational strategies, accompanied by environmental supports, designed to facilitate voluntary adoption of food choices and other food and nutrition-related behaviors conducive to health and well-being"[75]. Improved knowledge, skills and a supportive environment, that

addresses the underlying determinants of behavior, have been recognized as important components for behavior change[76]. Research has demonstrated evidence that nutrition education has the potential to improve nutrition knowledge among caregivers[72,77–79]. Nutrition education has also been associated with improved IYCF practices including dietary diversity and feeding frequency[80,81], food and nutrient intakes[82,83], as well as nutritional status of young children[72,77,81,83].

Rationale of the study

Interventions seeking to alleviate malnutrition, particularly micronutrient deficiencies have for a long time focused on single components within food and not paid attention to the foods themselves[34,84,85]. Micronutrient deficiencies interact and do not occur in isolation, hence strategies aimed at addressing multiple micronutrients simultaneously are considered to be more effective in alleviating these problems on a long term basis[86]. Agrobiodiversity, also referred to as agricultural biodiversity is defined as, “the biological variety exhibited among crops, animals and other organisms used for food and agriculture”[34]. Agrobiodiversity comprises a vast array of plants and animals, including those that are cultivated and wild species. Many of these crop and animal species including their varieties are rich sources of nutrients. If these crop and animal species are made available and utilized effectively, they could contribute significantly to improved dietary diversity and quality during all seasons of the year[60].

Food-based strategies aimed at promoting the re-introduction and utilization of local agrobiodiversity into the staple-based diets, are considered to be cost effective and sustainable on a long-term basis as means of improving dietary diversity and quality, and for providing non-dietary components important for good health[33,34,84]. Local agrobiodiversity could be used to complement and improve the quality of existing diets, particularly the complementary diets of children in resource-poor settings. However, lack of knowledge on the locally available nutrient-rich foods and how best to utilize them in the diet, has resulted in these foods being underutilized and neglected[33]. Therefore, integrated food-based and educational strategies focusing on increasing the utilization of local agrobiodiversity as a means of improving diet quality and diversity are needed, particularly among resource-limited rural communities.

Objectives of the thesis

The objectives of this thesis were:

1. To assess the dietary patterns, food and nutrient intakes of women and children 6-23 months during two seasons in a rural setting in Western Kenya. The effect of seasonality and other factors on dietary diversity, the factors influencing nutrient intakes among women, and the relationship between maternal and child dietary diversity were as also investigated.

2. To develop and evaluate the effect of a nutrition education intervention focusing on increased utilization of local agrobiodiversity and enhanced nutrition knowledge among caregivers on the diversity of complementary diets of children aged 6-23 months.

Conceptual framework

The effect of seasonality on the different areas affecting dietary intakes of women and children was assessed within the model of nutrition security (modified after UNICEF[87], Figure 1.1. The effect of the nutrition education intervention on children's dietary diversity and nutrition knowledge of caregivers were also assessed within the same model.

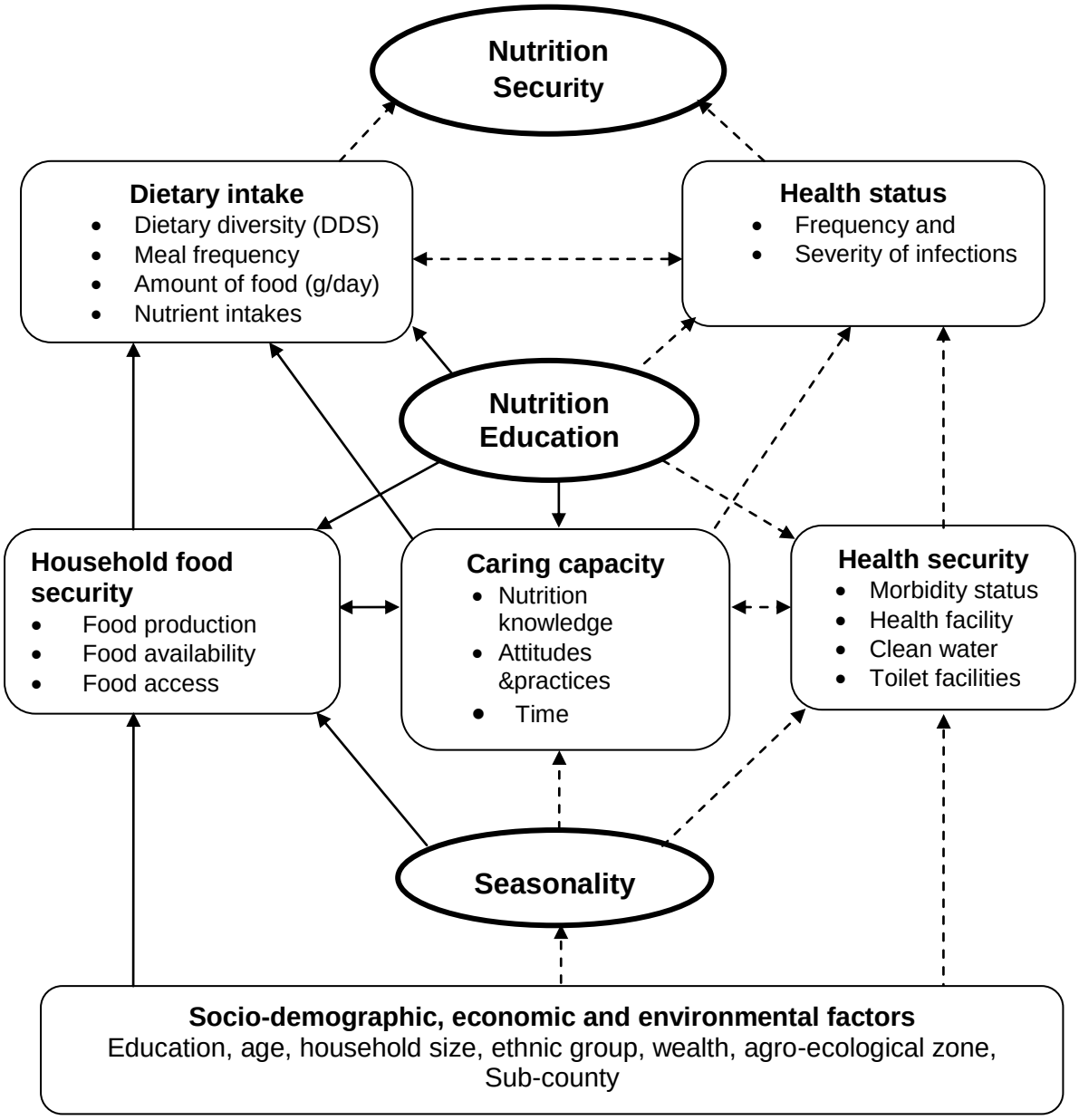

Figure 1.1: Model of nutrition security showing (dark arrows) the main areas investigated within the present study (modified after UNICEF[87]).

2 General Methodology

Introduction

The present study was embedded in a larger project, 'Improving nutritional health of women and children through increased utilization of local agrobiodiversity in Kenya, 'INULA'. The INULA project was conducted in collaboration between the Institute of Nutritional Sciences, Justus Liebig University, Giessen, Germany and Bioversity International, Nairobi Kenya.

Ethical clearance

Research permission including ethical clearance for the study was approved by the National Council of Science and Technology (NCST) Nairobi, Kenya. Further before the field work began, general consent was obtained from the District Commissioners (DC), District Ministry of Health Officers (DMOH) and the District Education Officers (DEO) in the study sub-counties. The caregivers were informed about the study and invited to participate in the surveys and nutrition education sessions voluntarily after giving both their informed verbal and written consent.

Study sites

The project was conducted in four sub-counties (formerly districts) namely: Bondo, Teso south, Mumias and Vihiga, in Western Kenya, Figure 2.1. The study sites were chosen because all except Vihiga, were research sites for a former Bioversity International project on "The effects of market integration on the nutritional contributions of traditional foods to the wellbeing of the rural poor in Africa". The four study sites lie in different agro-ecological zones (AEZ).

Figure 2.1: Map of Kenya indicating the geographical location of the study area in Western Kenya

Mumias, Teso South and Bondo sub-counties lie in the lower midland (LM) zone, while Vihiga sub-county lie in the humid upper midlands (UM1) zone, Figure 2.2. Mumias sub-county lies entirely in the humid lower midland zones (LM1), while Teso South sub-county lies partly in LM1 and in the sub-humid lower midland zone (LM2). Bondo sub-county lies across three agro-ecological zones namely: the semi-humid lower midland zone (LM3), transitional lower midland zone (LM4) and the semi-humid lower-midland zone (LM5).

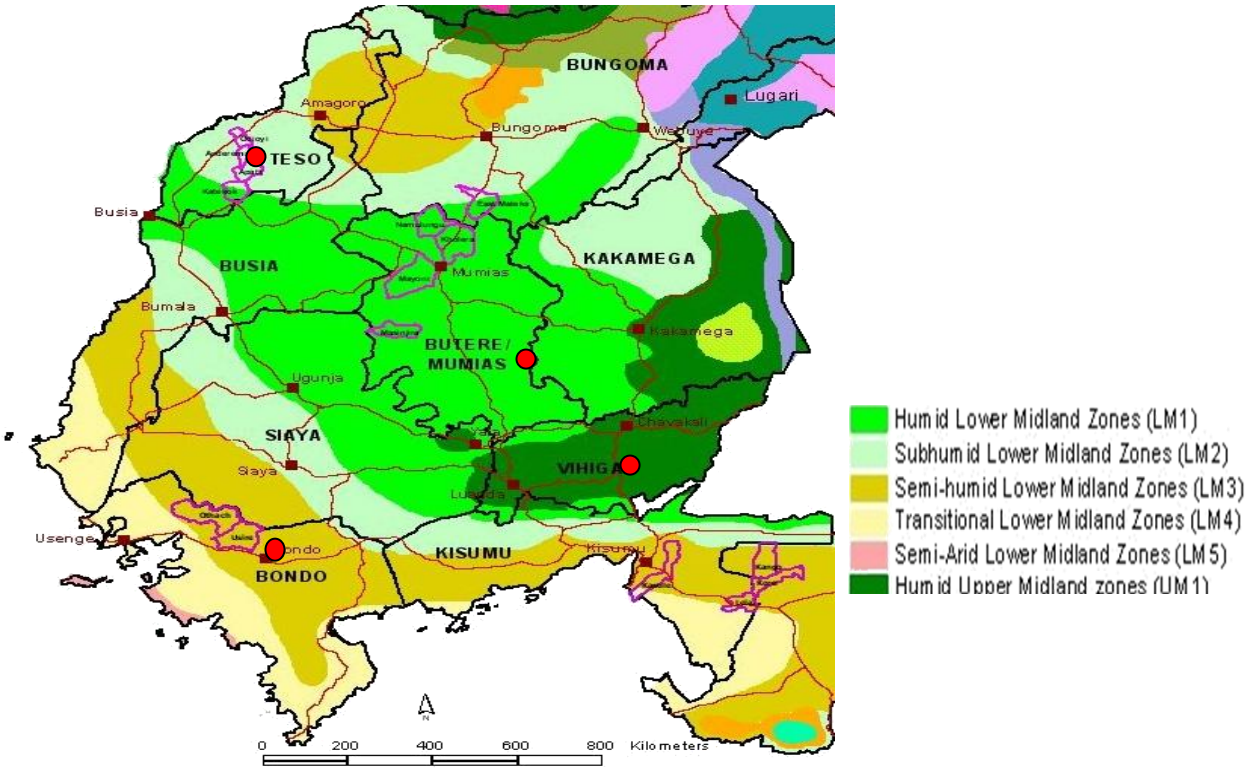

Figure 2.2: Agro-ecological zones of the study sites in Western Kenya

Mean annual rainfall in the study area ranges from 1020mm in the lower midlands to above 2000 mm in the upper midland zones, with the long rains usually concentrated during the period between May and June and the short rains between October and November[88]. According to the 2009 population and housing census, Bondo, Teso South, Mumias and Vihiga sub-counties cover an area of 593 km^2, 299.8 km^2, 590.2 km^2 and 299.6 km^2, with estimated populations of 157, 522; 137924; 359, 381 and 221, 294 persons, respectively[89]. The study area is inhabited by people from three major ethnic groups including the Luhya found mainly in Mumias and Vihiga sub-counties; the Teso in Teso South sub-county; and the Luo in Bondo sub-county.

Agriculture is the main economic activity in the study area with a majority of the population involved in both cash crop and subsistence farming. Sugarcane, tea, tobacco, cotton and coffee are grown predominantly as cash crops. Staple crops grown in the study area include cereals like maize, millets and sorghum; roots and tubers such as sweet potatoes and cassava; legumes, nuts and seeds such as beans, soya beans, sunflower and groundnuts and a variety of vegetables. Fishing is also an economic activity in Bondo sub-county which lies along the shores of Lake Victoria[90].

Study design

Repeated cross-sectional nutritional surveys were conducted during the study and data collected over three periods of time. The baseline survey was conducted in July/ August 2012 (harvest season) and the second survey (also referred to as the follow-up survey) in November 2012, to capture a different season (post-harvest season). The second survey also coincided with the short-rain season in the study areas. The endline survey was conducted one month after the end of the five month nutrition education intervention study, and at the same time as the baseline survey (July/ August 2013), Figure 2.3.

Sample size determination

The sample size was for this study was calculated at baseline, based on the estimated prevalence of children aged 6-23 month with a dietary diversity score (DDS) of ≥ 3 food groups for the breastfed and ≥ 4 food groups for the non-breastfed children in the project area, 49.7%[11], using the formula:

$N = t^2 * p (1-p) * D / m^2$, where:

N= required sample size.

t = confidence level at 95% (standard value of 1.96).

p= estimated prevalence of children aged 6-23 month with a DDS of ≥ 3 (breastfed) and ≥ 4 (non-breastfed) in the project area (49.7%).

m= margin of error at 5% (standard value of 0.05).

D= design effect 1.5 (no previous information on design effect in the project area).

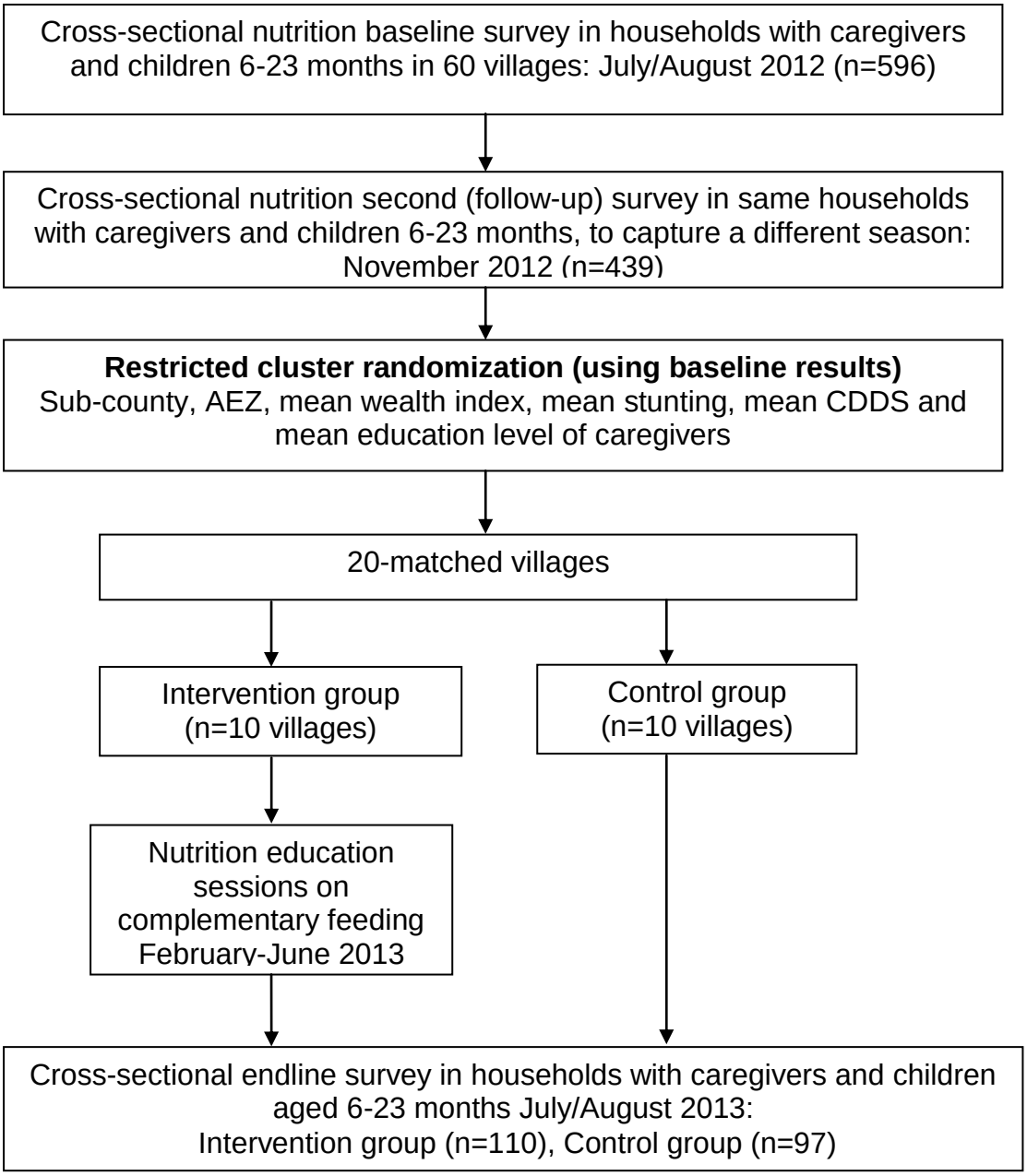

Figure 2.3: Overall study design showing the repeated cross-sectional surveys conducted over three periods of times and the nutrition education intervention study

The resulting minimum required sample size of 576 was increased by 5% to 605 to account for contingencies, and this figure rounded off to 600, a number that matched well with the four study sub-counties (150 households per sub-county).

Sampling methodology

The two-stage cluster sampling procedure was applied while selecting the study sample during the baseline cross-sectional survey. Information with regards to the number of villages and households per village in each of the sub-counties was obtained from the District Statistics Offices (now sub-counties). In the first sampling stage, 60 villages (15 per sub-county) were randomly selected with a probability proportional to size (PPS) method, using open source software R. In the second sampling stage, ten households with children aged 6 to 23 months and their caregivers (women) were randomly selected using the RAND function in excel, from household lists prepared by community health workers (CHW) from the sampled villages. A total of 596 caregivers with children aged 6-23 months were interviewed during the baseline survey in July/ August. The same caregivers interviewed in July/ August and whose children were still aged below two years participated in the follow-up survey in November. Thus, a total of 439 caregivers with children aged 6-23 months were interviewed during the two seasons, Figure 2.3.

Nutrition education intervention

The nutrition education intervention study applied the cluster-randomized control trial design and consisted of one intervention and one control group. Based on the results from the baseline survey, the most similar villages in Bondo and Teso South sub-counties were paired with respect to the following variables: sub-county, AEZ, mean children's dietary diversity scores (CDDS), mean stunting rate, mean wealth index and mean education level of caregivers. Twenty matched villages (ten from each sub-county) were then randomly assigned to the intervention (n=10) and control (n=10) groups. The nutrition education intervention study design is presented in Figure 4.1.

The nutrition education sessions

The nutrition education intervention consisted of four participatory nutrition education sessions, including group trainings and cooking demonstrations. The nutrition education sessions were conducted between February and June 2013. The themes and topics of the nutrition education sessions were based on the findings from the baseline survey, with reference to training materials from FAO[(91)], UNICEF[(92)] and Malawi[(93)]. Session one focused on the importance of complementary feeding starting at six months, with continued breastfeeding up to two years. Session two highlighted

the importance of feeding young children diverse diets during the complementary feeding period. The use of easily accessible and affordable locally available foods to improve the diversity of local complementary diets was emphasized and demonstrated during the cooking demonstration. Session three was a review of the first two sessions, and also included another cooking demonstration on how to prepare nutritious and diverse meals for children aged 6-23 months using locally available foods. Session four focused on how to obtain and prepare adequate and nutritious meals for children aged 6-23 months. Strategies to improve budgeting for food to get the best value for money and still prepare nutritious complementary foods were discussed.

One follow-up session was conducted in April 2013 on a sub-sample of caregivers (n=50) who had participated in the first and second nutrition education sessions. Detailed description of the four nutrition education sessions is presented in Table 4.1.

Development of nutrition education materials

The teaching materials used during the nutrition education sessions were developed by the INULA research team. These included: i) folders which contained leaflets with key messages on complementary feeding practices for children in the age groups 6-8 months, 9-11 months and 12-23 months, ii) food circle showing a variety of foods including locally available foods suitable for children aged 6-23 months grouped into six food groups[91], iii) brochures with key messages on the importance of: breastfeeding, starting complementary feeding at six months, maintaining hygiene during complementary feeding, and feeding young children a variety of foods, iv) seasonal food availability calendars with information on the availability of different foods in each of the study sub-county during all seasons throughout the year, and v) posters with key messages on the importance of feeding children a variety of foods, nutritious snacks for children 6-23 months, and foods/ ingredients that could be used to enrich complementary foods . More details on the development of the nutrition education materials are presented in chapter 4.

Training of community health workers (CHW)

The nutrition education sessions and follow-up visits were facilitated by the researcher in cooperation with trained CHW from the intervention villages. Prior to the commencement of the nutrition education sessions, the CHW participated in a

training workshop where they were trained by the INULA research team on general nutrition and the different topics of the nutrition education sessions.

Recruitment of nutrition education intervention participants

The nutrition education intervention targeted caregivers with children aged 6-17 months residing in the intervention villages. The caregivers and children were selected from household lists compiled by CHW from the intervention villages. In each intervention village, 10 to 15 caregivers with children aged 6 to 17 months were invited to participate in the nutrition education. Caregivers who were interviewed at baseline (July/ August 2012) and whose children were still aged below 18 months were also eligible to participate in the nutrition education sessions. Caregivers with children aged 6-17 months were chosen to participate in the nutrition education sessions to ensure that their children were aged below two years at the time of the endline survey. The procedures followed in the recruitment of the nutrition education participants are described in details in chapter 4.

Recruitment and training of enumerators

The data for this study was collected by a team of trained enumerators with at least university education and basic nutrition knowledge. The enumerators were fluent in English and Kiswahili, as well as the local vernacular languages (Luhya, Luo and Teso) spoken in the study areas. Prior to the commencement of each survey, the enumerators participated in workshops where they were intensively trained on the use and application of the survey tools, and on how to take accurate anthropometric measurements.

Data collection

Data collection for this study was done during three different periods of time: at baseline survey (July/ August 2012); during the second survey (November 2012); and at endline survey (July/ August 2013), one month after the end of the five month nutrition education intervention study. Data was collected using pre-tested semi-structured questionnaires through face to face interviews with the caregivers at their homesteads. The individual interviews were conducted by trained enumerators in Kiswahili or the local vernacular languages (Luhya, Luo and Teso).

The baseline questionnaire was divided into three parts: Part 1 was the household questionnaire which included questions on the household socio-demographic characteristics, living conditions, source of drinking water, type of fuel, sanitation facilities, possessions and household food insecurity status. Part 2 of the questionnaire was for the children aged 6-23 months. It included questions on child feeding practices and morbidity. Part 3 of the questionnaire targeted the caregivers and included questions on child feeding practices and nutrition knowledge of the caregivers.

Each part of the questionnaire included a 24-hour dietary recall questionnaire used to assess dietary intakes at household and individual levels for the children and caregivers. The questionnaire also included a section to record anthropometric measurements of the caregivers and the children. The baseline survey question was adapted and used to collect data during the second and endline surveys (Appendix).

Assessment of household socio-economic status

Information collected at household level included: housing characteristics (type of roofing materials), basic amenities (source of drinking water, type of fuel and type of toilet facilities), and ownership of land and other valuable assets including electricity, radio, mobile phone, watch/clock, television, sprayer, plough, bicycle, ox/donkey cart, motorcycle, car, boat, fishing net and computer). This information was used to construct a household wealth index, which was used to assess the household socio-economic status. Using principal component analysis (PCA)[(94)], weights were assigned to each of these variable in the household, and the weighted scores summed up to come up with the household wealth index score, with a high score representing high wealth. The wealth index scores were divided into quintiles to come up with a categorical variable classifying the households as: poorest, poor, middle, richer and richest.

Assessment of household food insecurity status

The household food insecurity status was assessed using the Household Hunger Scale (HHS)[(95)]. The HHS consists of a set of three occurrence questions and three frequency-of-occurrence questions adapted from the Food and Nutrition Technical Assistance (FANTA/ USAID) Household Food Insecurity Access Scale (HFIAS)[(96)]. The occurrence questions seek to identify if the following three food condition were

experienced in the household 30 days prior to the survey: i) if there was no food to eat of any kind in the household due to lack of resources to get it; ii) if any household member went to sleep hungry at night because there was not enough food, and iii) if any household member went the whole day and night without eating anything because there was not enough food.

A frequency-of-occurrence question was asked following an affirmative response to any of the occurrence questions in order to determine whether the condition happened in the household rarely (1-2 times), sometimes (3-10 times) or often (≥10 times) during the 30 days reference period. This data was used to construct a continuous Household Hunger Scale (HHS) score, in with a high score indicating the occurrence of severe hunger in the household. The HHS score was further used to construct a categorical HHS score indicator with three household hunger categories: 0 to 1 indicating little to no hunger in the household; 2 to 3, moderate hunger in the household; and 4 to 6, severe hunger in the household[95].

Assessment of dietary intakes

The dietary intakes of the study population were assessed using the 24-hour dietary recall method[97]. One day (single) 24-hour dietary recalls were conducted at the respondents' homestead during each survey. The 24-hour dietary recalls were conducted for the household and at individual levels for the children and caregivers. During the 24-hour dietary recalls conducted at the household level, the caregivers (respondents) were asked to describe all types of foods that they or any members of their households had eaten or drank in the previous 24 hours (Appendix). Only foods consumed by household members at home and not those purchased and consumed outside the home were recorded. In addition, the actual mounts of foods consumed by the household members were not recorded during the 24-hour dietary recalls conducted at household level.

For the 24-hour dietary recalls conducted at individual level, the caregivers were first asked to describe all the foods and beverages that their children had consumed the day preceding the survey. All the foods that the children had consumed both at home or outside the home were recorded. Detailed information on all of the ingredients that were used in the mixed dishes, snacks and beverages mentioned were obtained from the caregivers. The amounts of all the foods and beverages consumed by the children were estimated using local household measures including cups, plates and

spoons. The exact amounts of each ingredient in mixed dishes such as relish of different vegetables were collected prior to the baseline survey from a few households from each of the study areas and standard recipe calculated. The same procedure was followed while conducting the 24-hour recalls of the caregivers.

Data collected from the 24-hour dietary recalls were used to calculate the dietary diversity scores (DDS) at household and individual levels for the caregivers and children during each of the three surveys. The household dietary diversity score (HDDS) was computed based on twelve food groups recommended by FAO[98]. The HDDS ranges from 0 to 12, with a sum of 12 scores. The women's dietary diversity score (WDDS), with a score ranging from 0 to 9, was calculated based on nine food groups[98]. The new minimum dietary diversity-women (MDD-W) global dietary indicator for women[99], was not available at the time of implementing the current study. This indicator recommends that women consume foods from at least five out of ten foods, which is associated with a greater likelihood of them meeting their micronutrient needs. Therefore, the cut-offs used to define the diets of the women as having low DDS (≤ 3 food groups), medium DDS (4 food groups) or high DDS (5 to 9 food groups) in this study were defined by terciles of dietary diversity[32]. The terciles were created based on the observed distribution of the WDDS during the baseline survey, and the same cutoffs applied during the second surveys. The children's dietary diversity score (CDDS) ranging from 0 to 7 was constructed based on seven food groups following the WHO guidelines[69]. Children aged 6-23 months who consume foods from four or more food groups out of seven are considered to have received minimum dietary diversity (MDD)[100].

The nutrient intakes of the caregivers and children in July/ August and November were estimated from the 24-hour dietary recall data using the open source software package, Nutrisurvey[101]. The NutriSurvey program was based on the Kenyan food database with additional of missing foods from the German food database and other databases, mainly from the Prota database (http://www.prota4u.org/) for some traditional vegetables. The food intakes (g/day) of the caregivers in July/ August and November were also estimated using the same tool. The estimated average requirements (EAR) values were applied as reference values while estimating the prevalence of inadequate nutrient intakes among the caregivers[102]. The energy and nutrient requirements from complementary foods for children aged 6-23 months were calculated based on assumption of average breast milk intake for children in three

age groups; 6-8 months, 9-11 months and 12-23 months following the recommendation for developing countries[103]. Detailed description regarding the caregivers and children's nutrient and food (g/day) intake assessment and analysis are presented in chapter 3.

Assessment of nutrition knowledge among the caregivers

The nutrition knowledge of caregivers was assessed during the individual interviews conducted with the caregivers during the baseline and endline surveys. The nutrition knowledge was assessed based on the caregivers' knowledge of three nutrient; vitamin A, iron and vitamin C. The first question sought to find out whether the caregivers had any knowledge on the three nutrients. An affirmative answer for each nutrient was followed by another question asking the caregivers to name three foods rich in each of the nutrients. The last question required the caregivers to explain the importance of feeding young children foods rich in each of the three nutrients. One score was assigned for each correct response and a zero score (0) for incorrect responses. Each nutrient had a possible score ranging from 0 to 7, and a maximum possible score of 21 for the three nutrients. The nutrition knowledge score was used a continuous variable during the data analysis (chapter 4).

Assessment of anthropometric measurements

Anthropometric measurements of the caregivers and children were taken during the baseline and endline surveys. All the anthropometric measurements were taken by pairs of trained enumerators, each consisting of the measurer and note-taker, using standardized equipment, (from Seca Gmbh & Co KG, Hamburg, Germany), and following standard procedures[104]. The weights of the caregivers and children were measured with minimal clothing and no shoes, using the standardized digital flat scale (Seca 874, capacity 200 kg), with mother and child function. The height measurements of the caregivers were taken using the stadiometer (Seca 213, measuring range: 20-205 cm). Recumbent lengths of the children 6-23 months were measured using the length board (Seca 417, measurement range: 10-100 cm). The height/length measurements were taken to the nearest 0.1 cm, and weight measurements to the nearest 0.1 kg. All anthropometric measurements were taken twice and the mean values calculated.

The anthropometric measurements of the children (length and weight) and their ages were used to compute the height-for-age (HAZ), weight-for-age (WAZ) and weight-for-height (WHZ) indicators using WHO Anthro version 3.2.2[105]. The children with z scores below -2 SD values of the reference median HAZ, WAZ and WHZ were classified as being stunted, underweight and wasted, respectively[106]. The prevalence of these nutritional indicators were expressed as percentages and used to describe the prevalence of malnutrition among children in the study area. The weight and height measurements of the caregivers (non-pregnant) were used to calculate their BMI using the formula: BMI=weight in kilograms/ height in meter^2. Based on the WHO classification, the women were classified as underweight (BMI < 18.5kg/m^2), normal weight (BMI: 18.5 to 24.99 kg/m^2), overweight (BMI: 25 to 29.99 kg/m^2), and obese (BMI ≥ 30.00 kg/m^2)[107].

Ages of the children

The age of a child is a very important piece of information for use during the evaluation of many facets of a child's nutritional status[108]. The birth dates of the children were verified mainly from records including the children's immunization and growth monitoring cards, baptismal and birth certificates. The ages of the children were calculated by subtracting the survey dates from the birth dates during each survey. Only children aged ≥183 and ≤730 days (equivalent to 6 to 23 months)[100] and their caregivers were included in the analyses conducted with this study.

Assessment of infant and young child feeding practices

The feeding practices of the children were assessed based on three WHO indicators [100]. Minimum dietary diversity (MDD), is defined as the proportion of children 6-23 months who receive foods from four or more food groups out of seven per day[69]. Minimum meal frequency (MMF), is defined as the proportion of breastfed and non-breastfed children 6-23 months of age who receive solid, semi-solid or soft foods (including milk feeds for non-breastfed children) the minimum number of times or more the previous day. The minimum is defined as: two times for the breastfed children aged 6-8 months, three times for breastfed children aged 9-23 months and four or more times for the non-breastfed children aged 6-23 months. Minimum acceptable diet (MAD) is defined as the proportion of children 6-23 months of age who receive a minimum acceptable diet (apart from breast milk). MAD is a composite

indicator calculated from two fractions: breastfed children 6-23 months of age who have at least the MDD and MMF during the previous day, and non-breastfed children 6-23 months of age who receive at least two milk feedings, and have at least the MDD (not including milk feeds) and the MMF during the previous day[100].

Data management and statistical analysis

Double data entry was performed at the end of each survey and the entered data sets compared and cleaned prior to data analyses. The data were also checked for normal distribution using the Kolmogorov-Smirnov (K-S) and Shapiro-Wilk (S-W) tests. The requirements for normal distribution were confirmed when the test statistics for the K-S test was below 0.1 and that for the S-W test above 0.95[109]. All statistical analyses were performed using IBM SPSS Statistics version 22.0 statistical software program[110].

Data generated within this study was analyzed at two levels. First data from the repeated cross-sectional surveys conducted in July/ August and November 2012 was analyzed to assess the seasonal variations in dietary diversity, food intake (g/day) and nutrient intakes among the women and children 6-23 months between the two seasons. McNemar test was used to assess differences in the proportion of women and children 6-23 months consuming foods from different food groups during the two seasons. Differences in mean nutrient intake and food intake (g/day) between the seasons among the women were determined using the t-test and sign-test, respectively. The Wilcoxon sign-rank test was used to assess difference in the percentage met median energy and nutrient requirements from complementary foods for children aged 6-23 months between the two seasons.

The seasonal effect, and the effect of other variables on WDDS and CDDS was assessed using the generalized linear mixed model (GENLINMIXED) approach taking into account the repeated measurements, modelling the DDS as count variables with Poisson regression, and adjusting for covariates in the models[111]. Univariate analysis of variance (UNIANOVA) was used to determine the factors influencing nutrient intakes among the women. Pearson's correlation was used to assess the relationship between WDDS and CDDS. More details regarding analyses on seasonal variations in dietary patterns, food (g/day) and nutrients intakes among women and children 6-23 months are presented in chapter 3.

Analyses with regards to the effect of the nutrition education intervention on children's dietary diversity and nutrition knowledge of caregivers are presented in chapter 4. These analyses were based on data collected from caregivers and children 6-23 months from the intervention and control villages at baseline and endline survey, after the nutrition education intervention study. Pearson correlation was used to determine the relationship between frequency of exposure to the intervention and nutrition knowledge scores of the caregivers and children's dietary diversity. UNIANOVA was used to assess the influence of follow-up on nutrition knowledge of the caregivers and children's dietary diversity.

The effect of the nutrition education intervention on children' dietary diversity and nutrition knowledge of the caregivers was assessed using the differences-in-differences (DiD) estimator inside a generalized estimating equations (GEE) framework. This method was used in order to account for a data structure that included a true panel, where data was gathered on the same units at two time points, and repeated cross sectional data[112,113]. The effect of the nutrition education intervention on binary outcomes including MDD, MMF and MAD were analyzed using logistic regression inside the GEE framework (chapter 4).

3 Seasonal variations and relationship between the diets of mothers and their children in Western Kenya

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Submitted

Abstract

Seasonal variations in food availability contribute to inadequate nutrient intakes in low income countries. This study assessed the effect of seasonality on dietary intakes of 426 women and their children aged 6-23 months in Western Kenya. Repeated cross-sectional surveys were conducted in 60 randomly selected villages in July/August (harvest) and November 2012 (post-harvest) seasons. Dietary intakes were assessed using 24-hour recalls. Effect of seasonality on dietary diversity was assessed using generalized linear mixed models. Mean WDDS (4.62 *vs*. 4.16, $P<0.001$) and CDDS (3.91 *vs*. 3.61, $P=0.004$) were low but significantly higher in November compared with July/ August. Seasonality had a small but significant effect on women's dietary diversity score (WDDS), $P=0.008$ but not on children's dietary diversity scores (CDDS), $P=0.293$. Estimated marginal mean WDDS increased from 4.17 to 4.38, and decreased from 3.73 to 3.60 for CDDS between the seasons. The observed increase in CDDS in November was due to an age and not a seasonal effect. The proportion of women with high dietary diversity score (DDS) increased from 36.4% to 52.4% between the seasons. Intakes of iron, calcium and vitamin E were higher among the women in November and significantly different between the seasons. Higher women education and food security were associated with higher WDDS and CDDS. Agroecological zone, ethnic group and home gardening were found to influence nutrient intakes of the women. Next to interventions aimed at alleviating seasonal food insecurity, nutrition education strategies are needed to improve overall dietary diversity for women and children in rural communities.

Key words: seasonal variations, dietary diversity scores, food groups, nutrient intake

Introduction

Malnutrition has continued to be one of the major public health challenges, particularly in developing countries. According to FAO, an estimated 805 million people were undernourished worldwide in 2012-14, with a majority of them living in developing countries. With an estimated 214.1 million hungry people, the sub-Saharan region accounts for the highest rate of undernourished people in the world[1]. However, these estimates do not capture the even more widespread problem of micronutrient deficiencies, which affect over two billion people in the world. An estimated one third of the developing world's children under the age of five are vitamin A deficient while iron deficiency anaemia during pregnancy accounts for one fifth of all maternal deaths[2]. Many rural households in low income settings in developing countries subsist on staple-based diets with few or no animal products, fruits and vegetables[3–5]. Micronutrient deficiencies are attributed to many factors and can still occur even when there is adequate food to meet the energy requirements of different population groups[6,7]. However, consumption of poor quality diets coupled with the high rates of infectious diseases are major factors responsible for the high burden of micronutrient deficiencies and their consequences[8–12].

Seasonality, including variations in temperature and rainfall is a key factor influencing food production, availability and access, especially among rural households in developing countries who depend on food from their own agricultural production activities and annual harvest of staple crops following the main rain season[13–15]. Often, many such households also have limited financial resources, and are thus more likely to experience seasonal changes in food access during the lean seasons due to high food prices[16–18]. Seasonal variations in food availability leads households to adapt their food consumption patterns by modifying not only the types and quality of foods they consume, but also the number of meals and quantities of foods they consume[18,19]. In addition to affecting food availability and access, the food shortage period is also often characterized by increased agricultural workload and morbidity, which contribute to poor health and nutritional status[13,14]. Seasonal variations in food availability and access contributes to reduced dietary diversity[20–22] and consequently to inadequate intake of energy and nutrients, particularly micronutrients which are linked to negative consequences on health and nutritional status[23–26].

Women of child bearing age, especially during pregnancy and lactation, and young children who experience rapid growth and are prone to suffer from infectious diseases are particularly vulnerable due to their increased nutrient requirements[12,27]. The adverse short and long term consequences of inadequate energy and nutrient intakes especially during pregnancy, lactation and early childhood have been well documented[28–32]. The consumption of diversified diets, including a variety of animal source foods, fruits and vegetables, is therefore recommended in order to support normal growth and good health[33–35].

Studies conducted in low income countries have provided evidence of the effect of seasonality on food intakes for different population groups including older children aged above two years[16,36], school going children[18] and women[20,21]. Less studied is the influence of seasonality on the food intakes of mothers and their young children aged 6-23 months. This study aimed to examine the seasonal variations in dietary diversity, food and nutrient intakes among women and their children aged 6-23 months during two seasons in a rural setting in Western Kenya. The effect of seasonality and other factors on the dietary diversity of women and children, and the factors influencing nutrient intakes among the women were also investigated. Additionally, we assessed the relationship between the women's and children's dietary diversity .This study was embedded in a larger project entitled, "Improving nutritional health of women and children through increased utilization of local agro-biodiversity in Kenya", (INULA). The project was implemented by Bioversity International, Nairobi, Kenya in collaboration with the Institute of Nutritional Sciences, Justus Liebig University Giessen, Germany.

Methods

Study area

The study was conducted in four sub-counties (formerly districts) in rural Western Kenya with different characteristics as described in Table 3.1. The majority of the population is involved in agriculture with both cash crop and subsistence farming as the main economic activities. Fishing is also practiced in Bondo sub-county which is located along the shores of Lake Victoria.

Table 3.1: Characteristics of the study areas in Western Kenya

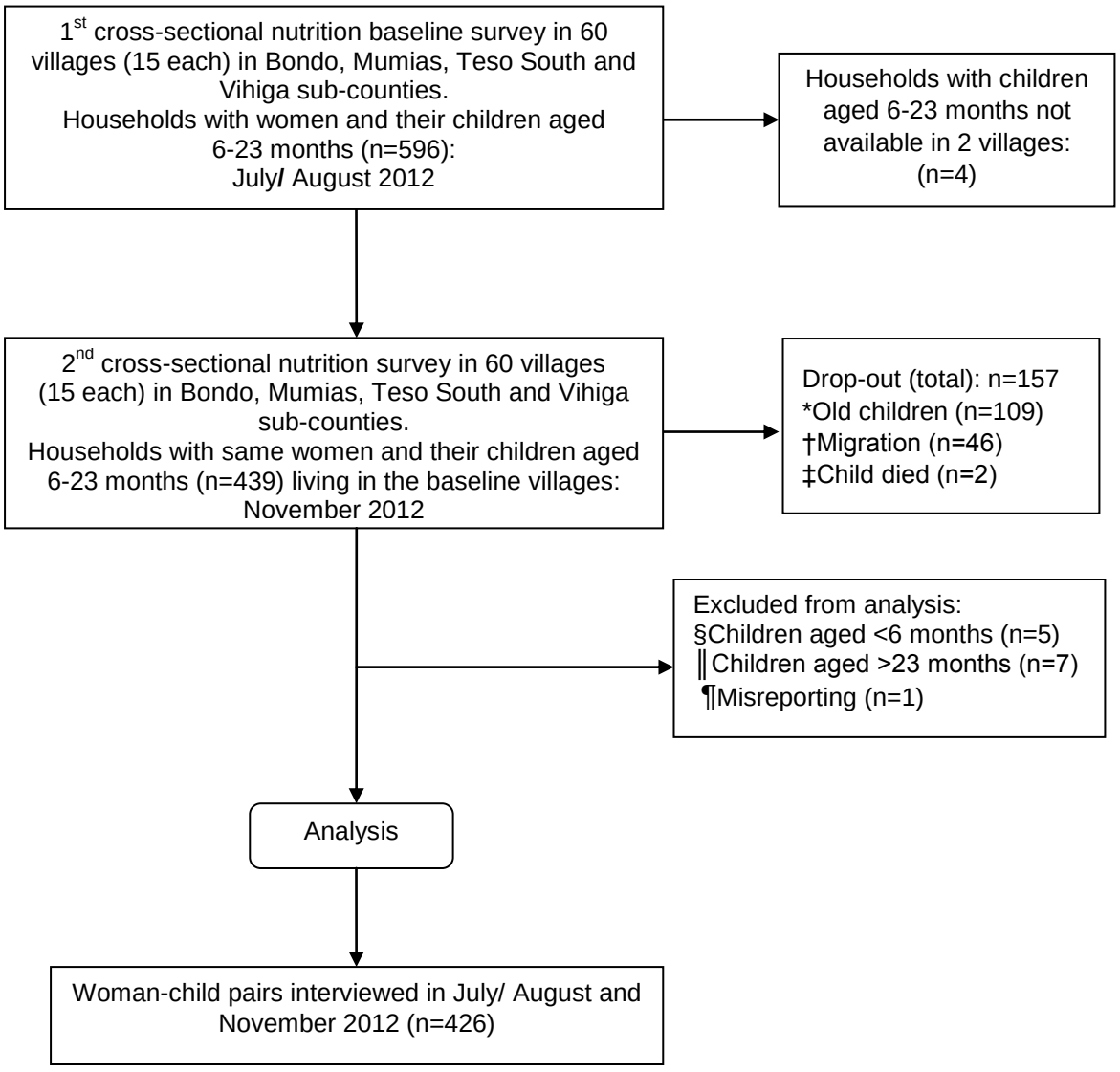
District/ Sub-county	Bondo	Mumias	Teso South	Vihiga
Main ethnic group	Luo	Luhya	Teso	Luhya
Agro-ecological zone[a]	LM3, LM4 and LM5	LM1	LM1 and LM2	UM1
Population density[b]	266	609	460	1101
Annual mean rainfall[b]	1020-1100 mm	1800-2000 mm	1550-1800 mm	2000 mm
Annual mean temperature	22.0-22.7˚C	21.0-22.0˚C	21.4-22.3˚C	18.5-21.0˚C

LM3, semi-humid lower midland zones; LM4, transitional lower midland zones; LM5, semi-arid lower midland zones; LM1, humid lower midland zones; LM2, sub-humid lower midland zones; UM, humid upper midland zones.
[a]Kenya National Bureau of Statistics[37]
[b]Jaetzold (2005)[38]

Study design

The sample for the current study stemmed from repeated cross-sectional nutritional surveys that were carried out in July/ August (harvest season) and November (post-harvest season) 2012, which also coincided with the short-rain season. Two-stage cluster sampling technique was applied during the survey conducted in July/ August, also referred to as the baseline survey. First, 60 villages (15 per sub-county) were randomly selected with a probability proportional to size (PPS) method using open source software R. Secondly, 10 households with women (caregivers) and their children aged 6-23 months residing in the sampled villages were randomly selected from household lists prepared by community health workers of the respective sampled villages.

A total of 596 women-children pairs were interviewed in July/ August. The same women-children pairs interviewed in July/ August and whose children were still aged between 6-23 months were interviewed again in November to capture a different season. As a result, a total of 439 women-children pairs participated in both surveys, while 157 were lost at follow-up in November. The main reasons for drop out included: the children having grown older than the eligible age of 23 months (n=109), migration of sampled household from study area (n=46), and death of the index child (n=2). Thirteen women-children pairs were excluded from analysis since the children were aged either below 6 months (n=5) or above 23 months (n=7), and one case (n=1) for misreporting. This resulted in a sub-sample of 426 women-children pairs that formed the panel data used in the analysis within the present study. The study profile is presented in Figure 3.1.



*old children: the children were aged above the required 23 months; †migration: sample households relocated from study area; ‡child died: the sampled children had passed away; §child<6 months: age of children less than the required age of 6 months; ‖age of children above the required age of 23 months; ¶ Misreporting: missing data.

Figure 3.1: Study profile

During the baseline survey, the sample size was calculated based on the estimated prevalence of children aged 6-23 month with a DDS ≥ 3 food groups (for breastfed) and ≥ 4 food groups (for non-breastfed) children in the project area (49.7%)[39], with a confidence level at 95% (standard value of 1.96), margin of error at 5% (standard value of 0.05), and design effect of 1.5 since there was no previous information on

the design effect in the project area. This resulted in a minimum required sample size of 576, which was further increased by 5% to 605 to account for contingencies. This figure was rounded off to 600, a number that matched well with the four sub-counties sampled for the study (150 households per sub-county).

In the statistical model that was set up to test the main hypothesis – in this case seasonal differences in WDDS as a main effect, including covariates (wealth index, ethnic group, household size, education of woman (years), age of women (years), household hunger score, home gardening, agroecological zone and sub-county), and including the interaction survey by ethnic group - the realized sample size of 414 women (828 observations at both time points) was able to detect a least significant difference (LSD) of 0.15 in WDDS. This represents a rather small difference in WDDS. Since small and not necessarily meaningful effects might reach statistical significance, we are not only interpreting the *P* values but the effect sizes as well.

All the women included in the study gave their verbal and informed written consent to participate in the study. Research permission including ethical approval for this study was obtained from the National Council of Science and Technology (NCST) Nairobi, Kenya.

Data collection

Data was collected by a team of eight trained enumerators with Bachelor of Science degrees in Nutrition, and who were conversant in English, Kiswahili and the local languages spoken in the study area (Luhya, Luo and Teso). Pre-tested semi-structured questionnaires were used to collect data through face to face interviews with the women in their homes.

Socio-economic status*:* Socio-economic data as well as data on water and sanitation were collected at both the household and individual level. Variables on the ownership of valuable durable assets, housing characteristics, source of drinking water, type of sanitation facilities and land ownership were used to construct the household wealth index score. Using principal component analysis (PCA), weights were assigned to each variable in the household; the weighted scores for each household were then summed up to come up with the wealth index score with a high score meaning high wealth[37].

Food consumption: The 24-hour recall method was used to assess the food consumption patterns at household and individual levels for the women and their children during the individual interviews conducted during each survey[41]. At the household level, the women who are responsible for food preparation were asked by the trained enumerators to recall all the foods that they or any member of their households had eaten at home during the previous 24 hours. Only foods consumed at home, and not those purchased and consumed outside the home during the previous 24-hours were recorded during the qualitative 24-hour dietary recalls conducted at household level[42].

Quantitative 24-hour dietary recalls were conducted at individual level and separately for the women and children during the two seasons. The women were asked to describe all the foods and drinks that they or their children had eaten or drank 24 hours preceding each of the two surveys. The names and where possible ingredients of all the dishes, snacks, beverages, or any other foods that they or their children had consumed at home or outside the home were recorded. The amounts of all the foods and beverages consumed by the women and the children were estimated using local household measures such as cups, plates and spoons. The exact amount of each ingredient in mixed dishes such as relish of different vegetables was collected before the survey from few households from each sub-county and standard recipes calculated.

The information collected from the 24-hour recalls was used to assess dietary diversity (DD), which is defined as the count of individual food items or food groups consumed over a given period of time, usually a reference period of the previous 24 hours[35]. DD is a qualitative measure of diet quality that can be assessed at either household or individual level by counting the number of food groups consumed and then calculating the dietary diversity scores (DDS)[42]. DD has been shown to be a good predictor of the quality and nutrient adequacy of diets for women and children[43–45], and as proxy indicator of household food security[46,47]. DD has also been positively associated with nutritional status[3,48]. DDS were calculated separately for the household, women and children in July/ August and November.
The household dietary diversity score (HDDS) and WDDS were constructed based on 12 and 9 food groups, respectively, following the recommendation from FAO[42]. HDDS has a sum of 12 scores ranging from 0 to 12 while WDDS ranges from 0 to 9

with a sum of 9 scores. At the time of designing and conducting the current study, the newly developed Minimum Dietary Diversity-Women (MDD-W) Global Dietary Diversity Indicator for women that recommend consumption of at least five of ten food groups was not available[49]. Thus, the choice of the cut-offs to define the diets of the women in this study as having low, medium or high DDS were defined by tertiles based on the observed distribution of the DDS during the survey in July/ August. The same cut-offs were applied in November. Women with diets consisting of ≤3 food groups were defined as having low DDS, 4 food groups as having medium DDS, and 5-9 food groups as having high DDS. The CDDS was also constructed from the 24-hour recall data and based on seven food groups[50].The CDDS ranges from 0 to 7, and children who consume foods from at least four or more food groups are considered to have received minimum dietary diversity (MDD)[51].

The amount of foods consumed by the women and children 24 hours preceding each survey were converted into nutrients using the open source software package, "NutriSurvey"[52] The NutriSurvey program was based on the Kenyan food database with additional of missing foods from the German food database and other databases, mainly from the Prota database (http://www.prota4u.org/) for some traditional vegetables.

We conducted single 24-hour dietary recalls during each of the surveys conducted during the different seasons in July/ August and November. Unusual low and high energy intakes were expected among a few women who reported either not having consumed any food or consumed only small quantities of foods the day preceding the survey, mainly due to sickness. On the other hand unusual high energy intakes were also expected among some women mainly due to festivities such as funerals which were common in the study areas. As a result these women had unusual low energy intakes during one season compared with the other season when they had normal foods intakes. In order to have a more clear interpretation of the results, with regards to seasonal differences in nutrient intakes, we excluded women with energy intakes < 2092 or > 14644 kJ/day (< 500 or > 3500 kcal/day) to control for unrealistic energy under-reporting and over-reporting[36]. This represented 5% (n=22) of the women who had either unusual low or high energy intakes during any of the two surveys. We decided in favour of this approach as our main aim was to analyze seasonal differences, and for this an extreme energy intake on one day due to

sickness or a feast – and not due to seasonal food availability – would have disrupted/ disturbed the analysis.

Individual energy and nutrient requirements were determined for each woman during each season based on their age and physiological status (pregnancy and lactation) and with reference to the estimated average requirements (EAR) values[54–56]. The percentage of women who were pregnant in July/ August and November were 4.7% and 6.2%, respectively. Thus an additional 1891kJ/day (452.kcal/day) and 1674 kJ/day (400 kcal/day) were added for pregnant and lactating women, respectively[55]. The mean energy and nutrient intakes were calculated and compared between the two seasons. The prevalence of inadequate nutrient intakes among the women during the two seasons were estimated based on individual requirements and using the EAR reference values[54]. In addition, the amount of single food (g/day) consumed by the women were also estimated using this programme and compared between the two seasons.

The estimated requirements for macronutrients and micronutrients from complementary foods for children aged 6-23 months were calculated based on an assumption of average breast milk intake for the age groups 6-8 months, 9-11 months and 12-23 months following the recommendation for developing countries[57]. Based on this recommendation, children in the age groups 6-8 months and 9-11 months with average breastmilk intake have no additional requirements for folic acid and vitamin C from complementary food. Similarly, children aged 6-23 months with average breast milk intake do not need additional requirements for vitamin B6 from complementary foods. Thus analysis with regards to folic acid and vitamin C was done only for breastfed children aged 12-23 months and non-breastfed fed children who received complementary foods during the two seasons. Analysis with regards to vitamin B6 was done only for non-breastfed children who received complementary foods during the two time points. Hence the different and small n-values for folic acid, vitamin C and vitamin B6 compared with the rest. It is also important to note that the study children had grown older at the time of the second survey in November and thus had different and higher requirements for energy and nutrients from complementary foods.

In order to control for age we determined the children's median percentage met requirements for energy and nutrients from complementary foods in July/August and November. The 'median percentage met requirements' is the median value for the percentage of requirements that were met for energy and selected nutrients. We also determined the differences in the met percentage requirements for energy and nutrients from complementary foods for the children between the two seasons.

***Household food insecurity assessment**:* Household food insecurity was measured using the household hunger scale (HHS)[58] which was adapted from the Food and Nutrition Technical Assistance (FANTA)/ USAID's Household Food Insecurity Access Scale (HFIAS)[59]. The HHS consists of three occurrence questions that provide information on the behaviour of households with regard to three food conditions related to household food insecurity, insufficient food quality and insufficient intake of food during a 30 day reference period. An affirmative response to each occurrence question is then followed by a frequency-of-occurrence question to determine if the condition happened rarely (1-2 times), sometimes (3-10 times) and often (≥10 times) during the 30 days reference period. Data from the HHS was used to construct a categorical household hunger scale score (HHS score) indicator with three household hunger categories: 0-1 indicating little to no hunger in the household; 2-3, moderate hunger in the household; and 4-6, severe hunger in the household[58].

Other information: Anthropometric measurements of the women and the children 6-23 months were taken once during the survey conducted in July/ August to determine the nutritional status of the women and children. The anthropometric measurements were taken by pairs of trained enumerators using standardized equipment from Seca (Seca Gmbh & Co KG, Hamburg, Germany), and following standard procedures[60]. Body mass index (kg/m^2) of mothers was calculated and the women classified as being underweight, normal, overweight or obese following the WHO classification[61]. Based on the anthropometric measurements of the children, height-for-age (HAZ), weight-for-age (WAZ) and weight-for-height (WHZ) Z-scores were calculated for the children using WHO Anthro version 3.2.2[62]. The children whose z scores were below -2 SD values of the reference median HAZ, WAZ and WHZ were classified as being stunted, underweight and wasted, respectively[63].

Statistical analyses

Descriptive analyses were performed to provide the background characteristics of the study population. The nutrient intake data for vitamin E and fat were log-transformed to correct for data distribution abnormalities including skewed data and outliers before data analysis. Differences in the proportion of women and children consuming foods from different food groups between the two seasons were determined using the McNemar test. Differences in intakes of foods (g/day) between the seasons by the women was determined using the sign test, while differences in mean nutrient intakes were assessed using the paired t-test. Wilcoxon sign-rank test was performed to test for difference in the median percentage met requirements for energy and nutrients from complementary foods among the children between the two seasons.

The Bonferroni-Holm correction for multiple comparison tests were performed to correct for type one error in the multiple analyses of food groups consumed, food (g/day) and nutrient intakes between the two seasons, and adjusted *P*-values reported[64]. This was done in order to ascertain that the observed changes in food and nutrient intakes between the seasons were not by chance. For each test, the *P*-values were sorted in order from the smallest to the largest and the total number of *P*-values (m) determined. Then, the total number of *P*-values, in this case 'm' was multiplied by the first smallest *P*-value. If the first *P*-value remained significant, the second *P*-value was multiplied by the total number of *P*-values less one (m-1). This sequential procedure was repeated until the last and largest *P*-value was multiplied by 1.

The assumption of linearity between WDDS and CDDS was checked and found to be reasonable. Pearson's correlation was used to assess the relationship between WDDS and CDDS in July/ August and November, as well as the relationship between change in WDDS and change in CDDS between the two seasons. The seasonal effect and the effect of other variables on DDS were assessed separately for the women and children using the generalized linear mixed model (GENLINMIXED) approach, taking into account the repeated measurements, modelling the dietary diversity scores as count variables with Poisson regression, and adjusting for covariates. Women age (years) and education (years), wealth index, household size, household hunger score, home gardening, ethnic group, agro-ecological zone and sub-county were used as covariates in the GENLINMIXED model with WDDS. The

GENLIMIXED model used to assess the effect of seasonality on CDDS included the covariates age of children (months), wealth index, ethnic group, household size, household hunger score, home gardening, agro-ecological zone and sub-county. Women's age (years) and education (years) were included as additional covariates in the GENLINMIXED model with CDDS to assessing the effect of other variables on CDDS.

Univariate analysis of variance (UNIANOVA) models, including age of women (years), education of women (years), wealth index, household hunger score, household size, breastfeeding status, home gardening and agro-ecological zone as covariates were used to determine the factors influencing nutrient intakes among the women. All statistical analyses were performed using IBM SPSS Statistics version 22.0 statistical software program[65].

Results

The basic characteristics of the study population are presented in Table 3.2. The average age of the study women was 27.4 years, with 87.1% being married. Most of the women (74.0%) had primary education. The household size ranged from 2 to 17 persons with an average of 6 persons. Approximately one third of the households (29.6%) experienced moderate hunger. The prevalence of underweight and overweight/obese among the study women was 10.3% and 16.7% respectively, while 28.4%, 12.9% and 3.5% of the study children were stunted, underweight and wasted, respectively.

Seasonal variations in dietary diversity of women and children

We observed changes in the food consumption patterns of the women and children between the seasons, with the women and children consuming foods from more food groups in November compared with July/ August. There was a significant increase in the proportion of women who consumed dark green leafy vegetables (85.9% *vs*.73.2%, $P<0.001$), legumes, nuts and seeds (44.1% *vs*. 29.8%, $P<0.001$) and vitamin A rich fruits and vegetables (22.3% *vs*. 12.9%, $P=0.002$) in November compared with July/ August, Table 3.3.

Table 3.2: Basic characteristics of study population in Western Kenya

Characteristics	**n=426**	**%**
Age of women (years)		
Mean	27.4	
SD	7.9	
Marital status		
Married	371	87.1
Widowed/divorced/single	55	12.9
Maternal education		
No formal education	27	6.3
Primary	351	74.0
Secondary	74	17.4
Higher	10	2.3
Age of children (months)		
Mean	12.78	
SD	4.0	
Sex of children		
Male	217	50.9
Female	209	49.1
Household size		
Mean	6.06	
SD	2.3	
Ethnic group		
Luo	111	26.1
Luhya	232	54.5
Teso	77	18.1
Others	6	1.4
Household food insecurity		
Little to no hunger in household	285	66.9
Moderate hunger in household	126	29.6
Severe hunger in household	15	3.5

SD, standard deviation.

The distributions of DDS among the women were also found to be different between the two seasons, with the proportion of women consuming diets with high DDS (5 to 9 food groups) increasing from 36.4% in July/ August to 52.4% in November, Figure 3.2. The observed mean WDDS (SD) was significantly higher in November compared with July/ August (4.62 (1.43) *vs*. 4.16 (1.14), $P<0.001$). The diets of nearly all the women included cereals, vegetables, oils/ fats, sugar and tea during the two

seasons. These foods dominated and formed the basic diets of the women with low DDS (≤3 food groups). Women with medium DDS (4 food groups) also consumed milk, fish, pulses and fruits in addition. Next to the foods consumed by women with both low and medium DDS, women with high DDS (5-9 food groups) also consumed animal source foods including milk, fish, meat and eggs during the two seasons.

Table 3.3: Consumption of foods from different food groups by women and children 6-23 months in Western Kenya (n=426)

Food groups	July/August 2012 n	%	November 2012 n	%	*Adj. P**
Consumption of foods from nine food groups by women†					
Starchy staples (cereals, roots and tubers)	424	99.5	425	99.8	1.000
Dark green leafy vegetables	312	73.2	366	85.9	**<0.001**
Vitamin A rich fruits and vegetables	55	12.9	95	22.3	**0.002**
Other fruits and vegetables	376	88.3	372	87.3	1.000
Organ meats	6	1.4	11	2.6	1.000
Meat and fish	207	48.6	204	47.9	1.000
Eggs	27	6.3	43	10.1	1.000
Legumes, Nuts and Seeds	127	29.8	188	44.1	**<0.001**
Milk and milk products	239	56.1	265	62.2	0.128
Consumption of food from seven food groups by children 6-23 months‡					
Grains, roots and tubers	411	96.5	405	95.1	1.000
Vitamin A rich fruits and vegetables	239	56.1	280	65.7	**0.015**
Other fruits and vegetables	303	71.1	334	78.4	0.059
Flesh foods	139	32.6	148	34.7	1.000
Eggs	49	11.5	50	11.7	1.000
Legumes, nuts and seeds	144	33.8	174	40.8	0.153
Dairy products	254	59.6	275	64.6	0.341

Adj., Adjusted
†Based on nine food groups FAO[42].
‡Based on seven food groups WHO[50].
*McNemar test, Adjusted *P-value*- Bonferroni-Holm correction test for multiple comparisons.

Similarly, a higher proportion of children consumed foods from more food groups in November compared with July/ August. However, after controlling for type one error, the observed increase remained significant only for the proportion of children who consumed vitamin A rich fruits and vegetables between the two seasons (65.7% *vs.* 56.1%, *P*=0.015), Table 3.3.

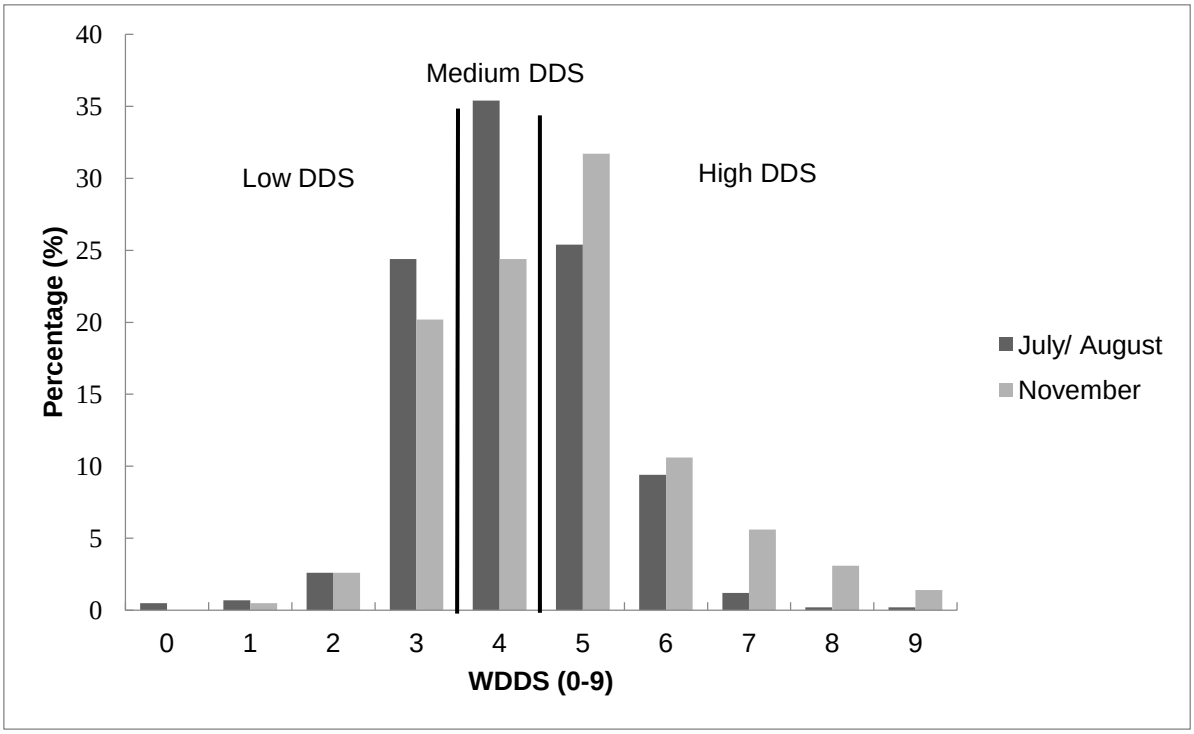


Figure 3.2: Distribution of WDDS and proportion of women with low, medium and high DDS in July/ August and November 2012 (n=426)

The observed mean CDDS (SD) was also significantly higher in November compared with July/ August (3.91 (1.43) *vs*. 3.61 (1.58), *P*=0.004). A significantly higher proportion of children consumed foods from ≥ 4 out of 7 food groups in November compared with July/August (62.4% *vs*. 52.6%, *P*=0.004). Overall diets of the women and their children were dominated by starchy staples with the consumption of animal source foods, vitamin A rich fruits and vegetables, and legumes, nuts and seeds being notably low during both seasons.

Seasonal variations in food and nutrient intakes among women and children

Results with regards to the estimated intakes of foods (g/day), showed a significant decrease in the mean (SD) amounts of cereals (347.19g (202.78) *vs.* 300.47g (151.56), *P*=0.018) and fruits (62.93g (146.62) *vs*. 34.42g (96.07), *P*=0.004) consumed by the women in November. On the other hand, we found a significant increase in the amounts of pulses (65.68g (130.43) *vs.* 98.06g (167.56), *P*=0.009) and milk (124.68g (136.66) *vs*. 140.47g (142.31), *P*=0.043) consumed by the women in November. However, the observed significant differences in the amounts of

cereals, fruits, pulses and milk consumed by the women between the seasons were very small and found to be non-significant after further analysis to control for type one error. In general, the amounts of animal source foods consumed by the women were low during both seasons. Tea consumption was notably high among the women in the study area during both seasons.

Energy, protein and fat intakes of the women were slightly higher in November but not significantly different between the seasons, Table 3.4. Carbohydrate intake was slightly lower in November but not significantly different between the seasons. Intakes of most micronutrients were slightly higher in November, with the exception of vitamin B1, folic acid and phosphorous which were lower, and vitamin B2 which was similar across the seasons. After controlling for type one error, only the intakes of iron (mean (SD) 14.04 (5.91) and 15.66 (6.16), P=0.001), calcium (mean (SD) 419.62 (240.59) and 500.23 (249.56), P<0.001) and vitamin E (median, 25-75 percentile 4.25, 3.03-6.04, and 4.94, 3.47-7.19, P=0.001) were found to be significantly different between the seasons, Table 3.4. Except for carbohydrates, magnesium and phosphorus, intakes of energy and most nutrients by the women were less than (or below) the EAR during both seasons.

Except for iron, zinc, calcium and phosphorus, 50% of the children met more than 100% of their energy, protein, fat, carbohydrates, vitamin B1, vitamin B2, vitamin B6 and folic acid requirements from complementary foods in July/August, Table 3.5. The proportion of vitamin C, iron and calcium requirements met by the children from complementary foods were less than 50% in July/ August, and thus notably low. The same trend was observed in November, however, the proportion of vitamin C, iron, zinc and calcium requirements met from complementary foods were higher during this season. Except for fat, folic acid, vitamin B6 and vitamin C, the children achieved significantly higher requirements for energy and most nutrients from complementary foods in November compared with July/ August

Table 3.4: Nutrient intakes among women in July/ August and November 2012 in Western Kenya (n=404)

Nutrient and unit of measures	July/ August 2012 Nutrient intake Mean EAR†	Mean	SD	Mean percentage met EAR	% of respondents < 100% of EAR	November 2012 Nutrient intake Mean EAR†	Mean	SD	Mean percentage met EAR	% of respondents < 100% of EAR	*Adj. P**
Energy, kJ	11830.66	7205.63	2572.98	61.03	94.06	11628.08	7241.82	2366.32	62.52	94.55	1.000
Protein, g	68.52	55.55	25.53	82.63	74.26	65.55	58.65	27.30	92.56	61.88	0.550
Fat (g)	-	39.51	25.47	-	-	-	40.07	23.18	-	-	1.000
Carbohydrates, g	152.88	308.90	116.12	205.66	5.45	145.38	301.18	102.32	215.40	3.71	1.000
Vitamin A RE, µg	843.18	761.76	616.64	94.80	59.95	790.47	860.55	616.63	115.85	49.63	0.165
Vitamin E, mg[a]	15.43	4.25	3.03, 6.04	38.15	59.95	14.88	4.94	3.47, 7.19	46.10	49.63	**0.010**
Vitamin B1, mg	1.17	1.76	1.96	151.64	31.68	1.13	1.61	0.84	144.11	31.68	0.148
Vitamin B2, mg	1.26	1.12	0.46	90.63	67.33	1.21	1.15	0.43	97.55	59.16	1.000
Vitamin B6, mg	1.64	1.72	0.82	107.06	54.70	1.56	1.86	0.84	122.74	40.35	0.096
Folic acid, µg	440.45	374.24	293.72	85.66	67.57	426.06	361.66	304.33	86.69	67.33	1.000
Vitamin C, mg	94.43	80.88	60.97	87.72	68.56	89.23	82.96	62.10	98.16	62.87	1.000
Iron, mg	7.41	14.04	5.91	203.40	10.89	7.83	15.66	6.16	218.12	10.40	**0.001**
Zinc, mg	10.03	9.60	3.92	97.34	58.66	9.58	10.03	3.93	108.00	47.28	0.617
Calcium, mg	814.85	419.62	240.59	51.82	93.07	814.85	500.23	249.56	61.77	90.10	**<0.001**
Magnesium, mg	268.38	481.41	179.28	179.54	8.91	268.90	499.02	165.54	185.60	6.68	0.782
Phosphorus, mg	603.51	1232.38	522.77	207.78	7.18	603.51	1225.88	493.93	206.51	8.66	0.840

EAR, estimated average requirements; SD, standard deviation; kJ, kilo joule; g, grams; µg, micrograms; mg, milligrams.
[a] Variable log-transformed before analysis, median, 25th-75th percentiles reported.
†Mean EARs calculated based on age and physiological status (pregnancy or lactation status) of the women in July/ August and November.
EARs references: Energy, carbohydrates, and protein[55]; Vitamin A, vitamin B1, vitamin B2, vitamin C, vitamin E, folic acid, iron, zinc, magnesium and phosphorus[54], and calcium[56] .
*t-test used to determine differences in mean nutrient intakes between July/ August and November
Adjusted *P-values*: Bonferroni-Holm correction test for multiple comparisons

Table 3.5: Median percentage met requirements for energy and nutrients from complementary foods among children 6-23 months in July/August and November 2012 in Western Kenya

Nutrients and unit of measure	July/ August 2012				November 2012			Adj P*
	n	Median percentage met requirements	Percentiles 25th	75th	Median percentage met requirements	Percentiles 25th	75th	
Energy (kJ)	426	140.11	88.83	233.84	193.28	125.17	276.49	**<0.001**
Protein (g)	426	424.75	225.50	797.13	625.41	328.21	999.25	**<0.001**
Fat (g)	426	216.09	82.19	525.92	270.07	111.27	488.46	0.499
Carbohydrates (g)	426	117.62	77.20	188.60	172.64	112.16	240.93	**<0.001**
Vitamin B1 (mg)	426	290.00	173.75	500.00	420.00	263.75	600.00	**<0.001**
Vitamin B2 (mg)	426	135.00	75.00	230.00	175.00	110.00	270.00	**<0.001**
Vitamin B6 (mg)	52[a]	206.67	125.83	354.17	263.33	146.67	388.33	0.150
Folic acid (µg)	52[b]	220.44	90.03	415.27	279.59	124.08	580.23	0.148
Vitamin C (mg)	67[b]	0.00	0.00	81.92	60.32	3.44	148.84	0.190
Iron (mg)	426	18.08	10.42	27.76	26.08	16.48	38.25	**<0.001**
Zinc (mg)	426	54.64	34.76	93.04	80.60	52.62	116.00	**<0.001**
Calcium (mg)	426	36.11	18.70	72.30	50.13	27.43	83.88	**<0.001**
Magnesium (mg)	426	233.94	147.32	367.70	337.81	216.54	449.08	**<0.001**
Phosphorus (mg)	426	88.94	51.16	144.18	129.60	84.04	179.37	**<0.001**

Adj, adjusted

Energy and nutrient requirements from complementary foods based on average breast milk consumption for children in the age groups 6-8, 9-11 and 12-23 months[(57)].

[a]Estimated requirements for vitamin B 6 from complementary foods for children in the age groups 6-8, 9-11 and 12-23 months=0. Results represent data for non-breastfed children aged 6-23 months who consumed complementary foods during both seasons.

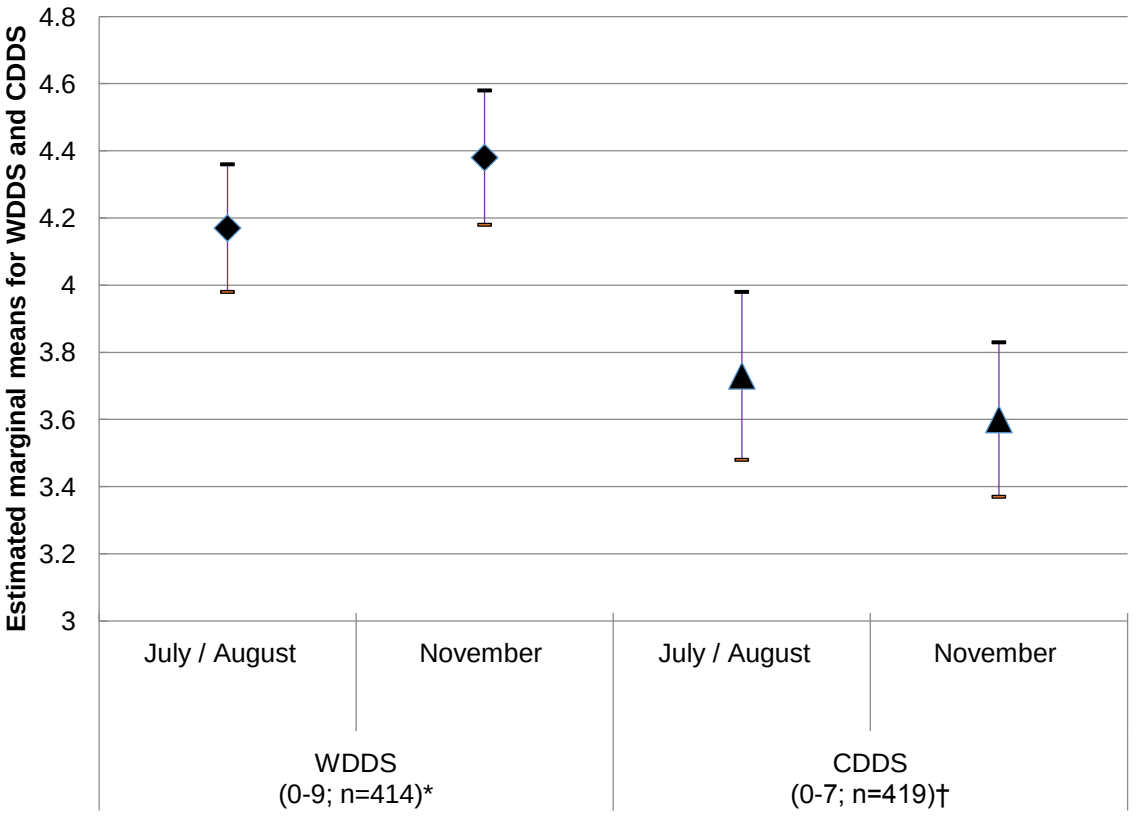
[b]Estimated requirements for folic acid and vitamin C from complementary foods for children in the age groups 6-8 and 9-11 months=0. Results represent data for breastfed children aged 12-23 months and non-breastfed children aged 6-23 months who consumed complementary foods during both seasons.

*Wilcoxon signed- rank test, used to determine differences in median percentage met requirements for energy and other nutrients from complementary foods between the two seasons.

Adjusted *P-values*- Bonferroni-Holm correction test for multiple comparisons.

Seasonal effects on dietary diversity

The results from the GENLINMIXED models with regard to the effect of seasonality on WDDS and CDDS are presented in Figure 3.3. Seasonality was found to have a small but significant effect on WDDS (*P*=0.008) but not on CDDS (*P*=0.293). While the estimated marginal mean (SEM) WDDS increased from 4.17 (0.10) in July/ August to 4.38 (0.10) in November, estimated marginal mean CDDS (SEM) decreased from (3.73 (0.13) to. 3.60 (0.11) during the two time points



Overall seasonal effect was significant on WDDS (*P*=0.008) and not on CDDS (*P*=0.293). CDDS, children's dietary diversity score; WDDS, women dietary diversity score. Covariate in GENLINMIXED models: * age of women (years), education of women (years), wealth index, household size, household hunger scale score, home gardening, ethnic group, agro-ecological zone and sub-county, † age of children (months), wealth index, ethnic group, household size, household hunger scale score, home gardening and agro-ecological zone and sub-county.

Figure 3.3: Estimated marginal means, 5th and 95th CI for WDDS (n=414) and CDDS (n=419) in July/ August and November 2012 in Western Kenya**.**

To better understand the above differences in DDS across the seasons, we assessed the seasonal variations in DDS as a function of ethnic group. The seasonal effect was different for the women from the three ethnic groups, (*P* interaction <0.001). The estimated marginal mean (SEM) WDDS increased between July/ August and November for Luhya (4.14 (0.12) *vs.* 4.79 (0.15) and Teso (4.05 (0.20) *vs.* 4.17 (0.18) women, and decreased for Luo women (4.33 (0.13) *vs.* 4.20 (0.16) between the seasons (Table 3.6). The estimated marginal mean WDDS were significantly different among women from the three ethnic groups in November, *P*= 0.006. The same phenomenon was observed with regard to seasonal variations on CDDS as a function of ethnic group, *P* (interaction) <0.001). While the estimated marginal mean (SEM) CDDS for Luo (3.93 (0.20) *vs*.3.40 (0.17) and Teso (3.63 (0.31) *vs*. 3.51 (0.27) children decreased, that for Luhya children (3.62 (0.17) *vs*. 3.91 (0.17) increased between the seasons. However, the estimated marginal mean CDDS were not significantly different for the children from the three ethnic groups during each season (Table 3.6).

We calculated the mean CDDS of the children stratified by age in July/ August and November to confirm the results with regard to the lack of a seasonal effect on CDDS. The results did not show a clear trend in the distribution of CDDS among the children between the two seasons. However, older children had higher mean CDDS compared to younger children during each seasons, Figure 3.4.

Factors associated with dietary diversity and nutrient intake

Results from the GENLIMIXED models showed that education of women (years) had a small but positive effect on both WDDS (odds ratio (OR) = 1.01 95% CI 1.00, 1.01, *P*=0.022) and CDDS (OR= 1.01 95% CI 1.00, 1.02, *P*=0.005), Table 3.7. On the other hand, household food insecurity had a negative influence on both WDDS (OR=0.95 95% CI 0.93, 0.96, *P*<0.001) and CDDS (OR=0.94 95% CI 0.92, 0.96, *P*<0.001). While increasing age (in years) among women had a very small negative effect on WDDS (OR=1.00 95% CI 0.99, 1.00, *P*=0.033), increasing age (in months) among children had a positive effect on CDDS (OR=1.02 95% CI 1.01, 1.02, *P*<0.001).

Table 3.6: Effects of seasonality and other factors on WDDS and CDDS in Western Kenya

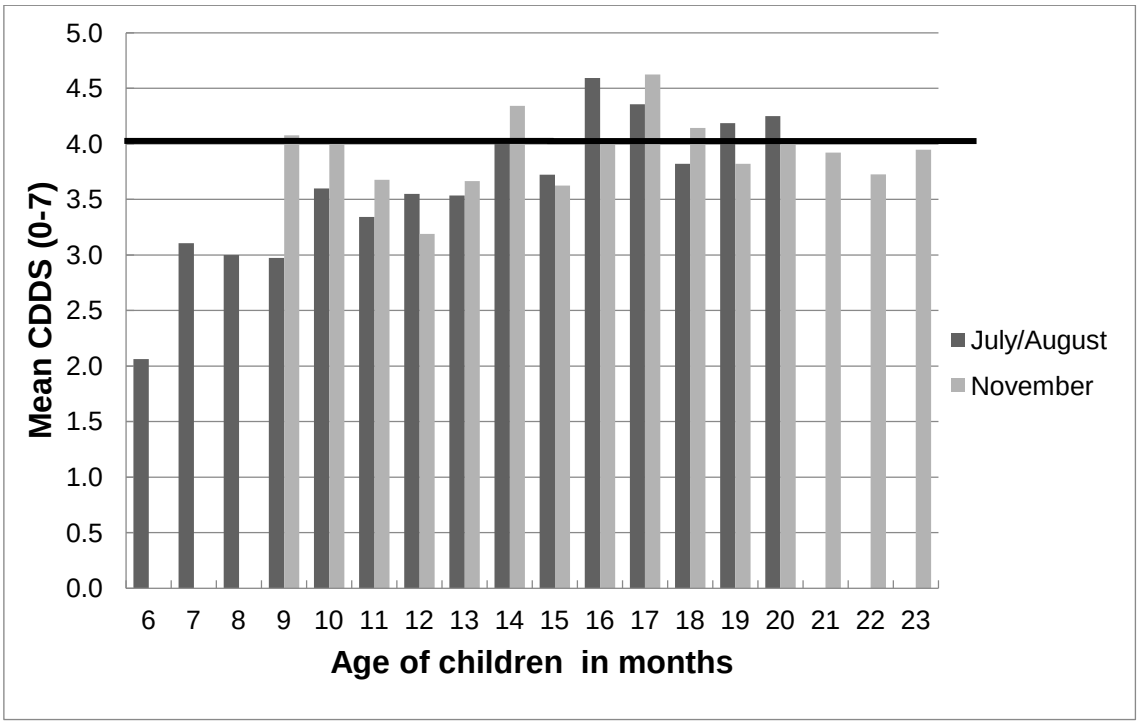
Variables		WDDS (n=414)[a]					CDDS (n=419)[b]				
		n	Estimated marginal mean	SEM	95% CI	*P**	n	Estimated marginal mean	SEM	95% CI	*P**
Survey	July/August	414	4.17	0.10	3.98, 4.36	**0.008**	419	3.73	0.13	3.48, 3.98	0.293
	November	414	4.38	0.10	4.18, 4.58		419	3.60	0.11	3.39, 3.81	
Survey*ethnic group						**<0.001**					**<0.001**
July/ August	Luo	110	4.33	0.13	4.08, 4.60	0.390	110	3.93	0.20	3.56, 4.33	0.592
	Luhya	229	4.14	0.12	3.90, 4.39		232	3.62	0.17	3.31, 3.96	
	Teso	75	4.05	0.20	3.68, 4.45		77	3.63	0.31	3.08, 4.29	
November	Luo	110	4.20	0.16	3.90, 4.52	**0.006**	110	3.40	0.17	3.09, 3.75	0.113
	Luhya	229	4.79	0.15	4.50, 5.09		232	3.91	0.17	3.59, 4.26	
	Teso	75	4.17	0.18	3.82, 4.55		77	3.51	0.27	3.03, 4.07	
Ethnic group	Luo	110	4.26	0.14	4.00, 4.54	0.195	110	3.66	0.16	3.35, 3.99	0.723
	Luhya	229	4.45	0.12	4.22, 4.70		232	3.76	0.16	3.47, 4.08	
	Teso	75	4.11	0.18	3.78, 4.47		77	3.57	0.26	3.10, 4.11	
Agro-ecological zones	UM1	101	4.44	0.21	4.06, 4.87	0.656	104	3.73	0.21	3.34, 4.18	0.659
	LM1	147	4.12	0.10	3.94, 4.32		147	3.47	0.15	3.19, 3.77	
	LM2	59	4.19	0.11	3.97, 4.41		61	3.60	0.18	3.26, 3.98	
	LM3	34	4.33	0.26	3.86, 4.87		34	3.62	0.27	3.12, 4.20	
	LM4	27	4.34	0.28	3.84, 4.92		27	3.97	0.30	3.43, 4.59	
	LM5	46	4.21	0.16	3.90, 4.54		46	3.60	0.25	3.14, 4.13	
Home gardening	Yes	332	4.33	0.09	4.17, 4.50	0.379	337	3.80	0.14	3.59, 3.82	**0.044**
	No	82	4.21	0.14	3.95, 4.49		82	3.53	0.10	3.60, 4.00	
Sub-county	Bondo	107	4.20	0.07	4.06, 4.35	0.190	107	3.66	0.09	3.49, 3.83	0.943
	Mumias	104	4.48	0.23	4.05, 4.97		105	3.68	0.27	3.18, 4.26	
	Teso	102	4.20	0.07	3.06, 4.35		103	3.66	0.09	3.49, 3.83	
	Vihiga	101	4.20	0.07	4.06, 4.35		104	3.66	0.09	3.49, 3.86	

WDDS, women's dietary diversity score; CDDS, children's dietary diversity score; SE, standard error; CI,confidence interval

[a]Covariates in model include wealth index, household size, age of women (years), education of women (years), household hunger score

[b]Covariates in model include wealth index, age of children (months), household size, household hunger scale score.

*GENLINMIXED model test



The black horizontal line indicates the threshold for minimum dietary diversity that 6-23 months old children should achieve from their diets according to WHO[50]. CDDS, children's dietary diversity score

Figure 3.4: Mean CDDS of children below 2 years stratified by age in months in July/ August and November 2012 in Western Kenya.

From the UNIANOVA analyses, we observed that agro-ecological zones influenced the intakes of energy (*P*=0.015), carbohydrates (*P*=0.005), protein (*P*<0.001), vitamin A (*P*=0.013), iron (*P*<0.001), zinc (*P*=0.003) and calcium (*P*<0.001), with a trend of higher nutrient intakes among women residing in the semi-humid lower midlands zone (LM3) and lower intakes among those living in the humid upper midland zones (UM1). We also found significant associations between ethnic group and intakes of energy (*P*=0.015) and fat (*P*=0.005) with higher intakes among Luhya women compared with those from the Luo and Teso ethnic groups. Additional results from the same UNIANOVA models showed that household food insecurity had a negative effect on the intakes of energy (*P*=0.046), carbohydrates (*P*=0.046), protein (*P*=0.026) and calcium (*P*<0.001), Table 3.8

Table 3.7: Factors associated with dietary diversity among women and children in Western Kenya (n=414)

	WDDS (n=414)[a]					CDDS (n=414)[b]				
	Coefficient	SE	OR	95% CI	*P**	Coefficient	SE	OR	95% CI	*P**
Education of women (years)	0.01	0.00	1.01	1.00, 1.01	**0.022**	0.01	0.00	1.01	1.00, 1.02	**0.005**
Household food insecurity	-0.06	0.01	0.95	0.93, 0.96	**<0.001**	-0.06	0.03	0.94	0.92, 0.96	**<0.001**
Age of women (years)	-0.01	0.02	1.00	0.99, 1.00	**0.033**	-0.00	0.00	1.00	0.99, 1.00	0.070
Household size	0.00	0.00	1.00	0.99, 1.01	0.978	0.01	0.01	1.01	0.99, 1.02	0.458
Wealth index	0.00	0.00	1.00	1.00, 1.01	0.350	0.00	0.01	1.00	0.99, 1.01	0.640
Age of children (months)						0.01	0.00	1.02	1.01, 1.02	**<0.001**

WDDS, women dietary diversity score; CDDS, children's dietary diversity score; SE, standard error; OR, odds ratio; CI, confidence interval

[a] Covariates in model : ethnic group, home gardening, agro-ecological zone and sub-county.

[b] Covariates in model: ethnic group, home gardening, agro-ecological zone and sub-county.

*GENLINMIXED model test

Table 3.8: Factors influencing nutrient intakes among women in Western Kenya (n=404)

Nutrients		B coefficient	SE	*P**	95 % CI
Energy, kJ[a]	Wealth index	-27.17	56.98	0.634	-139.21, 84.88
	Women's age (years)	8.35	18.94	0.660	-28.89, 45.57
	Education (years)	-34.33	42.56	0.420	-118.01, 49.35
	Household food insecurity	-217.50	108.58	**0.046**	-430.99, -4.01
	Breastfeeding status	-63.17	381.23	0.868	-812.76, 86.43
	Household size	-4.73	64.43	0.942	-131.40, 21.95
	Home gardening	651.14	344.42	0.059	-26.09, 328.37
Protein, g[b]	Wealth index	-0.10	0.56	0.855	-1.20, 1.00
	Women's age (years)	-0.18	0.17	0.326	-0.55, 0.18
	Education (years)	-0.02	0.42	0.964	-0.84, 0.80
	Household food insecurity	-2.39	1.07	**0.026**	-4.49, -0.29
	Breastfeeding status	3.77	3.75	0.314	-3.59, 11.14
	Household size	0.15	0.63	0.812	-1.09, 1.40
	Home gardening	5.12	3.39	0.131	-1.54, 11.77
Fat, g[c]†	Wealth index	0.01	0.01	0.398	-0.01, 0.04
	Women's age (years)	-0.00	0.00	0.394	-0.01, 0.01
	Education (years)	0.01	0.01	0.530	-0.01, 0.02
	Household food insecurity	-0.04	0.02	0.106	-0.09, 0.01
	Breastfeeding status	0.08	0.08	0.313	-0.08, 0.25
	Household size	-0.01	0.01	0.381	-0.04, 0.02
	Home gardening	0.05	0.08	0.511	-0.10, 0.20
Carbohydrates, g[d]	Wealth index	-3.21	2.57	0.212	-8.27, 1.84
	Women's age (years)	1.10	0.85	0.197	-.58, 2.78
	Education (years)	-2.93	1.92	0.128	-6.71, 0.84
	Household food insecurity	-9.82	4.90	**0.046**	-19.45, -0.19
	Breastfeeding status	-17.52	17.20	0.309	-51.33, 16.30
	Household size	1.19	2.91	0.682	-4.53, 6.91
	Home gardening	35.00	15.54	**0.025**	4.45, 65.55
Vitamin A, µg[e]	Wealth index	18.05	13.79	0.191	-9.05, 45.16
	Women's age (years)	13.11	4.60	**0.005**	4.07, 22.15
	Education (years)	-9.16	10.29	0.374	-29.39, 11.07
	Household food insecurity	1.39	26.29	0.958	-50.31, 53.09
	Breastfeeding status	-32.24	92.14	0.727	-213.42, 48.94
	Household size	-40.96	15.80	**0.010**	-72.02, -9.90
	Home gardening	156.92	83.28	0.060	-6.84, 320.68

SE, standard error; CI, confidence interval

[a]R squared= .089 (adjusted R squared=.055), [b]R squared=.117 (adjusted R squared=.084), [c]R squared=.092 (adjusted R squared=.058), [d]R squared=.104 (adjusted R squared=.070), [e]R squared=.105 (adjusted R squared=.072), [f]R squared=.114 (adjusted R squared=.081), [g]R squared=.183 (adjusted R squared=.153), [h]R squared=.085 (adjusted R squared=.051).

†Variable log-transformed before analysis.

*UNIANOVA test

Covariates in models include agro-ecological zone and ethnic group.

Table continues on next page

Continued Table 3.8

Nutrients		B coefficient	SE	*P**	95 % CI
Iron, mg[f]	Wealth index	-0.09	0.13	0.473	-0.35, 0.16
	Women's age (years)	-0.01	0.04	0.758	-0.10, 0.07
	Education (years)	-0.15	0.10	0.119	-0.34, 0.04
	Household food insecurity	-0.32	0.25	0.191	-0.80, 0.16
	Breastfeeding status	-0.12	0.86	0.889	-1.81, 1.57
	Household size	-0.01	0.15	0.975	-0.29, 0.28
	Home gardening	1.57	0.78	**0.045**	0.04, 3.10
Calcium, mg[g]	Wealth index	0.55	5.07	0.913	-9.42, 10.53
	Women's age (years)	2.31	1.69	0.171	-1.01, 5.62
	Education (years)	-2.39	3.79	0.530	-9.84, 5.07
	Household food insecurity	-34.13	9.67	<**0.001**	-53.13, -15.12
	Breastfeeding status	-1.26	33.94	0.970	-67.10, 65.48
	Household size	-0.05	5.74	0.993	-11.33, 11.23
	Home gardening	42.71	30.67	0.165	-17.59, 103.0
Zinc, mg[h]	Wealth index	-0.13	0.09	0.148	-0.30, 0.05
	Women's age (years)	-0.01	0.03	0.779	-0.07, 0.05
	Education (years)	0.00	0.07	0.981	-0.13, 0.13
	Household food insecurity	-0.30	0.17	0.070	-0.63, .025
	Breastfeeding status	0.29	0.58	0.623	-0.86, 1.43
	Household size	0.03	0.10	0.743	-0.16, 0.23
	Home gardening	1.08	0.53	**0.041**	0.05, 2.12

SE, standard error; CI, confidence interval
[a]R squared= .089 (adjusted R squared=.055), [b]R squared=.117 (adjusted R squared=.084), [c]R squared=.092 (adjusted R squared=.058), [d]R squared=.104 (adjusted R squared=.070), [e]R squared=.105 (adjusted R squared=.072), [f]R squared=.114 (adjusted R squared=.081), [g]R squared=.183 (adjusted R squared=.153), [h]R squared=.085 (adjusted R squared=.051).
†Variable log-transformed before analysis.
*UNIANOVA test
Covariates in models include agro-ecological zone and ethnic group.

Home gardening had a positive influence on the intakes of carbohydrate (*P*=0.025), iron (*P*=0.045 and zinc (*P*=0.041). While higher age had a positive effect on vitamin A intake (*P*=0.005), increasing household size had a negative influence on vitamin A intake (*P*=0.010).

Association between WDDS and CDDS

We performed additional analyses using Pearson's correlation tests to check for relationships between WDDS and CDDS in July/ August and November, and also between change in WDDS and change in CDDS between the seasons. WDDS was significantly correlated with CDDS both in July/ August (r = 0.39, P<0.001) and November (r = 0.45, P<0.001). Additionally, there was a significant relationship

between change in WDDS and change in CDDS between the seasons (r = 0.32, P<0.001).

Discussion

In this study WDDS was found to be sensitive to seasonal changes, with the scores being higher in November compared with July/ August. The increased consumption of legumes, nuts and seeds in November could be attributed to increased availability following the annual harvest. The short rains experienced during this season could explain the observed increase in consumption of dark green leafy vegetables, which are responsive to weather changes and thus readily availability during this seasons[66] Similar findings of seasonal variations in dietary diversity among women have been reported in other studies[14,17,20,21,67]. The intake of energy and most nutrients were slightly higher among the women during the post-harvest season in November. Except for vitamin E, iron and calcium intakes which were significantly different between the seasons, the intake of energy and other nutrients did not differ significantly among the women between the seasons. Similar results were found in a study conducted among women in rural Burkina Faso[36]. The increase in the intakes of vitamin E, iron and calcium by the women in November could be partly explained by the overall increase in the consumption of foods from more food groups during this season.

The fact that no seasonal effects were observed in the intakes of energy and other nutrients (except for iron, calcium and vitamin E) alludes to the fact that, households are able to adapt and change their feeding patterns to a certain extent in order to cope during periods of food shortage. This is more so at least with regards to energy intake from staple foods which are usually given priority in production, buying and consumption. The amounts of different foods (g/day) consumed by the women were not significantly different between the seasons. This could also partly explain the lack of seasonal differences in the intakes of energy and most nutrients. This finding suggests that while an increase in food availability may contribute to improved dietary diversity, it may not necessarily lead to improved energy and nutrient intakes if the actual amounts of different foods consumed are inadequate for the different population groups. Therefore, interventions seeking to promote the consumption of a variety of foods should also include strategies to increase the amounts of different

foods consumed to ensure overall adequate nutrient intakes not only for women and children, but for all family members.

Overall, inadequate nutrient intake among the women, i.e. not meeting the EAR, was found for most nutrients during both seasons. Similar findings of inadequate nutrient intakes among women have been reported in other studies conducted in Kenya[68,69], South Africa[70], and Burkina Faso[71]. These studies provide evidence of generally low nutrient intakes among women, and which is a reflection of overall poor quality diets across seasons. The observed changes in the intakes of key nutrients such as iron and calcium during the post-harvest season indicate that in most cases, families in rural areas tend to subsist only on a subset of foods mainly from their own production. In many cases, these families could have access to a variety of other local nutrient-rich foods, but these alternative foods are often abandoned in favour of a limited number of foods, usually the energy-dense staples[7,72]. This reliance on a limited number of foods in the presence of a variety of different foods could be attributed to many factors including lack of access due to high prices, low production, cultural food habits and practices, inadequate nutrition knowledge and skills on the available local foods and how to utilize them for improved diet quality[73–76]). Therefore, in addition to behaviour change communication strategies to promote the consumption of a variety of foods across seasons, there is need for agricultural strategies to ensure that farmers produce a variety of foods that can substitute each other and that are nutritionally appropriate during different seasons. Strategies promoting the preservation of surplus foods following the annual harvest are also needed to cover seasonal gaps and enhance overall household food security during lean seasons.

The children consumed foods from more food groups in November as they had grown older, and thus more likely to be fed on a variety of foods[77,78]. The diets of the children comprised mainly of cereal-based starchy staples with low consumption of animal source products during both seasons as it has also been reported from other studies[18,79–81]. The share of energy and nutrient requirements met from complementary foods was higher in November compared with July/ August, also confirming the effect of age, with older children receiving more nutrients from complementary foods. The fact that seasonality did not have an effect on CDDS

(while it had on WDDS) indicates that, while there may be variations in food availability across seasons, in most cases foods fed to young children do not change to an extent of influencing their dietary diversity. Therefore, other factors apart from food availability influence the diets of young children, particularly during the complementary feeding period. In the present study the effect of seasonality on dietary diversity was assessed during the harvest and post-harvest seasons. More seasonal variations in dietary patterns should be expected as the observed seasons were not representative of the year round food availability calendar. However, for children aged below two years, age effect seems to be more important. Still, it should be expected that with increasing age, reduced breastfeeding and more reliance on family foods, young children would also be affected by seasonality once they grow out of the complementary feeding period. There is need for behavior change interventions to sensitize caregivers on the importance of feeding young children a variety of family foods, including animal source foods in an age-appropriate manner during the complementary feeding.

The finding that WDDS and CDDS were positively associated is consistent with those reported from other studies[77,82]. While this may not be surprising, yet, it cannot also be assumed automatically as it is suggested by an increasing number of double burden households with overweight/obese mothers and underweight or stunted children[83]. And while it is expected that women and children from households having access to a variety of foods should consume better quality diets, this is not always the case. Analysis of data from the 2008 Ghana Demographic and Health Survey showed that not all the foods consumed by the mothers were given to the children[84].This suggests that in most cases caregivers usually tend to rely only on a subset of family when feeding young children due to several factors including inadequate nutrition knowledge, cultural practices and beliefs and limited time for child care[75,85]. Still, this finding indicates that maternal diets may be an important determinant of children's diets. Therefore, interventions aimed at improving the quality of diets consumed by children should include strategies to also promote maternal diets as this may have a direct effect on the diets consumed by other family members, including the children.

Ethnic group was found to have an effect on both dietary diversity and nutrient intake among the women. Ethnicity influences dietary habits with different ethnic groups ascribing to different traditional food cultures, which influence food consumption patterns including food choices and preferences[86,87]. The different food beliefs and taboos also influence the consumption of certain foods, particularly animal source foods, and which in most cases are tilted in favour of men[88],consequently affecting the quality of diets consumed by women and children. The effects of ethnicity on food pattern have been reported in other studies[67,86,89]. The evaluation of behavioural strategies of population groups to improve nutrition status have been recently identified as key research priorities [90], which need to be implemented. Such strategies would help in the identification of specific cultural barriers that are a hindrance to the consumption of specific foods among population groups, which should be addressed in order to promote good nutrition.

Socio-demographic factors including maternal education and household food security were found to have a positive effect on the DDS of women and children. Older age among the children was associated with higher DDS. Socio- demographic factors and household food security have been shown to be associated with dietary patterns of women and children in a similar way in other studies[77,91,92]. However, socio-economic status was found not to have a significant influence on dietary diversity and nutrient intake in this study. Strategies to improve dietary intakes for both women and children should also consider incorporating actions to address some of the underlying constraints including low levels of education among the women and household food insecurity, which would in the long run lead to improvements in the dietary intakes of all household members, and in particular of the women and children.

The strengths of this study included the repeated cross-sectional surveys conducted during different seasons within the same years and targeting the same woman and their children. This enabled us to assess not only the effect of seasonality on dietary diversity of women and their children aged 6-23 months, but also the seasonal differences in food (g/day) and nutrient intakes among the women. Even though the seasons were not very distinct (July/ August and November), still our results showed a seasonal effect on WDDS as well as seasonal variations in vitamin E, iron and calcium intakes among the women. Anthropometric measurements for the study

participants were taken only once during the survey in July/ August and not in November, thus, we were not able to assess the effects of seasonality on nutritional status of the women, which would have enriched the study. Future similar studies should be conducted during more distinct seasons in terms of food availability such as during the pre-harvest and harvest seasons that would clearly show the effects of seasonality on both dietary intakes and nutritional status outcomes.

A limitation of our study was attributed to the use of single 24-hour recall method to assess dietary intakes of the study participants during each season. The 24-hour recall method is prone to recall bias since it relies on memory in terms of identification of the foods eaten as well as the estimation of food portions consumed. To reduce this type of error, we used highly trained enumerators who spoke the local languages during the interviews with the women. We also used local household measures to estimate the amounts of foods consumed by the women and the children[93]. The use of single 24-hour recall may not be representative for estimating the individual's usual nutrient intake due to variability in the day to day intakes of foods[41]. The 24-hour recall is also prone to the problems of under-reporting and over-reporting and whether or not to exclude cases with extreme energy intake values is debatable. This study aimed to analyze seasonal differences in nutrient intakes of the women. We decided in favour of excluding women who had unusual low and high energy intakes during any of the two surveys because extreme intakes on any one day (which were expected due to sickness or festivities) would have lead to a misinterpretation of the results, with regards to seasonal food availability. This may have introduced bias and limited our findings, which may not be representative of usual food intakes among the women in the target population.

Conclusions

The results from this study showed that seasonality had an effect on the quality of diets consumed by women in rural households. Hence the need to include seasonality as a component in nutrition education programs as a way to ensure that households have access to a variety of food during all seasons throughout the year. On the contrary, the diets of the children were not affected by seasonality, indicating that other factors apart from food availability exert influences on the dietary patterns of children. Nutrition education programs are needed to enhance nutrition knowledge

among caregivers on the importance of feeding young children a variety of foods, especially animal source foods in an age-appropriate manner during the complementary feeding period. Behaviour change strategies should focus their key messages on addressing cultural barriers affecting the consumption of a variety of foods, especially animal source foods, which could contribute to improvements in the overall quality of diets consumed by women and children. Maternal and child dietary diversity were associated, hence the need for measures to improve maternal diets as a link to improving the quality of diets consumed not only by children, but by other family members.

Acknowledgements

The authors greatly acknowledge the support from Ms. Jacqueline Kipkorir who contributed with data collection during the surveys. We thank the caregivers and children who participated in this study. Thanks also to the enumerators who were involved in data collection and the community health workers for identification of the sampled households.

Financial support*:* This study was conducted with unrestricted financial support from the German Federal Ministry of Economic Cooperation and Development through the Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ) and the German Academic Exchange Service (DAAD). The funders had no role in the design, analysis or writing of this article.

Conflict of Interest*:* None of the authors has any conflict of interest to declare.

Authorship: The authors' contributions are as follows: L.W. was responsible for data collection, statistical analysis and manuscript preparation with contributions from G.K., J.H., I.J and M.K. G.K. was the principle investigator and contributed to the conceptualization of the study design. J.H. contributed to the statistical analysis and data interpretation. All the authors read and approved the final manuscript.

Name of approving ethics committee*:* Research permission including ethical approval for this study was granted by the National Council of Science and Technology (NCST) Nairobi, Kenya.

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4 Community-based educational intervention improved the diversity of complementary diets in Western Kenya: results from a randomized control trial

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Public Health Nutrition: doi: 10.1017/S1368980015000920- EPub ahead of print

Abstract

***Objective**:* Lack of diversity is a major factor contributing to inadequate nutrient intakes among children during the complementary feeding period in many rural areas in developing countries. This has been attributed to inadequate feeding practices and nutrition knowledge among the caregivers. The aim of the present study was to assess the effect of an educational intervention on children's dietary diversity and nutrition knowledge of caregivers.

***Design**:* Cluster randomization was applied and twenty matched village pairs were randomly assigned to the intervention or control group. The nutrition education intervention consisted of 4 sessions comprising of group trainings and cooking demonstrations that were conducted over a period of 5 months.

***Setting**:* Households in rural communities in Bondo and Teso South sub-counties, western Kenya.

Subjects: Caregivers with children aged 6-17 months receiving nutrition education.

***Results**:* The children's dietary diversity scores (CDDS) and nutrition knowledge scores of the caregivers improved significantly in the intervention group at endline. The treatment effect on CDDS was positive and significant (P=0.001).The CDDS rate of the children in the intervention group was 27% larger than it would have been without the treatment effect. The intervention also had a significant effect on the caregivers' nutrition knowledge scores (incidence rate ratio = 2.05; P<0.001). However, the nutrition knowledge of the caregivers did not have a significant effect on CDDS (P=0.731).

Conclusions: The nutrition education intervention led to improvements in the children's dietary diversity and nutrition knowledge of the caregivers.

Key words: Nutrition education, complementary feeding, dietary diversity, caregivers, intervention

Introduction

Malnutrition among children under five years is still a widespread problem in many developing countries. Worldwide, approximately 162 million children under 5 years are stunted, while 99 million and 51 million are underweight and wasted, respectively[1]. An analysis of data from the Kenya Demographic and Health Surveys (KDHS) over the last three decades shows that there has been a slow decline in the prevalence of malnutrition among young children in Kenya[2,3]. Data from the 2008-2009 KDHS showed that in Kenya, 35% of children aged <5 years were stunted, 16% underweight and 7% wasted. The prevalence of stunting was highest (46%) among children aged 18-24 months and 42% among those aged 6-12 months. Stunting rates were highest among children living in rural areas (37%) compared with those living in urban areas (26%)[4].

While the causes of malnutrition are complex, inappropriate feeding practices during the complementary feeding period have been identified as major contributing factors to inadequate nutrient intakes among infants and young children[5–9]. While consuming a variety of foods is important for meeting essential nutrient requirements needed to promote growth, traditional diets fed to children in developing countries are based predominantly on starchy staples and include few or no nutrient-rich food sources such as animal proteins, fruits and vegetables[10–12]. Often infants and young children are not given the care and attention needed during the selection of nutritious foods, and the encouragement needed to eat sufficient amounts of foods[13]. In addition, even when food resources are available in the home, caregivers might not make the best use of them due to lack of knowledge of the best foods for young children, cultural beliefs and practices and inappropriate advice[14–16]. Studies on young children's feeding practices in other countries have demonstrated evidence that educational interventions have positive effects on knowledge of caregivers, complementary feeding practices and growth among children[17–21].

Inadequate nutrition during the complementary feeding period is associated with growth faltering, increased risk for morbidity and mortality, delayed motor development, impaired cognitive development, and reduced educational attainments and social capacities[22–25]. Interventions are needed that seek to improve the overall dietary quality of complementary diets and that promote the consumption of a variety

of foods, including local foods, and not merely on the intake of individual foods or nutrients, especially in poor rural communities in developing countries[26]. Food-based approaches using local agro-biodiversity have been considered to be more cost-effective and sustainable on a long-term basis as a means of ensuring dietary diversity and quality[27,28].

The purpose of the present study was to assess the effect of an education intervention focusing on the utilization of local agro-biodiversity in improving the diversity of children's complementary diets and nutrition knowledge of caregivers. It was hypothesized that children whose caregivers participated in the nutrition education intervention would receive more diversified complementary diets and that caregivers who participated in the nutrition education sessions would have improved nutrition knowledge. The present study was part of a larger study aiming at "Improving nutritional health of women and children through increased utilization of local agro-biodiversity in Kenya" (INULA) undertaken by Bioversity International, Nairobi, Kenya in collaboration with Justus Liebig University Giessen, Germany.

Methods

Study setting and participants

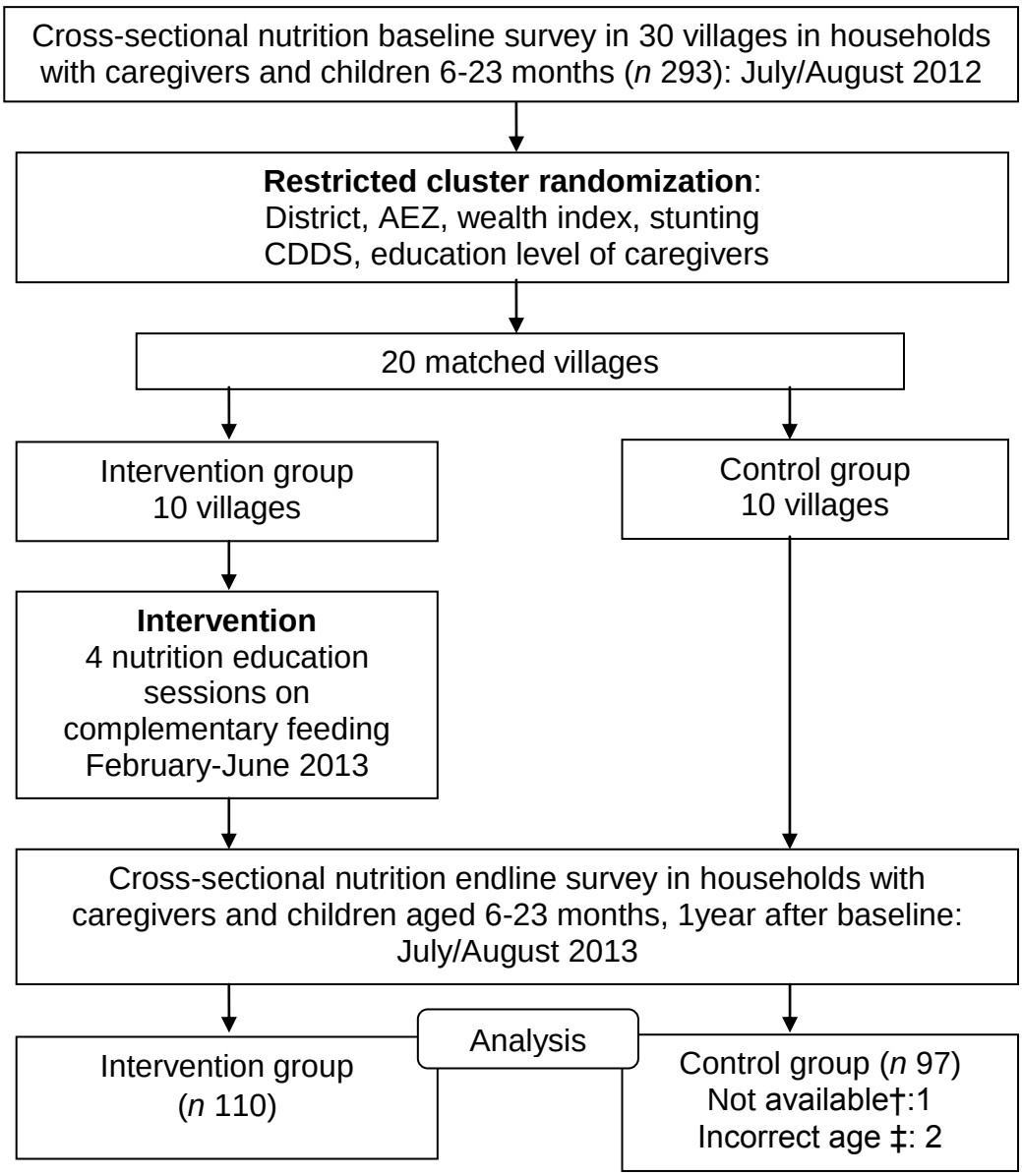
A cross sectional baseline survey was conducted between July and August 2012 in Teso South and Bondo sub-counties in Western Kenya. Two-stage cluster sampling was applied in selecting the sample. In the first sampling stage, fifteen villages were randomly selected from each sub-county using probability proportional to population size, giving a total of thirty villages. Second, ten households with children aged 6-23 months and their caregivers were randomly selected from each of the sampled villages. Prior to the baseline survey four enumerators conversant in Kiswahili (the national language spoken in Kenya) and the native languages, Teso and Luo (spoken in the study areas) were recruited and intensively trained on the use and application of the survey tools. Informed written consent was sought from the caregivers before any data was collected. Data on the socio-demographic characteristics of the households were collected using pre-tested semi-structured questionnaires through face-to-face interviews with the caregivers. Data on infant and young child feeding (IYCF) practices and knowledge of the caregivers were also collected during the interviews. Data on the dietary consumption and composition of

complementary foods were obtained using 24 h recalls[29,30]. Anthropometric measurements were taken for the children and the caregivers following standard procedures[31]. Research permission including ethical approval for this study was granted by the National Council of Science and Technology, Nairobi, Kenya.

The intervention

The nutrition education intervention study applied the cluster-randomized control trial design. The most similar villages from each sub-county were paired based on the following variables: districts, agro-ecological zone (AEZ), mean children's dietary diversity scores (CDDS), mean stunting rate, mean wealth index and mean education level of caregivers. The first five village pairs from each sub-county with the smallest mahalanobis distance between them were chosen because they were less different in terms of the above-mentioned variables. The five village pairs from each sub-county were randomly assigned to the control (*n* 10) and intervention (*n* 10) groups.

The intervention targeted ten to fifteen caregivers with children aged 6-17 months, residing in the intervention villages. Community health workers (CHW) compiled lists of all caregivers with children in this age group residing in their villages and invited them to participate in the nutrition education sessions. Caregiver-child pairs who were interviewed during the baseline survey and who met the inclusion criteria were also invited to participate in the nutrition education sessions. Participation in the nutrition education sessions was voluntary, and consent was sought from the caregivers before the commencement of the sessions. Caregivers with children aged 6-17 months were chosen to participate in the intervention in order to ensure that their children were aged below 24 months at the time of the endline survey. Figure 4.1 presents the intervention study design. The intervention consisted of four nutrition education sessions which were participatory and included both group trainings and cooking demonstrations (Table 4.1).



AEZ, agro-ecological zone; CDDS, children's dietary diversity score; †not available: the caregiver was not available at the time of the survey; ‡incorrect age: child's age not recorded correctly

Figure 4.1: Study design for the intervention

The themes and topics for the nutrition education sessions were selected based on the findings from the baseline survey and with reference to materials from FAO[32] and UNICEF[33].

Table 4.1: Nutrition education sessions conducted among caregivers in the intervention villages in Bondo and Teso South sub-counties, western Kenya

Session	**Content**	**Materials for participants and resources**
February 2013 Session 1: The importance of complementary feeding	• The concepts of 'exclusive breast-feeding' and 'complementary feeding', the advantages of exclusive breast-feeding for the first six months, and the benefits of continuing breast-feeding after the introduction of complementary foods starting at six months were highlighted • The characteristics of complementary foods and feeding practices for different age groups with regard to feeding frequency, amount of food, consistency of the foods and variety were discussed • The importance of using separate bowls/ cups and responsive feeding were discussed • The importance of observing hygiene while preparing, cooking and feeding children was highlighted • *Main activity: participatory group discussions*	Folders UNICEF[33]
February/ early March 2013 Session 2: Dietary diversity during complementary feeding	• The importance of feeding infants and young children diverse and balanced diets during the complementary feeding period was stressed. Six food groups, (i) cereals roots and tubers; (ii) animal-source foods, (iii) legumes nut and seeds, (iv) vegetables, (v) fruits and (vi) fat and oils, were discussed using the concept of the food circle. The key nutrients required by infants and young children and their food sources were discussed • The seasonal availability of different foods from the different food groups was discussed using the seasonal food availability calendars for each of the sub-counties • This session included a cooking demonstration that aimed to teach the caregivers how to enrich local complementary diets by incorporating a variety of locally available foods • The caregivers brought different locally available foods including: dark green leafy vegetables, pumpkin, orange-	Food circle, seasonal food availability calendars, local foods FAO[32]

Session	Content	Materials for participants and resources
	fleshed sweet potatoes, beans, groundnuts, fish, milk and cooking oil • The foods were used to modify the existing traditional complementary diets, rather than coming up with new recipes • The prepared complementary foods were fed to the children • *Main activities: participatory group discussions and cooking demonstration*	
General election in March 2013 and follow-up visits in April 2013		
May 2013 Session 3: Making nutritious and diverse meals for children aged 6-23 months	• Caregivers' knowledge on breast-feeding and complementary feeding practices and the importance of feeding children a variety of foods were reviewed • A cooking demonstration on how to prepare nutritious complementary meals using a variety of locally available foods was conducted • The availability of different foods in the sub-counties was also reviewed using the seasonal food availability calendars • *Main activities: group discussions and participatory cooking demonstration*	Folders, food circle, brochures, seasonal food availability calendars, local foods
June 2013 Session 4: How to obtain and prepare adequate and nutritious meals for children 6-23 months	• Different examples of complementary food menus fed to children in the 6-8 months, 9-11 months and 12-23 months age-groups in a day were presented and discussed • The menus were evaluated based on how diverse they were • Through discussion with the caregivers, other locally available and affordable foods or ingredients that the caregivers could use to improve the quality of the complementary food menus were identified • Different ways to improve budgeting for food to get the best value for money and still prepare nutritious complementary foods were debated with the mothers • Examples of locally available nutritious snacks that could be fed to children in between meals were also discussed • *Main activities: group discussions and presentations*	Posters

The teaching materials were developed by the INULA project research team, consisting of an agricultural scientist and two nutritionists who were also PhD student researchers, at Bioversity International, Nairobi, Kenya. The materials were developed in both English and Kiswahili, the national language spoken in Kenya. The key messages and pictures on the importance of breast-feeding, age-appropriate complementary feeding practices, hygiene and feeding young children a variety of foods were compiled into folders, brochures and posters. The food circle was used to described the six food groups and examples of locally available foods from each group, a concept used in Malawi[34]. Seasonal food availability calendars were developed from the knowledge gained through focus group discussions conducted within this project for each of the sub-counties and contained information on the seasons when the different foods from the six food groups were available in the study area throughout the year. The posters had key messages on the importance of feeding children a variety of foods, healthy snacks for children and how to enrich complementary foods using locally available foods. The nutrition education materials were pre-tested with a group of caregivers from a village that was not sampled for the study. During the nutrition education sessions, every participant received a copy of the folder, brochure, seasonal food availability calendar and the poster. The mean duration of the sessions was 2.5 h.

As shown in Table 4.1, the first two nutrition education sessions were conducted in February and early March 2013. The general elections were held in Kenya on 4th March 2013. The results of the presidential elections were challenged leading to a petition in the Supreme Court of Kenya, which was dismissed on 30th March 2013. The period during and after the elections was characterized by tension and unrest in several parts of the country, including the study areas. Hence, no field work activities were to be conducted during this period for safety reasons of both the research team and the participants (Bioversity International regulation). Therefore, at the end of the second session the caregivers were encouraged to use this time to go through the nutrition education materials that they had received and to try out the demonstrated complementary diet recipes using locally available foods and based on the knowledge they had acquired during the first two sessions.

In April 2013, individual home-based follow-up visits were made on a randomly selected sub-sample of caregivers in the intervention villages who had participated in the first two sessions. The households for the follow-up visits were sampled randomly using the RAND function in Microsoft Excel, and the first five from the list of fifteen households in each intervention village selected. The follow-up visits were conducted by the researcher and respective CHW from the intervention villages. The purpose of the follow-up visits was to assess whether the caregivers' adoption of the feeding practices they had been taught during the first and second sessions, reinforce appropriate practices and to correct harmful practices. The follow-up sessions were also used to assess the factors hindering the caregivers from preparing diversified diets for their children. Based on the feedback, individual counselling and advice was offered to the caregivers. Feedback from the follow-up visits also informed the decision to review and modify the contents of the third and fourth sessions which were conducted in May and June 2012.

The nutrition education sessions and follow up visits were facilitated by the PhD student researcher in cooperation with the respective trained CHW from the intervention villages. The researcher is a nutritionist with experience working as a Nutrition Officer with the rural community under the Ministry of Health and training nutrition students at the university level. The CHW worked on voluntary basis and under the supervision of the District Public Health Officers in the Ministry of Health. The CHW had basic education and no formal training in nutrition. The CHW participated in an intense 3 d workshop prior to the commencement of the intervention, where they were trained on the topics of the nutrition education sessions. The training of CHW was facilitated by a team of three researchers from the INULA project, consisting of an agricultural scientist and two nutritionists, who were also PhD students. Before the commencement of the project, the INULA project research team travelled to the two study districts (now sub-counties) and briefed the District Commissioners (DC), District Medical Officers of Health (DMOH) and officials from the Ministry of Agriculture on the aim and activities of the project. The trained CHW from the intervention villages organized the venues where the sessions were conducted, and also informed and mobilized the caregivers. The nutrition education sessions were conducted in different venues including churches, chiefs' offices and in

open shaded places that were away from distractions and onlookers, neutral and easily accessed by all the participants.

Endline survey

The endline survey was conducted in the intervention (*n* 10) and control (*n* 10) villages between July and August 2013, the same season as the baseline survey. Only caregivers who participated in the nutrition education sessions and whose children did not exceed 24 months of age were interviewed from the intervention villages. Ten households with children aged 6-23 months and their caregivers were randomly selected and surveyed from each of the control villages. Most of the caregiver-child pairs interviewed during the baseline survey did not participate in the nutrition education sessions and endline survey. This is because the endline survey was conducted one year after the baseline survey; as such, most of the children surveyed at baseline had grown older than the eligible age of 6-17 months and 6-23 months at the time of the intervention and endline survey, respectively. Some families surveyed at baseline had also migrated from the study area. Caregivers and their children who were surveyed at baseline and who met the inclusion criteria participated in the nutrition education sessions and endline survey. As a result, in the control group, thirty caregiver-child pairs were interviewed at both times, while sixty-seven were interviewed only once at endline and represented the replacement. The intervention group at endline consisted of twenty-two caregiver-child pairs who were also interviewed at baseline and a fresh sample of eighty-eight caregivers with children aged 6-23 months interviewed only at endline. The baseline survey questionnaire, with additional questions targeting the nutrition education intervention, was administered during interviews with the caregivers.

Data management and statistical analysis

Double data entry was performed by two different people using Epi Data Entry Client software version 1.4.2 in order to check for data entry accuracy. The data were analyzed using the statistical package IBM SPSS Version 22.0.0.1. A wealth index was computed to assess the socio-economic status of households using principal component analysis[35] and based on the following variables: main source of drinking water, type of latrine, main material of the roof, main type of fuel, ownership of land and household assets (electricity, radio, mobile phone, watch/clock, television,

sprayer, plough, bicycle, ox/donkey cart, motorcycle, car, boat, fishing net and computer). The CDDS were calculated from the 24 h recalls based on seven food groups recommended by WHO[36] The CDDS score ranges from 0-7 and children who eat foods from four or more food groups daily are considered to have consumed the minimum recommended dietary diversity[37]. The variety of foods consumed by the children was further analyzed in more details using thirteen food groups.

Data on child feeding practices was used to compute additional age-specific IYCF indicators including minimum dietary diversity (MDD), minimum meal frequency (MMF) and minimum acceptable diet (MAD) according to the WHO guidelines[37]. MDD is defined as the proportion of children 6-23 months who received foods from four or more food groups per day. The calculation of this indicator was based on the seven food groups recommended for children 6-23 months by WHO[36]. MMF is defined as the proportion of breastfed and non-breastfed children 6-23 months of age who receive solid, semi-solid or soft foods (including milk feeds for non-breastfed children) the minimum number of times or more the previous day. The minimum is defined as: two times for the breast-fed children aged 6-8 months, three times for breast-fed children aged 9-23 months and four or more times for the non-breast-fed children aged 6-23 months. MAD is defined as the proportion of children 6-23 months of age who receive a minimum acceptable diet (apart from breast milk). MAD is a composite indicator calculated from two fractions: breast-fed children 6-23 months of age who had at least the minimum dietary diversity and minimum meal frequency during the previous day; and non-breast-fed children 6-23 months of age who received at least two milk feedings and had a least the minimum dietary diversity not including milk feeds and the minimum meal frequency during the previous day [37] In the present study, MMF and MAD were calculated only for the breast-fed children since we did not have information on the number of milk feeds received by the non-breastfed children.

The height-for-age (HAZ), weight-for-age (WAZ) and weight-for-height (WHZ) *Z*-scores for the children were calculated using WHO Anthro version 3.2.2. The children whose height-for-age, weight-for-age and weight-for-height values were below -2 SD of the reference median (HAZ <-2, WAZ < -2 and WHZ <-2) were classified as being stunted, underweight and wasted, respectively[38].

The nutrition knowledge of the caregivers was assessed based on the caregivers' knowledge of three key nutrients (vitamin A, iron and vitamin C), foods rich in these nutrients and importance of feeding children these foods. The caregivers were asked to name three rich food sources and three functions of each of the three nutrients. Each of the three scores had a potential range of 0-7, giving a maximum score range of 0-21.

Descriptive analyses were performed to provide general information on the characteristics of the study population. Differences in socio-demographic characteristics between the control and intervention groups were tested using the chi-square test for nominal variables, Mann-Whitney test for ordinal variables and the *t* test for continuous variables. Pearson correlation was used to determine if there was a relationship between the frequency of exposure to the intervention and the knowledge scores of the caregivers and CDDS. Further analysis using the Univariate ANOVA was performed to determine the influence of the follow-up on the nutrition knowledge of the caregivers and CDDS.

The treatment effect was assessed using the difference-in-differences (DiD) estimator inside a generalized estimating equations (GEE) framework to account for a data structure where 25% of the data are panel data and the remaining 75% are repeated cross sectional data[39,40]. The underlying assumption of the DiD model is that the intervention group would have developed in a similar way to the control group, if they did not receive any treatment. In the present study, there is no reason to assume that the intervention group would have developed differently, given the study design. Binary outcomes (MDD, MMF, MAD) were analyzed using logistic regression inside the GEE framework. The CDDS and the knowledge score were treated as count variables and analyzed using count regression with Poisson link function and negative binominal function in the statistical models, respectively[41]. The results from Poisson regression are presented as incidence rate ratio (IRR), which expresses the treatment effect in percentages.

Results

During the baseline survey, 198 caregivers with children aged 6-23 months were interviewed in the control (*n* 99) and intervention (*n* 99) groups. Two caregivers were not available for the interviews during the baseline survey. At endline 207 caregiver-

child pairs were interviewed, 110 in the intervention group and ninety-seven in the control group. One caregiver was not available for the interview in the control group during the endline survey. Two children from the control group during the endline survey were excluded from the analysis since their ages were not recorded correctly. There were no significant differences in the socio-demographic characteristics of the households, caregivers and children in the intervention and control groups at baseline and endline. Table 4.2 and 4.3 summarize the descriptive characteristics of the children, caregivers and households at baseline and endline.

The mean HAZ declined in both the control and intervention groups between the baseline and endline surveys, while the mean WAZ and WHZ increased slightly in both groups between the two time points (Table 4.2). Table 4.2 also shows that mean height of the caregivers was not statistically different between the control and intervention groups at baseline (161cm *v.* 162cm, *P*=0.334). This was different at endline, where caregivers in the control group were taller compared with caregivers in the intervention group (162 cm *v.* 161cm, *P*= 0.044). Stunting prevalence increased from 29.3 % in the intervention group at baseline to an alarming 49.1% at endline, whereas wasting prevalence dropped from 2.0 % at baseline to 0.0 % at endline in the same group. This is different to the control group where we found 29.3 % stunting at baseline and 34% stunting at endline and an increase in wasting from 2.0% at baseline to 3.1% at endline, (Table 4.3).

Table 4.2: Descriptive characteristics of children, caregivers and household at baseline and endline in Bondo and Teso South sub-counties, western Kenya: continuous variables

	Baseline survey (*n* 198, July/August 2012					**Endline Survey (*n* 207), July/August 2013**				
	Control group (*n* 99)		Intervention group (*n* 99)			Control group (*n* 97)		Intervention group (*n* 110)		
Characteristics	Mean	SD	Mean	SD	*P*†	Mean	SD	Mean	SD	*P*†
Children										
Age (months)	13.53	5.15	14.46	4.74	0.188	15.88	5.11	16.55	4.30	0.301
Weight (kg)	9.06	1.67	8.96	1.58	0.670	9.72	1.42	9.54	1.36	0.353
Height (cm)	72.84	5.80	73.16	5.58	0.693	74.81	5.52	74.83	4.96	0.979
HAZ	-1.31	1.45	-1.61	1.27	0.121	-1.50	1.41	-1.85	1.31	0.064
WAZ	-0.57	1.26	-0.87	1.18	0.093	-0.39	1.15	-0.74	1.04	**0.022**
WHZ	0.15	1.10	-0.04	1.14	0.237	0.49	1.00	0.25	0.89	0.070
Caregiver										
Age (years)	25.09	5.04	26.56	7.32	0.103	26.15	6.20	26.35	6.49	0.822
Weight (kg)	56.60	10.95	56.81	9.57	0.888	57.60	9.21	56.63	9.71	0.479
Height (cm)	160.91	4.97	161.73	6.47	0.334	162.22	5.64	160.59	5.60	**0.044**
BMI (kg/m^2)	21.86	4.15	21.71	3.31	0.792	21.90	3.40	21.93	3.36	0.951
Household										
No. of people in household	6.11	2.83	6.13	2.45	0.957	5.72	2.20	5.67	2.30	0.876
Wealth Index	-0.46	3.01	-0.32	3.13	0.746	-0.30	2.63	0.27	2.56	0.114

HAZ, height-for-age Z-score; WAZ, weight-for-age Z-score; WHZ, weight-for-height Z-score.
†*P* value from *t* test.

Table 4.3: Descriptive characteristics of children, caregivers and household at baseline and endline in Bondo and Teso South sub-counties, western Kenya: categorical variables

	Baseline survey(n=198) (July/ August 2012)					**Endline Survey (*n*=207, July/August 2013)**				
	Control group (*n* 99)		Intervention group (*n* 99)			Control group (*n* 97)		Intervention group (*n* 110)		
Characteristics	n	%	n	%	*P*†	n	%	n	%	*P*†
Children										
Sex										
Male	53	53.5	53	53.5	1.000	52	53.6	63	57.3	0.697
Female	46	46.5	46	46.5		45	46.4	47	42.7	
Child nutritional status										
Stunting (HAZ<-2)	29	29.3	29	29.3	1.000	33	34.0	54	49.1	**0.040**
Underweight (WAZ<-2)	10	10.1	17	17.2	0.214	7	7.2	9	8.2	1.000
Wasting (WHZ<-2)	2	2.0	2	2.0	1.000	3	3.1	0	0.0	0.202
Caregivers										
Relationship with child										
Biological mother	98	99.0	94	94.9	0.214	95	97.9	108	98.2	1.000
Caregiver	1	1.0	5	5.1		2	2.1	2	1.8	
Level of education*										
No education	9	9.1	3	3.1	0.541‡	4	4.1	3	2.7	0.159‡
Some primary	41	41.4	45	45.9		33	34	55	50.0	
Completed primary	31	31.3	30	30.6		35	36.1	25	22.7	
Some secondary	9	9.1	13	13.3		15	15.5	17	15.5	
Completed secondary	7	7.1	5	5.1		6	6.2	7	6.4	
Higher education	2	2.0	2	2.0		4	4.1	3	2.7	
Marital status										
Married monogamous	77	77.8	70	70.7	0.244	77	79.4	75	68.2	0.117
Married polygamous	11	11.1	14	14.1		7	7.2	19	17.3	
Widowed	1	1.0	6	6.1		3	3.1	9	8.2	
Divorced	2	2.0	3	3.0		1	1.0	0	0.0	
Single	8	8.1	6	6.1		9	9.3	7	6.4	

HAZ, height-for-age Z-score; WAZ, weight-for-age Z-score; WHZ, weight-for-height Z-score.

†*P* value from X^2 test for nominal variables.

‡*P* value from Mann-Whitney test for ordinal variables

Table continued on next page

Continued Table 4.3

Characteristics	Baseline survey(n=198) (July/ August 2012)					Endline Survey (*n*=207, July/August 2013)				
	Control group (*n* 99)		Intervention group (*n* 99)			Control group (*n* 97)		Intervention group (*n* 110)		
	n	%	n	%	*P*†	n	%	n	%	*P*†
Household										
Sex of household head										
Male	93	93.9	89	89.9	0.612	90	92.8	97	88.2	0.279
Female	6	6.1	10	10.1		7	7.2	13	11.8	
Occupation of household head										
Farming	14	14.1	21	21.2		20	20.6	22	20.0	
Business/ petty trade	35	35.4	25	25.3		28	28.9	27	24.5	
Casual labour	15	15.2	13	13.1		17	17.5	12	10.9	
Wage employment	10	10.1	10	10.1		13	13.4	22	20.0	
Fishing	18	18.2	18	18.2		16	16.5	19	17.3	
Others	7	7.1	12	12.1		3	3.1	8	7.3	
Wealth index										
Poorest	23.2	23	26.3	26	0.908‡	19.6	19	11.8	13	0.107‡
Poor	25.3	25	18.2	18		21.6	21	18.2	20	
Middle	15.2	15	16.2	16		19.6	19	26.4	29	
Richer	19.2	19	24.2	24		19.6	19	16.4	18	
Richest	17.2	17	15.2	15		19.6	19	27.3	30	

HAZ, height-for-age Z-score; WAZ, weight-for-age Z-score; WHZ, weight-for-height Z-score.

†*P* value from X^2 test for nominal variables.

‡*P* value from Mann-Whitney test for ordinal variables.

Feeding practices of the children

Table 4.4 presents results on child feeding practices in the two groups at baseline and endline. There were no significant differences between the control and intervention groups at baseline and endline in the proportion of children who were still being breast-fed. At baseline there were no significant differences in the proportion of children who achieved MDD, MMF and MAD between the control and intervention groups. At endline, a significantly higher proportion of children in the intervention group compared with those in the control group achieved MDD (87.3% *v.* 55.7%, *P*<0.001). The proportion of breast-fed children who achieved MMF (98.8% *v*. 88.6%, *P*=0.010) and MAD (87.8% v. 51.9%, *P*<0.001) was significantly higher in the intervention group compared with the control group at endline.

The consumption of foods from different foods groups improved significantly among children in the intervention group after the nutrition education programme. The children were compared based on whether they had been fed foods from the seven food groups recommended by WHO[(36)]. At endline, a significantly higher proportion of children in the intervention group consumed legumes, nuts and seeds (74.5% *v.* 39.2%, *P*=<0.001), dairy products (91.8% *v.* 74.2%, *P*=0.001), flesh foods such as meats, poultry and fish (71.8% *v*. 42.3%, *P*<0.001), vitamin-A rich fruits and vegetables (60.0% *v.* 33.0%, *P*<0.001) and other fruits and vegetables (70.0% *v*. 45.4%, *P*=0.001). There were no significant differences in the proportion of children who consumed grains, roots and tubers and eggs in the intervention and control groups at both time points (Table 4.4).

Further analysis was done to determine the consumption of single food items within food groups by the children. At baseline, there were no significant differences in the proportion of children who had consumed different food items within food groups (Table 4.4). At endline, an increase was observed in the intervention group in the proportion of children who had been fed vitamin A- rich vegetables and tubers (14.5% *v.* 0.0%), dark green leafy vegetables (68.2% *v*. 37.1%) and fats and oils (96.4% *v*.79.4%), all *P*<0.001). Similarly, a higher proportion of children in the intervention compared with control group at endline consumed fish (61.8% *v*. 37.1%), legumes and nuts (52.7% *v.* 28.9%), milk (70.0% *v*. 45.4%) and vitamin A-rich fruits (18.2% *v.*3.1%; all *P* =0.001.

Table 4.4: Feeding practices of children in the control and intervention groups at baseline and endline in Bondo and Teso South sub-counties, western Kenya

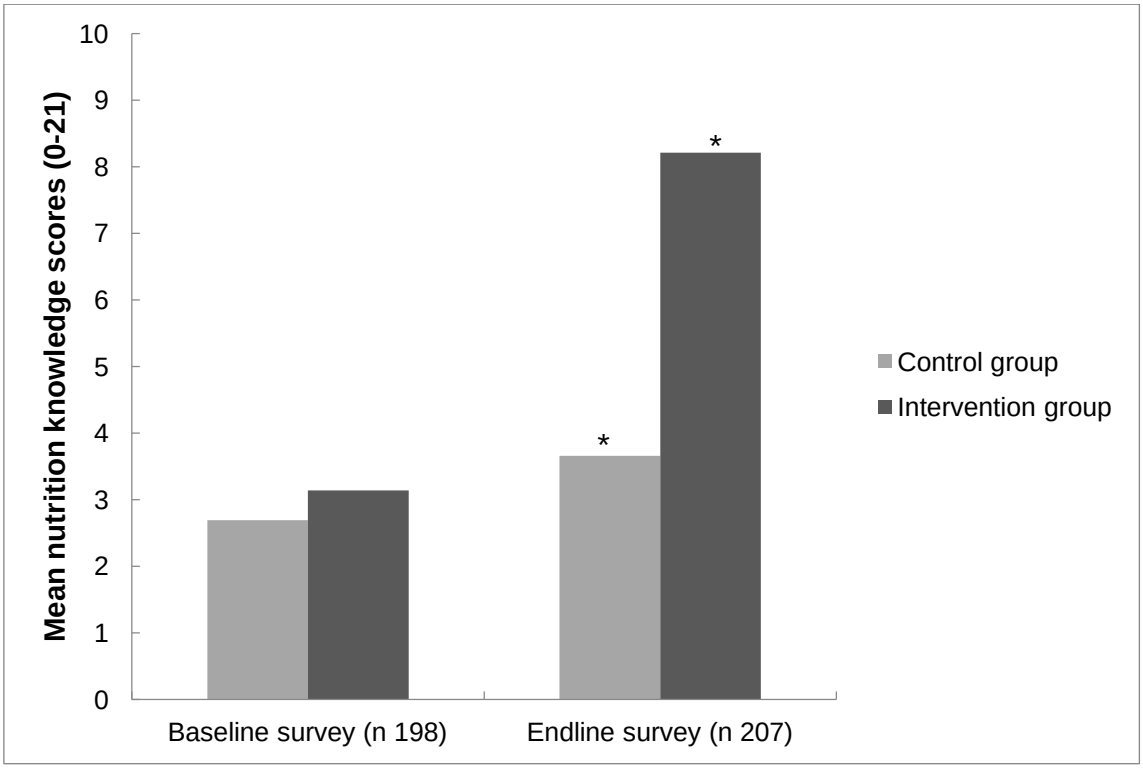
	Baseline survey (*n* 198, July/August 2012)					**Endline survey (*n* 207, July/August 2013)**				
	Control group (*n* 99)		Intervention group (*n* 99)			Control group (*n* 97)		Intervention group (*n* 110)		
Characteristics	n	%	n	%	*P*†	n	%	n	**%**	*P*†
Breastfeeding status	82	82.8	74	74.7	0.224	79	81.4	82	74.5	0.306
Infants 6-23 months who receive food from ≥4 food groups (MDD)	50	50.5	55	55.6	0.569	54	55.7	96	87.3	**<0.001**
Infants 6-23 months who receive food the minimum number of times or more (MMF)	81	88.9	58	80.6	0.225	70	88.6	81	98.8	**0.010**
Infants 6-23 months who achieve a minimum acceptable diet (MAD)	35	43.2	34	47.2	0.738	41	51.9	72	87.8	**<0.001**
Proportion of children fed foods from seven food groups										
Grain roots and tubers	96	97.0	94	94.9	0.718	96	99.0	110	100.0	0.950
Legumes, nuts and seed	61	61.6	64	64.6	0.768	38	39.2	82	74.5	**<0.001**
Dairy products	74	74.7	70	70.7	0.632	72	74.2	101	91.8	**0.001**
Flesh foods (meat, fish, poultry etc)	41	41.4	50	50.5	0.254	41	42.3	79	71.8	**<0.001**
Eggs	18	18.2	18	18.2	1.000	7	7.2	17	15.5	0.103
Vitamin-A rich fruits and vegetables	38	38.4	49	49.5	0.152	32	33.0	66	60.0	**<0.001**
Other vegetables and fruits	46	46.5	53	53.5	0.394	44	45.4	77	70.0	**0.001**
Proportion of children consuming:										
Cereals	96	97.0	93	93.9	0.495	95	97.9	110	100	0.423
Vitamin A rich vegetables and tubers	5	5.1	10	10.1	0.283	0	0	16	14.5	**<0.001**
White roots and tubers	22	22.2	16	16.2	0.367	34	35.1	41	37.3	0.852
Green leafy vegetables	45	45.5	55	55.6	0.201	36	37.1	75	68.2	**<0.001**
Vitamin A rich fruits	28	28.3	20	20.2	0.246	3	3.1	20	18.2	**0.001**
Other fruits and vegetables	74	74.7	70	70.7	0.632	72	74.2	101	91.8	**0.001**
Organ meats	0	0	3	3.0	0.245	1	1.0	1	0.9	1.000
Flesh meats	10	10.1	11	11.1	1.000	5	5.2	16	14.5	**0.045**
Eggs	18	18.2	18	18.2	1.000	7	7.2	17	15.5	0.103
Fish	40	40.4	42	42.4	0.885	36	37.1	68	61.8	**0.001**
Legumes, nut and seeds	36	36.4	44	44.4	0.311	28	28.9	58	52.7	**0.001**
Milk	46	46.5	53	53.5	0.394	44	45.4	77	70.0	**0.001**
Oils and fats	77	77.8	81	81.8	0.595	77	79.4	106	96.4	**<0.001**

MDD, minimum dietary diversity; MMF, minimum meal frequency; MAD, minimum acceptable diet. *P*† value from X^2 test

While an increase was found in the proportion of children fed flesh meats, (excluding fish) in the intervention group compared with the control group at endline (14.5% v. 5.2%, P=0.045), overall the consumption of animal-source foods by young children in the study area remained low.

Effect of treatment on nutrition knowledge of caregivers and children's dietary diversity

The results with respect to caregivers' mean knowledge scores are presented in Figure 4. 2. At endline more caregivers in the intervention group than in the control group reported correct answers to the nutrition knowledge questions on their knowledge of the three nutrients (vitamin A, iron and vitamin C), foods rich in these nutrients and the importance of feeding their children these foods.



*Mean nutrition knowledge score was significantly higher in the intervention group compared with .the control group at endline (P<0.001)

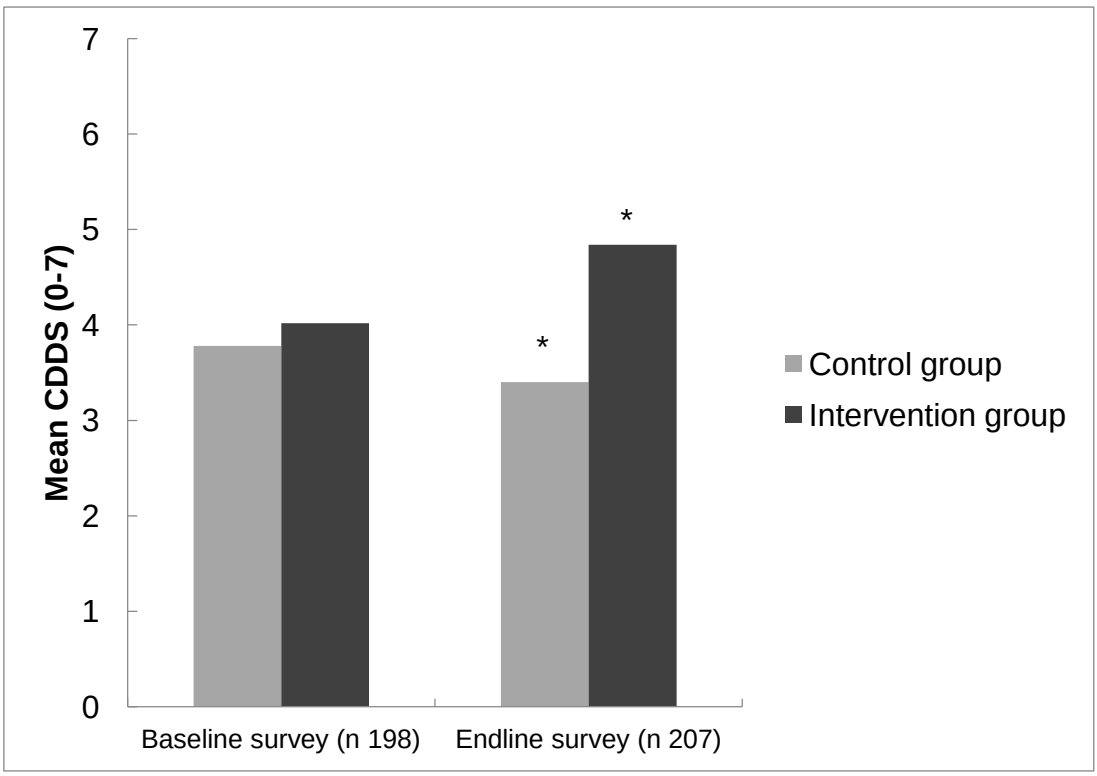
Figure 4.2: Mean nutrition knowledge scores of caregivers in the control group and intervention group at baseline (July/ August 2012) and endline (July/ August 2013) in Bondo and Teso South sub-counties, western Kenya.

At baseline there was no significant difference in the mean nutrition knowledge scores, indicating that the caregivers in the two groups were comparable in terms of their knowledge on the key nutrients. After the intervention, the mean nutrition knowledge score was significantly higher among caregivers in the intervention group compared with those in the control group at endline (8.21_{SD} 3.67 *v.* 3.66 $_{SD}$ (3.02), $P<0.001$).

The caregiver-child pairs were counted as exposed to the intervention if they had participated in any one out of the four nutrition education sessions. Analysis using Pearson correlation showed positive and significant relationships between the number of nutrition education sessions attended and the nutrition knowledge scores of the caregivers ($P<0.001$) and the CDDS ($P=0.032$). The nutrition knowledge scores of the caregivers and CDDS increased as the number of nutrition education sessions attended increased. Results from the univariate ANOVA showed that the follow-up had a positive and significant influence on the nutrition knowledge scores of the caregivers, after controlling for household wealth status, size and food security status, age and education level of the caregivers, age of the child and agro-ecological zone. The caregivers who were followed up had higher nutrition knowledge scores compared with those who were not followed up ($P=0.041$). The follow-up, however, did not have a significant influence on CDDS ($P=0.338$).

The mean CDDS in the control and intervention groups were not significantly different at baseline. At endline, the mean CDDS was significantly higher among children in the intervention group compared with those in the control group (Figure 4.3). In order to assess the treatment effect on CDDS, the difference-in-difference (DiD) estimator was calculated. The variables child's age in months, wealth index, agro-ecological zone and caregivers' nutrition knowledge were included in the first model as covariates. The results showed that the CDDS in the control and intervention groups did not differ significantly at baseline ($P=0.510$). The mean CDDS in the control group dropped significantly at endline ($P=0.006$) and the endline rate of CDDS was at 85.6 % of the baseline values (IRR = 0.856).The treatment effect on CDDS was found to be large, positive and significant ($P=0.001$).The results show an estimated average treatment effect on the number of food groups consumed by the children during the last 24 h of +27% (IRR=1.27). The results showed that the CDDS rate of the children

in the intervention group was 27% larger than it would have been without the treatment effect.

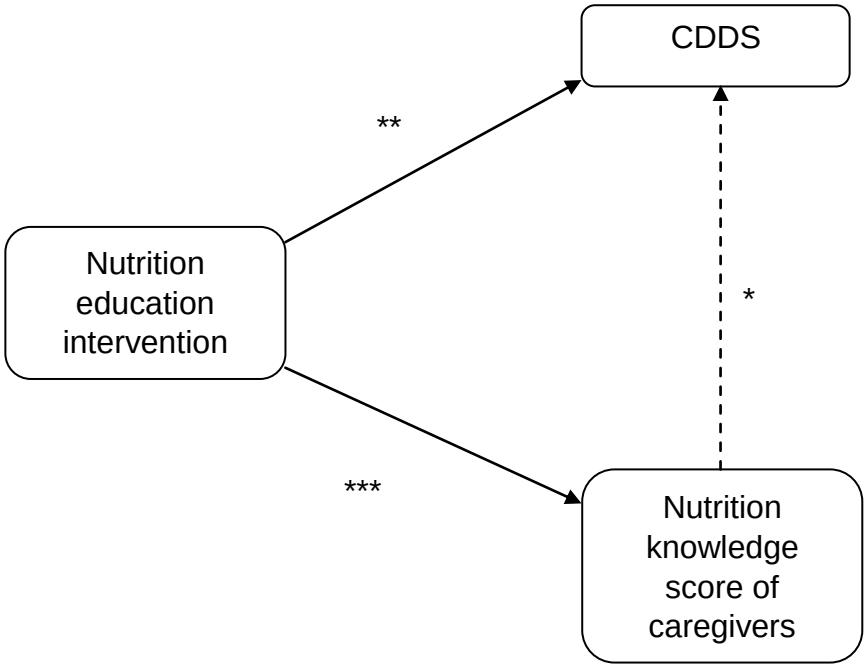


*Mean CDDS was significantly higher in the intervention group compared with the control group at endline (P<0.001)

Figure 4.3: Mean children's dietary diversity scores (CDDS) in the control group and intervention group at baseline (July/ August 2012) and endline (July/ August 2013) in Bondo and Teso South sub-counties, western Kenya.

Our assumption was that the intervention would lead to improvements in nutrition knowledge among the caregivers and that improved nutrition knowledge would lead to improvements in the CDDS. Indeed, a second DiD model revealed that the treatment had a large, positive and significant effect on the knowledge scores of the caregivers (*P*<0.001, IRR=2.05). However, in our first model with CDDS as the dependent variable, nutrition knowledge score did not have a significant or strong effect on CDDS (*P*=0.731) nor on the treatment effect on CDDS (*P*=0.433). That is why the reported treatment effect on CDDS can be interpreted although knowledge was included in the model as a covariate. If there was an indirect effect from

treatment via nutrition knowledge score to CDDS, the direct effect of treatment on CDDS would underestimate the true relationship. Figure 4.4 visualizes the findings from the two reported models.



Continuous line=significant effect; dotted line=non-significant effect.
*(*P*=0.731); ** (*P*=0.001); *** (*P*<0.001)

Figure 4.4: Effect of the education intervention on children's dietary diversity scores (CDDS) and nutrition knowledge scores of the caregivers in Bondo and Teso South sub-counties, western Kenya

Further analysis using the DiD model with logistic regression for binary dependent variables was done to determine the effect of the intervention on the IYCF indicators. We found a significant effect of the treatment on the proportion of children who achieved MDD, (OR=4.82, 95% CI 1.94, 11.98, *P*= 0.001). In addition, the treatment had a significant effect on the proportion of breast-fed children who achieved MMF (OR=19.98; 95% CI 2.05, 195.15, *P*=0.0.010) and MAD (OR=6.01; 95% CI 2.14, 16.93, P=0.001), after controlling for age. Additional analysis using the DiD model with breast-feeding as the dependent variable, showed that the treatment did not have an influence on breast-feeding, *P*=0.980. In yet another DiD model with HAZ as

the dependent variable, breast-feeding was found not to have a significant effect on stunting, after controlling for age, (*P*=0.398).

Discussion

The nutrition education intervention aimed to improve the diversity of complementary diets fed to children 6-23 months and nutrition knowledge of caregivers. The intervention was community-based and participatory, and this motivated the caregivers to attend and participate in the nutrition education sessions. The major focus of the intervention was to promote the integration of a variety of locally available and nutritious foods into the existing traditional homemade complementary foods in order to improve their diversity and quality. The intervention was successful and lead to improvements in the diversity of complementary foods and the level of nutrition knowledge among the caregivers in the intervention group.

The study findings revealed that more children in the intervention than control group at endline were fed on more varied diets. There was a significant increase in the proportion of children consuming vitamin-A rich vegetables and fruits, dark green leafy vegetables, legumes and nuts and other fruits and vegetables in the intervention compared with the control group at endline. In a randomized controlled intervention study in Uganda[42], caregivers in the intervention group selected an increased variety of foods for their children including legumes, meat, fruits and vegetables compared with those from the control group. In another trial educational intervention in rural China[19], the consumption of meats, eggs, dark green leafy vegetables, fruits, cooking oils and beans increased significantly among children in the intervention group compared with those in the control group.

An assessment of the contribution of single food items to the diets of the children showed that milk and fish were the common animal-source foods fed to children in the study area. The actual amount of milk consumed by the children was minimal since milk was mainly used in the preparation of beverages such as tea and porridge which were frequently consumed by the children. The high consumption of fish could be explained by the fact that one of the communities in the study area resided near Lake Victoria, where fish was more accessible and thus the major source of protein. The low consumption of other animal-source foods such as meats, organ meats and poultry could be explained by the fact that more family resources are need to access

them. Eggs are recognized for their nutritional value, easy in preparation and consumption; however, their consumption among young children remains minimal in many rural communities[43]. While poultry rearing is a common practice in the study areas, there was no significant difference in the proportion of children fed eggs in the control and intervention groups at both baseline and endline. This could be partly explained by the common belief among the communities in the study area that feeding young children eggs could result in delayed speech development. Similar findings of low intake of animal-source foods such as meat, fish and fowl by young and older children in Kenya has been documented [44]. In Ghana economic constraints and fear of establishing taste preferences among children were reported by caregivers as the major barriers to feeding children animal-source foods like meat and eggs[45] . In a study in Nepal, mothers reported not feeding their <1-year-old children animal-source foods such as meat and eggs because they were difficult to digest and the children did not have teeth[46]. In a study in Uganda[42], few changes were observed in the consumption of meat because it was not locally available in the study area. Similarly in a formative research in Nepal[46], very few children consumed anima- source foods including eggs since the community did not rear or consume poultry, believing they were unclean.

Complementary foods fed to children 6-24 months, particularly in developing countries, are plant-based and are not sufficient to meet nutrient needs at this age. It is therefore recommended to frequently feed children small amounts of meat, poultry, fish and eggs since animal-source foods are not only rich in proteins but also micronutrients which are important in the growth and development of young children[47,48]. The findings from the present study suggest the need for interventions to address barriers affecting the consumption of a variety of animal-source foods among young children. Integrated educational, health, nutrition and agricultural programmes promoting the rearing of small animals and consumption of a variety of animal-source foods are needed.

During the cooking demonstrations, the caregivers were taught how to incooperate a variety of nutrient-rich local foods into the existing home made complementary foods. The use of locally available foods, which required less family resources such as money and time to acquire, was well accepted by the caregivers. This contributed to

the significant increase in the proportion of children receiving more diversified diets in the intervention group at endline. The use of locally available foods needs to be included as a component of policies to improve overall dietary quality, especially during the complementary feeding period in order to prevent malnutrition among young children and particularly in resource-poor rural households.

The nutrition education intervention in our study also had a significant effect on the IYCF indicators. A significantly higher proportion of children in the intervention group achieved MDD, MMF and MAD compared with those in the control group at endline. Similar findings were reported in a monthly nutrition education study in rural Karnataka, India which targeted children aged 5-11 months[49]. In that study, infants in the intervention group were found to be more likely to have a higher daily meal frequency by being fed at least four times a day and a higher dietary diversity by receiving foods from at least five different food groups compared with their counterparts in the non-intervention group. The calculation of minimum meal frequency and minimum acceptable diet was not done for the non-breastfed children in our study because data on the minimum number of non-breast-milk feeds they received, which was required for calculation of these indicators, were not available. This limited our study because we were not able to determine the prevalence of MMF and MAD for the non-breastfed children. There is need to collect information on the number of milk feeds fed to non-breast-fed in future similar studies.

Another key finding of our study was that the intervention had a significant effect on the nutrition knowledge of the caregivers in the intervention group at endline. Positive effect of educational interventions on nutrition knowledge of caregivers has been reported in other studies. A cluster-randomized controlled trial education intervention in Peru[21] showed improvements in the nutrition knowledge of caregivers who participated in the educational intervention to improve nutrition in young children. In a study in Indonesia[17], the percentage of correct answers on nutrition knowledge in the intensive nutrition education group was significantly higher than in the non-nutrition education group after the intervention. Similarly in a community-based nutrition education intervention study in China[15], mothers in the education group showed significantly higher nutrition knowledge than their control group counterparts. Significantly more mothers in the education group than in the control group reported

correct answers on questions about the types of foods that would help their children grow well and the foods that were not good for their infants. In a similar study in China, the percentage of correct answers on nutrition knowledge in the intervention group was significantly higher than that of the control group after the mothers were educated about feeding guidelines for infant and young children[50].

However, the increase in nutrition knowledge did not have a significant effect on the children's dietary diversity in the present study. This finding demonstrates that the effect of the intervention on child dietary diversity was not via an increase in nutrition knowledge of the caregivers, and that while increased nutrition knowledge is an important factor, on its own it cannot lead to changes in behaviours. Accordingly nutrition education approaches are most effective when they focus on behaviour change and not merely on information transfer. This is because changes in attitudes and behaviour towards child feeding are reflected by the adoption of appropriate feeding practices[5]. In our study, the nutrition knowledge scores were based only on three key nutrients and did not refer to the knowledge about the importance of a balanced diet and dietary diversity in general. This could explain the missing link from nutrition knowledge to child dietary diversity in the present study (Fig. 4). However, during the nutrition education sessions the importance of using local food resources to achieve a balanced and diverse diet was emphasized. This partly newly gained knowledge could have motivated the caregivers to change their children's feeding practices.

Our study had a cross-sectional design and targeted children aged 6-23 months and their caregivers. The endline survey was conducted 1 year after the baseline survey. Hence most of the children who were aged 6-23 months at baseline were not eligible to participate in the endline survey as they were aged above the required 23 months, and had to be replaced with a new fresh sample. However the replaced households with children aged 6-23 months and their caregivers were sampled from the same villages and were comparable to those who were not eligible with respect to socio-demographic and economic characteristics. Thus, the results were compared among two different groups at baseline and endline, showing community and not individual effects. Future studies might target a large sample of young children aged below 1 year and who would still be eligible to participate in both the intervention and endline

survey. While through this no children in the age group 12-23 months would be captured at baseline, this would at least enable comparison of data on the same sample and hence analysis of individual effects. In addition, longitudinal study designs are also recommended for future studies to enable follow-up of cases for a longer period in order to also capture seasonal differences and enable more precise estimation of the impact of such interventions on child feeding practices and growth[51].

The observed development in mean HAZ in the control and intervention groups between the baseline and endline survey might be partially explained by the fact that more than 50% of the children assessed at baseline were not eligible to participate in the nutrition education sessions and endline survey and were replaced by other children with (inadvertently) shorter mothers. Maternal height is known to significantly influence HAZ of the offspring, which might have contributed to the observed change in mean HAZ values[52]. Breast-feeding was found to influence HAZ, but after controlling for age, the association was no longer statistically significant. This might have been different in a larger study population. Thus, the observed poor nutritional status could be attributed to an interaction of other multiple factors at the individual, family and community levels prior to the intervention, such as inadequate complementary feeding practices, infections and diseases, poor hygiene and access to medical care, and poverty, among other factors[53,54].

Further, as already discussed, the study population was not the same at both times, thus a community effect and not individual effect was observed in the nutritional status of the children. The endline survey was conducted one month after the end of the nutrition education sessions. These results showed the short-term effects of the intervention on child dietary diversity and the nutrition knowledge of the caregivers. To better understand the long-term effects of such an intervention, where dietary diversity is expected to contribute to improvements in growth and overall health of children, there is need to allow for a longer period of time such as 1 year between the end of the intervention and the impact survey. This would enable the assessment of the long-term impact of the intervention on child feeding practices and growth outcomes.

The follow-up visits in our study were found to have a positive and significant influence on the nutrition knowledge scores of the caregivers. The follow-up visits were used to reinforce the messages received during the first two nutrition education sessions. The feedback from the follow-up sessions also informed the decision to review the information and messages delivered during the first two sessions during session three. This was a major strength of our study and contributed to the success of the intervention. Our study had only one follow-up session; hence we recommend that similar studies in the future be accompanied with more follow-up visits to reinforce behaviour change and adoption of improved child feeding practices.

The intervention targeted caregivers, who were mainly the mothers of the children. However, for effectiveness of such nutrition education interventions in the future, it is important to include other members of the family such as husbands and grandmothers who have been shown to have a great influence on child feeding and caring practices in other projects[55]. This could ultimately lead to improvements in child feeding practices which would translate into improved overall health and growth among young children.

Conclusions

Inappropriate feeding practices during the complementary feeding period are known to negatively impact child nutrition, health and overall development. The results from our study have contributed to the evidence about the favourable role of participatory nutrition education interventions focusing on the utilization of locally available food resources in improving the diversity of complementary diets. The results also suggest the need for similar approaches including other family members especially grandmothers and husbands, who would provide a supportive environment that would enable lasting behaviour change among caregivers.

Acknowledgements

Acknowledgement: The authors greatly acknowledge the support from Ms. Judith Kuchenbecker who contributed to the development of the data collection tools.

Financial support*:* This work was conducted with unrestricted financial support of the Federal Ministry of Economic Cooperation and Development, Germany, through Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ) and Deutscher

Akademischer Austausch Dienst (DAAD). The funder had no role in the design, analysis or writing of this article.

Conflict of interest: None. Authorship: L.M.W. was responsible for data collection and intervention, and drafted the manuscript with contributions from G.B.K., J.H., I.J. and M. B. K. G. B. K. was the principle investigator and contributed to the conceptualization of the study design. J.H. contributed to the statistical analysis. M. B. K contributed to the revision of the final manuscript.

Ethics of human subject participation: Research permission including ethical approval for this study was granted by the National Council of Science and Technology (NCST) Nairobi, Kenya.

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5 General Discussion

Malnutrition, including chronic undernutrition and micronutrient deficiencies remains a problem of public health concern, and a major contributing factor to the high rates of mortality and morbidity among under five year old children in the world[15,16]. At the same time, there is an emerging problem of overweight and obesity which is affecting adults and young children in both the poor and rich populations[28,114]. Next to poverty which is the main underlying cause of malnutrition [27], decline in the diversity and nutritional quality of diets has been recognized as one key factor contributing to malnutrition among rural populations in developing countries[31]. The diets consumed in most of these households consist mainly of starchy staples with few or no nutrient-rich sources of food including animal proteins, fruits and vegetables[64,115].

Lack of dietary diversity is a particularly critical problem for infants and young children during the complementary feeding period, because they need energy and nutrient-dense foods for optimal growth and development[14,63]. The consumption of poor quality diets among young children is attributed to several factors including poverty, inadequate access to a variety of foods, inadequate nutrition knowledge and feeding practices of caregivers, cultural beliefs and practices and inappropriate advice[13,71,72,116]. Nutrition education interventions that are integrated with food-based strategies promoting the utilization of local agrobiodiversity could contribute significantly to improved diversity dietary[33], especially for infants and young children in resource poor settings.

The main objectives of this thesis were to:

1. Assess the dietary patterns, food and nutrient intakes of women and children 6-23 months during two seasons in a rural setting in Western Kenya. The effect of seasonality and other factors on dietary diversity and the factors influencing nutrient intakes among the women were also investigated. In addition, the relationship between maternal and child dietary diversity was also assessed.
2. Develop and evaluate the effect of a nutrition education intervention focusing on increased utilization of local agrobiodiversity and enhanced nutrition knowledge among caregivers on the diversity of complementary foods for children aged 6-23 months.

Main findings

Seasonal variations in dietary diversity of the women and children

The mean WDDS increased and was significantly higher in November compared with July/ August (4.6 *vs.* 4.2, *P*<0.001). Still, this was rather low compared with the nine food groups recommended for women to consume per day[98], suggesting overall poor dietary quality during the two seasons. This finding is similar to those from other studies. Median DDS of women was found to be 6.0 out of 14 food groups in a study conducted during three seasons in Tanzania[117]. In Burkina Faso, mean DDS of women increased from 3.4 to 3.8 between the beginning and end of the cereal shortage season[50]. While the DDS in these studies were calculated based on different numbers of food groups, still the findings confirm the consumption of diets low in diversity among women. The diets of women with low DDS (≤ 3 food groups) were dominated by cereals, vegetables, oils/fat, sugar and tea (black tea). On the other hand, in addition to the foods consumed by women with low DDS, women with high DDS (≥5 food groups) consumed more animal source foods, legumes / nuts / seeds and fruits, Figure 5.1. Similar findings where diets of women with low DDS consisted mainly of cereals, green leafy vegetables and condiments were reported in studies conducted in Burkina Faso and Tanzania[47,117].

In this study, a significant increase was observed in the proportion of women who consumed dark green leafy vegetables, legumes/nuts/seeds and vitamin A rich fruits and vegetables during the post-harvest season (Table 3.1). This could be attributed to increased food availability and accessibly following the annual harvest. In addition, the short rains experienced during the post-harvest season could explain the increased availability and supply of dark green leafy vegetables[118], which were consumed by more women during this season. The children also consumed foods from more food groups in November compared with July/ August. However, a significant seasonal difference was observed only in the proportion of children consuming vitamin A rich fruits and vegetables (*P*=0.015). The proportion of children 6-23 months who consumed foods from ≥ 4 more food groups was significantly higher in November compared with July/ August (62.4% *vs.* 52.6%, *P*=0.004), Figure 5.2. Mean CDDS was found to be significantly higher in November compared with July/ August (3.9.*vs.* 3.6, *P*=0.004). However it was below the minimum for an

adequate diet (≥4 food groups out of seven per day) for 47.4% and 37.6% of the children in July/ August and November, respectively.

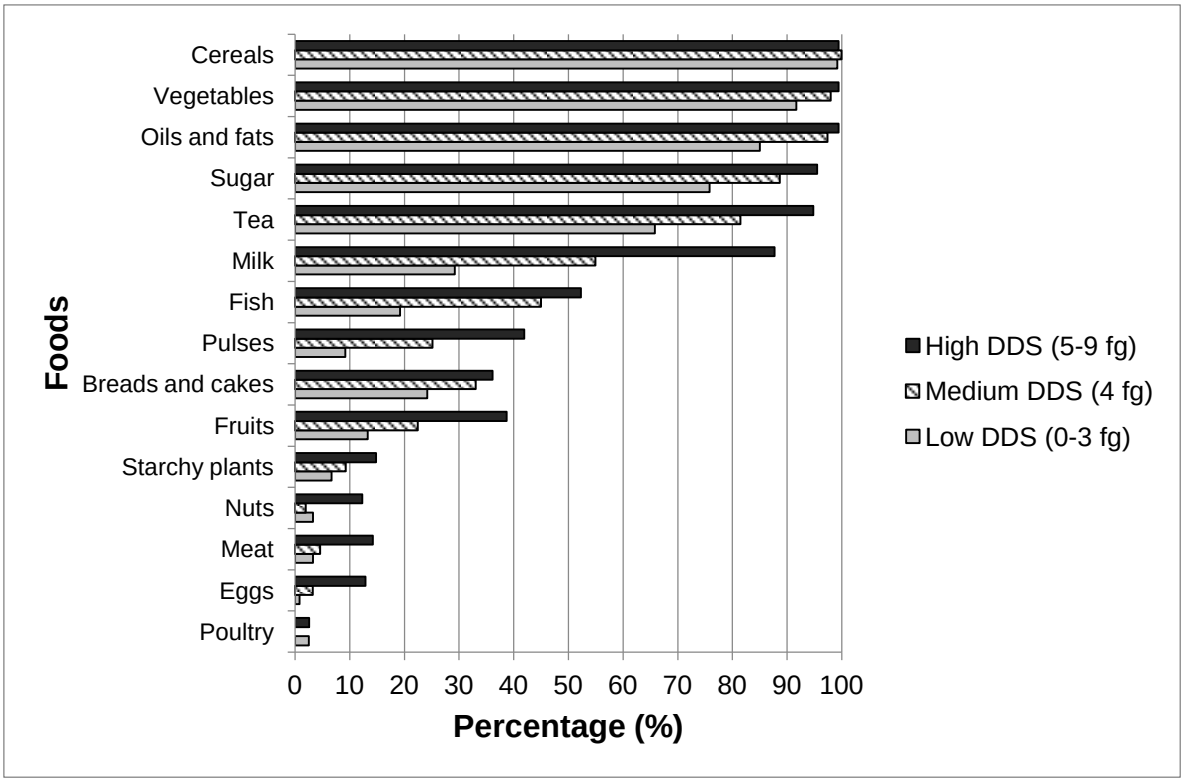

Figure 5.1: Proportions of women consuming different foods as a function of DDS categories in July/ August (n=426). fg, food group

The diets consumed by the women and children were based predominantly on starchy staples with low consumption of animal source foods, legumes and fruits during both seasons. Similar results with regards to consumption of staple-based diets with little contributions from animal source foods, fruits and vegetables among children and women have been reported[64,73,119,120].

Seasonality was found to have a small but significant effect on WDDS *(P*=0.008), but not on CDDS (*P*=0.293). This was reflected in an increase in estimated marginal mean WDDS from 4.2 to 4.4, while it decreased for CDDS from 3.7 to 3.6 between the two seasons (Figure 3.2). Seasonal variations in women's dietary diversity were found in other studies[50,121,122]. In Benin, seasonal variations were observed on food patterns but not on energy and nutrient intakes among older (school-aged)

children[54].The fact that the children consumed foods from more food groups in November was confirmed to be due to an age effect rather than a seasonal effect.

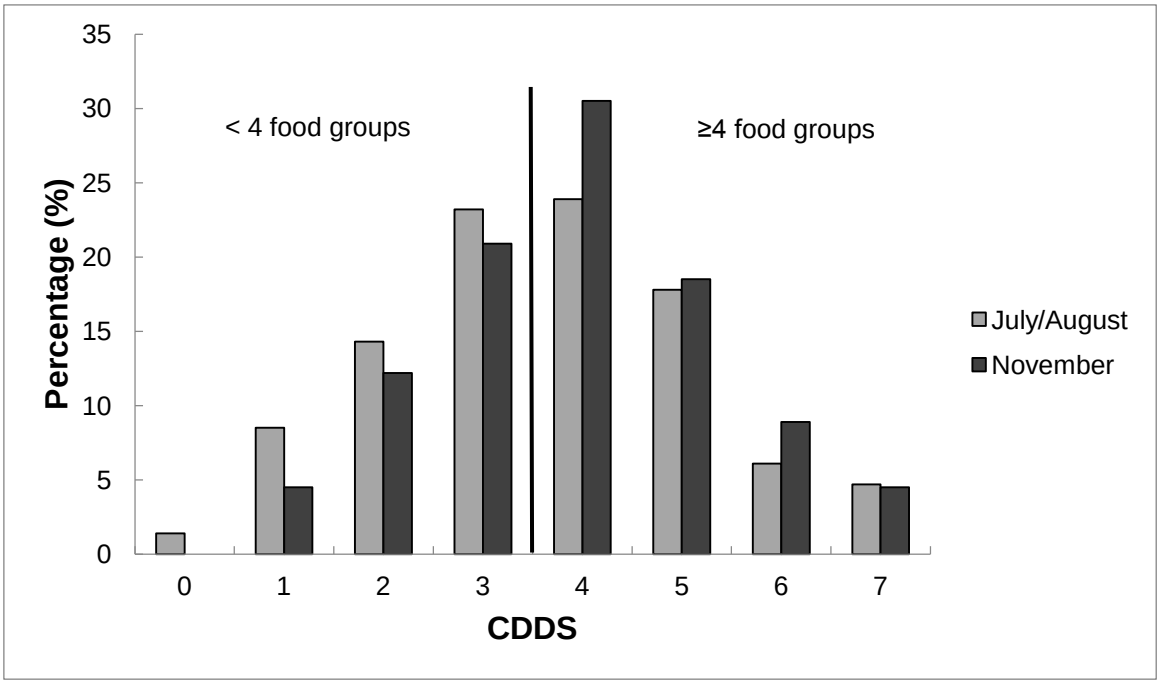

Figure 5.2: Distribution of CDDS and proportion of children who received minimum adequate diet (≥4 food groups out of 7) in July/August and November 2012 (n=426)

Since the children had grown older in November, they were more likely to be fed on a variety of family foods unlike in July/ August when they were younger. This finding shows that age is an important determinant of diet quality among young children[123]. Still, as children grow older and out of the complementary feeding period, and start to rely more on family foods for their energy and nutrient requirements, the quality of their diets is expected to be affected by seasonality. The finding that seasonality did not have an effect on CDDS indicates that other factors influence the dietary intakes of infants and young children. Contrary to popular beliefs, consumption of poor quality diets among young children may not necessarily be due to lack of access to adequate food. Other factors including inadequate nutrition knowledge among caregivers, cultural beliefs and practices and lack of time have been linked to poor child feeding practices [30,72,73]. Therefore, nutrition education interventions are need to sensitize caregivers on the importance of feeding young children a variety of foods, starting early during the complementary feeding period. In addition, behavior change

strategies are needed to identify specific barriers that are hindrances to consumption of specific foods, especially animal source foods among young children.

Seasonal variations in nutrient intakes of the women and children

There was a slight increase in the intake of energy and most nutrients among the women in the post-harvest season. However, significant seasonal variations were found only in the intakes of vitamin E, iron and calcium (*Ps*<0.05). Similar findings were reported in a study conducted during the lean and post-harvest seasons in rural Burkina Faso[124]. Overall inadequate energy and nutrient intakes was found among the women during the two seasons, a trend that has also been found in other studies[120,125].

The proportion of energy and most nutrients met from complementary foods were also significantly higher among the children 6-23 months in November compared with July/ August. This could be explained by the increase in age among the children between the two time points, which could have resulted in increased consumption of family foods, hence higher nutrient intakes from complementary foods. However, the proportions of vitamin C, iron, calcium and zinc met from complementary foods were notably low during both seasons. Consumption of a variety of foods is associated with improved intake of essential nutrients[44]. Still, consuming a diet high in diversity may not necessarily guarantee adequate nutrient intake, when the quantities of the different foods groups consumed are insufficient to meet the dietary requirements of people[126]. Thus, interventions promoting dietary diversification need to also take into consideration actions to ensure that adequate amounts of different foods are consumed to meet the energy and nutrient requirements of the people.

Relationship between WDDS and CDDS

The women's and children's dietary diversity were found to be associated, whereby an increase in WDDS was reflected in an increase in CDDS. Maternal and child dietary diversity were also found to be related in other studies[123,127]. However, while it is assumed that children of mothers who consume better quality diets are more likely to have comparable diets[128], this is not always the case since not all the foods consumed by the mothers are fed to young children[127]. The diets of young children in many developing countries are basic and based only a subset of family foods[127]. Still, the positive association between maternal and child dietary diversity points to

the need for interventions to improve overall maternal diets as a potential means of improving the quality of diets consumed by young children and also other family members.

Factors influencing dietary diversity and nutrient intakes of women

While women education was found to have a positive effect on both WDDS and CDDS, household food insecurity exerted a negative influence on the DD of both women and children. Higher age was associated with lower DD among the women. On the other hand, higher age among the children was a predictor of improved DD. Agroecological zone was found to have an influence on nutrient intakes with higher energy, carbohydrates, protein, vitamin A, iron, zinc and calcium intakes among women residing in the semi-humid lower midlands zone (LM3) compared with those living in the humid upper midland zones (UM1). The important role played by an individual's location or residence in predicting food availability, access and consumption was also observed in a study conducted in Nigeria[129]. Ethnicity was also found to have an effect on dietary patterns, a finding that has been reported in other studies[117,130]. Socio-demographic factors were found to influence dietary patterns of women and children in a similar way as in other studies[123,131,132]. On the contrary, the household socio-economic status, assessed using the wealth index score, was however found not to have a significant effect on DD and nutrient intakes of the women and children 6-23 months in this study. Nutrition education interventions promoting the consumption of diverse diets among women and children need to be integrated with other strategies to address some of the underlying constraints including low education levels among women and household food insecurity.

Effect of the nutrition education intervention on children's dietary diversity and nutrition knowledge of caregivers

The nutrition education intervention promoting the utilization of local agrobiodiversity had a positive and significant effect on CDDS (IRR=0.27, *P*=0.001). Mean CDDS increased and was significantly higher among children in the intervention group compared with those in the control group (3.4 *vs*. 4.8, *P*<0.001). The children in the intervention group were also more likely to receive MDD (OR=4.82, 95% CI 1.94, 11.98, *P*= 0.001), MMF (OR=19.98; 95% CI 2.05, 195.15, *P*=.0.010), and MAD

(OR=6.01; 95% CI 2.14, 16.93, *P*=0.001). The positive effects of nutritional education interventions on child feeding practices have been demonstrated in several studies. In a community-based nutrition education intervention conducted in India, infants in the intervention group were more likely to be fed solid foods (OR= 4.35, 95% CI 1.96, 10.00) and to receive a more diverse diet (OR=3.23, 95% CI 1.28, 7.69)[80]. In a randomized controlled intervention in Uganda, children in the intervention group were provided with better quality meals and more snacks at both follow-ups than those in the control groups[133] Similarly, food diversity and meal frequency improved among children in the intervention group compared with those in control group in a cluster randomized trial in China[81].

While this study focused on the effects of the nutrition education on children's dietary diversity, other similar studies investigated the effects of nutrition education interventions on food (g/day), energy and nutrient intakes among children. In a participatory nutrition education intervention conducted in Malawi, the amount of complementary foods (g/day) and energy, animal protein, niacin, riboflavin, calcium, iron, and zinc intakes were significantly greater (*P*<0.05) in the intervention compared to control group[82]. In Peru, fewer children in the intervention areas failed to meet dietary requirements for energy, iron and zinc compared with those in the control areas[83]. While ensuring dietary diversity is a key determinant for improved nutrient intakes, similar interventions promoting dietary diversification among children need to include strategies to ensure that young children also consume adequate amounts of different foods each day in order to meet their dietary requirements.

The nutrition education intervention also had a positive and significant effect on nutrition knowledge of caregivers (IRR=2.05; *P*<0.001). After participating in the nutrition education sessions, more caregivers in the intervention group compared with the control group reported correct answers to the nutrition knowledge questions. This was reflected in the mean nutrition knowledge score being significantly higher for the caregivers in the intervention group compared with their counterparts in the control group 8.2 *vs*. 3.7, *P*<0.001). Improvements in nutrition knowledge among caregivers following their participation in nutrition education interventions have been reported in other studies. In a cluster-randomized controlled trial nutrition education study in China, caregivers in the intervention group achieved better knowledge and practices related to complementary feeding, and significantly higher infant and child

feeding index scores at each follow-up point compared to those in the control group[77]. In a nutrition education program in Indonesia, the percentage of correct answers on knowledge and practice in the intensive nutrition education group were significantly higher than in the non-intensive nutrition education group[78]. In another study in rural China, the Knowledge Attitude and Practice (KAP) scores of caregivers in intervention group I (12.0) and intervention group II (11.6) at six months, were higher than those of the control group (10.5) (LSD) t = 5.96, $P < 0.001$; LSD t = 4.25, $P < 0.001$)[79]. In yet another study conducted in China, mothers in the education group showed significantly higher nutrition knowledge and reported better infant feeding practices than their control group counterparts after one year[72].

In this study, it was hypothesized that caregivers who participated in the nutrition education intervention would have improved nutrition knowledge, and that children whose caregivers participated in the nutrition education intervention would have improved dietary diversity. Indeed, as already discussed above, the nutrition education intervention had a positive and significant effect on nutrition knowledge among caregivers. However, the increase in nutrition knowledge among caregivers did not have a direct and significant effect on CDDS (P=0.731), Figure 4.4. This could be explained partly by the fact that the level of nutrition knowledge among the caregivers was assessed based only on a subset of questions related to three key nutrients (vitamin A, iron and vitamin C), and not on overall knowledge of the caregivers on the importance of feeding young children a variety of foods. Still, this finding alludes to the fact that increased nutrition knowledge is not sufficient on its own to lead to changes in attitudes and behaviors with regard to child feeding practices, which are usually reflected in the adoption of improved feeding practices[134]. This is because change in behavior is influenced directly or indirectly by multiple and related factors which need to be considered and addressed in order to make nutrition education interventions more effective. Some of these factors play a role in motivating the intension to change behaviour, other factors are important in translating motives and intensions into behavior change, and others provide a supportive environment that is important in facilitating behavior change[76].

The nutrition education intervention conducted within this study emphasized the use of locally available nutrient-rich foods that are easily accessible and affordable to improve the quality of existing complementary diets. The caregiver brought the local

food resources from their homes and also participated in the preparation of the improved complementary foods during the cooking demonstrations. Through this participatory nutrition education sessions, the caregivers were able to translate the acquired knowledge and skills into actions. This could have partly motivated them to adopt new behavior with regards to food choices that lead to improvements in the children's' dietary diversity. Therefore nutrition education interventions that promote the use of local food resource to improve DD are needed, especially in resource poor-settings. Nutrition education interventions that include strategies to provide caregivers with practical skills and a supportive environment are more likely to be effective in promoting behavior change with regard to overall improved child feeding practices.

The focus of the nutrition education intervention conducted within the current study was to improve DD among children during the complementary period. Improved DD has been associated with improved growth outcomes among young children in other studies[44–46]. In this study, while mean WAZ and WHZ of the children in the intervention group improved, mean HAZ declined in both the intervention and control groups (Table 4.2) The observed declined in HAZ among the study children could be partly explained by the fact that the study populations in both the intervention and control groups were different at baseline and endline. As such, the observed development in WAZ, WHZ and HAZ among the study children between the baseline and endline surveys was a reflection of a community effect and not an individual effect. The observed poor nutrition status among the children could also be linked to preexisting poor nutritional and health status and other related factors[46,74,135] . The time between the end of the intervention and the endline survey (one month) was also short, and not sufficient to observe significant changes in growth outcomes. In order to have more precise estimation of the impact of similar interventions on child feeding practices and subsequently on growth outcomes, future similar interventions need to include a longer implementation time. In addition, longitudinal study designs including larger samples are also recommended for future similar studies.

Strengths and limitations of the study

This study had a number of strengths. The first part of the study included repeated cross-sectional surveys targeting the same women (caregivers) with children aged 6-

23 months conducted during two different seasons: the baseline survey during the harvest season (July/ August) and the second survey during the post-harvest season (November) 2012. Data from the baseline survey enabled the description and estimation of the prevalence of outcome variables of interest for the study population including socio-demographic characteristics, socio-economic status, food security status, dietary diversity and nutritional status. The cross-sectional data also allowed for the assessment of associations between factors at the same time point. Seasonal variations in dietary diversity, food (g/day) and nutrient intakes of women and children aged 6-23 months were also assessed based on data from the repeated cross-sectional surveys. The findings from the baseline survey informed the hypotheses for designing the nutrition education intervention and choice of the themes and topics for the nutrition education sessions.

The cluster-randomized controlled trial design adopted for the nutrition education intervention was another strength of this study. During the randomization, the villages which represented the clusters were paired based on how similar they were with regards to outcome variables of interest from the baseline survey. The matched village pairs were randomly assigned to the intervention and control groups, enabling the comparison of the results between the groups at baseline and at endline, after the nutrition education intervention. The randomization process also helped to control for intervention contamination by minimizing the spread of knowledge taught to participants during the nutrition education sessions from the intervention to control groups.

The nutrition education intervention conducted within the current study focused on promoting the utilization of locally available foods while preparing foods for young children during the complementary feeding period. The use of local food resources that are easily accessible and affordable to modify existing complementary diets during the participatory nutrition education sessions was well accepted by the caregivers. This contributed to improvements in the diversity of complementary diets.

Lastly, the sample size for the study was also large and thus fairly representative of the study region. The random selection of the study villages (clusters) and households provided an equal opportunity for the target population to be selected and included in the study and thus the sampled villages and households were also

representative of the target population of the study. The use of standardized methods and well trained interviewers were also strengths of this study.

The study also had a number of limitations which may call for caution in the interpretation of the findings. The study was based on cross-sectional data, which allowed for the assessment of associations between factors. However, cross-sectional data does not allow for the identification of causal relationship between factors, as is the case in longitudinal studies.

The time period between the baseline survey (July/ August) and the second survey (November) was fairly short, and the two seasons less distinct. Despite this concern, results from the repeated cross-sectional surveys showed a small but significant effect of seasonality on WDDS and on the intakes of iron, calcium and vitamin E among the women. The impact of seasonality on dietary intakes, and subsequently on growth outcomes would be more clearly demonstrated in similar studies: conducted over longer periods and during more distinct seasons in terms of food availability, and in longitudinal studies. Assessment of the effect of seasonality on growth outcomes of the women would have enriched the results from this study. However, this was not possible since anthropometric measurements were taken once at baseline (July/ August).

The use of a one day 24-hour dietary recall to assess the food and nutrient intakes of the study population was another concern for the study. This is because data from a one day 24-hour recall is not representative of an individual's usual food intake which may be affected by day-to-day variations. Thus, use of repeated 24-hour recalls conducted on non-consecutive days and over a longer period of time is recommended to estimate usual food intakes[97].The 24-hour recall method is also prone to recall bias with regard to identification of foods eaten, meal frequency, as well as the estimation of food portions consumed which contributes to the problems of under and over-reporting. The main aim of the repeated cross-sectional surveys conducted during the two different seasons was to explore seasonal variations in dietary diversity, food (g/day) and nutrient intakes of the study population. Unusual low and high energy intakes were expected among some study participants during each survey due to factors such as sickness and festivities. Thus in order to control for implausibly high or low nutrient intakes, we excluded women with energy intakes

below 500 and above 3500 kcal/day during any of the two seasons[136], during the analyses with regard to seasonal variations in nutrient intakes. This is because the reported food intakes on the observed days may have been exceptional low or high, and contributed to a misinterpretation of the data as the observed differences in nutrient intakes between the seasons cannot be attributed to possible seasonal effects.

Analyses with regards to the proportion of women with inadequate nutrient intakes was based on the EAR reference values which were established for healthy people, and also considering the levels of physical activity[102]. In this study the level of physical activity, health status, use of medication and supplement and presence of chronic diseases were not investigated, yet they could have had an influenced on nutrient intakes and requirements.

The new Minimum Dietary Diversity-Women (MDD-W) global dietary diversity indicator for women was not available at the time of designing and conducting this study[99]. This indicator recommends that women should consume foods from at least 5 out of 10 food groups, which is associated with a greater likelihood of them meeting their micronutrient needs. Thus, the cutoff points used to define the varying levels of DD among the study women were created based on terciles[32] determined from the observed distribution of DDS at baseline. The same cutoff points were adopted during the second survey. The women were defined as having low DDS if their diets consisted of ≤3 food groups, medium DDS if the diets consisted of 4 food groups, and high DDS if their diets consisted of ≥5 food groups. While it is possible that the use of the cutoff points based on terciles could have overestimated the proportion of women with diets low in diversity, most of the women were likely not to meet the threshold of at least five out of ten food groups as indicated by the low mean WDDS during both seasons.

Approximately 26% of the study participants were lost to follow-up during the second cross-sectional survey conducted during the post-harvest season in November. This was mainly due to the fact that the study children at baseline had grown older than the eligible age of between 6-23 months. Other reasons for the drop-out included migration of the sampled women and children from the study areas and death of the index child. The caregiver-child pairs lost to follow-up were however not significantly

different from those who remained in the study with respect to baseline socio-demographic characteristics. Thus we do not think that the loss to follow-up could have contributed to a significant bias in the study.

Evaluation of the effect of the nutrition education intervention in this study entailed the comparison of cross-sectional data on CDDS and nutrition knowledge among caregivers in two different populations groups of caregiver-child pairs during the pre- and post-intervention time periods. Most of the children who participated in the baseline survey had grown older, and hence not eligible to participate in the nutrition education intervention which targeted caregivers with children age 6-17 months, and subsequently the endline survey which targeted children aged 6-23 months. The caregivers with older children were replaced with a fresh sample of caregivers with younger children from the same intervention and control villages. As such the results with respect to the effect of the intervention on children's dietary diversity and nutrition knowledge of caregivers represent a community effect and not an individual effect. This methodological problem could have limited the validity of the intervention study results. However, the households from which the new samples were drawn were comparable to those replaced with respect to baseline socio-demographic characteristics.

6 Conclusions and Recommendations

The main findings of this study are presented within the two main papers that formed this thesis. To conclude, an overview of the main findings with regards to the effect of seasonality on dietary intakes, and the effect of the nutrition education intervention on children's dietary diversity and nutrition of caregivers is given. This will be followed by the recommendations for future research.

Overall, dietary quality was poor among the women and children, as was reflected in the low mean WDDS and CDDS in July/ August and November. The diets consumed by women and children were dominated by starchy staples with low consumption of animal products, fruits and vegetables during both seasons. The contribution of animal source foods was notably low, particularly among the children aged 6-23 months.

Seasonality was found to have a small but significant effect on WDDS but not on CDDS. No significant seasonal differences were found in food intake (g/day) among the women. Intake of energy and most nutrients among the women increased slightly in the post-harvest season, however significant seasonal variations were found only for vitamin E, iron and calcium. Overall, inadequate intake of key nutrients was found among the women during both seasons.

The observed increase in CDDS between the two seasons was linked to an age effect, with the children consuming more diversified diets with increasing age. Additionally, the children achieved significantly higher requirements for energy and most nutrients from complementary foods in November compared with July/ August.

The women's and children's DDS were positively associated, with an increase in WDDS reflected in an increase in CDDS. Higher level of education among women and household food security were associated with higher DDS among the women and children. While higher age among women was associated with low DD, higher age among children was a predictor of improved DD. Factors found to influence nutrient intakes among the women included household food security status, AEZ of residence, ethnic group and existence of a home garden.

The nutrition education intervention had a positive and significant effect on children's dietary diversity. The children in the intervention group were fed more diversified diets compared to their counterparts in the control group. Children in the intervention group were also more likely to receive MDD, MMF and MAD. The intervention was also found to have had a positive and significant effect on the nutrition knowledge of the caregivers. The nutrition knowledge scores also increased, and were significantly higher among caregivers in the intervention group compared with those in the control group. While it was hypothesized that an increase in nutrition knowledge among the caregivers would lead to improvements in children's dietary diversity, the direct link between nutrition knowledge and children's dietary diversity was found not to be significant.

In conclusion, the results from this study showed that seasonality had an effect on the quality of diets consumed by women in rural communities. Therefore, seasonality needs to be included as a component in agricultural and food-based programs aiming to promote overall household food security throughout the year. The finding that seasonality did not have a significant effect on children's dietary diversity points to the fact that household food security may not necessarily guarantee consumption of better quality diets among young children. This finding shows that other underlying factors may exert negative influences on the dietary intakes of young children. Other factors which have been found to influence the food consumption patterns of young children include; lack of nutrition knowledge among caregivers, cultural beliefs and practices, inappropriate advice and lack of time due to heavy workload [30,137]. This calls for the need of nutrition education interventions to enhance nutrition knowledge among caregivers on the importance of feeding young children a variety of foods. Behaviour change strategies with key messages focusing on addressing the underlying constraints affecting the consumption of a variety of foods, especially animal source foods among women and young children are also needed. Maternal and child dietary diversity were associated, hence the need for measures to improve maternal diets as a potential means for improving the quality of diets consumed not only by children, but also by other household members.

The nutrition education intervention emphasized the use of easily accessible and affordable local food resources to improve the diversity and quality of local

complementary diets for children 6-23 months. While the overall children's dietary diversity improved, the consumption of animal-source foods, especially flesh meats and eggs, remained low among the children, even after their caregivers participated in the nutrition education intervention. While this could be attributed to factors such as limited access due to cost, cultural practices and lack of knowledge, caregivers could still feed young children larger amounts of animal source foods than they are currently receiving in many poor households[138]. Nutrition education interventions need to include strategies to teach caregivers the importance of consuming animal-source foods, especially for young children during the complementary feeding period. The caregivers also need to be taught on how best to prepare animal-source foods, particularly the flesh meats to encourage infants and young children to consume them. The use of local food resources as a strategy for improving dietary quality needs to be included in national nutrition guidelines and programs.

The nutrition knowledge of caregivers also improved with the caregivers in the intervention group having significantly higher nutrition knowledge scores compared to those in the control group. However, the increase in nutrition knowledge among the caregivers did not have a direct and significant effect on children's dietary diversity. This indicates that, while increased nutrition knowledge is an important factor for improving child feeding practices, it is not sufficient on its own to lead to changes in behavior. Thus for nutrition education interventions to be effective, they need to focus beyond knowledge transfer and seek to motivate caregivers by providing them with the necessary skills to translate the gained knowledge into practices. Nutrition education interventions should also provide a supportive environment to facilitate behavior change by addressing the underlying factors that may impede behavior change among the caregivers[76]. Nutrition education programs aimed at improving dietary diversity could also be more effective when integrated with other strategies aimed at improving overall household socio-economic status. In addition, there is need to integrate nutrition education interventions into food-based and agricultural programs targeting rural-farm households. This could in the long-run contribute not only to increased production of a variety of foods, but also to improved dietary diversity among poor rural populations.

The nutrition education intervention was conducted by the researcher in collaboration with trained CHW. The knowledge and skills gained during the training motivated the CHW to participate in and facilitate the nutrition education sessions. The important role played by CHWs as immediate contact and resource persons for many caregivers in remote rural areas has not been given due recognition by the government. The CHW are recruited to work on voluntary basis with no regular remuneration. In most cases these CHW lack training and skills on basic nutrition knowledge, which impedes their work. While the use of trained CHW was key in this study, sustainability of such educational interventions facilitated by CHW in the community set-up remains a challenge. There is need for governments to come up with policies and strategies that would ensure that CHW receive regular training on nutrition and other related issues. The CHW also need to be routinely supervised in addition to receiving regular incentives. These would not only motivate the CHW, but also enhance their commitment to participate in activities aimed at improving overall child health and nutrition in the communities.

In summary, the main recommendations for future research include the following:

1. There is need to understand the link between seasonality and food intake (g/day) in addition to dietary diversity. This is because a higher dietary diversity may not necessarily translate to adequate nutrient intake if the amounts of different foods consumed are not sufficient to meet the dietary requirements of different population groups.
2. There is also need to conduct nutritional and biochemical assessments alongside the dietary assessment in order to provide an indication of the relationship between seasonality, food intake (g/day), nutrient intake and nutritional status.
3. The effect of seasonality on the dietary diversity of older children after they grow out of the complementary feeding period and rely more on family foods needs further investigation.
4. Maternal and child dietary diversity were found to be significantly associated. Therefore, in order to develop effective interventions to improve the quality of diets fed to young children, there is need to understand the mechanism through which maternal DD is linked to child DD.

5. There is need to include nutrition education as a component in behaviour change strategies targeting, not only the caregivers, but also other family members such as grandmothers and husbands. This may contribute to nutrition education interventions being more effective in promoting dietary diversity, since these other family members may have a great influence on overall child feeding and caring practices.
6. The use of affordable and easily accessible local food resources to improve the quality and diversity of typical staple-based diets consumed by other family members needs to be promoted in similar nutrition education interventions.
7. Further research is also needed to determine if nutrition education could be more effective in promoting dietary diversification when combined with other strategies, such as agricultural activities.

7 Summary

The current thesis had two major objectives. The first one was to assess dietary patterns, food and nutrient intakes of women and children aged 6-23 months during two seasons in Western Kenya. The second objective was to develop and evaluate the effect of a nutrition education intervention focusing on increased utilization of local agrobiodiversity and enhanced nutrition knowledge among caregivers on the diversity of complementary diets of children aged 6-23 months. Repeated cross-sectional surveys were conducted at three time points: the baseline survey in July/ August 2012 (harvest season), a second survey in November 2012 to capture a different season (post-harvest season), and an endline survey in July/ August 2013, after the completion of the five month nutrition education intervention. The intervention study applied the cluster-randomized control trial design and included one intervention and one control group.

Data on household socio-demographic characteristics, food security, child feeding practices and nutrition knowledge were collected through individual interviews with the caregivers. Dietary intake was assessed using one day 24-hour dietary recalls at each time point. Anthropometric measurements of the women and children were taken to determine their nutritional status. The effect of seasonality and other factors on dietary diversity was assessed using the generalized linear mixed model approach. The effect of the nutrition education intervention on the children's dietary diversity and nutrition knowledge of caregivers was assessed using the differences-in-differences estimator inside the generalized estimating equations.

The diets consumed by the women and children were found to be low in diversity, as evidenced by the low mean women's dietary diversity score (WDDS) (4.2 and 4.6 out of nine food groups), and children's dietary diversity score (CDDS) (3.6 and 3.9 out of 7 food groups) in July/August and November, respectively. Diets consumed by the women and children were dominated by starchy staples with low contributions from animal-source foods, fruits and vegetables during the two seasons. Seasonality had a small but significant effect on WDDS (P=0.008) but not on CDDS (P=0.293). However, the amounts of different foods (g/day) consumed by the women did not differ significantly between the seasons. The intake of energy and most nutrients were slightly higher in the post- harvest season. However, only the intakes of iron

(*P*=0.001), calcium (*P*<0.001), and vitamin E (*P*=0.001) were found to be significantly different between the seasons. The observed increase in CDDS in November was due to an age effect, with older children more likely to be fed more diversified diets. The share of energy and nutrient requirements met by the children from complementary foods was also found to be significantly higher in November compared with July/August. A positive and significant association was found between WDDS and CDDS during each season. Higher women education and food security were associated with higher dietary diversity among women and children. Older age among children was associated with improved CDDS. Factors found to influence nutrient intakes among the women included: household food security, agro-ecological zone, ethnic group and home gardening.

The nutrition education intervention had a positive and significant effect on CDDS (IRR=1.27, *P*=0.001). After the intervention, mean CDDS of children in the intervention group increased and was significantly higher compared with that of children in the control group (4.8 *vs*.3.4, *P*<0.001). Children in the intervention group were also more likely to receive minimum dietary diversity (OR=4.82; 95%CI 1.94-11.98, *P*=0.001); minimum meal frequency (OR=19.98; 95% CI 2.05-195.15, *P*=0.010), and minimum acceptable diet (OR=6.01; 95% CI 2.14-16.93, *P*=0.001). The nutrition education also had a positive and significant effect on the level of nutrition knowledge among the caregivers (IRR=2.05, *P*<0.001). Mean nutrition knowledge score of caregivers in the intervention group increased after they participated in the nutrition education sessions, and was significantly higher compared with that of caregivers in the control group (8.2 *vs.* 3.7, *P*<0.001). However, increase in nutrition knowledge among caregivers, did not have a direct and significant effect on CDDS (*P*=0.731). This finding indicates that increased nutrition knowledge among caregivers is not sufficient on its own to lead to changes in behavior with regards to child feeding practices. The use of local food resources that are affordable and easily accessible to modify the existing complementary foods could have motivated the caregivers to change behavior with regards to feeding their children more diverse diets.

In conclusion, the results from this thesis points to the need to include seasonality as a component in food-based interventions aiming at improving dietary diversity among

resource-poor rural households. Focus in such interventions should be on promoting the production and consumption of a variety of local foods that are affordable and easily accessible. The finding that seasonality did not have an effect on CDDS shows that other factors than food availability exert influences on the quality of diets fed to young children. The nutrition education intervention promoting the use of local food resources was found to be effective in improving the children's dietary diversity. Hence, nutrition education is an important component in behavior change strategies. Further research is needed to determine if nutrition education could be more effective in promoting dietary diversification when combined with other strategies, such as agricultural activities.

8 Zusammenfassung

Die vorliegende Arbeit beinhaltet zwei Zielsetzungen: zum Einen die Erfassung der Ernährungsmuster, Lebensmittel- und Nährstoffaufnahmen von Frauen und Kindern im Alter von 6-23 Monaten unter Berücksichtigung saisonaler Unterschiede in Westkenia. Die zweite Zielsetzung war die Erstellung und Evaluierung einer Ernährungsbildungsintervention (EBI), die die Diversität von Beikosternährung von Kindern zwischen 6 und 23 Monaten zum Inhalt hatte. Diese Intervention fokussierte den vermehrten Gebrauch lokaler Agrobiodiversität und gesteigertem Ernährungswissen unter Müttern. In drei verschiedenen Zeiträumen wurden Querschnittsstudien durchgeführt: die Baselineerhebung im Juli/August 2012 (Erntesaison), die zweite Erhebung im November 2012, um eine andere Saison abzubilden (Nacherntesaison), und die Abschlusserhebung im Juli/August 2013. Die fünfmonatige EBI fand zwischen der zweiten und der Abschlusserhebung statt. Die Interventionsstudie verwendete ein Cluster-randomisiertes Kontrollstudien-Design und umfasste eine Interventions- und eine Kontrollgruppe.

Daten bezüglich der sozio-demographischen Charakteristiken der Haushalte, Nahrungsmittelsicherheit, Ernährungspraktiken für Kinder und Ernährungswissen wurden mittels Einzelinterviews mit Müttern/Bezugspersonen gesammelt. Die Nahrungsaufnahme wurde durch jeweils eintägige 24-Stunden-Ernährungsprotokolle bei jeder Erhebung ermittelt. Zur Ermittlung des Ernährungsstatus von Frauen und Kindern, wurden anthropometrische Messungen durchgeführt. Um den Unterschied zwischen den Jahreszeit und den Einfluss anderer Faktoren auf die Ernährungsvielfalt zu analysieren wurden generalisierte lineare gemischte Modelle (Prozedur GENLINMIXED in SPSS) genutzt. Der Effekt der EBI auf die Ernährungsvielfalt der Kinder und auf das ernährungsbezogene Wissen der Mütter/Bezugspersonen der Kinder wurde mit einem *Differences-in-Differences* Modell im Rahmen von generalisierten Schätzungsgleichungen (Prozedur GEE in SPSS) analysiert.

Die Ernährung der Frauen und Kinder wies im Allgemeinen eine niedrige Diversität auf, ersichtlich durch die niedrigen mittleren *Dietary Diversity Scores* bei Frauen (WDDS) von 4,2 und 4,6 aus insgesamt neun Lebensmittelgruppen und den *Dietary Diversity Scores* von Kindern (CDDS) von 3,6 und 3,9 aus insgesamt sieben

Lebensmittelgruppen im Juli/August beziehungsweise im November. Während beider Jahreszeiten dominierten in der Ernährung der Frauen und Kinder stärkehaltige Grundnahrungsmittel, während wenige Lebensmittel tierischen Ursprungs, Früchte und Gemüse verzehrt wurden. Saisonalität hatte einen geringen, aber signifikanten Einfluss auf WDDS (*P*=0,008), nicht aber auf CDDS (*P*=0,293). Es gab keine signifikanten Unterschiede bezüglich der von den Frauen verzehrten Mengen an verschiedenen Lebensmitteln (g/Tag) zu den verschiedenen Jahreszeiten. Bezüglich der Nährstoffaufnahme, zeigten nur die Aufnahmen an Eisen (*P*=0,001), Calcium (*P*<0,001) und Vitamin E (*P*=0,001) einen saisonalen signifikant Unterschied auf, mit einer höheren Energie- und Nährstoffaufnahme in der Nacherntezeit (November). Der beobachtete Anstieg des CDDS im November ist auf einen Alterseffekt zurückzuführen, da mit steigendem Alter der Kinder vermutlich eine vielseitigerere Ernährung gegeben wird. Der Anteil des Energie- und Nährstoffbedarfs, der von den Kindern durch Beikost gedeckt wurde, lag im November ebenfalls signifikant höher als im Juli/August.

Eine positive und signifikante Assoziation konnte zu jeder Jahreszeit zwischen WDDS und CDDS festgestellt werden. Eine höhere Bildungsrate der Frauen und Nahrungsmittelsicherheit standen in Verbindung mit einer größeren Ernährungsdiversität der Frauen und Kinder. Ebenso wiesen Kinder älterer Altersgruppen einen höheren CDDS auf. Faktoren, die Einfluss auf die Nährstoffaufnahme der Frauen hatten waren Nahrungsmittelsicherheit des Haushalts, die agro-ökologische Zone, die ethnische Gruppe und das Vorhandensein von Hausgärten. Die EBI hatte einen positiven und signifikanten Effekt auf den CDDS (IRR=1,27, *P*=0,001). Nach der Intervention stieg der mittlere CDDS in der Interventionsgruppe an und lag signifikant höher im Vergleich zu den Kindern der Kontrollgruppe (4,8 *vs*.3,4, *P*<0,001). Außerdem erreichten Kinder der Interventionsgruppe eher die minimale Nahrungsvielfalt, (*minimum dietary diversity*) (OR=4.82; 95%CI 1,94-11,98, *P*=0,001); die minimale Anzahl an Mahlzeiten pro Tag, (*minimum meal frequency*) (OR=19,98; 95% CI 2,05-195,15, *P*=0,010); und die minimal akzeptable Diät, (*minimum acceptable diet*) (OR=6,01; 95% CI 2,14-16,93, *P*=0,001), verglichen mit denen der Kontrollgruppe. Die Intervention hatte ebenfalls einen positiven und signifikanten Effekt auf das Ernährungswissen der Mütter/Bezugspersonen (IRR=2,05, *P*<0,001). Das durchschnittliche

Ernährungswissen der Mütter/Bezugspersonen nahm zu, nachdem sie an der Ernährungsbildung teilgenommen hatten und war signifikant höher im Vergleich zu dem der Mütter/Bezugspersonen in der Kontrollgruppe (8,2 *vs.* 3,7, $P<0,001$). Der Anstieg an Ernährungswissen unter den Müttern/Bezugspersonen hatte jedoch keinen direkten signifikanten Einfluss auf CDDS ($P=0,731$). Diese Feststellung deutet darauf hin, dass gesteigertes Ernährungswissen der Mütter/Bezugspersonen allein nicht ausreicht, um Veränderungen in der Beikostgabe für Kinder hervorzurufen. Die Verwendung von lokalen Nahrungsmitteln, die erschwinglich und verfügbar sind, um die vorhandene Beikost zu verbessern, hat die Mütter/Bezugspersonen anscheinend dazu anregt, den Kindern eine vielfältigere Ernährung zu geben.

Aus der Studie lässt sich schlussfolgern, dass Saisonalität als eine Komponente in ernährungsbasierten Interventionen integriert werden muss, vor allem wenn das Ziel ist Ernährungsdiversität von ruralen und ressourcenarmen Haushalten zu verbessern. Der Fokus solcher Interventionen sollte auf einer Förderung der Produktion und des Verzehrs vielfältiger, erschwinglicher und einfach zugänglicher lokaler Nahrungsmittel liegen. Die Feststellung, dass Saisonalität keinen Effekt auf CDDS hatte zeigt, dass andere Faktoren als Nahrungsmittelverfügbarkeit die Qualität der Beikost-Ernährung beeinflussen. Die untersuchte EBI, welche den Gebrauch von lokalen Nahrungsmittelressourcen gefördert hat, hat effektiv die Ernährungsdiversität der Kinder gesteigert. Folglich sollte Ernährungsbildung als eine Komponente in Maßnahmen zur Verhaltensänderung eingebunden werden. Weitere Forschung wird benötigt, um zu untersuchen, ob eine Kombination aus Ernährungsbildung mit anderen Strategien, wie z.B. landwirtschaftlichen Maßnahmen, effektiver die Nahrungsvielfalt fördern könnte.

Acknowledgements

This study would not have been possible without the support and assistance of several people and institutions. I sincerely thank my first supervisor Prof. Dr. Michael Krawinkel, for accepting me as a doctoral student in his working group, and for his advice and support throughout this study. I also thank Prof Dr. Meier-Graewe for her willingness to be my second supervisor.

I am greatly indebted to Dr. Gudrun Keding, my 'local' supervisor in Kenya, and the principal investigator of the INULA project, under which this study was embedded. I am also very thankful to Dr. Irmgard Jordan for the invaluable time and fruitful discussions during the process of this study. Their valuable advice, constructive criticism, comments, ideas and support from the initial stage of this study, and during the review of the manuscripts that formed this thesis are highly appreciated. I also thank Dr. Johannes Herrmann for his valuable comments and advice on data analysis.

I enjoyed working with the community health workers, village elders, caregivers and their children, and I am grateful for their time and willingness to participate in this study. I am also thankful to the enumerators who were involved in data collection.

I wish to thank all my colleagues and staff at the Institute of Nutritional Sciences for their support, friendship and encouragement throughout my stay in Germany. I especially thank Anna Schelling and Christine Ludwig for the German translation, and Aarati Pillai for proofreading the earlier drafts of my papers. Special thanks go to Dr. Friederike and her family for their friendship and for making my stay in Giessen memorable.

My appreciation also goes to my parents, siblings, in-laws and their families for their prayers and support. I am also thankful to my dearest sons Timothy and Alvin, for their understanding during my long absence, and to my husband Kennedy for his love, patience and constant prayers throughout my studies.

Last but not least, I extend my gratitude to the German Academic Exchange Service (DAAD) and the Kenyan Government for granting me the scholarship that enabled my stay in Germany during the study period.

For health, strength and the gift of life, thanks to God Almighty.

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Appendix

1. Baseline Survey Questionnaire

Improving nutritional health of women and children through increased utilisation of local agrobiodiversity in Kenya (INULA)

Bioversity International and Justus Liebig University Giessen

Questionnaire

Baseline Survey

Western and Nyanza Province

July/August 2012

Date of the Interview (day/month/year):	DATE	⌊⌊⌊⌊⌊⌊
ID Number Interviewer 1:	INTNO1	⌊⌊
ID Number Interviewer 2:	INTNO2	⌊⌊
Project ID Number of the household:	IDNO	□-□□□-□
Time interview started:	Time interview ended:	Total time:

ANTHROPOMETRIC MEASUREMENTS

MOTHER

Measurement	1st Reading	2nd Reading	3rd Reading	Average	CODE
Weight (in kg)	⌊⌋⌋.⌋⌋	⌊⌋⌋.⌋⌋	⌊⌋⌋.⌋⌋	⌊⌋⌋.⌋⌋	WEIGHTMO
Height (in cm)	⌊⌋⌋⌋.⌋	⌊⌋⌋⌋.⌋	⌊⌋⌋⌋.⌋	⌊⌋⌋⌋.⌋	HEIGHTMO
MUAC (in cm)	⌊⌋⌋.⌋	⌊⌋⌋.⌋	⌊⌋⌋.⌋	⌊⌋⌋.⌋	MUACMO

THE INDEX CHILD 6-23 MONTHS

(Youngest child in the age group 6 – 23 months)

Measurement	1st Reading	2nd Reading	3rd Reading	Average	CODE
Weight (in kg)	⌊⌋⌋.⌋⌋	⌊⌋⌋.⌋⌋	⌊⌋⌋.⌋⌋	⌊⌋⌋.⌋⌋	WEIGHTCH
Height (in cm)	⌊⌋⌋.⌋	⌊⌋⌋.⌋	⌊⌋⌋.⌋	⌊⌋⌋.⌋	HEIGHTCH
MUAC (in cm)	⌊⌋⌋.⌋	⌊⌋⌋.⌋	⌊⌋⌋.⌋	⌊⌋⌋.⌋	MUACCH
Sex of child 1= male 2= female				⌊⌋	SEXCH
Date of Birth (dd/mm/yy)				⌊⌋⌋.⌋⌋.⌋⌋	BIRTHDAT
Oedema	1=yes 2=no			⌊⌋	OEDEMCH

Part I: HOUSEHOLD QUESTIONNAIRE

Date: _____
Name of Mother/ Caretaker: _____
Name of Child: _____
ID Number Interviewer: ⌊⌋⌊⌋
ID Number Interviewer: ⌊⌋⌊⌋

DEMOGRAPHIC DATA

1 a	Do you have a written record of your child's date of birth (such as health card, birth certificate)? *Please ask other household members to confirm the date*	*If yes, please record*: day, month, year → ***Q 2*** If not, *please proceed* → ***Q* 1b**	BIRTHDAT	⌊⌋⌊⌋⌊⌋⌊⌋⌊⌋⌊⌋⌊⌋⌊⌋ Day Month Year
1 b	*Use the local calendar and ask:* Do you remember a local event (or the season) when your child was born? *Use this as the starting point to begin to narrow down the month and year of birth of the child by asking further questions*		BIRTHCAL	⌊⌋⌊⌋⌊⌋⌊⌋ Month Year
2	What is your relationship to this child?	1= Mother 2= Caretaker	RELTOCH	⌊⌋

Please note: If the child's age is equal or over 24 months thank the mother for her time and end interview.

3	What is your marital status?	1= Currently Married – monogamous 2= Currently Married – polygamous 3= Widowed 4= Divorced 5= Single 6= Orphan (under 18 years of age)	HEADMAR	⌊⌋
4	What is the sex of the household head?	1= male 2= female	HEADHH	⌊⌋
5	What is the religion of this household?	1= Christian 2= Muslim 4= No religion 99= Other (specify):	RELHHH	⌊⌋⌊⌋
6	What is your tribe or ethnic group?	1= Luo 2= Luyha 3= Teso 99= Other (specify): _____	ETHICHH	⌊⌋⌊⌋
7	How many people live permanently in your household for the past 6 months?	0-2 years: 2-5 years: 5-15 years: 15-49 years: >49 years:	HHTOTAL	⌊⌋⌊⌋
8	Have you ever attended school?	1= yes 2= no → **Q 10**	EDUCMO	⌊⌋
9	What is the highest level of school you completed: primary, secondary, or higher?	1= Some primary 2= Completed Primary (Standard 8) 3= Some secondary 4= Completed Secondary (Form 4) 5= Higher 99= Other (Specify): _____	EDUCLEV	⌊⌋
10	What is the highest level of school the head of the household attended: primary, secondary, or higher?	1= No education 2= Some primary 2= Completed Primary (Standard 8) 3= Some secondary 4= Completed Secondary (Form 4)	EDUCHH	⌊⌋

		5= Higher 99= Other (Specify): _____		
11	What is the main occupation of the household head (mention one or two with priority):	1= Farming (focus crops) 2= Farming (focus livestock) 3= Farming (mixed crop/livestock) 4= Business 5= Petty Trader/vocational skills 6= Casual labour 7= Wage employment 8=Fishing 9=Short contract 10= Boda boda taxi 11= None 99= Other (Specify): _____	MAINOCC1 MAINOCC2	⌊⌋ ⌊⌋

LIVING CONDITIONS AND INCOME

12	***Observe, but do not ask***: *What is the main material of the roof?*	1=Natural roofing: Bamboo with grass 2= Rudimentary Roofing: Rustic mat, Wood planks 3= Finished/durable roofing: Corrugated iron, Wood, Calamine/cement fibre, Ceramic tiles, Cement, Roofing shingles 99= Other (specify): _____	MATROOF	⌊⌋⌋
13	What type of fuel does your household mainly use for cooking?	1= Agricultural crop residue 2= Straw/shrubs/grass 3= Firewood → **Q 14** 4= Charcoal 5= Paraffin 99= Other (specify): _____	COOKEN	⌊⌋⌋
14	*If firewood*: Who usually goes to collect firewood in your household?	1= respondent 2= family member → **Q 16**	FIRECOLL	⌊⌋
15	How long does it take to collect firewood and come back?	_____ hours 88= don't know	FIRETIME	⌊⌋⌋
16	What is the main source of drinking water for members of your HH?	1= Piped water into dwelling, yard or plot, Public tap/standpipe, Tube well / borehole Protected dug well, protected spring Rainwater collection 2= Unprotected well, unprotected spring Tanker-truck, Cart with small tank/drum Surface water (river, stream, dam, lake, pond, canal, irrigation channel) 99 = other (specify): _____	DRINKWA	⌊⌋⌋ ***if 1 → Q 22***
17	Do you treat your water in any way to make it safer to drink?	1= yes 2= no → ***Q 19*** 88= don't know → ***Q 19***	WATSAFE	⌊⌋⌋
18	What do you usually do to the water to make it safer to drink? *Record all items mentioned with priority*	1= Boil 2= Add bleach/chlorine ("Water guard") 3= Strain it through a cloth 4= Let it stand and settle 88= don't know 99= Other (specify): _____	WTREAT1 WTREAT2	⌊⌋⌋ ⌊⌋⌋
19	How do you store the water?	1= with lid/covered 2= without lid/uncovered 99= Other (specify):	WSTORE	⌊⌋⌋
20	Who <u>usually</u> goes to fetch the water for your household?	1= respondent 2= family member →***Q 22*** 3= water source on premise → ***Q 22***	WFETCH	⌊⌋⌋
21	How long does it take to collect water and come back? ***NB: This includes the amount of time it takes to wait in line to fetch***	Number of minutes _____ 88= don't know	WTIME	⌊⌋⌋

	water.			
22	Observe, but do not ask: *What kind of toilet facility do members of the household usually use?*	**1=**Flush / pour flush to: piped sewer system, septic tank, pit (latrine), unknown place/ not known where Ventilated Improved Pit latrine (VIP) Pit latrine with slab Composting toilet **2=**Flush/ pour flush to elsewhere Pit latrine without slab/open pit Bucket Hanging toilet/hanging latrine No facilities or bush or field **99=** Other (specify): _____	LATRINE	⌊⌋⌋
23	How long does it take to walk to the nearest health facility for treatment? (one way)	1= less than 30 minutes 2= more than 30 minutes less than 1 hour 3= between 1 and 2 hours 4= more than 2 hours	TIMEHEAL	⌊⌋⌋
24	What was the main source of income of your household during the last 4 weeks?	1= sale of agricultural products (crops/livestock) 2= sale of firewood/charcoal 3= casual labour 4= petty trade 5= small business 6= employment/salary 7= loan 8= cash remittance 9= safety net labour 10= none **88=** don't know 99= other (specify): _____	INCMON	⌊⌋⌋
25	What is the main source of income of your household throughout the year?	1= sale of agricultural products (crops/livestock) 2= sale of firewood/charcoal 3= casual labour 4= petty trade 5= small business 6= employment/salary 7= loan 8= cash remittance 9= safety net labour 10=brewing alcohol 11= none **88=** don't know 99= other (specify): _____	INCYEAR	⌊⌋⌋

POSSESSIONS

26	Does any member of this household own any land that can be used for agriculture?	1= yes 2= no → ***Q 28***	HHLAND	⌊⌋
27	How many hectares of agricultural land do members of this household own? *If more than 99, record '99'.* *If unknown, record '00'.*	Acres: (or) Hectares:	LANDACR LANDHEC	⌊⌋.⌊⌋ ⌊⌋⌋
28	Do you sometimes hire labour for household or agriculture activities?	1= yes 2= no	HIRELAB	⌊⌋
29	Do you have a home garden?	1= yes 2= no→ ***Q 34***	HOMEGAR	⌊⌋

30	Do you grow vegetables?	1= yes 2= no → ***Q 32***	GARVEG	⌊_⌋
31	Main use of vegetable products grown	1= mainly own consumption 2= mainly for sale 3= both (in approx. equal amounts) 99= other	USEVEG	⌊_⌋
32	Do you grow fruits?	1= yes 2= no → ***Q 34***	GARFRUIT	⌊_⌋
33	Main use of fruits grown	1= mainly own consumption 2= mainly for sale 3= both (in approx. equal amounts) 99= other	USEFRU	⌊_⌋
34	Does this household own any livestock, herds, or farm animals?	1= yes 2= no → ***Q 36***	ANIMALS	⌊_⌋

35	a) How many of the following livestock does your household own?	**Number**		b) For what reason do you keep animals? REAANIM	
				1= mainly own consumption **2**= mainly for sale **3**= both (in approx. equal amounts) **99**= other	
	Ox	OX	⌊_⌋		⌊_⌋
	Cattle	CATTLE	⌊_⌋		⌊_⌋
	Donkey/mule/horse	DONKEY	⌊_⌋		⌊_⌋
	Sheep/goat	SHEEP	⌊_⌋		⌊_⌋
	Pig	PIG	⌊_⌋		⌊_⌋
	Rabbit	RABBIT	⌊_⌋		⌊_⌋
	Chicken/duck/doves/guinea fowl/turkey/geese	CHICKEN	⌊_⌋		⌊_⌋

36	Does your household, you or anyone in your household own:		**1= yes** **2= no**
	Electricity/Solar	POSELEC	⌊_⌋
	Radio	POSRAD	⌊_⌋
	Cell phone	POSCELL	⌊_⌋
	Watch or clock	POSWAT	⌊_⌋
	Television	POSTV	⌊_⌋
	Sprayer	POSSPR	⌊_⌋
	Plough or any other ox-drawn implements	POSPLO	⌊_⌋
	Bicycle	POSBICY	⌊_⌋
	Ox/donkey cart	POSCART	⌊_⌋
	Motorcycle	POSMOT	⌊_⌋
	Car or truck	POSCAR	⌊_⌋
	Boat	POSBOAT	⌊_⌋
	Fishing net	POSFHNET	⌊_⌋
	Computer	POSCOM	⌊_⌋

HOUSEHOLD HUNGER SCALE

37	In the past four weeks, did you worry that your household would not have enough food?	1= yes 2= no → ***Q 39***	FOODWOR	⌊⌋
38	***READ TO RESPONDENT:*** "For each of the following questions, consider whether this has happened in the past 4 weeks. If the answer is yes to a question, please indicate how often this happened."			
a	In the past [4 weeks/30days] was there ever no food to eat of any kind in your house because of lack of resources to get food?	1= yes 2= no → ***Q c***	HHSA	⌊⌋
b	How often did this happen in the past [4 weeks/30 days]?	1= rarely (1-2 times) 2= sometimes (3-10 times) 3= often (more than 10 times)	HHSB	⌊⌋
c	In the past [4 weeks/30 days] did you or any household member go to sleep at night hungry because there was not enough food?	1= yes 2= no → **Q e**	HHSC	⌊⌋
d	How often did this happen in the past [4 weeks/30days]?	1= rarely (1-2 times) 2= sometimes (3-10 times) 3= often (more than 10 times)	HHSD	⌊⌋
e	In the past [4 weeks/30 days] did you or any household member go a whole day and night without eating anything at all because there was not enough food?	1= yes 2= no → ***Q 39***	HHSE	⌊⌋
f	How often did this happen in the past [4 weeks/30 days]	1= rarely (1-2 times) 2= sometimes (3-10 times) 3= often (more than 10 times)	HHSF	⌊⌋
39	In the past 12 months did your household experience a hungry season? *The hungry season means the number of month a household does not have enough food because their own food stores are depleted and they do not have enough money to buy food.*	1= yes 2= no → ***Q 41*** 88= don't know	HUNSEAS	⌊⌊⌋
40	During what month did the hungry season begin, when did it end?	Month begun: _____ Month ended: _____	HUNGMO	⌊⌋

HOUSEHOLD DIETARY DIVERSITY

41	Please describe the foods (meals and snacks) **that you or any member of your household ate or drank** yesterday during the day and night. Include only foods consumed at home, not those purchased and consumed outside of the home. Start with the first food eaten in the morning.

*Write down in the space below all **foods and drinks** mentioned. When composite dishes are mentioned ask for the list of ingredients. Probe for any meals/snacks not mentioned. When the recall is complete, fill in the food groups based on the foods mentioned during the recall. For any food groups not mentioned, ask the respondent if a food item from this group was consumed.*

breakfast	Snack	Lunch	snack	dinner	snack

Food groups	**Examples**	1= yes 2= no	
Cereals	Any food such as ugali, chapati, porridge, bread, spaghetti, scones, biscuits, rice, boiled whole maize grain, sweet beer, doughnuts, maize- banana pan cake, or any food made from finger millet, sorghum, bulrush millet, maize or wheat	HHDD1	⌊⌋
Vitamin A rich vegetables and tubers	pumpkin, carrots, squash, or sweet potatoes that are orange inside + *other locally available vitamin-A rich vegetables (e.g. sweet pepper)*	HHDD2	⌊⌋
White tubers and roots	irish potatoes, white sweet potatoes, white yams, coco yams, cassava, or any white roots and tubers or foods made from these	HHDD3	⌊⌋
Dark green leafy vegetables	relish of dark green leafy vegetables as well as the indigenous vegetables such as Amaranth, pumpkin leaves, cassava leaves, sweet potato leaves, cowpeas leaves, spiderplant, mrere, mito, etc.	HHDD4	⌊⌋
Other vegetables	other vegetables (e.g. tomato, onion, eggplant, any kind of relish from leafy vegetables e.g. Chinese cabbage, okra, cabbage, green pepper and green beans) including wild vegetables; mushrooms	HHDD5	⌊⌋
Vitamin A rich fruits	pawpaw, ripe mangoes, cantaloupe + *other locally available vitamin A-rich fruits*	HHDD6	⌊⌋
Other fruits	other fruits, including wild fruits, e.g. oranges, tangerines, lemons, tamarind, avocado pears, bananas and baobab fruits	HHDD7	⌊⌋
Organ meat (iron rich)	liver, kidney, heart or other organ meats or blood- based foods	HHDD8	⌊⌋
Flesh meats	beef, pork, lamb, mutton, goat, rabbit, wild game, chicken, duck, or other birds	HHDD9	⌊⌋
Eggs	eggs from chicken, ducks, guinea fowl or any other eggs	HHDD10	⌊⌋
Fish	fresh or dried fish or shellfish	HHDD11	⌊⌋
Legumes, nuts and seeds	beans, lentils, cow peas, pigeon peas, peas, Bambara groundnuts, soya beans, ground nuts, green gram, chick peas, nuts, seeds	HHDD12	⌊⌋
Insects	insect larvae, caterpillars, ants …	HHDD13	⌊⌋
Milk and milk products	milk, lala, yogurt, cheese or other milk products	HHDD14	⌊⌋
Oils and fats	oil, fats or butter added to food or used for cooking, avocado	HHDD16	⌊⌋
Sweets	sugar, honey, sweetened soda or sugary foods such as chocolates, sweets or candies	HHDD17	⌊⌋
Spices, condiments, beverages	spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages alcoholic drinks such as: locally brewed beer, bottled beer, spirits, wine, traditional spirits, traditional brews	HHDD18	⌊⌋
Did you or anyone in your household eat anything (meal or snack) OUTSIDE the home yesterday	1= yes 2= no 88= don't know	HHOUT	⌊⌋

Part II: QUESTIONNARE FOR CHILD 6-23 MONTHS

Date of interview (dd/mm/yyyy): _____
Name of mother/ caregiver: _____
Name of child: _____
ID 1st Interviewer: ⌊⌊⌋⌋
ID 2nd Interviewer: ⌊⌊⌋⌋

BREASTFEEDING AND COMPLEMENTARY FEEDING PRACTICES

1	Is your child a boy or a girl?	1= male 2= female	CHSEX	⌊⌋
2	Has (name of child) ever been breastfed?	1= yes 2= no	BREVER	⌊⌋
3	Was (name of child) given anything to drink or eat BEFORE the first breastfed?	1= yes 2= no 88=Don't know	PRELACF	⌊⌊⌋⌋
4	In the first three days after delivery, was (name of child) given anything to drink other than breast milk?	1= yes 2= no 88= don't know	RECFLU	⌊⌊⌋⌋
5	At what age did you start giving (name of child) other liquids or semi-solid/solid foods apart from breast milk? ***(Please verify by asking other household members and by using the local calendar)***	*Record age in months* 88=Don't know	CFAGE	⌊⌊⌋⌋
6	Did (name of child) receive liquids, solid, semi-solid or soft food yesterday?	1= yes 2= no	CHRFOOD	⌊⌋
7	How many times did (name of child) receive liquids, solid, semi-solid or soft foods yesterday?	*Record number of times* _____ times 88= don't know	FEEDFQ	⌊⌊⌋⌋
8	Was (name of child)'s intake of solid, semi-solid or soft food yesterday different from usual?	1= yes 2= no 88= don't know	CFUSUAL	⌊⌊⌋⌋
9	Did you prepare any special meals for (name of child) yesterday?	1= yes → **Q11** 2= no	SPMEAL	⌊⌋
10	What prevented you from preparing any <u>special meals</u> for (name of child) yesterday? ***Do not read out the list***	1= lack of time 2= do not know how to do it 3= no food available 4= child old enough to eat family food 99= Other (specify)_____	SPMPREV	⌊⌊⌋⌋
11	Is (name of child) still being breastfed?	1= yes → **Q14** 2= no	BFSTILL	⌊⌋
12	If the child is not breastfed anymore, at what age (in months) did the child stop breastfeeding? ***Please use the events calendar to verify the exact time the child stopped breastfeeding***	*Record age in months* _____ months 88= don't know	BREASTSTOP	⌊⌊⌋⌋
13	Why did you stop breastfeeding the child?	1= not enough breastmilk 2= no time to breastfeed 3= baby refused to breastfeed 4= wanted to stop (child old enough) 5= pregnancy 6= breastfeeding younger child 7=feel too weak 99=other (specify)_____	WHYSTOP	⌊⌋

14	Was (name of child) breastfed yesterday during the day and/or at night?	1= yes 2= no→**17**	BFYESTER	⌊⌋
15	How many times was (name of child) breastfed yesterday during day and night?	Number of times during the day Number of times during the night 88= don't know	BFFREQ	Day⌊⌋⌊⌋ Night⌊⌋⌊⌋ Total⌊⌋⌊⌋
16	Was (name of child) breastfed yesterday more or less than usual?	1= more than usual 2= less than usual 3= same as usual 88= don't know	BFUSUAL	⌊⌋⌊⌋
17	What do you usually do to ensure that (name of child) eats his/her portion of food? ***Do not read out the list, probe for further responses. More than one answer is possible*** **RECORD 1=yes, 2= no**			
	Actively participate in the feeding		RESPFEED1	⌊⌋
	Feed chid slowly and patiently		RESPFEED2	⌊⌋
	Talk to child while feeding		RESPFEED3	⌊⌋
	Minimize destructions		RESPFEED4	⌊⌋
	99=Other (Specify):_____		RESPFEED5	⌊⌋⌊⌋
18	What do you usually do when (name of child) refuses to eat a particular food? ***Do not read out the list, probe for further responses. More than one answer is possible*** **RECORD 1=yes, 2= no**			
	Do not give the child the particular food again until child is much older		CHREFPFD1	⌊⌋
	Try giving the particular food again after a few days		CHREFPFD2	⌊⌋
	Combine the particular food with other foods		CHREFPFD3	⌊⌋
	Force the child to eat the particular food		CHREFPFD4	⌊⌋
	99= Other (Specify):_____		CHREFPFD5	⌊⌋⌊⌋

CHILD FEEDING PRACTICES DURING SICKNESS

19	Has (name of child) been sick in the past two weeks?	1= yes2= no→ **Q21**	CHSICK	⌊⌋
20	What was (name of child) suffering from?	**Record all sicknesses mentioned** 1._____ 2. _____ 3. _____ 4. _____	TYPSICK	
21	How often do you offer the breast when (name of child) is sick?	1= more than usual 2= less than usual 3= same as usual	ILLBREAST	⌊⌋
22	How much do you give your child to <u>drink</u> (including breastmilk) during illness: less than usual, about the same amount, or more than usual? *If less, probe: Was he/she given much less than usual to drink or somewhat less?*	1= much less 2= somewhat less 3= about the same 4= more 5= nothing 88= don't know	ILLDRINK	⌊⌋⌊⌋
23	Why did you give (name of child) less to drink when he/she was sick? ***Do not read out list***	1= child refused 2= child was too weak to drink 3= no drinks available 4= no time 99= other (specify)_____	ILLNODR	⌊⌋⌊⌋
24	How much do you give your child	1= much less	ILLFOOD	⌊⌋⌊⌋

	to <u>eat</u> during illness: less than usual, about the same amount, or more than usual? *If less, probe: Was he/she given much less than usual to eat or somewhat less?*	2= somewhat less 3= about the same 4= more 5= nothing 88= don't know		
25	Why did you give (name of child) less to eat when he/she was sick? ***Do not read out list***	1= child refused 2= child was too weak to eat 3= no food available 4= no time 99= other (specify)_____	ILLNOFO	☐☐

24-HOUR DIETARY RECALL FOR THE CHILD 6-23 MONTHS

Please describe everything that (name of child) ate yesterday during the day or night, whether at home or outside the home.

a) Think about when *(name of child)* first woke up yesterday. Did *(name of child)* eat anything at that time? If Yes, please tell me everything *(name of child)* ate at that time and how much he/she ate. *Probe:* Anything else? *Then continue to question* ***b)***

b) What did *(name of child)* do after that? Did *(name of child)* eat anything at that time? If yes, please tell me everything that *(name of child)* ate at that time. *Probe:* Anything else? *Probe for any meals/snacks not mentioned.*

Continue through the day, repeating the question until the respondent indicates <u>child went to sleep until the next day</u>. If respondent mentions a mixed dish like a porridge, relish or stew, ask about all ingredients that went into the dish, including added oil, sugar or condiments.

When the recall is complete, fill in the food groups below (Past 24h) based on the foods mentioned during the recall. For any food groups not mentioned, ask: Yesterday during the day or night, did *(name of child)* eat any foods such as *(read examples of food group items)?*

Food item	**Ingredients**	**Species, sub-species, type, cultivar, breed etc.**	**Amount consumed** (cup, plate, table spoon, tea spoon, piece etc. – if piece indicate small, medium or large)	**Source** 1 = purchased 2 = produced 3 = collected 4 = gift 5 = other (specify)	**Processing** 1= boiled 2= fried 3= raw 4= steamed 5= other (specify)

7 DAY RECALL FOR THE CHILD 6-23 MONTHS

After completing the past 24h, ask the mother: How often during the past 7 days did (name of child) eat foods from the following food groups? *Record the number of days in the column on the far right.*		**Past 24h** 1= yes 2= no 88= don't know		**Number of days**	
Cereals	Porridge, bread, rice, noodles, spaghetti, or other foods made from grains like sorghum, millet, rice, wheat etc.	**CFA**	⌊⌋	CHDD1	⌊⌋
Vitamin A rich vegetables and tubers	Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside	**CFB**	⌊⌋	CHDD2	⌊⌋
White roots and tubers	White potatoes, white yams, manioc, cassava, or any other foods made from roots	**CFC**	⌊⌋	CHDD3	⌊⌋
Dark green leafy vegetables	Any dark green leafy vegetables including wild green vegetables like cassava leaves, amaranth, bean leaves, pumpkin leaves, rape mustard, kales,Sarat, Nderema, Miro, Mrere, Terere,	**CFD**	⌊⌋	CHDD4	⌊⌋
Vitamin A rich fruits	Ripe mangoes, ripe pawpaw, or other local vitamin A rich foods	**CFE**	⌊⌋	CHDD5	⌊⌋
Other vegetables and fruits	Any other fruits or vegetables like cabbage, eggplant, tomatoes, onions, green pepper, green beans, mushrooms, oranges, lemons, tangerines, banana, loquads, guava, passion fruits, Zambarau, goose berries,	**CFF**	⌊⌋	CHDD6	⌊⌋
Organ meat (iron rich)	Liver, kidney, heart, or other organ meats.	**CFG**	⌊⌋	CHDD7	⌊⌋
Flesh meats	Any meat, such as beef, pork, lamb, goat, chicken, rabbit, duck, turkey, dove	**CFH**	⌊⌋	CHDD8	⌊⌋
Eggs	Eggs from any kind of birds	**CFI**	⌊⌋	CHDD9	⌊⌋
Fish	Fresh or dried fish, shellfish, or seafood	**CFJ**	⌊⌋	CHDD10	⌊⌋
Legumes, nuts and seeds	Any foods made from beans, ground beans, peas, lentils, soya beans, green grams, nuts, mbande, sesame seeds or other seeds	**CFK**	⌊⌋	CHDD11	⌊⌋
Foods made with Groundnut	Any foods made with groundnuts	**CFL**	⌊⌋	CHDD12	⌊⌋
Milk and milk products	Cheese, cream, yogurt or other milk products	**CFM**	⌊⌋	CHDD13	⌊⌋
Oils and fats	Any fat, oil or butter or foods made with any of these	**CFN**	⌊⌋	CHDD14	⌊⌋
Sweets	Any sugary foods such as chocolates, sugar, honey, sweets, candies, pastries, cakes, biscuits, soda etc.	**CFO**	⌊⌋	CHDD15	⌊⌋
Spices, condiments, beverages	Condiments for flavour, such as chilies, pepper, ginger, spices, herbs,salt or fish powder	**CFP**	⌊⌋	CHDD16	⌊⌋
Insects	Insects (termites, grasshoppers, crickets), grubs	**CFQ**	⌊⌋	CHDD17	⌊⌋

Part III: QUESTIONNAIRE FOR MOTHER/ CAREGIVER

Date of interview (dd/mm/yyyy): _____

Name of mother/ caregiver _____

ID 1st Interviewer: ☐☐

ID 2nd Interviewer: ☐☐

1	Age of mother in years?	_____ years	AGEMOTH	☐☐
2	Are you pregnant at the moment?	1= yes 2= no 88= don't know	PREGNANT	☐☐
CHILD FEEDING PRACTICES				
3	Who do you ask for advice when you have a question about feeding your child? ***Do not read out the list, probe for further responses. More than one answer is possible*** **RECORD 1= yes, 2= no**			
	Health professional (Health worker, hospital)		IFSUPP1	☐
	Mother		IFSUPP2	☐
	Mother in law		IFSUPP3	☐
	Grandmother		IFSUPP4	☐
	Friend/neighbour		IFSUPP5	☐
	99= Other (specify)_____		IFSUPP6	☐☐
4	Who decides how you feed your child? ***Do not read out the list, probe for further responses. More than one answer is possible*** **RECORD 1=yes, 2= no**			
	Myself		DESCHF1	☐
	Husband/partner		DESCHF2	☐
	Mother		DESCHF2	☐
	Grandmother		DESCHF4	☐
	Mother in law		DESCHF5	☐
	99=Other (specify)_____		DESCHF6	☐☐
5	Do you prepare special foods for your child?	1= yes → **Q6** 2= no	SPFDCH	☐
5a	If no, why don't you prepare special foods for your child? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Lack of time		WHYNSPFD 1	☐
	No food		WHYNSPFD 2	☐
	Don't know how to do it		WHYNSPFD 3	☐
	Child is old enough to eat family food		WHYNSPFD 4	☐

	88= don't know		WHYNSPFD 5	
	99= Other (specify)_____		WHYNSPFD 6	
6	In the past month did you see or hear any message about complementary feeding	1=yes 2=no → **Q7**	CFMSG	
6a	If yes, where did you see or hear it? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Health institution (Health centre, hospital, dispensary, clinic)		SORCFMSG1	
	Radio		SORCFMSG2	
	Television		SORCFMSG3	
	99 =Other (specify)_____		SORCFMSG4	
7	Have you ever attended or participated in a cooking demonstration on how to feed a child under 2 years of age?	1= yes 2= no	PATCKDEM	
8	Do you currently feed your child any <u>vegetables</u>?	1= yes 2= no →**Q8d** 88=don't know	FDCHV	
8a	If yes, which vegetables do you feed your child on?	**List all the responses**	TYVGFDCH	
		1.		
		2.		
		3.		
		4.		
		5.		
8b	Why do you feed your child vegetables? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	I was told by the health worker		WHYFEV1	
	It is good for my child		WHYFEV2	
	Everybody does it		WHYFEV3	
	88= don't know		WHYFEV4	
	99= Other (specify)_____		WHYFEV	
8c	What factors do you consider when choosing vegetables for your child? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	Price		FTCHVCH1	
	Availability		FTCHVCH2	
	Taste		FTCHVCH3	
	Freshness		FTCHVCH4	
	Colour		FTCHVCH5	
	Texture		FTCHVCH6	
	99= Others (Specify)_____		FTCHVCH7	
8d	**<u>If no</u>**, why don't you feed your child any vegetables? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			

	Children cannot eat vegetables		FTCHVNO1	⌊⌋
	Texture is not appropriate for children		FTCHVNO2	⌊⌋
	Taste is not appropriate for children		FTCHVNO3	⌊⌋
	They are expensive		FTCHFNO4	⌊⌋
	They are not available		FTCHFNO5	⌊⌋
	99= Others (Specify)_____		FTCHVNO4	⌊⌋⌋
9	Do you currently feed your child any <u>fruits</u>?	1=yes 2= no → **Q9d** 88=don't know	FDCHFR	⌊⌋⌋
9a	If yes, which fruits do you feed your child on?	**List all the responses**	TYFRFDCH	
		1.		
		2.		
		3.		
		4.		
		5.		
9b	Why do you feed your child fruits? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	I was told by the health worker		WHYFEFR1	⌊⌋
	It is good for my child		WHYFEFR2	⌊⌋
	Everybody does it		WHYFEFR3	⌊⌋
	88= don't know		WHYFEFR4	⌊⌋⌋
	99= Other (specify)_____		WHYFEFR5	⌊⌋⌋
9c	What factors do you consider when choosing fruits for your child? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	Price		FTCHFRCH1	⌊⌋
	Availability		FTCHFRCH2	⌊⌋
	Taste		FTCHFRCH3	⌊⌋
	Freshness		FTCHFRCH4	⌊⌋
	Colour		FTCHFRCH5	⌊⌋
	Texture		FTCHFRCH6	⌊⌋
	99= Others (Specify)_____		FTCHFRCH7	⌊⌋⌋
9d	**<u>If no</u>**, why don't you feed your child any fruits? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Children cannot eat fruits		FTCHFNO1	⌊⌋
	Texture is not appropriate for children		FTCHFNO2	⌊⌋
	Taste is not appropriate for children		FTCHFNO3	⌊⌋
	They are too expensive		FTCHFNO4	⌊⌋
	They are not available		FTCHFNO5	⌊⌋
	99= Others (Specify)_____		FTCHFNO6	⌊⌋⌋
10	Do you currently feed your child any <u>animal source foods</u>?	1= yes 2=no → **Q10d** 88=don't know	FDCHPR	⌊⌋⌋

10a	If yes, which animal source foods do you feed your child?	List all the responses	TYANFDCH	
		1.		
		2.		
		3.		
		4.		
		5.		
10b	Why do you feed your child animal source foods? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	I was told by the health worker		REFDANFD1	⌊⌋
	Everybody does it		REFDANFD2	⌊⌋
	It is good for my child		REFDANFD3	⌊⌋
	I do not know		REFDANFD4	⌊⌋
	99=Others (specify)_____		REFDANFD5	⌊⌋⌋
10c	What factors do you consider when feeding your child animal source foods? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	Price		FTCHANFD1	⌊⌋
	Availability		FTCHANFD2	⌊⌋
	Taste		FTCHANFD3	⌊⌋
	Colour		FTCHANFD4	⌊⌋
	Texture (softness)		FTCHANFD5	⌊⌋
	99= Others (specify)_____		FTCHANFD6	⌊⌋⌋
10d	**<u>If no</u>**, why don't feed your child any animal source foods? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Texture is not appropriate for children		FTCHVNO1	⌊⌋
	Culture / taboo		FTCHVNO2	⌊⌋
	Religious reason		FTCHVNO3	⌊⌋
	They are too expensive		FTCHVNO4	⌊⌋
	They are not available		FTCHVNO5	⌊⌋
	99= Others (Specify)_____		FTCHVNO6	⌊⌋⌋
KNOWLEDGE ABOUT NUTRITION AND HEALTH				
11	Have you heard about Vitamin A as a nutrient?	1=yes 2=no → **Q12**	KNVA	⌊⌋
11a	If yes, do you know why it is an important micronutrient for the body?	1= yes 2= no → **Q12**	IMTVAV	⌊⌋
11b	If yes, why is it important?	***Record all reasons mentioned*** **1.**_____ **2.**_____ **3.**_____	WHYVAIMT	
11c	Please name 3 foods that are good sources of vitamin A.	1=able to name 3 foods 2=unable to name 3 foods ***Record foods:*** **1.**_____ **2.**_____ **3.**_____	FOODVITA	⌊⌋
12	Have you heard about iron as a nutrient?	1= yes 2= no → **Q13**	KNIRON	⌊⌋
12a	If yes, do you know why it is an important micronutrient for the body?	1= yes 2= no → **Q13**	IMPTIRON	⌊⌋

12b	If yes, why is it important?	***Record all reasons mentioned*** ***1.***_____ ***2.***_____ ***3.***_____	WHYIRONIM	
12c	Please name 3 foods that are good sources of iron.	1=able to name 3 foods 2=unable to name 3 foods ***Record foods:*** ***1.***_____ ***2.***_____ ***3.***_____	FOODIRON	⌊⌋
13	Have you heard about Vitamin C as a nutrient?	1= yes 2= no → **Q14**	KNVITC	⌊⌋
13a	If yes, do you know why it is an important micronutrient for the body?	1= yes 2= no → **Q14**	IMPTVITC	⌊⌋
13b	If yes, why is it important?	***Record all reasons mentioned*** ***1.***_____ ***2.***_____ ***3.***_____	WHYVITCIM	
13c	Please name 3 foods that are good sources of vitamin C.	1= able to name 3 foods 2= unable to name 3 foods ***Record foods:*** ***1.***_____ ***2.***_____ ***3.***_____	FOODVITC	⌊⌋

24-HOUR RECALL FOR THE MOTHER

14) Please describe everything that you (alone) ate yesterday during the day or night, whether at home or outside the home. Was the food item processed and where did you get it from?

a) Think about when you first woke up yesterday. Did you eat anything at that time? If Yes, please tell me everything you ate at that time. *Probe: Anything else? Then continue to question b)*

b) What did you do after that? Did you eat anything at that time? If yes, please tell me everything that you ate at that time. *Probe: Anything else? Probe for any meals/snacks not mentioned*

Continue through the day, ***repeating question b until respondent indicates she went to sleep*** *until the next day. If respondent mentions a mixed dish like a porridge, relish or stew, ask about all ingredients that went into the dish, including added oil, sugar or condiments. When the recall is complete, fill in the food groups based on the foods mentioned during the recall. For any food groups not mentioned, ask:* "Yesterday during the day or night, did you eat any foods such as (read examples of food group items)?"

Food item	**Ingredients**	**Species, sub-species, type, cultivar, breed etc.**	**Amount consumed** (cup, plate, table spoon, tea spoon, piece etc. – if <u>piece</u> indicate small, medium or large)	**Source** 1 = purchased 2 = produced 3 = collected 4 = gift 5 = other (specify)	**Processing** 1= boiled 2= fried 3= raw 4= steamed 5= other (specify)

DIETARY DIVERSITY FOR THE MOTHER

Food groups	Examples 1= yes 2= no 88= don't know		
Cereals	Ugali, chapati, porridge, bread, rice, spaghetti, boiled maize noodles, mandazi or other foods made from millet, sorghum, maize or wheat	CFA	
Vitamin A rich vegetables and tubers	Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside, sweet pepper	CFB	
White roots and tubers	White potatoes, white yams, irish potatoes, manioc, cassava, or any other foods made from roots	CFC	
Dark green leafy vegetables	Any dark green leafy vegetables such as amaranth, pumpkin leaves, sweet potato leaves, spiderplant, mrere, managu, miro, sarat, beans leaves, nderema, kales	CFD	
Other vegetables	Tomato, onion, white cabbage, green pepper, egg plant, cucumber, mushrooms etc.	CFDA	
Vitamin A rich fruits	Ripe mangoes, ripe papayas, or tree tomato + other locally available vitamin A-rich fruits	CFE	
Other fruits	Any other fruits or vegetables such as passion fruits, guavas, pineapple, loquads, Zambarau, guavas, oranges, tangerines, + any other locally available fruits	CFF	
Organ meat	Liver, kidney, heart, or other organ meats	CFG	
Flesh meat	Any meat, such as beef, pork, lamb, goat, chicken, mice, rats	CFH	
Eggs	Eggs from chicken, duck or any other eggs	CFI	
Fish	Fresh or dried fish, Omena, shellfish, + seafoods such as crabs etc	CFJ	
Legumes, nuts and seeds	Any foods made from beans, peas, lentils, soya, nuts, green beans, Njahe or seeds	CFK	
Milk and milk products	Fresh milk, sour milk, yogurt , cream, cheese or other milk products	CFM	
Oils and fats	Any fat, oil or butter or foods made with any of these	CFN	
Sweets	Any sugary foods such as chocolates, sweets, candies, pastries,honey, cakes, or biscuits, soda	CFO	
Spices, condiments, beverages	Condiments for flavor, such as chilies, spices, herbs, or fish powder; coffee, tea,salt other beverages	CFP	
Insects	Insects (termites, grasshoppers, crickets).	CFQ	

2. Middle Survey Questionnaire

Improving nutritional health of women and children through increased utilization of local agrobiodiversity in Kenya (INULA)

Bioversity International and Justus Liebig University Giessen

Questionnaire

Middle Survey

Western and Nyanza Province

November 2012

Date of the Interview (day/month/year)	DATE	⌊⌊⌋⌊⌊⌋⌊⌊⌋
ID Number Interviewer	INTNO	⌊⌊⌋
Project ID Number of the household	IDNO	□-□□□-□
ID Number Village and name	IDVILL	□-□□
Name of Household Head		
Name of Mother/ Caretaker		
Name of Child		
Telephone no. of Mother		
GPS Co-ordinates of the Household	LONGITUDE	□□□-□□□□□
	LATITUDE	□□□-□□□□□
	ELEVATION	□□□□□
Time interview started:	Time interview ended:	Total time:

DEMOGRAPHIC DATA

1	Do you have a written record of your child's date of birth (such as health card, birth certificate)? *Please ask other household members to confirm the date*	*If yes, please record*: day, month, year	BIRTHDAT	⌊⌊⌋⌊⌊⌋⌊⌊⌊⌊⌋ Day Month Year
2	What is your relationship to this child?	1= Mother 2= Caretaker	RELTOCH	⌊⌋
Please note: If the child's age is equal or over 24 months thank the mother for her time and end interview.				

INCOME

3	What was the main source of income of your household during the last 4 weeks?	1= sale of agricultural products (crops/livestock) 2= sale of firewood/charcoal 3= casual labour 4= petty trade 5= small business 6= employment/salary 7= loan 8= cash remittance 9= safety net labour 10= none 88= don't know 99= other (specify): _____	INCMON	⌊⌊⌋
4	In which income range does your household fall when you consider the overall income from household members per month?	1=< Ksh 5000 2=Ksh 5,000-10,000 3=Ksh 10,001-15,000 4=Ksh15,001-20,000 5=>Ksh 20,000 88=do not know	INCRANGE	⌊⌊⌋
5	What percentage of this income comes from farming activities?	_____%	PERICFR	
6	How much of your income do you approximately spend on food each month?	_____%	PERICSF	

3	What was the main source of income of your household during the last 4 weeks?	1= sale of agricultural products (crops/livestock) 2= sale of firewood/charcoal 3= casual labour 4= petty trade 5= small business 6= employment/salary 7= loan 8= cash remittance 9= safety net labour 10= none 88= don't know 99= other (specify): _____	INCMON	⌊⌊⌋
4	In which income range does your household fall when you consider the overall income from household members per month?	1=< Ksh 5000 2=Ksh 5,000-10,000 3=Ksh 10,001-15,000 4=Ksh15,001-20,000 5=>Ksh 20,000 88=do not know	INCRANGE	⌊⌊⌋

5	What percentage of this income comes from farming activities?	_____%	PERICFR	
6	How much of your income do you approximately spend on food each month?	_____%	PERICSF	

HOUSEHOLD HUNGER SCALE

6	In the past four weeks, did you worry that your household would not have enough food?	1= yes 2= no → ***Q 8***	FOODWOR	⌊⌋
7	***READ TO RESPONDENT:*** "For each of the following questions, consider whether this has happened in the past 4 weeks. If the answer is yes to a question, please indicate how often this happened."			
a	In the past [4 weeks/30days] was there ever no food to eat of any kind in your house because of lack of resources to get food?	1= yes 2= no → ***Q c***	HHSA	⌊⌋
b	How often did this happen in the past [4 weeks/30 days]?	1= rarely (1-2 times) 2= sometimes (3-10 times) 3= often (more than 10 times)	HHSB	⌊⌋
c	In the past [4 weeks/30 days] did you or any household member go to sleep at night hungry because there was not enough food?	1= yes 2= no → **Q e**	HHSC	⌊⌋
d	How often did this happen in the past [4 weeks/30days]?	1= rarely (1-2 times) 2= sometimes (3-10 times) 3= often (more than 10 times)	HHSD	⌊⌋
e	In the past [4 weeks/30 days] did you or any household member go a whole day and night without eating anything at all because there was not enough food?	1= yes 2= no → ***Q 8***	HHSE	⌊⌋
f	How often did this happen in the past [4 weeks/30 days]	1= rarely (1-2 times) 2= sometimes (3-10 times) 3= often (more than 10 times)	HHSF	⌊⌋
8	In the past 12 months did your household experience a hungry season? *The hungry season means the number of month a household does not have enough food because their own food stores are depleted and they do not have enough money to buy food.*	1= yes 2= no → ***Q 10*** 88= don't know	HUNSEAS	⌊⌋⌋
9	During what month did the hungry season begin, when did it end?	Month begun: _____ Month ended: _____	HUNGMO	⌊⌋

SEASONAL FOOD AVAILABILITY

10	If you consider the food demand of your household during the past four weeks (1 month), what percentage was supplied from your own production and what percentage did you collect, buy or got in exchange or as a gift? (*If respondent is not able to give these values only ask about the own food production to get at least an estimate there!)*	Own production:	%	PEINCOPR	⌊⌊⌋
		Collected:	%		
		Purchased:	%		
		Exchange:	%		
		Gift:	%		
		Other:	%		
		88=do not know			
a	What fraction (percentage) of **starchy staple foods** (i.e. grains, cereals, starchy roots and tubers –*give examples if necessary*) was supplied from your own production?	_____% 88=do not know		PESTOPR	⌊⌊⌋
b	What fraction (percentage) of **vegetables** (*give examples if necessary*) was supplied from your own production?	_____ % 88=do not know		PEVGOPR	⌊⌊⌋
c	What fraction (percentage) of **fruits** (*give examples if necessary*) was supplied from your own production?	_____% 88=do not know		PEFROPR	⌊⌊⌋
d	What fraction (percentage) of **legumes** (*give examples if necessary*) was supplied from your own production?	_____% 88=do not know		PELGOPR	⌊⌊⌋
e	What fraction (percentage) of **animal source foods** (*give examples if necessary*) was supplied from your own production?	_____% 88=do not know		PEANFDOPR	⌊⌊⌋
11	Does the food demand of your household change with season?	1=yes 2=no → ***Q13***			⌊⌋
12	In which season is the food demand of your family high?	***Record in months:*** ***From:*** _____ ***To:*** _____		SEFDDHG	⌊⌊⌋
13	Is your household lacking any of the following food groups during one year and if yes, during which month? ***Give examples ONLY if the respondent does not understand.***		***Record Month:***		
a	Cereals and grains (*e.g. maize, millet, sorghum*)	1=yes 2=no		HHLKCG	⌊⌋
b	Starchy roots and tubers (*e.g. cassava, yams, potatoes*)	1=yes 2=no		HHLKRT	⌊⌋
c	Vegetables (*e.g. leafy vegetables, pumpkin, tomato, onion*)	1=yes 2=no		HHLKVG	⌊⌋
d	Fruits (*e.g. mangoes, pawpaw, guava, pineapple, orange*)	1=yes 2=no		HHLKFR	⌊⌋
e	Legumes, nuts and seeds (*e.g. beans, peas, lentils, groundnuts*)	1=yes 2=no		HHLKLG	⌊⌋
f	Animal sourced foods (*e.g. milk, eggs, meat, fish*)	1=yes 2=no		HHLKANFD	⌊⌋

HOUSEHOLD DIETARY DIVERSITY

13	Please describe the foods (meals and snacks) **that you or any member of your household ate or drank** yesterday during the day and night. Include only foods consumed at home, not those purchased and consumed outside of the home. Start with the first food eaten in the morning.

*Write down in the space below all **foods and drinks** mentioned. When composite dishes are mentioned ask for the list of ingredients. Probe for any meals/snacks not mentioned. When the recall is complete, fill in the food groups based on the foods mentioned during the recall. For any food groups not mentioned, ask the respondent if a food item from this group was consumed.*

breakfast	Snack	Lunch	snack	dinner	snack

Food groups	**Examples**	1= yes 2= no	
Cereals	Any food such as ugali, chapati, porridge, bread, spaghetti, scones, biscuits, rice, boiled whole maize grain, sweet beer, doughnuts, maize- banana pan cake, or any food made from finger millet, sorghum, bulrush millet, maize or wheat	HHDD1	⌊⌋
Vitamin A rich vegetables and tubers	pumpkin, carrots, squash, or sweet potatoes that are orange inside + *other locally available vitamin-A rich vegetables (e.g. sweet pepper)*	HHDD2	⌊⌋
White tubers and roots	irish potatoes, white sweet potatoes, white yams, coco yams, cassava, or any white roots and tubers or foods made from these	HHDD3	⌊⌋
Dark green leafy vegetables	relish of dark green leafy vegetables as well as the indigenous vegetables such as Amaranth, pumpkin leaves, cassava leaves, sweet potato leaves, cowpeas leaves, spider plant, mrere, mito, etc.	HHDD4	⌊⌋
Other vegetables	other vegetables (e.g. tomato, onion, eggplant, any kind of relish from leafy vegetables e.g. Chinese cabbage, okra, cabbage, green pepper and green beans) including wild vegetables; mushrooms	HHDD5	⌊⌋
Vitamin A rich fruits	pawpaw, ripe mangoes, cantaloupe + *other locally available vitamin A-rich fruits*	HHDD6	⌊⌋
Other fruits	other fruits, including wild fruits, e.g. oranges, tangerines, lemons, tamarind, avocado pears, bananas and baobab fruits	HHDD7	⌊⌋
Organ meat (iron rich)	liver, kidney, heart or other organ meats or blood- based foods	HHDD8	⌊⌋
Flesh meats	beef, pork, lamb, mutton, goat, rabbit, wild game, chicken, duck, or other birds	HHDD9	⌊⌋
Eggs	eggs from chicken, ducks, guinea fowl or any other eggs	HHDD10	⌊⌋
Fish	fresh or dried fish or shellfish	HHDD11	⌊⌋
Legumes, nuts and seeds	beans, lentils, cow peas, pigeon peas, peas, Bambara groundnuts, soya beans, ground nuts, green gram, chick peas, nuts, seeds	HHDD12	⌊⌋
Insects	insect larvae, caterpillars, ants …	HHDD13	⌊⌋
Milk and milk products	milk, lala, yogurt, cheese or other milk products	HHDD14	⌊⌋
Oils and fats	oil, fats or butter added to food or used for cooking, avocado	HHDD16	⌊⌋
Sweets	sugar, honey, sweetened soda or sugary foods such as chocolates, sweets or candies	HHDD17	⌊⌋
Spices, condiments, beverages	spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages alcoholic drinks such as: locally brewed beer, bottled beer, spirits, wine, traditional spirits, traditional brews	HHDD18	⌊⌋

Did you or anyone in your household eat anything (meal or snack) OUTSIDE the home yesterday	1= yes 2= no 88= don't know	HHOUT	⌊⌊⌋

Part II: QUESTIONNARE FOR CHILD 6-23 MONTHS

BREASTFEEDING AND COMPLEMENTARY FEEDING PRACTICES

1	Is your child a boy or a girl?	1= male 2= female	CHSEX	⌊⌋
2	At what age did you start giving (name of child) other liquids or semi-solid/solid foods apart from breast milk? ***(Please verify by asking other household members and by using the local calendar)***	***Record age in months*** 88=Don't know	CFAGE	⌊⌋⌋
3	Did (name of child) receive liquids, solid, semi-solid or soft food yesterday?	1= yes 2= no	CHRFOOD	⌊⌋
4	How many times did (name of child) receive liquids, solid, semi-solid or soft foods yesterday?	***Record number of times*** _____ times 88= don't know	FEEDFQ	⌊⌋⌋
5	Was (name of child)'s intake of solid, semi-solid or soft food yesterday different from usual?	1= yes 2= no 88= don't know	CFUSUAL	⌊⌋⌋
6	Did you prepare any special meals for (name of child) yesterday?	1= yes → **Q 8** 2= no	SPMEAL	⌊⌋
7	What prevented you from preparing any special meals for (name of child) yesterday? ***Do not read out the list***	1= lack of time 2= do not know how to do it 3= no food available 4= child old enough to eat family food 99= Other (specify)_____	SPMPREV	⌊⌋⌋
8	Is (name of child) still being breastfed?	1= yes → **Q11** 2= no	BFSTILL	⌊⌋
9	If the child is not breastfed anymore, at what age (in months) did the child stop breastfeeding? ***Please use the events calendar to verify the exact time the child stopped breastfeeding***	*Record age in months* _____ months 88= don't know	BREASTSTOP	⌊⌋⌋
10	Why did you stop breastfeeding the child?	1= not enough breastmilk 2= no time to breastfeed 3= baby refused to breastfeed 4= wanted to stop (child old enough) 5= pregnancy 6= breastfeeding younger child 7=feel too weak 8=Mother sick 99=other (specify)_____	WHYSTOP	⌊⌋
11	Was (name of child) breastfed yesterday during the day and/or at night?	1= yes 2= no→**14**	BFYESTER	⌊⌋
12	How many times was (name of child) breastfed yesterday during day and night?	Number of times during the day Number of times during the night 88= don't know	BFFREQ	Day⌊⌋⌋ Night⌊⌋⌋ Total⌊⌋⌋
13	Was (name of child) breastfed yesterday more or less than usual?	1= more than usual 2= less than usual 3= same as usual 88= don't know	BFUSUAL	⌊⌋⌋
14	Who usually helps you feed (name of child)?	1= Grandmother 2=Elder siblings 3=Husband 4= House help	HEFDCH	⌊⌋⌋

		5= No one 99=Other (specify)_____		
15	Does (name of child) use a separate bowl when being fed?	1=yes→ **Q17** 2=no	SEBWFDCH	⌊⌋
16	Why don't you use a separate bowl when feeding (name of child)?	***Record response:*** _____	RENOSEBO	
17	Are there foods that young children like (name of child) are not fed/ should not eat?	1=yes 2=no 88=do not know	FDNOCHEAT	⌊⌋⌋

18 What foods don't you fed to young children like (name of child) what is the reason for not feeding the particular foods?

Type of food not fed		**Reason for not feeding**	
1	TYPFDNOFDCH1		REFDNOFDCH1
2	TYPFDNOFDCH2		REFDNOFDCH2
3	TYPFDNOFDCH3		REFDNOFDCH3
4	TYPFDNOFDCH4		REFDNOFDCH4
5	TYPFDNOFDCH5		REFDNOFDCH5

CHILD FEEDING PRACTICES DURING SICKNESS

19	Has (name of child) been sick in the past two weeks?	1= yes 2= no→ **Q21**	CHSICK	⌊⌋
20	What was (name of child) suffering from?	***Record all sicknesses mentioned*** 1._____ 2. _____ 3. _____ 4. _____	TYPSICK	
21	Are there foods that you do not feed (name of child) when he/she is sick?	1=yes 2=no→ **Q23**	FDNOSKCH	⌊⌋

22 Which foods do you withhold from (name of child) when he/she is sick?
Record each food mentioned and the reason for withholding it.

Type of food withheld		**Reason for withholding the food**	
1.	TYFDWT1		REFDWT1
2.	TYFDWT2		REFDWT2
3.	TYFDWT3		REFDWT3
4.	TYFDWT4		REFDWT4
5.	TYFDWT5		REFDWT5

24-HOUR DIETARY RECALL FOR THE CHILD 6-23 MONTHS

23 Please describe everything that (name of child) ate yesterday during the day or night, whether at home or outside the home.

a) Think about when *(name of child)* first woke up yesterday. Did *(name of child)* eat anything at that time? If Yes, please tell me everything *(name of child)* ate at that time and how much he/she ate. *Probe:* Anything else? *Then continue to question* ***b)***

b) What did *(name of child)* do after that? Did *(name of child)* eat anything at that time? If yes, please tell me everything that *(name of child)* ate at that time. *Probe:* Anything else? *Probe for any meals/snacks not mentioned.*

Continue through the day, repeating the question until the respondent indicates child went to sleep until the next day. If respondent mentions a mixed dish like a porridge, relish or stew, ask about all ingredients that went into the dish, including added oil, sugar or condiments.

When the recall is complete, fill in the food groups below (Past 24h) based on the foods mentioned during the recall. For any food groups not mentioned, ask: Yesterday during the day or night, did *(name of child)* eat any foods such as *(read examples of food group items)?*

Ask the respondent to show you the utensils they used. Use water to approximate amount and pour that water into available utensils (small cup, big cup, small plate, big plate) to get the exact amount.

Food item	**Ingredients**	**Species, sub-species, type, cultivar, breed etc.** Still not clear how to handle this column	**Amount consumed** (cup, plate, table spoon, tea spoon, piece etc. – if piece indicate small, medium or large)	**Source** 1 = purchased 2 = produced 3 = collected 4 = gift 5 = other (specify)	**Processing** 1= boiled 2= fried 3= raw 4= steamed 5= other (specify)

DIETARY DIVERSITY AND 7 DAY RECALL FOR THE CHILD 6-23 MONTHS

After completing the <u>past 24h</u>, ask the mother: How often during the past 7 days did (name of child) eat foods from the following food groups? *Record the number of days in the column on the far right.*		**Past 24h** 1= yes 2= no 88= don't know		**Number of days**	
Cereals	Porridge, bread, rice, noodles, spaghetti, or other foods made from grains like sorghum, millet, rice, wheat etc.	CHDD1	⌊⌋	**CFA**	⌊⌋
Vitamin A rich vegetables and tubers	Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside	CHDD2	⌊⌋	**CFB**	⌊⌋
White roots and tubers	White potatoes, white yams, manioc, cassava, or any other foods made from roots	CHDD3	⌊⌋	**CFC**	⌊⌋
Dark green leafy vegetables	Any dark green leafy vegetables including wild green vegetables like cassava leaves, amaranth, bean leaves, pumpkin leaves, rape mustard, kales,Sarat, Nderema, Miro, Mrere, Terere,	CHDD4	⌊⌋	**CFD**	⌊⌋
Vitamin A rich fruits	Ripe mangoes, ripe pawpaw, or other local vitamin A rich foods	CHDD5	⌊⌋	**CFE**	⌊⌋
Other vegetables and fruits	Any other fruits or vegetables like cabbage, eggplant, tomatoes, onions, green pepper, green beans, mushrooms, oranges, lemons, tangerines, banana, loquats, guava, passion fruits, Zambarau, goose berries,	CHDD6	⌊⌋	**CFF**	⌊⌋
Organ meat (iron rich)	Liver, kidney, heart, or other organ meats.	CHDD7	⌊⌋	**CFG**	⌊⌋
Flesh meats	Any meat, such as beef, pork, lamb, goat, chicken, rabbit, duck, turkey, dove	CHDD8	⌊⌋	**CFH**	⌊⌋
Eggs	Eggs from any kind of birds	CHDD9	⌊⌋	**CFI**	⌊⌋
Fish	Fresh or dried fish, shellfish, or seafood	CHDD10	⌊⌋	**CFJ**	⌊⌋
Legumes, nuts and seeds	Any foods made from beans, ground beans, peas, lentils, soya beans, green grams, nuts, mbande, sesame seeds or other seeds	CHDD11	⌊⌋	**CFK**	⌊⌋
Foods made with Groundnut	Any foods made with groundnuts	CHDD12	⌊⌋	**CFL**	⌊⌋
Milk and milk products	Cheese, cream, yogurt or other milk products	CHDD13	⌊⌋	**CFM**	⌊⌋
Oils and fats	Any fat, oil or butter or foods made with any of these	CHDD14	⌊⌋	**CFN**	⌊⌋
Sweets	Any sugary foods such as chocolates, sugar, honey, sweets, candies, pastries, cakes, biscuits, soda etc.	CHDD15	⌊⌋	**CFO**	⌊⌋
Spices, condiments, beverages	Condiments for flavour, such as chilies, pepper, ginger, spices, herbs,salt or fish powder	CHDD16	⌊⌋	**CFP**	⌊⌋
Insects	Insects (termites, grasshoppers, crickets), grubs	CHDD17	⌊⌋	**CFQ**	⌊⌋

Part III: QUESTIONNAIRE FOR MOTHER/ CAREGIVER

1	Age of mother in years?	_____ years	AGEMOTH	⌊⌊⌋⌋
2	Are you pregnant at the moment?	1= yes 2= no 88= don't know	PREGNANT	⌊⌊⌋⌋
CHILD FEEDING PRACTICES				
3	In the past month did you see or hear any message about complementary feeding	1=yes 2=no → **Q4**	CFMSG	⌊⌋
3a	If yes, where did you see or hear it? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Health institution (Health centre, hospital, dispensary, clinic)		SORCFMSG1	⌊⌋
	Radio		SORCFMSG2	⌊⌋
	Television		SORCFMSG3	⌊⌋
	99 =Other (specify)_____		SORCFMSG4	⌊⌊⌋⌋
4	Have you ever attended or participated in a cooking demonstration on how to feed a child under 2 years of age?	1= yes 2= no	PATCKDEM	⌊⌋
5	Do you currently feed your child any <u>vegetables</u>?	1= yes 2= no →**Q5d** 88=don't know	FDCHV	⌊⌊⌋⌋
6a	If yes, which vegetables do you feed your child on?	**List all the responses**	TYVGFDCH	
		1.		
		2.		
		3.		
		4.		
		5.		
6b	Why do you feed your child vegetables? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	I was told by the health worker		WHYFEV1	⌊⌋
	It is good for my child		WHYFEV2	⌊⌋
	Everybody does it		WHYFEV3	⌊⌋
	88= don't know		WHYFEV4	⌊⌊⌋⌋
	99= Other (specify)_____		WHYFEV5	⌊⌊⌋⌋
6c	What factors do you consider when choosing vegetables for your child? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	Price		FTCHVCH1	⌊⌋
	Availability		FTCHVCH2	⌊⌋
	Taste		FTCHVCH3	⌊⌋
	Freshness		FTCHVCH4	⌊⌋
	Colour		FTCHVCH5	⌊⌋
	Texture		FTCHVCH6	⌊⌋

	Nutritive value		FTCHVCH7	⌊⌋
	99= Others (Specify)_____		FTCHVCH8	⌊⌋⌋
6d	**If no**, why don't you feed your child any vegetables? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Children cannot eat vegetables		FTCHVNO1	⌊⌋
	Texture is not appropriate for children		FTCHVNO2	⌊⌋
	Taste is not appropriate for children		FTCHVNO3	⌊⌋
	They are expensive		FTCHFNO4	⌊⌋
	They are not available		FTCHFNO5	⌊⌋
	99= Others (Specify)_____		FTCHVNO6	⌊⌋⌋
7	Do you currently feed your child any fruits?	1=yes 2= no → **Q7d** 88=don't know	FDCHFR	⌊⌋⌋
7a	If yes, which fruits do you feed your child on?	**List all the responses**	TYFRFDCH	
		1.		
		2.		
		3.		
		4.		
		5.		
7b	Why do you feed your child fruits? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	I was told by the health worker		WHYFEFR1	⌊⌋
	It is good for my child		WHYFEFR2	⌊⌋
	Everybody does it		WHYFEFR3	⌊⌋
	88= don't know		WHYFEFR4	⌊⌋⌋
	99= Other (specify)_____		WHYFEFR5	⌊⌋⌋
7c	What factors do you consider when choosing fruits for your child? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	Price		FTCHFRCH1	⌊⌋
	Availability		FTCHFRCH2	⌊⌋
	Taste		FTCHFRCH3	⌊⌋
	Freshness		FTCHFRCH4	⌊⌋
	Colour		FTCHFRCH5	⌊⌋
	Texture		FTCHFRCH6	⌊⌋
	Nutritive value		FTCHFRCH7	⌊⌋
	99= Others (Specify)_____		FTCHFRCH8	⌊⌋⌋
7d	**If no**, why don't you feed your child any fruits? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Children cannot eat fruits		FTCHFNO1	⌊⌋
	Texture is not appropriate for children		FTCHFNO2	⌊⌋
	Taste is not appropriate for children		FTCHFNO3	⌊⌋
	They are too expensive		FTCHFNO4	⌊⌋
	They are not available		FTCHFNO5	⌊⌋

	99= Others (Specify)_____		FTCHFNO6	⌊⌊⌋⌋
8	Do you currently feed your child any animal source foods?	1= yes 2=no → **Q8d** 88=don't know	FDCHPR	⌊⌊⌋⌋
8a	If yes, which animal source foods do you feed your child?	List all the responses	TYANFDCH	
		1.		
		2.		
		3.		
		4.		
		5.		
8b	Why do you feed your child animal source foods? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	I was told by the health worker		REFDANFD1	⌊⌋
	Everybody does it		REFDANFD2	⌊⌋
	It is good for my child		REFDANFD3	⌊⌋
	88= do not know		REFDANFD4	⌊⌊⌋⌋
	99=Others (specify)_____		REFDANFD5	⌊⌊⌋⌋
8c	What factors do you consider when feeding your child animal source foods? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	Price		FTCHANFD1	⌊⌋
	Availability		FTCHANFD2	⌊⌋
	Taste		FTCHANFD3	⌊⌋
	Colour		FTCHANFD4	⌊⌋
	Texture (softness)		FTCHANFD5	⌊⌋
	Nutritive value		FTCHANFD6	⌊⌋
	99= Others (specify)_____		FTCHANFD7	⌊⌊⌋⌋
8d	**If no**, why don't feed your child any animal source foods? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Texture is not appropriate for children		FTCHANNO1	⌊⌋
	Culture / taboo		FTCHANNO2	⌊⌋
	Religious reason		FTCHANNO3	⌊⌋
	They are too expensive		FTCHANNO4	⌊⌋
	They are not available		FTCHANNO5	⌊⌋
	99= Others (Specify)_____		FTCHANNO6	⌊⌊⌋⌋
	KNOWLEDGE ABOUT NUTRITION AND HEALTH			
9	Have you ever seen or heard about the food pyramid/food circle?	1=yes 2=no	KNFDPYRD	⌊⌋
10	If yes, what does it communicate (tell us)?	***Record response:***	MNFDPYRD	
11	Do you understand the meaning of "a diverse diet?"	1=yes 2=no→ **Q13**	KNOWDD	⌊⌋
12	If yes, please explain what a "diverse diet" means to you.	***Record response:*** _____	MEANDD	

		_____		
13	What types of food would you give to your child in one day so that it is diverse?	***Record the response:*** _____ _____ _____ _____ _____ 88= do not know	TYPFDD	⌊⌊⌊
14	Do you consume different types of foods in a day?	1=yes 2=no→ **Q16** 88=do not know	CODFTYFD	⌊⌊⌊
15	Why do you think it is important to consume many different types of foods in a day?	***Record the reasons given:*** ***1.***_____ ***2.***_____ ***3.***_____	IMCODFTYFD	⌊⌊

24-HOUR RECALL FOR THE MOTHER

16 Please describe everything that you (alone) ate yesterday during the day or night, whether at home or outside the home. Was the food item processed and where did you get it from?

a) Think about when you first woke up yesterday. Did you eat anything at that time? If Yes, please tell me everything you ate at that time. *Probe: Anything else? Then continue to question b)*

b) What did you do after that? Did you eat anything at that time? If yes, please tell me everything that you ate at that time. *Probe: Anything else? Probe for any meals/snacks not mentioned*

Continue through the day, ***repeating question b until respondent indicates she went to sleep*** *until the next day. If respondent mentions a mixed dish like a porridge, relish or stew, ask about all ingredients that went into the dish, including added oil, sugar or condiments. When the recall is complete, fill in the food groups based on the foods mentioned during the recall. For any food groups not mentioned, ask: "Yesterday during the day or night, did you eat any foods such as (read examples of food group items)?"*

Ask the respondent to show you the utensils they used. Use water to approximate amount and pour that water into available utensils (small cup, big cup, small plate, big plate) to get the exact amount.

Food item	**Ingredients**	**Species, sub-species, type, cultivar, breed etc.**	**Amount consumed** (cup, plate, table spoon, tea spoon, piece etc. – if piece indicate small, medium or large)	**Source** 1 = purchased 2 = produced 3 = collected 4 = gift 5 = other (specify)	**Processing** 1= boiled 2= fried 3= raw 4= steamed 5= other (specify)

DIETARY DIVERSITY AND 7 DAY RECALL FOR THE MOTHER

After completing the <u>past 24h</u>, ask the mother: How often during the past 7 days she eats foods from the following food groups? *Record the number of days in the column on the far right.*		**Past 24h** 1= yes 2= no 88= don't know		**Number of days**	
Cereals	Porridge, bread, rice, noodles, spaghetti, or other foods made from grains like sorghum, millet, rice, wheat etc.	WDD1	⌊⌋	**WFA**	⌊⌋
Vitamin A rich vegetables and tubers	Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside	WDD2	⌊⌋	**WFB**	⌊⌋
White roots and tubers	White potatoes, white yams, manioc, cassava, or any other foods made from roots	WDD3	⌊⌋	**WFC**	⌊⌋
Dark green leafy vegetables	Any dark green leafy vegetables including wild green vegetables like cassava leaves, amaranth, bean leaves, pumpkin leaves, rape mustard, kales,Sarat, Nderema, Miro, Mrere, Terere,	WDD4	⌊⌋	**WFD**	⌊⌋
Vitamin A rich fruits	Ripe mangoes, ripe pawpaw, or other local vitamin A rich foods	WDD5	⌊⌋	**WFE**	⌊⌋
Other vegetables and fruits	Any other fruits or vegetables like cabbage, eggplant, tomatoes, onions, green pepper, green beans, mushrooms, oranges, lemons, tangerines, banana, loquats, guava, passion fruits, Zambarau, goose berries,	WDD6	⌊⌋	**WFF**	⌊⌋
Organ meat (iron rich)	Liver, kidney, heart, or other organ meats.	WDD7	⌊⌋	**WFG**	⌊⌋
Flesh meats	Any meat, such as beef, pork, lamb, goat, chicken, rabbit, duck, turkey, dove	WDD8	⌊⌋	**WFH**	⌊⌋
Eggs	Eggs from any kind of birds	WDD9	⌊⌋	**WFI**	⌊⌋
Fish	Fresh or dried fish, shellfish, or seafood	WDD10	⌊⌋	**WFJ**	⌊⌋
Legumes, nuts and seeds	Any foods made from beans, ground beans, peas, lentils, soya beans, green grams, nuts, mbande, sesame seeds or other seeds	WDD11	⌊⌋	**WFK**	⌊⌋
Foods made with Groundnut	Any foods made with groundnuts	WDD12	⌊⌋	**WFL**	⌊⌋
Milk and milk products	Cheese, cream, yogurt or other milk products	WDD13	⌊⌋	**WFM**	⌊⌋
Oils and fats	Any fat, oil or butter or foods made with any of these	WDD14	⌊⌋	**WFN**	⌊⌋
Sweets	Any sugary foods such as chocolates, sugar, honey, sweets, candies, pastries, cakes, biscuits, soda etc.	WDD15	⌊⌋	**WFO**	⌊⌋
Spices, condiments, beverages	Tea, coffee, other beverages; condiments for flavour, such as chilies, pepper, ginger, spices, herbs, salt or fish powder	WDD16	⌊⌋	**WFP**	⌊⌋
Insects	Insects (termites, grasshoppers, crickets), grubs	WDD17	⌊⌋	**WFQ**	⌊⌋

3. Endline Survey Questionnaire: Intervention

Improving nutritional health of women and children through increased utilisation of local agrobiodiversity in Kenya (INULA)

Bioversity International and Justus Liebig University Giessen

Questionnaire

Endline Survey

Intervention

Western and Nyanza Province

July/August 2013

Time interview started:	Time interview ended:	Total time:
Date of the Interview (day/month/year):	DATE	⌊⌊⌋⌊⌊⌋⌊⌊⌋
ID Number Interviewer	INTNO	⌊⌊⌋
Name of Village	VILLNAME	
ID Number of Village	IDNOVILL	□-□□
Project ID Number of the household:	IDNOHH	□-□□□-□
Name of Household Head	NAMEHHH	
Name of Mother/ Caregiver	NAMECG	
Name of Child	NAMECH	
Telephone no. Mother		
GPS Co-ordinates of the Household	LONGITUDE	□□□-□□□□□
	LATITUDE	□□□-□□□□□
	ELEVATION	□□□□

ANTHROPOMETRIC MEASUREMENTS

MOTHER

Measurement	**1st Reading**	**2nd Reading**	**Average**	**CODE**
Weight (in kg)	⌊⌋⌋.⌋⌋⌋	⌊⌋⌋.⌋⌋⌋	⌊⌋⌋.⌋⌋⌋	WEIGHTMO
Height (in cm)	⌊⌋⌋⌋.⌋⌋⌋	⌊⌋⌋⌋.⌋⌋⌋	⌊⌋⌋.⌋⌋⌋	HEIGHTMO
MUAC (in cm)	⌊⌋⌋.⌋⌋⌋	⌊⌋⌋.⌋⌋⌋	⌊⌋⌋.⌋⌋⌋	MUACMO

INDEX CHILD 6-23 MONTHS

(Youngest child in the age group 6 – 23 months

Measurement	**1st Reading**	**2nd Reading**	**3rd Reading**	**Average**	**CODE**
Weight (in kg)	⌊⌋⌋.⌋⌋⌋	⌊⌋⌋.⌋⌋⌋	⌊⌋⌋.⌋⌋⌋	⌊⌋⌋.⌋⌋⌋	WEIGHTMO
Height (in cm)	⌊⌋⌋.⌋⌋⌋	⌊⌋⌋.⌋⌋⌋	⌊⌋⌋.⌋⌋⌋	⌊⌋⌋.⌋⌋⌋	HEIGHTMO
MUAC (in cm)	⌊⌋⌋.⌋⌋⌋	⌊⌋⌋.⌋⌋⌋	⌊⌋⌋.⌋⌋⌋	⌊⌋⌋.⌋⌋⌋	MUACMO
Sex of child	1= male 2= female			⌊⌋	SEXCHILD
Oedema	1=yes 2=no			⌊⌋	OEDEMCH

Part I: HOUSEHOLD QUESTIONNAIRE

DEMOGRAPHIC DATA

1.	Do you have a written record of your child's date of birth (such as health card, birth certificate)? ***Please ask other household members to confirm the date***	***Please record*:** day, month, year	BIRTHDAT	⌊⌊⌋⌊⌋⌊⌊⌋⌊⌋⌊⌊⌋⌊⌋ Day Month Year
2.	What is your relationship to this child?	1= Mother 2= Caregiver	RELTOCH	⌊⌋
Please note: If the child's age is equal/over 24 or below 6 months thank the mother for her time and end interview.				
3.	What is your marital status?	1= Currently Married – monogamous 2= Currently Married – polygamous 3= Widowed 4= Divorced 5= Single 6= Orphan (under 18 years of age)	HEADMAR	⌊⌋
4.	What is the sex of the household head?	1= male 2= female	HEADHH	⌊⌋
5.	What is the religion of this household?	1= Christian 2= Muslim 3= No religion 99= Other (specify):	RELHHH	⌊⌋⌊⌋
6.	What is your tribe or ethnic group?	1= Luo 2= Luyha 3= Teso 99= Other (specify): _____	ETHICHH	⌊⌋⌊⌋
7.	How many people live permanently in your household for the past 6 months?	***Record the number of people for each age group. Record "0" If none in any age group*** 0-2 years: _____ 2-5 years:_____ 5-15 years:_____ 15-49 years:_____ >49 years:_____	HHTOTAL	⌊⌋⌊⌋
8.	Have you ever attended school?	1= yes 2= no → **Q 10**	EDUCMO	⌊⌋
9.	What is the highest level of school you completed: primary, secondary, or higher?	1=Some primary 2= Completed Primary (Standard 8) 3= Some secondary 4= Completed Secondary (Form 4) 5= Higher 99= Other (Specify): _____	EDUCLEV	⌊⌋⌊⌋
10.	What is the highest level of school the head of the household attended: primary, secondary, or higher?	1= No education 2=Some primary 3= Completed Primary (Standard 8) 4= Some secondary 5= Completed Secondary (Form 4) 6= Higher (College/University etc) 99= Other (Specify): _____	EDUCHH	⌊⌋⌊⌋
11.	What is the main occupation of the household head (mention one or two with priority):	1= Farming (focus crops) 2= Farming (focus livestock) 3= Farming (mixed crop/livestock) 4= Business 5= Petty Trader/vocational skills 6= Casual labour 7= Wage employment 8=Fishing 9=Short contract 10= Boda boda taxi 11= None 99= Other (Specify): _____	MAINOCC1 MAINOCC2	⌊⌋⌊⌋ ⌊⌋⌊⌋

LIVING CONDITIONS AND INCOME

12.	***Observe, but do not ask***: *What is the main material of the roof?*	1=Natural roofing: Bamboo with grass 2=Finished/durable roofing: Corrugated iron, Wood, Calamine/cement fibre, Ceramic tiles, Cement, Roofing shingles 99= Other (specify): _____	MATROOF	⌊⌋⌋
13.	What type of fuel does your household mainly use for cooking?	1= Agricultural crop residue 2= Straw/shrubs/grass 3= Firewood → **GO TO Q 14 and Q15** 4= Charcoal 5= Paraffin 99= Other (specify): _____	COOKEN	⌊⌋⌋
14.	*If firewood*: Who usually goes to collect firewood in your household?	1= respondent 2= family member → **Q 16**	FIRECOLL	⌊⌋
15.	How long does it take to collect firewood and come back?	1= less than 30 minutes 2= more than 30 minutes less than 1 hour 3= between 1 and 2 hours 4= more than 2 hours 88= don't know	FIRETIME	⌊⌋⌋⌋
16.	What is the main source of drinking water for members of your household?	1= Piped water into dwelling, yard or plot, Public tap/standpipe, Tube well / borehole Protected dug well, protected spring Rainwater collection 2= Unprotected well, unprotected spring Tanker-truck, Cart with small tank/drum Surface water (river, stream, dam, lake, pond, canal, irrigation channel) 99 = other (specify): _____	DRINKWA	⌊⌋⌋
17.	Do you treat your water in any way to make it safer to drink?	1= yes 2= no → ***Q 19*** 88= don't know → ***Q 19***	WATSAFE	⌊⌋⌋
18.	What do you usually do to the water to make it safer to drink? ***Record all items mentioned with priority***	1= Boil 2= Add bleach/chlorine ("Water guard") 3= Strain it through a cloth 4= Let it stand and settle 88= don't know 99= Other (specify): _____	WTREAT1 WTREAT2	⌊⌋⌋ ⌊⌋⌋
19.	How do you store the water?	1= with lid/covered 2= without lid/uncovered 99= Other (specify):_____	WSTORE	⌊⌋⌋
20.	Who <u>usually</u> goes to fetch the water for your household?	1= respondent 2= family member →***Q 22*** 3= water source on premise → ***Q 22***	WFETCH	⌊⌋⌋
21.	How long does it take you to collect water and come back? ***NB: This includes the amount of time it takes to wait in line to fetch water.***	1= less than 30 minutes 2= more than 30 minutes less than 1 hour 3= between 1 and 2 hours 4= more than 2 hours 88=Do not know	WTIME	⌊⌋⌋
22.	What kind of toilet facility do members of the household usually use?	**1=** Flush / pour flush to: piped sewer system, septic tank, pit (latrine), unknown place/ not known where Ventilated Improved Pit latrine (VIP) Pit latrine with slab **2=** Flush/ pour flush to elsewhere Pit latrine without slab/open pit Bucket Hanging toilet/hanging latrine No facilities or bush or field	LATRINE	⌊⌋⌋

		99= Other (specify): _____		
23.	How long does it take to walk to the nearest health facility for treatment? (one way)	1= less than 30 minutes 2= more than 30 minutes less than 1 hour 3= between 1 and 2 hours 4= more than 2 hours 88=do not know	TIMEHEAL	⌊⌊⌋
24.	What was the main source of income for your household during the last 4 weeks?	1= sale of agricultural products (crops/livestock) 2= sale of firewood/charcoal 3= casual labour 4= petty trade 5= small business 6= employment/salary 7= loan 8= cash remittance 9= none 88= don't know 99= other (specify): _____	INCMON	⌊⌊⌋
25.	What is the main source of income for your household throughout the year?	1= sale of agricultural products (crops/livestock) 2= sale of firewood/charcoal 3= casual labour 4= petty trade 5= small business 6= employment/salary 7= loan 8= cash remittance 9= none 88= don't know 99= other (specify): _____	INCYEAR	⌊⌊⌋

POSSESSIONS

26.	Does any member of this household own any land that can be used for agriculture?	1= yes 2= no → ***Q 28***	HHLAND	⌊⌋
27.	How many hectares of agricultural land do members of this household own? ***If more than 99, record '99'.*** ***If unknown, record '00'.***	Acres: (or) Hectares:	LANDACR LANDHEC	⌊⌊⌋.⌊⌊⌋ ⌊⌊⌋.⌊⌊⌋
28.	Do you sometimes hire labour for household or agriculture activities?	1= yes 2= no	HIRELAB	⌊⌋
29.	Do you have a home garden?	1= yes 2= no	HOMEGAR	⌊⌋
30.	Do you grow vegetables?	1= yes 2= no → ***Q 32***	GARVEG	⌊⌋
31.	Main use of vegetable products grown	1= mainly own consumption 2= mainly for sale 3= both (in approx. equal amounts) 99= other(specify)_____	USEVEG	⌊⌊⌋
32.	Do you grow fruits?	1= yes 2= no → ***Q 34***	GARFRUIT	⌊⌋
33.	Main use of fruits grown	1= mainly own consumption 2= mainly for sale 3= both (in approx. equal amounts) 99= other (specify)_____	USEFRU	⌊⌊⌋
34.	Does this household own any livestock/herds/r farm animals?	1= yes 2= no → ***Q 36***	ANIMALS	⌊⌋
35.	a) How many of the following livestock does your household own? ***For every type of livestock owned, indicate the number and the reason for keeping in the spaces provided***.		b) For what reason do you keep animals? REAANIM	

	RECORD "00" if no livestock is owned.			
		Animals	**Number of animals**	**1**= mainly own consumption **2**= mainly for sale **3**= both (in approx. equal amounts) 4=Labour(ploughing, fetching water etc) **99**= Other (specify) _____
	Ox	OX	⌊⌊⌋⌋	⌊⌊⌋⌋
	Cattle	CATTLE	⌊⌊⌋⌋	⌊⌊⌋⌋
	Donkey/mule/horse	DONKEY	⌊⌊⌋⌋	⌊⌊⌋⌋
	Sheep/goat	SHEEP	⌊⌊⌋⌋	⌊⌊⌋⌋
	Pig	PIG	⌊⌊⌋⌋	⌊⌊⌋⌋
	Rabbit	RABBIT	⌊⌊⌋⌋	⌊⌊⌋⌋
	Chicken/duck/doves/guinea fowl/turkey/geese	CHICKEN	⌊⌊⌋⌋	⌊⌊⌋⌋

36.	Does your household, you or anyone in your household own:		**1= yes** **2= no**
	Electricity/Solar	POSELEC	⌊⌋
	Radio	POSRAD	⌊⌋
	Cell phone	POSCELL	⌊⌋
	Watch or clock	POSWAT	⌊⌋
	Television	POSTV	⌊⌋
	Sprayer	POSSPR	⌊⌋
	Plough or any other ox-drawn implements	POSPLO	⌊⌋
	Bicycle	POSBICY	⌊⌋
	Ox/donkey cart	POSCART	⌊⌋
	Motorcycle	POSMOT	⌊⌋
	Car or truck	POSCAR	⌊⌋
	Boat	POSBOAT	⌊⌋
	Fishing net	POSFHNET	⌊⌋
	Computer	POSCOM	⌊⌋

HOUSEHOLD HUNGER SCALE

37.	In the past four weeks, did you worry that your household would not have enough food?	1= yes 2= no → ***Q 39***	FOODWOR	⌊⌋
38.	***READ TO RESPONDENT:*** "For each of the following questions, consider whether this has happened in the past 4 weeks. If the answer is yes to a question, please indicate how often this happened."			
a	In the past [4 weeks/30days] was there ever no food to eat of any kind in your house because of lack of resources to get food?	1= yes 2= no → ***Q c***	HHSA	⌊⌋
b	How often did this happen in the past [4 weeks/30 days]?	1= rarely (1-2 times) 2= sometimes (3-10 times) 3= often (more than 10 times)	HHSB	⌊⌋
c	In the past [4 weeks/30 days] did you or any household member go to sleep at night hungry because there was not enough food?	1= yes 2= no → **Q e**	HHSC	⌊⌋
d	How often did this happen in the past [4 weeks/30days]?	1= rarely (1-2 times) 2= sometimes (3-10 times) 3= often (more than 10 times)	HHSD	⌊⌋
e	In the past [4 weeks/30 days] did you or any household member go a whole day and night without eating anything at all because there was not enough food?	1= yes 2= no → ***Q 39***	HHSE	⌊⌋
f	How often did this happen in the past [4 weeks/30 days]	1= rarely (1-2 times) 2= sometimes (3-10 times) 3= often (more than 10 times)	HHSF	⌊⌋
39.	In the past 12 months did your household experience a hungry season? *The hungry season means the number of month a household does not have enough food because their own food stores are depleted and they do not have enough money to buy food.*	1= yes 2= no → ***Q 41*** 88= don't know	HUNSEAS	⌊⌋⌋
40.	During what month did the hungry season begin, when did it end?	Month begun: _____ Month ended: _____	HUNGMO	⌊⌋

HOUSEHOLD DIETARY DIVERSITY

41.	Please describe the foods (meals and snacks) **that you or any member of your household ate or drank** yesterday during the day and night. Include only foods consumed at home, not those purchased and consumed outside of the home. Start with the first food eaten in the morning.

*Write down in the space below all **foods and drinks** mentioned. When composite dishes are mentioned ask for the list of ingredients. Probe for any meals/snacks not mentioned. When the recall is complete, fill in the food groups based on the foods mentioned during the recall. For any food groups not mentioned, ask the respondent if a food item from this group was consumed.*

breakfast	snack	Lunch	snack	Dinner	snack

Food group	**Examples**	1= yes 0= no	
Cereals	Any food such as ugali, chapati, porridge, bread, spaghetti, scones, biscuits, rice, boiled whole maize grain, sweet beer, doughnuts, maize-banana pan cake, or any food made from finger millet, sorghum, bulrush millet, maize or wheat	HHDD1	⌊⌋
Vitamin A rich vegetables and tubers	pumpkin, carrots, squash, or sweet potatoes that are orange inside + *other locally available vitamin-A rich vegetables (e.g. sweet pepper)*	HHDD2	⌊⌋
White tubers and roots	Irish potatoes, white sweet potatoes, white yams, coco yams, cassava, or any white roots and tubers or foods made from these	HHDD3	⌊⌋
Dark green leafy vegetables	relish of dark green leafy vegetables as well as the indigenous vegetables such as Amaranth, pumpkin leaves, cassava leaves, sweet potato leaves, cowpeas leaves, spider plant, mrere, mito, etc.	HHDD4	⌊⌋
Other vegetables	other vegetables (e.g. tomato, onion, eggplant, any kind of relish from leafy vegetables e.g. Chinese cabbage, okra, cabbage, green pepper and green beans) including wild vegetables; mushrooms	HHDD5	⌊⌋
Vitamin A rich fruits	pawpaw, ripe mangoes, cantaloupe + *other locally available vitamin A-rich fruits*	HHDD6	⌊⌋
Other fruits	other fruits, including wild fruits, e.g. oranges, tangerines, lemons, tamarind, avocado pears, bananas and baobab fruits	HHDD7	⌊⌋
Organ meat (iron rich)	liver, kidney, heart or other organ meats or blood- based foods	HHDD8	⌊⌋
Flesh meats	beef, pork, lamb, mutton, goat, rabbit, wild game, chicken, duck, or other birds	HHDD9	⌊⌋
Eggs	eggs from chicken, ducks, guinea fowl or any other eggs	HHDD10	⌊⌋
Fish	fresh or dried fish or shellfish	HHDD11	⌊⌋
Legumes, nuts and seeds	beans, lentils, cow peas, pigeon peas, peas, Bambara groundnuts, soya beans, ground nuts, green gram, chick peas, nuts, seeds	HHDD12	⌊⌋
Insects	insect larvae, caterpillars, ants …	HHDD13	⌊⌋
Milk and milk products	milk, lala, yogurt, cheese or other milk products	HHDD14	⌊⌋
Oils and fats	oil, fats or butter added to food or used for cooking, avocado	HHDD16	⌊⌋
Sweets	sugar, honey, sweetened soda or sugary foods such as chocolates, sweets or candies	HHDD17	⌊⌋
Spices, condiments, beverages	spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages alcoholic drinks such as: locally brewed beer, bottled beer, spirits, wine, traditional spirits, traditional brews	HHDD18	⌊⌋

Did you or anyone in your household eat anything (meal or snack) OUTSIDE the home yesterday	1= yes 2= no 88= don't know	HHOUT	⌊⌊⌋⌋

Part II: QUESTIONNARE FOR CHILD 6-23 MONTHS

BREASTFEEDING AND COMPLEMENTARY FEEDING PRACTICES

1.	Has (name of child) ever been breastfed?	1= yes 2= no	BREVER	⌊⌋
2.	Was (name of child) given anything to drink or eat BEFORE the first breastfed?	1= yes 2= no 88=Don't know	PRELACF	⌊⌋⌋
3.	In the first three days after delivery, was (name of child) given anything to drink other than breast milk?	1= yes 2= no 88= don't know	RECFLU	⌊⌋⌋
4.	How long did you breastfeed (name of child) exclusively?	***Record response in months in the column on the right.*** If weeks record: _____weeks	DURBR	⌊⌋⌋
5.	Please name three (3) advantages of exclusively breastfeeding the baby for the first six months.	***Record the responses*** _____ _____ _____ 1= able to name 1 correct advantage only 2= able to name 2 correct advantages only 3= able to name 3 correct advantages 4= able to name 1 correct + 1 incorrect advantage 5= able to name 1 correct + 2 incorrect advantages 6 = able to name 2 correct + 1 incorrect advantage 7= all answers incorrect 88=do not know	ADVEBF	⌊⌋⌋
6.	Do you think it is important to continue breastfeeding a child older than six months?	1= yes 2= no → **Q8** 88= do not know	IMPTCTNBR	⌊⌋⌋
7.	If yes, why do you think it is important to continue breastfeeding a child older than six months?	***Record response*** 1= able to name 1 correct advantage only 2= able to name 2 correct advantages only 3= able to name 3 correct advantages 4= able to name 1 correct + 1 incorrect advantage 5= able to name 1 correct + 2 incorrect advantages 6 = able to name 2 correct + 1 incorrect advantage 7= all answers incorrect 88=do not know	REACTBR	⌊⌋⌋
8.	At what age did you start giving (name of child) other liquids or semi-solid/solid foods apart from breast milk? ***(Please verify by asking other household members)***	***Record age in months in the column on the right*** *If weeks record:* _____weeks 88=Don't know	CFAGE	⌊⌋⌋
9.	Did (name of child) receive liquids, solid, semi-solid or soft food yesterday?	1= yes 2= no	CHRFOOD	⌊⌋
10.	How many times did (name of child) receive liquids, solid, semi-solid or soft foods yesterday?	***Record number of times***	FEEDFQ	⌊⌋⌋
11.	Did you give (name of child) any foods from the family pot?	1= yes 2= no→ **Q14**	FEEDFP	⌊⌋
12.	Did you do anything to the food from the family pot to make it suitable for (name of child)?	1= yes 2= no→ **Q14**	FEEDSUIT	⌊⌋
13.	If yes, what did you do to the food from the family pot to make it suitable for	FEEDADD1-3 **What did you add?**	FEEDMASH1-3 **What else was done to**	

	(name of child)? ***This refers to both whether anything was added and whether the food was mashed, chopped etc. Probe the mother to find out what she did to the food before feeding it to the child.***		**the food? (e.g. mash, chop etc.)**	
		1.	1.	
		2.	2.	
		3.	3.	
14.	Was (name of child)'s intake of solid, semi-solid or soft food yesterday different from usual?	1= yes 2= no 88= don't know	CFUSUAL	⌊⌊⌋
15.	Did you prepare any extra meals for (name of child) yesterday? ***For interviewer: Extra meal is a meal which was not consumed among other family members and was cooked to feed the child only.***	1= yes → **Q17** 2= no	EXTRMEAL	⌊⌋
16.	What prevented you from preparing any extra meals for (name of child) yesterday? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Lack of time		SPMPREV1	⌊⌋
	Do not know how to do it		SPMPREV2	⌊⌋
	No food available		SPMPREV3	⌊⌋
	Child old enough to eat family food		SPMPREV4	⌊⌋
	99=Other (Specify):_____		SPMPREV5	⌊⌊⌋
17.	How did (name of child) receive the food yesterday?	1= The child ate by him/herself 2= The child was fed by me 3= The child was fed by someone else 99= Other (specify) _____	METRECFD	⌊⌊⌋
18.	Does (name of child) use a separate bowl/plate/cup for feeding?	1=yes 2=no→ **Q20**	SEBWFDCH	⌊⌋
19.	If yes, why do you think it is important for (name of child) to use a separate bowl/plate/cup for feeding?	***Record response*** _____ _____ 88= do not know	IMPTSPBW	⌊⌊⌋
20.	If no, please name the reason why (name of child) does not use a separate bowl/cup when feeding.	***Record response*** _____ _____ _____	RENOSEBO	⌊⌊⌋
21.	Is (name of child) still being breastfed?	1= yes → **Q24** 2= no	BFSTILL	⌊⌋
22.	If (name of child) is not breastfed anymore, at what age (in months) did (name of child) stop breastfeeding?	***Record age in months*** 88= don't know	BREAST STOP	⌊⌊⌋
23.	Why did you stop breastfeeding (name of child)?	1= not enough breast milk 2= no time to breastfeed 3= baby refused to breastfeed 4= wanted to stop (child old enough) 5= next pregnancy 6= breastfeeding younger child 7= feel too weak 99=other (specify)_____	WHYSTOP	⌊⌋
24.	Was (name of child) breastfed yesterday during the day and/or at night?	1= yes 2= no→**27**	BFYESTER	⌊⌋

25.	How many times was (name of child) breastfed yesterday during day and night?	Number of times during the day Number of times during the night 88= don't know	BFFREQ	Day ☐☐ Night ☐☐ Total ☐☐
26.	Was (name of child)'s breastfed yesterday more or less than usual?	1= more than usual 2= less than usual 3= same as usual 88= don't know	BFUSUAL	☐☐
27.	What do you usually do to ensure that (name of child) eats his portion of food? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Actively participates in the feeding		RESPFEED1	☐
	Feeds child slowly and patiently		RESPFEED2	☐
	Talks to child while feeding		RESPFEED3	☐
	Minimize distractions		RESPFEED4	☐
	99=Other (Specify):_____		RESPFEED5	☐☐
28.	What do you usually do when (name of child) refuses to eat a particular food? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Do not give the child the particular food again until child is much older		CHREFPFD1	☐
	Try giving the particular food again after a few days		CHREFPFD2	☐
	Combine the particular food with other foods		CHREFPFD3	☐
	Force the child to eat the particular food		CHREFPFD4	☐
	99= Other (Specify):_____		CHREFPFD5	☐☐

CHILD FEEDING PRACTICES DURING SICKNESS

29.	Has (name of child) been sick in the past two weeks?	1= yes 2= no→ **Q31**	CHSICK	☐
30.	What was (name of child) suffering from?	**Record all sicknesses mentioned** 1. 2. 3. 4.	TYPSICK	☐☐
31.	How often do you offer the breast when (name of child) is sick?	1= more than usual 2= less than usual 3= same as usual	ILLBREAST	☐
32.	How much do you give your child to <u>drink</u> (including breast milk) during illness: less than usual, about the same amount, or more than usual? ***If less, probe: Why was he/she given much less than usual to drink or somewhat less?***	1= much less→ **Q33** 2= somewhat less→ **Q33** 3= about the same 4= more 5= nothing 88= don't know	ILLDRINK	☐☐
33.	Why did you give (name of child) less to drink when he/she was sick? ***Do not read out list***	1= child refused 2= child was too weak to drink 3= no drinks available 4= no time 99=other (specify)_____	ILLNODR	☐☐
34.	How much do you give your child to <u>eat</u> during illness: less than usual, about the same amount, or more than usual? ***If less, probe: Why was he/she given much less than usual to eat or somewhat less?***	1= much less→ **Q35** 2= somewhat less→ **Q35** 3= about the same 4= more 5= nothing 88= don't know	ILLFOOD	☐☐

35.	Why did you give (name of child) less to eat when he/she was sick? ***Do not read out list***	1= child refused 2= child was too weak to eat 3= no food available 4= no time 99= other (specify)_____	ILLNOFO	⌊⌊⌋⌋

24-HOUR DIETARY RECALL FOR THE CHILD 6-23 MONTHS

Please describe everything that (name of child) ate yesterday during the day or night, whether at home or outside the home.

a) Think about when *(name of child)* first woke up yesterday. Did *(name of child)* eat anything at that time? If Yes, please tell me everything *(name of child)* ate at that time and how much he/she ate. *Probe:* Anything else? *Then continue to question* ***b)***

b) What did *(name of child)* do after that? Did *(name of child)* eat anything at that time? If yes, please tell me everything that *(name of child)* ate at that time. *Probe:* Anything else? *Probe for any meals/snacks not mentioned.*

Continue through the day, repeating the question until the respondent indicates child went to sleep until the next day. If respondent mentions a mixed dish like a porridge, relish or stew, ask about all ingredients that went into the dish, including added oil, sugar or condiments.

When the recall is complete, fill in the food groups below (Past 24h) based on the foods mentioned during the recall. For any food groups not mentioned, ask: Yesterday during the day or night, did *(name of child)* eat any foods such as *(read examples of food group items)?*

Food item	**Ingredients**	**Species, sub-species, type, cultivar, breed etc.** *(If the type (local name) is not known, ask for a description, especially the colour)*	**Amount consumed** (Piece, handful, cup, table spoon, tea spoon etc.; if piece show the pictures and specify small, medium, large)	**Source** 1 = purchased 2 = produced 3 = collected 4 = gift 5 = other (specify)	**Processing** 1= boiled 2= fried 3= raw 4= steamed 5= other (specify)

7 DAY RECALL FOR THE CHILD 6-23 MONTHS

After completing the past 24h, ask the mother: How often during the past 7 days did (name of child) eat foods from the following food groups? ***Record the number of days in the column on the far right.***		**Past 24h** 1= yes 0= no 88= don't know		**Number of days**	
Cereals	Porridge, bread, rice, noodles, spaghetti, or other foods made from grains like sorghum, millet, rice, wheat etc.	CHDD1	⌊⌊⌋⌋	**CFA**	⌊⌋
Vitamin A rich vegetables and tubers	Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside	CHDD2	⌊⌊⌋⌋	**CFB**	⌊⌋
White roots and tubers	White potatoes, white yams, manioc, cassava, or any other foods made from roots	CHDD3	⌊⌊⌋⌋	**CFC**	⌊⌋
Dark green leafy vegetables	Any dark green leafy vegetables including wild green vegetables like cassava leaves, amaranth, bean leaves, pumpkin leaves, rape mustard, kales,Sarat, Nderema, Miro, Mrere, Terere,	CHDD4	⌊⌊⌋⌋	**CFD**	⌊⌋
Vitamin A rich fruits	Ripe mangoes, ripe pawpaw, or other local vitamin A rich foods	CHDD5	⌊⌊⌋⌋	**CFE**	⌊⌋
Other vegetables and fruits	Any other fruits or vegetables like cabbage, eggplant, tomatoes, onions, green pepper, green beans,mushrooms, oranges, lemons, tangerines, banana, loquads, guava, passion fruits, Zambarau, goose berries,	CHDD6	⌊⌊⌋⌋	**CFF**	⌊⌋
Organ meat (iron rich)	Liver, kidney, heart, or other organ meats.	CHDD7	⌊⌊⌋⌋	**CFG**	⌊⌋
Flesh meats	Any meat, such as beef, pork, lamb, goat, chicken, rabbit, duck, turkey, dove	CHDD8	⌊⌊⌋⌋	**CFH**	⌊⌋
Eggs	Eggs from any kind of birds	CHDD9	⌊⌊⌋⌋	**CFI**	⌊⌋
Fish	Fresh or dried fish, shellfish, or seafood	CHDD10	⌊⌊⌋⌋	**CFJ**	⌊⌋
Legumes, nuts and seeds	Any foods made from beans, ground beans, peas, lentils, soya beans, green grams, nuts, mbande, sesame seeds or other seeds	CHDD11	⌊⌊⌋⌋	**CFK**	⌊⌋
Foods made with Groundnut	Any foods made with groundnuts	CHDD12	⌊⌊⌋⌋	**CFL**	⌊⌋
Milk and milk products	Cheese, cream, yogurt or other milk products	CHDD13	⌊⌊⌋⌋	**CFM**	⌊⌋
Oils and fats	Any fat, oil or butter or foods made with any of these	CHDD14	⌊⌊⌋⌋	**CFN**	⌊⌋
Sweets	Any sugary foods such as chocolates, sugar, honey, sweets, candies, pastries, cakes, biscuits, soda etc.	CHDD15	⌊⌊⌋⌋	**CFO**	⌊⌋
Spices, condiments, beverages	Condiments for flavour, such as chilies, pepper, ginger, spices, herbs, salt or fish powder	CHDD16	⌊⌊⌋⌋	**CFP**	⌊⌋
Insects	Insects (termites, grasshoppers, crickets), grubs	CHDD17	⌊⌊⌋⌋	**CFQ**	⌊⌋

PART III: QUESTIONNAIRE FOR MOTHER/CAREGIVER

1.	How old are you (*in years*)?	***Record age in the box in the last column***	AGEMOTH	⌊⌋⌊⌋
2.	Are you pregnant at the moment?	1= yes 2= no 88= don't know	PREGNANT	⌊⌋⌊⌋
CHILD FEEDING PRACTICES				
3.	Whom do you ask for advice when you have a question about feeding your child? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	Health professional (Health worker, hospital)		IFSUPP1	⌊⌋
	Mother		IFSUPP2	⌊⌋
	Mother in law		IFSUPP3	⌊⌋
	Grandmother		IFSUPP4	⌊⌋
	Friend/neighbour		IFSUPP5	⌊⌋
	99=Other (specify)		IFSUPP6	⌊⌋⌊⌋
4.	Who decides how you feed your child? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Myself		DESCHF1	⌊⌋
	Husband/partner		DESCHF2	⌊⌋
	Mother		DESCHF2	⌊⌋
	Grandmother		DESCHF4	⌊⌋
	Mother in law		DESCHF5	⌊⌋
	99= Other (specify)		DESCHF6	⌊⌋⌊⌋
5.	Do you usually prepare extra meals for your child?	1= yes → **Q6** 2= no	SPFDCH	⌊⌋
5a.	If no, why don't you prepare extra foods for your child? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Lack of time		WHYNSPFD 1	⌊⌋
	No food		WHYNSPFD 2	⌊⌋
	Don't know how to do it		WHYNSPFD 3	⌊⌋
	Child is old enough to eat family food		WHYNSPFD 4	⌊⌋
	88= don't know		WHYNSPFD 5	⌊⌋⌊⌋
	99= Other (specify)		WHYNSPFD 6	⌊⌋⌊⌋
6	In the past month did you see or hear any message about complementary feeding?	1=yes 2=no → **Q7**	CFMSG	⌊⌋
6a.	If yes, where did you see or hear it? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Health institution (Health centre, hospital, dispensary, clinic)		SORCFMSG1	⌊⌋
	Radio		SORCFMSG2	⌊⌋

	Television		SORCFMSG3	⌊⌋
	99 =Other (specify)		SORCFMSG4	⌊⌋⌋
7.	Do you currently feed your child any <u>vegetables</u>?	1= yes 2= no →**Q7d** 88=don't know	FDCHV	⌊⌋⌋
7a.	If yes, which vegetables do you feed your child on?	**List all the responses**	TYVGFDCH	
		1.		
		2.		
		3.		
		4.		
		5.		
7b.	Why do you feed your child vegetables? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	I was told by the health worker		WHYFEV1	⌊⌋
	It is good for my child		WHYFEV2	⌊⌋
	Everybody does it		WHYFEV3	⌊⌋
	88= don't know		WHYFEV4	⌊⌋⌋
	99= Other (specify)_____		WHYFEV5	⌊⌋⌋
7c.	What factors do you consider when choosing vegetables for your child? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	Price		FTCHVCH1	⌊⌋
	Availability		FTCHVCH2	⌊⌋
	Taste		FTCHVCH3	⌊⌋
	Freshness		FTCHVCH4	⌊⌋
	Colour		FTCHVCH5	⌊⌋
	Texture		FTCHVCH6	⌊⌋
	99= Others (Specify)_____		FTCHVCH7	⌊⌋⌋
7d.	**<u>If no</u>**, why don't you feed your child any vegetables? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Children cannot eat vegetables		FTCHVNO1	⌊⌋
	Texture is not appropriate for children		FTCHVNO2	⌊⌋
	Taste is not appropriate for children		FTCHVNO3	⌊⌋
	They are expensive		FTCHFNO4	⌊⌋
	Not available		FTCHFNO5	⌊⌋
	99= Others (Specify)_____		FTCHVNO4	⌊⌋⌋
8.	Do you currently feed your child any <u>fruits</u>?	1=yes 2= no → **Q8d** 88=don't know	FDCHFR	⌊⌋⌋
8a.	If yes, which fruits do you feed your child on?	**List all the responses**	TYFRFDCH	
		1.		
		2.		
		3.		

		4.		
		5.		
8b.	Why do you feed your child fruits? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	I was told by the health worker		WHYFEFR1	
	It is good for my child		WHYFEFR2	
	Everybody does it		WHYFEFR3	
	88= don't know		WHYFEFR4	
	99= Other (specify)_____		WHYFEFR5	
8c.	What factors do you consider when choosing fruits for your child? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	Price		FTCHFRCH1	
	Availability		FTCHFRCH2	
	Taste		FTCHFRCH3	
	Freshness		FTCHFRCH4	
	Colour		FTCHFRCH5	
	Texture		FTCHFRCH6	
	99= Others (Specify)_____		FTCHFRCH7	
8d.	If no, why don't you feed your child any fruits? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Children cannot eat fruits		FTCHFNO1	
	Texture is not appropriate for children		FTCHFNO2	
	Taste is not appropriate for children		FTCHFNO3	
	It is too expensive		FTCHFNO4	
	It is not available		FTCHFNO5	
	99= Others (Specify)_____		FTCHFNO6	
9.	Do you currently feed your child any animal source foods?	1= yes 2=no → **Q9d** 88=don't know	FDCHPR	
9a.	If yes, which animal source foods do you feed your child?	List all the responses	TYANFDCH	
		1.		
		2.		
		3.		
		4.		
		5.		
9b.	Why do you feed your child animal source foods? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	I was told by the health worker		REFDANFD1	
	Everybody does it		REFDANFD2	
	It is good for my child		REFDANFD3	
	I do not know		REFDANFD4	
	99=Others (specify)_____		REFDANFD5	
9c.	What factors do you consider when feeding your child animal source foods? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2=**			

	no		
	Price	FTCHANFD1	⌊⌋
	Availability	FTCHANFD2	⌊⌋
	Taste	FTCHANFD3	⌊⌋
	Colour	FTCHANFD4	⌊⌋
	Texture (softness)	FTCHANFD5	⌊⌋
	99= Others (specify)_____	FTCHANFD6	⌊⌋⌋
9d.	**If no**, why don't feed your child any animal source foods? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**		
	Texture is not appropriate for children	FTCHVNO1	⌊⌋
	Culture / taboo	FTCHVNO2	⌊⌋
	Religious reason	FTCHVNO3	⌊⌋
	Too expensive	FTCHVNO4	⌊⌋
	Availability	FTCHVNO5	⌊⌋
	99= Others (Specify)_____	FTCHVNO6	⌊⌋⌋

KNOWLEDGE ABOUT NUTRITION AND HEALTH

10.	Which of the nutrition education sessions on complementary feeding conducted in your village during the last 6 months did you attend? ***Note: 1st and 2nd session were conducted in February before the elections while the 3rd and 4th sessions were conducted May/June.***	***Probe for further responses. More than one answer is possible*** **RECORD 1=yes, 2= no**		
		1st Session	SESSION1	⌊⌋
		2nd Session	SESSION2	⌊⌋
		3rd Session	SESSION3	⌊⌋
		4th Session	SESSION4	⌊⌋

11.	If you did not attend all of the sessions mentioned above, what was/were the reason (s)? ***Do not read out the answers aloud!***	***More than one answer is possible.*** **RECORD 1=yes, 2= no**		
		My child was sick	RESESSNO1	⌊⌋
		Attended a funeral	RESESSNO2	⌊⌋
		Attended the election campaigns	RESESSNO3	⌊⌋
		Ploughing/weeding the farm	RESESSNO4	⌊⌋
		Drying/selling fish	RESESSNO5	⌊⌋
		Taking care of the children	RESESSNO6	⌊⌋
		Other (Specify)_____	RESESSNO7	⌊⌋
12.	Do you still have the nutrition education materials on complementary feeding given to you during the training sessions? ***(Ask the mother to show you the folder and brochure. For the poster observe whether it is***	***More than one answer is possible.*** **RECORD 1=yes, 2= no**		
		Folder	NUTEDMAT1	⌊⌋
		Brochure	NUTEDMAT2	⌊⌋
		Poster (available)	NUTEDMAT3	⌊⌋

	hanging on the wall.	Poster (hanging on the wall)	NUTEDMAT4	⌊⌋
13.	Which nutrition materials have been useful to you in terms of preparing food and feeding your child?	***More than one answer is possible.*** **RECORD 1=yes, 2= no**		
		Folder	USENUTMAT1	⌊⌋
		Brochure	USENUTMAT2	⌊⌋
		Poster	USENUTMAT3	⌊⌋
14.	Which topic/session did you find most useful when it comes to preparing food for and feeding (name of child)?	***More than one answer is possible.*** **RECORD 1=yes, 2= no**		
		Importance of breastfeeding the baby	IMPNUTSESS1	⌊⌋
		Complementary feeding practices at different age	IMPNUTSESS2	⌊⌋
		The food circle, food groups, important nutrients and seasonal food calendar	IMPNUTSESS3	⌊⌋
		Preparing nutritious complementary foods using a variety of locally available foods (Cooking demonstrations).	IMPNUTSESS4	⌊⌋
		How to enrich complementary foods	IMPNUTSESS5	⌊⌋
		Nutritious snacks	IMPNUTSESS6	⌊⌋
		Budgeting for food to get the best value for money	IMPNUTSESS7	⌊⌋
		Others (specify)_____	IMPNUTSESS8	⌊⌋

15.	During the second session we looked at the food circle. ***Show the picture of the food circle and ask the mother:*** What does it communicate to us? ***Do not read out the list, probe for further responses.*** **RECORD 1= yes, 2= no**			
	Eat a balanced diet everyday		KNFDCR1	⌊⌋
	Eat a variety of foods/ different foods every day		KNFDCR2	⌊⌋
	Different food and the nutrients they provide		KNFDCR3	⌊⌋
	Different food groups		KNFDCR4	⌊⌋
	Other (Specify) _____		KNFDCR5	⌊⌋
	88= Do not know		KNFDCR6	⌊⌋⌊⌋
16.	Have you heard about the importance of eating a "diverse diet"?	1= yes 2= no→ **Q18**	KNDVDT	⌊⌋ ⌊⌋
17.	If yes, where did you hear about the importance of eating a "diverse diet"? ***Do not read out the list, probe for further responses. More than one answer is possible. RECORD 1=yes, 2=no***			
	Health Institution (Health centre, dispensary, hospital, clinic etc)		SCKNDVDT1	⌊⌋
	Mass media (Radio, TV, news papers etc)		SCKNDVDT2	⌊⌋
	Community outreach in the village, CHWs		SCKNDVDT3	⌊⌋

	Training/Workshop/Seminar etc		SCKNDVDT4	⌊⌋
	99=Other (specify) _____		SCKNDVDT5	⌊⌋⌋
18.	Have you been able to feed (name of child) a diversified diet? ***Diversified diet means eating foods from the different food groups every day.***	1= yes 2= no → **Q21** 88= do not know	FDCHDVDT	⌊⌋⌋
19.	If yes, what types of food would you give (name of child) in one day so that it is diverse?	Record the response: _____ _____ _____ _____ 88=do not know	TYPFDDVDT	⌊⌋⌋
20.	Why do you think it is important for (name of child) to consume a diversified diet (different types of foods) every day?	***Record the response*** _____ _____ _____ 88=do not know	IMPDVDTCD	⌊⌋⌋
21.	What are some of the challenges you face when trying to feed (name of child) a diversified diet (different types of foods)? ***Do not read out the list, probe for further responses. More than one answer is possible. RECORD 1=yes, 2=no***			
	Foods are not available → **GO TO Q22**		CHFDDVDTCH1	⌊⌋⌋
	Lack of money to buy the different foods		CHFDDVDTCH2	⌊⌋⌋
	Lack of time to prepare the foods		CHFDDVDTCH3	⌊⌋⌋
	Do not know how to prepare some foods		CHFDDVDTCH4	⌊⌋⌋
	Other (Specify)_____		CHFDDVDTCH5	⌊⌋⌋
22.	If "Foods are not available": Which foods are not available? ***More than one answer is possible. Please specify the type of foods. RECORD 1=yes, 2=no***			
	Food group	**Type of foods**		⌊⌋
	Staples		FDNOAVAL1	⌊⌋
	Vegetables		FDNOAVAL2	⌊⌋
	Fruits		FDNOAVAL3	⌊⌋
	Pulses, nuts, seeds		FDNOAVAL4	⌊⌋
	Animal source foods		FDNOAVAL5	⌊⌋
	Fats and oils		FDNOAVAL6	⌊⌋
23.	Do you usually add any other foods/ingredients to the foods/meals that you have been preparing for (name of child) to improve its quality/make it more	1=yes 2=no → **Q25**	ENRCHFD	⌊⌋⌋

	nutritious?			
24.	What foods/ingredients have you been adding to the foods/meals of (name of child) to improve its quality/make it more nutritious?	***Record the responses*** _____ _____ _____ _____	INGENRFD	
25.	How many main meals and snacks do you usually give (name of child) each day?	***No. of meals per day***	NOMEALS	⌊⌋
		No. of snacks	NOSNKS	⌊⌋
		Total meals	TOTMEALS	⌊⌋⌋
26.	What type of snacks do you usually buy/give (name of child) between meals?	***Record the responses*** _____ _____ _____	TYPSNKS	

27. Please describe/name some of the local wild foods (plant or animal!) that are found in your village and that you prepare and feed (name of child)? ***Ask the mother the season the wild foods are available in the village and how often they are fed to (name of child).***

	Name of wild food	***Season available*** *(name months)*	***How often fed*** 1= < 1 per week 2= 1-3 times/week 3= 4-6 times/week 4= every day		

28.	After attending the nutrition education sessions about complementary feeding (infant and young child feeding), have you changed anything in the way you prepare food and feed (name of child)?	1= yes 2= no → **Q31**	CHFDPR	⌊⌋
29.	If yes, what have you changed in the way you prepare food for (name of child)?	***Record the responses*** _____ _____ _____	CHPRFDCH	
30.	If yes, what have you changed in the way you feed (name of child)?	***Record the responses*** _____ _____ _____	CHFDCH	

31. If no, what has prevented you from changing the way you prepare food and feed (name of child)?
Do not read out the list, probe for further responses. More than one answer is possible. RECORD 1=yes, 2=no

Foods are not available	RENOCHFDPR1	⌊⌋
Lack of money to buy the different foods	RENOCHFDPR2	⌊⌋
Lack of time to prepare the foods	RENOCHFDPR3	⌊⌋

	Do not know how to prepare some foods		RENOCHFDPR4	⌊⌋
	Training was not convincing/ understood		RENOCHFDPR5	⌊⌋
	99=Other (Specify)_____		RENOCHFDPR6	⌊⌋
32.	Have you heard about the nutrient called vitamin A?	1=yes 2=no → **Q35**	KNVITA	⌊⌋
33.	Please name three good food sources of vitamin A.	***Record the foods*** _____ _____ _____ 1= able to name 1 correct food only 2= able to name 2 correct foods only 3= able to name 3 correct foods 4= able to name 1 correct food + 1 incorrect food 5= able to name 1 correct food + 2 incorrect foods 6 = able to name 2 correct foods + 1 incorrect food 7= all answers incorrect 88=do not know	FDVITA	⌊⌋⌋
34.	Why is it important to feed (name of child) foods rich in vitamin A?	***Record the responses*** _____ _____ _____ 1= able to name 1 correct answer only 2= able to name 2 correct answers only 3= able to name 3 correct answers 4= able to name 1 correct + 1 incorrect answer 5= able to name 1 correct + 2 incorrect answers 6 = able to name 2 correct + 1 incorrect answer 7= all answers incorrect 88=do not know	IMPTVITA	⌊⌋⌋
35.	Have you heard about the nutrient called iron?	1=yes 2=no → **Q38**	KNIRON	⌊⌋
36.	Please name three (3) good food sources of iron?	***Record the foods*** _____ _____ _____ 1= able to name 1 correct food only 2= able to name 2 correct foods only 3= able to name 3 correct foods 4= able to name 1 correct food + 1 incorrect food 5= able to name 1 correct food + 2 incorrect foods 6 = able to name 2 correct foods + 1 incorrect food 7= all answers incorrect 88=do not know	FDIRON	⌊⌋⌋
37.	Why is it important to feed (name of child) foods rich in iron?	***Record the responses*** _____ _____ 1= able to name 1 correct answer only 2= able to name 2 correct answers only	IMPTIRON	⌊⌋⌋

		3= able to name 3 correct answers 4= able to name 1 correct + 1 incorrect answer 5= able to name 1 correct + 2 incorrect answers 6 = able to name 2 correct + 1 incorrect answer 7= all answers incorrect 88=do not know		
38.	Have you heard about the nutrient called vitamin C?	1=yes 2=no → **Q41**	KNVITC	⌊_⌋
39.	Please name three (3) good food sources of vitamin C?	***Record the foods*** _____ _____ _____ 1= able to name 1 correct food only 2= able to name 2 correct foods only 3= able to name 3 correct foods 4= able to name 1 correct food + 1 incorrect food 5= able to name 1 correct food + 2 incorrect foods 6 = able to name 2 correct foods + 1 incorrect food 7= all answers incorrect 88=do not know	FDVITC	⌊_⌋⌊_⌋
40.	Why is it important to feed (name of child) foods rich in vitamin C?	***Record the responses*** _____ _____ _____ 1= able to name 1 correct answer only 2= able to name 2 correct answers only 3= able to name 3 correct answers 4= able to name 1 correct + 1 incorrect answer 5= able to name 1 correct + 2 incorrect answers 6 = able to name 2 correct + 1 incorrect answer 7= all answers incorrect 88=do not know	IMPTVITC	⌊_⌋⌊_⌋
41.	Have you heard about the nutrient called proteins?	1=yes 2=no	KNPRTN	⌊_⌋
42.	Please name three (3) good food sources of protein?	***Record the foods*** _____ _____ _____ 1= able to name 1 correct food only 2= able to name 2 correct foods only 3= able to name 3 correct foods 4= able to name 1 correct food + 1 incorrect food 5= able to name 1 correct food + 2 incorrect foods 6 = able to name 2 correct foods + 1 incorrect food 7= all answers incorrect 88=do not know	FDPRTN	⌊_⌋⌊_⌋
43.	Why is it important to feed (name of child) foods rich in protein?	***Record the responses*** _____ _____	IMPTPRTN	⌊_⌋⌊_⌋

		_____ 1= able to name 1 correct answer only 2= able to name 2 correct answers only 3= able to name 3 correct answers 4= able to name 1 correct + 1 incorrect answer 5= able to name 1 correct + 2 incorrect answers 6 = able to name 2 correct + 1 incorrect answer 7= all answers incorrect 88=do not know		

24-HOUR RECALL FOR THE MOTHER

Please describe everything that you (alone) ate yesterday during the day or night, whether at home or outside the home. Was the food item processed and where did you get it from?
a) Think about when you first woke up yesterday. Did you eat anything at that time? If Yes, please tell me everything you ate at that time. *Probe: Anything else? Then continue to question b)*
b) What did you do after that? Did you eat anything at that time? If yes, please tell me everything that you ate at that time. *Probe: Anything else? Probe for any meals/snacks not mentioned*

Continue through the day, ***repeating question b until respondent indicates she went to sleep*** *until the next day. If respondent mentions a mixed dish like a porridge, relish or stew, ask about all ingredients that went into the dish, including added oil, sugar or condiments. When the recall is complete, fill in the food groups based on the foods mentioned during the recall. For any food groups not mentioned, ask:* "Yesterday during the day or night, did you eat any foods such as (read examples of food group items)?"

Food item	**Ingredients**	**Species, sub-species, type, cultivar, breed etc.** *(If the type (local name) is not known, ask for a description, especially the colour)*	**Amount consumed** (Piece, handful, cup, table spoon, tea spoon etc.; if piece show the pictures and specify small, medium, large)	**Source** 1 = purchased 2 = produced 3 = collected 4 = gift 5 = other (specify)	**Processing** 1= boiled 2= fried 3= raw 4= steamed 5= other (specify)

After completing the past 24h, ***Record in the column on the far right whether or not the food from the food group was consumed.***		**Past 24h** 1= yes 2= no	
Cereals	Porridge, bread, rice, noodles, spaghetti, or other foods made from grains like sorghum, millet, rice, wheat etc.	WDD1	⌊⌋
Vitamin A rich vegetables and tubers	Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside	WDD2	⌊⌋
White roots and tubers	White potatoes, white yams, manioc, cassava, or any other foods made from roots	WDD3	⌊⌋
Dark green leafy vegetables	Any dark green leafy vegetables including wild green vegetables like cassava leaves, amaranth, bean leaves, pumpkin leaves, rape mustard, kales,Sarat, Nderema, Miro, Mrere, Terere,	WDD4	⌊⌋
Vitamin A rich fruits	Ripe mangoes, ripe pawpaw, or other local vitamin A rich foods	WDD5	⌊⌋
Other vegetables and fruits	Any other fruits or vegetables like cabbage, eggplant, tomatoes, onions, green pepper, green beans,mushrooms, oranges, lemons, tangerines, banana, loquads, guava, passion fruits, Zambarau, goose berries,	WDD6	⌊⌋
Organ meat (iron rich)	Liver, kidney, heart, or other organ meats.	WDD7	⌊⌋
Flesh meats	Any meat, such as beef, pork, lamb, goat, chicken, rabbit, duck, turkey, dove	WDD8	⌊⌋
Eggs	Eggs from any kind of birds	WDD9	⌊⌋
Fish	Fresh or dried fish, shellfish, or seafood	WDD10	⌊⌋
Legumes, nuts and seeds	Any foods made from beans, ground beans, peas, lentils, soya beans, green grams, nuts, mbande, sesame seeds or other seeds	WDD11	⌊⌋
Foods made with Groundnut	Any foods made with groundnuts	WDD12	⌊⌋
Milk and milk products	Cheese, cream, yogurt or other milk products	WDD13	⌊⌋
Oils and fats	Any fat, oil or butter or foods made with any of these	WDD14	⌊⌋
Sweets	Any sugary foods such as chocolates, sugar, honey, sweets, candies, pastries, cakes, biscuits, soda etc.	WDD15	⌊⌋
Spices, condiments, beverages	Condiments for flavour, such as chilies, pepper, ginger, spices, herbs,salt or fish powder	WDD16	⌊⌋
Insects	Insects (termites, grasshoppers, crickets), grubs	WDD17	⌊⌋

4. Endline Survey Questionnaire: Control

Improving nutritional health of women and children through increased utilisation of local agrobiodiversity in Kenya (INULA)

Bioversity International and Justus Liebig University Giessen

Questionnaire

Endline Survey

Control

Western and Nyanza Province

July/August 2013

Time interview started:	Time interview ended:	Total time:
Date of the Interview (day/month/year):	DATE	⌊⌊⌋⌊⌊⌋⌊⌊⌋
ID Number Interviewer	INTNO	⌊⌊⌋
Name of Village	VILLNAME	
ID Number of Village	IDVILL	□–□□
Project ID Number of the household:	IDNO	□–□□□–□
Name of Household Head	NAMEHHH	
Name of Mother/ Caregiver	NAMECG	
Name of Child	NAMECH	
Telephone no. Mother		
GPS Co-ordinates of the Household	LONGITUDE	□□□–□□□□□
	LATITUDE	□□□–□□□□□
	ELEVATION	□□□□

ANTHROPOMETRIC MEASUREMENTS

MOTHER

Measurement	**1st Reading**	**2nd Reading**	**Average**	**CODE**
Weight (in kg)	⌊⌋⌊⌋.⌊⌋	⌊⌋⌊⌋.⌊⌋	⌊⌋⌊⌋.⌊⌋	WEIGHTMO
Height (in cm)	⌊⌋⌊⌋⌊⌋.⌊⌋	⌊⌋⌊⌋⌊⌋.⌊⌋	⌊⌋⌊⌋.⌊⌋	HEIGHTMO
MUAC (in cm)	⌊⌋⌊⌋.⌊⌋	⌊⌋⌊⌋.⌊⌋	⌊⌋⌊⌋.⌊⌋	MUACMO

INDEX CHILD 6-23 MONTHS

(Youngest child in the age group 6 – 23 months)

Measurement	**1st Reading**	**2nd Reading**	**Average**	**CODE**
Weight (in kg)	⌊⌋⌊⌋.⌊⌋	⌊⌋⌊⌋.⌊⌋	⌊⌋⌊⌋.⌊⌋	WEIGHTMO
Height (in cm)	⌊⌋⌊⌋.⌊⌋	⌊⌋⌊⌋.⌊⌋	⌊⌋⌊⌋.⌊⌋	HEIGHTMO
MUAC (in cm)	⌊⌋⌊⌋.⌊⌋	⌊⌋⌊⌋.⌊⌋	⌊⌋⌊⌋.⌊⌋	MUACMO
Sex of child	1= male 2= female		⌊⌋	SEXCHILD
Oedema	1=yes 2=no		⌊⌋	OEDEMCH

Part I: HOUSEHOLD QUESTIONNAIRE

DEMOGRAPHIC DATA

1.	Do you have a written record of your child's date of birth (such as health card, birth certificate)? ***Please ask other household members to confirm the date***	***Please record*:** day, month, year	BIRTHDAT	⌊⌊⌋⌊⌊⌋⌊⌊⌊⌊⌋ Day Month Year
2.	What is your relationship to this child?	1= Mother 2= Caregiver	RELTOCH	⌊⌋
Please note: If the child's age is equal/ over 24 or below 6 months thank the mother for her time and end interview.				
3.	What is your marital status?	1= Currently Married – monogamous 2= Currently Married – polygamous 3= Widowed 4= Divorced 5= Single 6= Orphan (under 18 years of age)	HEADMAR	⌊⌋
4.	What is the sex of the household head?	1= male 2= female	HEADHH	⌊⌋
5.	What is the religion of this household?	1= Christian 2= Muslim 3= No religion 99= Other (specify):	RELHHH	⌊⌊⌋
6.	What is your tribe or ethnic group?	1= Luo 2= Luyha 3= Teso 99= Other (specify): _____	ETHICHH	⌊⌊⌋
7.	How many people live permanently in your household for the past 6 months?	***Record the number of people for each age group. Record "0" If none in any age group*** 0-2 years: _____ 2-5 years:_____ 5-15 years:_____ 15-49 years:_____ >49 years:_____	HHTOTAL	⌊⌊⌋
8.	Have you ever attended school?	1= yes 2= no → **Q 10**	EDUCMO	⌊⌋
9.	What is the highest level of school you completed: primary, secondary, or higher?	1=Some primary 2= Completed Primary (Standard 8) 3= Some secondary 4= Completed Secondary (Form 4) 5= Higher (College/University etc) 99= Other (Specify): _____	EDUCLEV	⌊⌊⌋
10.	What is the highest level of school the head of the household attended: primary, secondary, or higher?	1= No education 2= Nursery school 3=Some primary 4= Completed Primary (Standard 8) 5= Some secondary 6= Completed Secondary (Form 4) 7= Higher 99= Other (Specify): _____ 88= Do not know	EDUCHH	⌊⌊⌋
11.	What is the main occupation of the household head (mention one or two with priority):	1= Farming (focus crops) 2= Farming (focus livestock) 3= Farming (mixed crop/livestock) 4= Business 5= Petty Trader/vocational skills 6= Casual labour 7= Wage employment 8=Fishing	MAINOCC1 MAINOCC2	⌊⌊⌋ ⌊⌊⌋

		9=Short contract 10= Boda boda taxi 11= None 99= Other (Specify): _____		

LIVING CONDITIONS AND INCOME

12.	***Observe, but do not ask***: *What is the main material of the roof?*	1= Natural roofing: Bamboo with grass 2= Finished/durable roofing: Corrugated iron, Wood, Calamine/cement fibre, Ceramic tiles, Cement, Roofing shingles 99= Other (specify): _____	MATROOF	⌊⌋⌋
13.	What type of fuel does your household mainly use for cooking?	1= Agricultural crop residue 2= Straw/shrubs/grass 3= Firewood → **Q 14 and Q15** 4= Charcoal 5= Paraffin 99= Other (specify): _____	COOKEN	⌊⌋⌋
14.	*If firewood*: Who usually goes to collect firewood in your household?	1= respondent 2= family member → **Q 16**	FIRECOLL	⌊⌋
15.	How long does it take to collect firewood and come back?	1= less than 30 minutes 2= more than 30 minutes less than 1 hour 3= between 1 and 2 hours 4= more than 2 hours 88= don't know	FIRETIME	⌊⌋⌋
16.	What is the main source of drinking water for members of your household?	1= Piped water into dwelling, yard or plot, Public tap/standpipe, Tube well / borehole Protected dug well, protected spring Rainwater collection 2= Unprotected well, unprotected spring Tanker-truck, Cart with small tank/drum Surface water (river, stream, dam, lake, pond, canal, irrigation channel) 99 = other (specify): _____	DRINKWA	⌊⌋⌋
17.	Do you treat your water in any way to make it safer to drink?	1= yes 2= no → ***Q 19*** 88= don't know → ***Q 19***	WATSAFE	⌊⌋⌋
18.	What do you usually do to the water to make it safer to drink? ***Record all items mentioned with priority***	1= Boil 2= Add bleach/chlorine ("Water guard") 3= Strain it through a cloth 4= Let it stand and settle 88= don't know 99= Other (specify): _____	WTREAT1 WTREAT2	⌊⌋⌋ ⌊⌋⌋
19.	How do you store the water?	1= with lid/covered 2= without lid/uncovered 99= Other (specify):	WSTORE	⌊⌋⌋
20.	Who <u>usually</u> goes to fetch the water for your household?	1= respondent 2= family member →***Q 22*** 3= water source on premise → ***Q 22***	WFETCH	⌊⌋⌋
21.	How long does it take you to collect water and come back? ***NB: This includes the***	1= less than 30 minutes 2= more than 30 minutes less than 1 hour	WTIME	⌊⌋⌋

	amount of time it takes to wait in line to fetch water.	3= between 1 and 2 hours 4= more than 2 hours 88= don't know		
22.	What kind of toilet facility do members of the household usually use?	**1** Flush / pour flush to: piped sewer system, septic tank, pit (latrine), unknown place/ not known where Ventilated Improved Pit latrine (VIP), Pit latrine with slab, Composting toilet **2** Flush/ pour flush to elsewhere Pit latrine without slab/open pit Bucket Hanging toilet/hanging latrine 3-No facilities or bush or field **99=** Other (specify): _____	LATRINE	⌊⌊⌋
23.	How long does it take to walk to the nearest health facility for treatment? (one way)	1= less than 30 minutes 2= more than 30 minutes less than 1 hour 3= between 1 and 2 hours 4= more than 2 hours 88= don't know	TIMEHEAL	⌊⌊⌋
24.	What was the main source of income for your household during the last 4 weeks?	1= sale of agricultural products (crops/livestock) 2= sale of firewood/charcoal 3= casual labour 4= petty trade 5= small business 6= employment/salary 7= loan 8= cash remittance 9= none 88= don't know 99= other (specify): _____	INCMON	⌊⌊⌋
25.	What is the main source of income for your household throughout the year?	1= sale of agricultural products (crops/livestock) 2= sale of firewood/charcoal 3= casual labour 4= petty trade 5= small business 6= employment/salary 7= loan 8= cash remittance 9= safety net labour 10= non 88= don't know 99= other (specify): _____	INCYEAR	⌊⌊⌋

POSSESSIONS

26.	Does any member of this household own any land that can be used for agriculture?	1= yes 2= no → ***Q 28***	HHLAND	⌊⌋
27.	How many hectares of agricultural land do members of this household own? ***If more than 99, record '99'.*** ***If unknown, record '00'.***	Acres: (or) Hectares:	LANDACR LANDHEC	⌊⌊.⌊⌋⌋ ⌊⌊.⌊⌋
28.	Do you sometimes hire labour for household or agriculture activities?	1= yes 2= no	HIRELAB	⌊⌋
29.	Do you have a home garden?	1= yes 2= no	HOMEGAR	⌊⌋
30.	Do you grow vegetables?	1= yes 2= no	GARVEG	⌊⌋

31.	Main use of vegetable products grown	1= mainly own consumption 2= mainly for sale 3= both (in approx. equal amounts) 99= other(specify)_____	USEVEG	⌊⌊⌋⌋
32.	Do you grow fruits?	1= yes 2= no → ***Q 34***	GARFRUIT	⌊⌋
33.	Main use of fruits grown	1= mainly own consumption 2= mainly for sale 3= both (in approx. equal amounts) 99= other (specify)_____	USEFRU	⌊⌊⌋⌋
34.	Does this household own any livestock, herds, or farm animals?	1= yes 2= no → ***Q 36***	ANIMALS	⌊⌋

35.	a) How many of the following livestock does your household own? ***For every type of livestock owned, indicate the number and the reason for keeping in the spaces provided***. **RECORD "00" if no livestock is owned.**	**Animals**	**Number of animals**	b) For what reason do you keep animals? REAANIM **1**= mainly own consumption **2**= mainly for sale **3**= both (in approx. equal amounts) **4**=Labour(ploughing, fetching water etc) **99**= Other (specify) _____
	Ox	OX	⌊⌊⌋⌋	⌊⌊⌋⌋
	Cattle	CATTLE	⌊⌊⌋⌋	⌊⌊⌋⌋
	Donkey/mule/horse	DONKEY	⌊⌊⌋⌋	⌊⌊⌋⌋
	Sheep/goat	SHEEP	⌊⌊⌋⌋	⌊⌊⌋⌋
	Pig	PIG	⌊⌊⌋⌋	⌊⌊⌋⌋
	Rabbit	RABBIT	⌊⌊⌋⌋	⌊⌊⌋⌋
	Chicken/duck/doves/guinea fowl/turkey/geese	CHICKEN	⌊⌊⌋⌋	⌊⌊⌋⌋

36.	Does your household, you or anyone in your household own:		**1= yes 2= no**
	Electricity/Solar	POSELEC	⌊⌋
	Radio	POSRAD	⌊⌋
	Cell phone	POSCELL	⌊⌋
	Watch or clock	POSWAT	⌊⌋
	Television	POSTV	⌊⌋
	Sprayer	POSSPR	⌊⌋
	Plough or any other ox-drawn implements	POSPLO	⌊⌋
	Bicycle	POSBICY	⌊⌋
	Ox/donkey cart	POSCART	⌊⌋
	Motorcycle	POSMOT	⌊⌋
	Car or truck	POSCAR	⌊⌋
	Boat	POSBOAT	⌊⌋
	Fishing net	POSFHNET	⌊⌋
	Computer	POSCOM	⌊⌋

HOUSEHOLD HUNGER SCALE

37.	In the past four weeks, did you worry that your household would not have enough food?	1= yes 2= no → ***Q 39***	FOODWOR	⌊⌋
38.	***READ TO RESPONDENT:*** "For each of the following questions, consider whether this has happened in the past 4 weeks. If the answer is yes to a question, please indicate how often this happened."			
a	In the past [4 weeks/30days] was there ever no food to eat of any kind in your house because of lack of resources to get food?	1= yes 2= no → ***Q c***	HHSA	⌊⌋
b	How often did this happen in the past [4 weeks/30 days]?	1= rarely (1-2 times) 2= sometimes (3-10 times) 3= often (more than 10 times)	HHSB	⌊⌋
c	In the past [4 weeks/30 days] did you or any household member go to sleep at night hungry because there was not enough food?	1= yes 2= no → **Q e**	HHSC	⌊⌋
d	How often did this happen in the past [4 weeks/30days]?	1= rarely (1-2 times) 2= sometimes (3-10 times) 3= often (more than 10 times)	HHSD	⌊⌋
e	In the past [4 weeks/30 days] did you or any household member go a whole day and night without eating anything at all because there was not enough food?	1= yes 2= no → ***Q 39***	HHSE	⌊⌋
f	How often did this happen in the past [4 weeks/30 days]	1= rarely (1-2 times) 2= sometimes (3-10 times) 3= often (more than 10 times)	HHSF	⌊⌋
39.	In the past 12 months did your household experience a hungry season? *The hungry season means the number of month a household does not have enough food because their own food stores are depleted and they do not have enough money to buy food.*	1= yes 2= no → ***Q 41*** 88= don't know	HUNSEAS	⌊⌋⌋
40.	During what month did the hungry season begin, when did it end?	Month begun: _____ Month ended: _____	HUNGMO	⌊⌋

HOUSEHOLD DIETARY DIVERSITY

41.	Please describe the foods (meals and snacks) **that you or any member of your household ate or drank** yesterday during the day and night. Include only foods consumed at home, not those purchased and consumed outside of the home. Start with the first food eaten in the morning.

*Write down in the space below all **foods and drinks** mentioned. When composite dishes are mentioned ask for the list of ingredients. Probe for any meals/snacks not mentioned. When the recall is complete, fill in the food groups based on the foods mentioned during the recall. For any food groups not mentioned, ask the respondent if a food item from this group was consumed.*

Breakfast	snack	Lunch	Snack	dinner	snack

Food group	**Examples**	1= yes 0= no	
Cereals	Any food such as ugali, chapati, porridge, bread, spaghetti, scones, biscuits, rice, boiled whole maize grain, sweet beer, doughnuts, maize-banana pan cake, or any food made from finger millet, sorghum, bulrush millet, maize or wheat	HHDD1	⌊⌋
Vitamin A rich vegetables and tubers	pumpkin, carrots, squash, or sweet potatoes that are orange inside + *other locally available vitamin-A rich vegetables (e.g. sweet pepper)*	HHDD2	⌊⌋
White tubers and roots	irish potatoes, white sweet potatoes, white yams, coco yams, cassava, or any white roots and tubers or foods made from these	HHDD3	⌊⌋
Dark green leafy vegetables	relish of dark green leafy vegetables as well as the indigenous vegetables such as Amaranth, pumpkin leaves, cassava leaves, sweet potato leaves, cowpeas leaves, spiderplant, mrere, mito, etc.	HHDD4	⌊⌋
Other vegetables	other vegetables (e.g. tomato, onion, eggplant, any kind of relish from leafy vegetables e.g. Chinese cabbage, okra, cabbage, green pepper and green beans) including wild vegetables; mushrooms	HHDD5	⌊⌋
Vitamin A rich fruits	pawpaw, ripe mangoes, cantaloupe + *other locally available vitamin A-rich fruits*	HHDD6	⌊⌋
Other fruits	other fruits, including wild fruits, e.g. oranges, tangerines, lemons, tamarind, avocado pears, bananas and baobab fruits	HHDD7	⌊⌋
Organ meat (iron rich)	liver, kidney, heart or other organ meats or blood- based foods	HHDD8	⌊⌋
Flesh meats	beef, pork, lamb, mutton, goat, rabbit, wild game, chicken, duck, or other birds	HHDD9	⌊⌋
Eggs	eggs from chicken, ducks, guinea fowl or any other eggs	HHDD10	⌊⌋
Fish	fresh or dried fish or shellfish	HHDD11	⌊⌋
Legumes, nuts and seeds	beans, lentils, cow peas, pigeon peas, peas, Bambara groundnuts, soya beans, ground nuts, green gram, chick peas, nuts, seeds	HHDD12	⌊⌋
Insects	insect larvae, caterpillars, ants …	HHDD13	⌊⌋
Milk and milk products	milk, lala, yogurt, cheese or other milk products	HHDD14	⌊⌋
Oils and fats	oil, fats or butter added to food or used for cooking, avocado	HHDD16	⌊⌋
Sweets	sugar, honey, sweetened soda or sugary foods such as chocolates, sweets or candies	HHDD17	⌊⌋
Spices, condiments, beverages	spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages alcoholic drinks such as: locally brewed beer, bottled beer, spirits, wine, traditional spirits, traditional brews	HHDD18	⌊⌋
Did you or anyone in your household eat anything (meal or snack) OUTSIDE the home yesterday	1= yes 2= no 88= don't know	HHOUT	⌊⌋⌊⌋

Part II: QUESTIONNARE FOR CHILD 6-23 MONTHS

BREASTFEEDING AND COMPLEMENTARY FEEDING PRACTICES

1.	Has (name of child) ever been breastfed?	1= yes 2= no	BREVER	⌊⌋
2.	Was (name of child) given anything to drink or eat BEFORE the first breastfed?	1= yes 2= no 88=Don't know	PRELACF	⌊⌋⌋
3.	In the first three days after delivery, was (name of child) given anything to drink other than breast milk?	1= yes 2= no 88= don't know	RECFLU	⌊⌋⌋
4.	How long did you breastfeed (name of child) exclusively?	***Record response in months in the column on the right*** *if weeks record*_____weeks	DURBR	⌊⌋⌋
5.	Please name three (3) advantages of exclusively breastfeeding the baby for the first six months.	***Record the responses*** _____ _____ _____ 1= able to name 1 correct advantage only 2= able to name 2 correct advantages only 3= able to name 3 correct advantages 4= able to name 1 correct + 1 incorrect advantage 5= able to name 1 correct + 2 incorrect advantages 6 = able to name 2 correct + 1 incorrect advantage 7= all incorrect answers 88=do not know	ADVEBF	⌊⌋⌋
6.	Do you think it is important to continue breastfeeding a child older than six months?	1= yes 2= no → **Q8** 88= do not know	IMPTCTNBR	⌊⌋
7.	If yes, why do you think it is important to continue breastfeeding a child older than six months?	***Record response*** _____ _____ _____ 1= able to name 1 correct advantages only 2= able to name 2 correct advantages 3= able to name 3 correct advantages 4= able to name 1 correct + 1 incorrect advantages 5= able to name 1 correct + 2 incorrect advantages 6 = able to name 2 correct + 1 incorrect advantage 7= all incorrect answers 88=do not know	REACTBR	⌊⌋⌋
8.	At what age did you start giving (name of child) other liquids or semi-solid/solid foods apart from breast milk? ***(Please verify by asking other household members).***	***Record age in months in the column on the right*** *If weeks record*_____weeks 88=Don't know	CFAGE	⌊⌋⌋
9.	Did (name of child) receive liquids, solid, semi-solid or soft food yesterday?	1= yes 2= no	CHRFOOD	⌊⌋
10.	How many times did (name of child) receive liquids, solid, semi-solid or soft foods yesterday?	***Record number of times***	FEEDFQ	⌊⌋⌋
11.	Did you give (name of child) any foods from the family pot?	1= yes 2= no→ **Q14**		⌊⌋

12.	Did you do anything to the food from the family pot to make it suitable for (name of child)?	1= yes 2= no→ **14**			⌊⌋
13.	If yes, what did you do to the food from the family pot to make it suitable for (name of child)? ***This refers to both whether anything was added and whether the food was mashed, chopped etc. Probe the mother to find out what she did to the food before feeding it to the child.***	**What did you add?**	**What else was done to the food e.g. mash, chop etc**		
					⌊⌋
					⌊⌋
					⌊⌋
14.	Was (name of child)'s intake of solid, semi-solid or soft food yesterday different from usual?	1= yes 2= no 88= don't know		CFUSUAL	⌊⌋
15.	Did you prepare any extra meals for (name of child) yesterday? ***For interviewer: Extra meal is a meal which was not consumed among other family members and was cooked to feed the child only.***	1= yes → **Q17** 2= no		EXTRMEAL	⌊⌋
16.	What prevented you from preparing any extra meals for (name of child) yesterday? ***Do not read out the list, probe for further responses, more than one answer is possible, RECORD 1=Yes 2=No***				
	Lack of time			SPMPREV1	⌊⌋
	Do not know how to do it			SPMPREV2	⌊⌋
	No food available → **Q16a**			SPMPREV3	⌊⌋
	Child is old enough to eat family food			SPMPREV4	⌊⌋
	99=Other (Specify):_____			SPMPREV5	⌊⌋
16a.	If answer above is "*3= no food available"*, what kind of foods were not available? ***More than one answer is possible. Please specify the type of foods. RECORD 1=yes, 2=no***				
	Food group	**Type of foods not available**			
	1 = Staples				⌊⌋
	2 = Vegetables				⌊⌋
	3 = Fruits				⌊⌋
	4= Pulses, nuts, seeds				⌊⌋
	5= Animal source foods				⌊⌋
	6 = Fats and oils				⌊⌋
17.	How did (name of child) receive the food yesterday?	1= The child ate by him/herself 2= The child was fed by me 3= The child was fed by someone else 99= Other (specify) _____		METRECFD	⌊⌋
18.	Does (name of child) use a separate bowl/plate/cup for feeding?	1=yes 2=no→ **Q20**		SEBWFDCH	⌊⌋
19.	If yes, why do you think it is important for (name of child) to use a separate bowl/plate/cup for feeding?	***Record response*** 88= Do not know		IMPTSPBW	⌊⌋

20.	If no, please name the reason why (name of child) does not use a separate bowl/cup when feeding.	***Record response*** _____	RENOSEBO	⌊⌊⌋⌋
21.	Is (name of child) still being breastfed?	1= yes → **Q24** 2= no	BFSTILL	⌊⌋
22.	If (name if child) is not breastfed anymore, at what age (in months) did (name of child) stop breastfeeding? ***Please use the events calendar to verify the exact time the child stopped breastfeeding***	***Record age in months*** _____ months 88= don't know	BREASTSTOP	⌊⌊⌋⌋
23.	Why did you stop breastfeeding(name of child)?	1= not enough breast milk 2= no time to breastfeed 3= baby refused to breastfeed 4= wanted to stop (child old enough) 5= next pregnancy 6= breastfeeding younger child 7= feel too weak 99=other (specify)_____	WHYSTOP	⌊⌊⌋⌋
24.	Was (name of child) breastfed yesterday during the day and/or at night?	1= yes 2= no→**27**	BFYESTER	⌊⌋
25.	How many times was (name of child) breastfed yesterday during day and night?	Number of times during the day Number of times during the night 88= don't know	BFFREQ	Day ⌊⌊⌋⌋ Night ⌊⌊⌋⌋ Total ⌊⌊⌋⌋
26.	Was (name of child)'s breastfed yesterday more or less than usual?	1= more than usual 2= less than usual 3= same as usual 88= don't know	BFUSUAL	⌊⌊⌋⌋
27.	What do you usually do to ensure that (name of child) eats his portion of food? ***Do not read out the list, probe for further responses. More than one answer is possible*** **RECORD 1=yes, 2= no**			
	Actively participates in the feeding		RESPFEED1	⌊⌋
	Feeds chid slowly and patiently		RESPFEED2	⌊⌋
	Talks to child while feeding		RESPFEED3	⌊⌋
	Minimize destructions		RESPFEED4	⌊⌋
	99=Other (Specify):_____		RESPFEED5	⌊⌊⌋⌋
28.	What do you usually do when (name of child) refuses to eat a particular food? ***Do not read out the list, probe for further responses. More than one answer is possible*** **RECORD 1=yes, 2= no**			
	Do not give the child the particular food again until child is much older		CHREFPFD1	⌊⌋
	Try giving the particular food again after a few days		CHREFPFD2	⌊⌋
	Combine the particular food with other foods		CHREFPFD3	⌊⌋
	Force the child to eat the particular food		CHREFPFD4	⌊⌋
	99= Other (Specify):_____		CHREFPFD5	⌊⌊⌋⌋

CHILD FEEDING PRACTICES DURING SICKNESS

29.	Has (name of child) been sick in the past two weeks?	1= yes 2= no→ **Q31**	CHSICK	⌊⌋
30.	What was (name of child) suffering from?	**Record all sicknesses mentioned** 1. 2. 3. 4.	TYPSICK	⌊⌋⌋
31.	How often do you offer the breast when (name of child) is sick?	1= more than usual 2= less than usual 3= same as usual	ILLBREAST	⌊⌋
32.	How much do you give your child to drink (including breast milk) during illness: less than usual, about the same amount, or more than usual? ***If less, probe why was he/she given much less than usual to drink or somewhat less?***	1= much less→ **Q33** 2= somewhat less→ **Q33** 3= about the same 4= more 5= nothing 88= don't know	ILLDRINK	⌊⌋⌋
33.	Why did you give (name of child) less to drink when he/she was sick? ***Do not read out list***	1= child refused 2= child was too weak to drink 3= no drinks available 4= no time 99= other (specify)_____	ILLNODR	⌊⌋⌋
34.	How much do you give your child to eat during illness: less than usual, about the same amount, or more than usual? ***If less, probe why was he/she given much less than usual to eat or somewhat less?***	1= much less→ **Q35** 2= somewhat less→ **Q35** 3= about the same 4= more 5= nothing 88= don't know	ILLFOOD	⌊⌋⌋
35.	Why did you give (name of child) less to eat when he/she was sick? ***Do not read out list***	1= child refused 2= child was too weak to eat 3= no food available 4= no time 99=other (specify)_____	ILLNOFO	⌊⌋⌋

24-HOUR DIETARY RECALL FOR THE CHILD 6-23 MONTHS

Please describe everything that (name of child) ate yesterday during the day or night, whether at home or outside the home.

a) Think about when *(name of child)* first woke up yesterday. Did *(name of child)* eat anything at that time? If Yes, please tell me everything *(name of child)* ate at that time and how much he/she ate. *Probe:* Anything else? *Then continue to question* ***b)***

b) What did *(name of child)* do after that? Did *(name of child)* eat anything at that time? If yes, please tell me everything that *(name of child)* ate at that time. *Probe:* Anything else? *Probe for any meals/snacks not mentioned.*

Continue through the day, repeating the question until the respondent indicates child went to sleep until the next day. If respondent mentions a mixed dish like a porridge, relish or stew, ask about all ingredients that went into the dish, including added oil, sugar or condiments.

When the recall is complete, fill in the food groups below (Past 24h) based on the foods mentioned during the recall. For any food groups not mentioned, ask: Yesterday during the day or night, did *(name of child)* eat any foods such as *(read examples of food group items)?*

RECORD: 1= yes, 2= no, 88= don't know

Food item	**Ingredients**	**Species, sub-species, type, cultivar, breed etc.** *(If the type (local name) is not known, ask for a description, especially the colour)*	**Amount consumed** (*Piece, handful, cup, table spoon, tea spoon etc.) .If piece show the pictures and specify small, medium, large*)	**Source** 1 = purchased 2 = produced 3 = collected 4 = gift 5 = other (specify)	**Processing** 1= boiled 2= fried 3= raw 4= steamed 5= other (specify)

7 DAY RECALL FOR THE CHILD 6-23 MONTHS

After completing the past 24h, ask the mother: How often during the past 7 days did (name of child) eat foods from the following food groups? ***Record the number of days in the column on the far right.***		**Past 24h** 1= yes 0= no 88= don't know		**Number of days**	
Cereals	Porridge, bread, rice, noodles, spaghetti, or other foods made from grains like sorghum, millet, rice, wheat etc.	CHDD1	⌊⌋	**CFA**	⌊⌋
Vitamin A rich vegetables and tubers	Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside	CHDD2	⌊⌋	**CFB**	⌊⌋
White roots and tubers	White potatoes, white yams, manioc, cassava, or any other foods made from roots	CHDD3	⌊⌋	**CFC**	⌊⌋
Dark green leafy vegetables	Any dark green leafy vegetables including wild green vegetables like cassava leaves, amaranth, bean leaves, pumpkin leaves, rape mustard, kales,Sarat, Nderema, Miro, Mrere, Terere,	CHDD4	⌊⌋	**CFD**	⌊⌋
Vitamin A rich fruits	Ripe mangoes, ripe pawpaw, or other local vitamin A rich foods	CHDD5	⌊⌋	**CFE**	⌊⌋
Other vegetables and fruits	Any other fruits or vegetables like cabbage, eggplant, tomatoes, onions, green pepper, green beans,mushrooms, oranges, lemons, tangerines, banana, loquads, guava, passion fruits, Zambarau, goose berries,	CHDD6	⌊⌋	**CFF**	⌊⌋
Organ meat (iron rich)	Liver, kidney, heart, or other organ meats.	CHDD7	⌊⌋	**CFG**	⌊⌋
Flesh meats	Any meat, such as beef, pork, lamb, goat, chicken, rabbit, duck, turkey, dove	CHDD8	⌊⌋	**CFH**	⌊⌋
Eggs	Eggs from any kind of birds	CHDD9	⌊⌋	**CFI**	⌊⌋
Fish	Fresh or dried fish, shellfish, or seafood	CHDD10	⌊⌋	**CFJ**	⌊⌋
Legumes, nuts and seeds	Any foods made from beans, ground beans, peas, lentils, soya beans, green grams, nuts, mbande, sesame seeds or other seeds	CHDD11	⌊⌋	**CFK**	⌊⌋
Foods made with Groundnut	Any foods made with groundnuts	CHDD12	⌊⌋	**CFL**	⌊⌋
Milk and milk products	Cheese, cream, yogurt or other milk products	CHDD13	⌊⌋	**CFM**	⌊⌋
Oils and fats	Any fat, oil or butter or foods made with any of these	CHDD14	⌊⌋	**CFN**	⌊⌋
Sweets	Any sugary foods such as chocolates, sugar, honey, sweets, candies, pastries, cakes, biscuits, soda etc.	CHDD15	⌊⌋	**CFO**	⌊⌋
Spices, condiments, beverages	Condiments for flavour, such as chilies, pepper, ginger, spices, herbs,salt or fish powder	CHDD16	⌊⌋	**CFP**	⌊⌋
Insects	Insects (termites, grasshoppers, crickets), grubs	CHDD17	⌊⌋	**CFQ**	⌊⌋

PART III: QUESTIONNAIRE FOR MOTHER/CAREGIVER

1.	How old are you *(in years)?*	***Record age in years in the box in the last column***	AGEMOTH	⌊⌊⌋⌋
2.	Are you pregnant at the moment?	1= yes 2= no 88= don't know	PREGNANT	⌊⌊⌋⌋
CHILD FEEDING PRACTICES				
3.	Whom do you ask for advice when you have a question about feeding your child? ***Do not read out the list, probe for further responses. More than one answer is possible*** **RECORD 1= yes, 2= no**			
	Health professional (Health worker, hospital)		IFSUPP1	⌊⌋
	Mother		IFSUPP2	⌊⌋
	Mother in law		IFSUPP3	⌊⌋
	Grandmother		IFSUPP4	⌊⌋
	Friend/neighbour		IFSUPP5	⌊⌋
	99=Other (specify)_____		IFSUPP6	⌊⌊⌋⌋
4.	Who decides how you feed your child? ***Do not read out the list, probe for further responses. More than one answer is possible*** **RECORD 1=yes, 2= no**			
	Myself		DESCHF1	⌊⌋
	Husband/partner		DESCHF2	⌊⌋
	Mother		DESCHF2	⌊⌋
	Grandmother		DESCHF4	⌊⌋
	Mother in law		DESCHF5	⌊⌋
	99=Other (specify)_____		DESCHF6	⌊⌊⌋⌋
5.	Do you usually prepare extra meals for your child?	1= yes → **Q7** 2= no	EXTRFDCH	⌊⌋
6.	If no, why don't you prepare extra meals for your child? ***Do not read out the list, probe for further responses. More than one answer is possible*** **RECORD 1=yes, 2= no**			
	Lack of time		WHYNSPFD 1	⌊⌋
	No food		WHYNSPFD 2	⌊⌋
	Don't know how to do it		WHYNSPFD 3	⌊⌋
	Child is old enough to eat family food		WHYNSPFD 4	⌊⌋
	88= don't know		WHYNSPFD 5	⌊⌊⌋⌋
7.	Do you currently feed your child any <u>vegetables</u>?	1= yes 2= no →**Q7d** 88=don't know	FDCHV	⌊⌊⌋⌋

7a.	If yes, which vegetables do you feed your child on?	**List all the responses**	TYVGFDCH	
		1.		
		2.		
		3.		
		4.		
		5.		
7b.	Why do you feed your child vegetables? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	I was told by the health worker		WHYFEV1	⌊_⌋
	It is good for my child		WHYFEV2	⌊_⌋
	Everybody does it		WHYFEV3	⌊_⌋
	88= don't know		WHYFEV4	⌊_⌋⌊_⌋
	99= Other (specify)_____		WHYFEV5	⌊_⌋⌊_⌋
7c.	What factors do you consider when choosing vegetables for your child? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	Price		FTCHVCH1	⌊_⌋
	Availability		FTCHVCH2	⌊_⌋
	Taste		FTCHVCH3	⌊_⌋
	Freshness		FTCHVCH4	⌊_⌋
	Colour		FTCHVCH5	⌊_⌋
	Texture		FTCHVCH6	⌊_⌋
	99= Others (Specify)_____		FTCHVCH7	⌊_⌋⌊_⌋
7d.	**<u>If no</u>**, why don't you feed your child any vegetables? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**			
	Children cannot eat vegetables		FTCHVNO1	⌊_⌋
	Texture is not appropriate for children		FTCHVNO2	⌊_⌋
	Taste is not appropriate for children		FTCHVNO3	⌊_⌋
	They are expensive		FTCHFNO4	⌊_⌋
	Not available		FTCHFNO5	⌊_⌋
	99= Others (Specify)_____		FTCHVNO4	⌊_⌋⌊_⌋
8.	Do you currently feed your child any <u>fruits</u>?	1=yes 2= no → **Q8d** 88=don't know	FDCHFR	⌊_⌋⌊_⌋
8a.	If yes, which fruits do you feed your child on?	**List all the responses**	TYFRFDCH	
		1.		
		2.		
		3.		
		4.		
		5.		
8b.	Why do you feed your child fruits? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**			
	I was told by the health worker		WHYFEFR1	⌊_⌋

	It is good for my child	WHYFEFR2	⌊⌋
	Everybody does it	WHYFEFR3	⌊⌋
	88= don't know	WHYFEFR4	⌊⌋⌋
	99= Other (specify)_____	WHYFEFR5	⌊⌋⌋
8c.	What factors do you consider when choosing fruits for your child? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**		
	Price	FTCHFRCH1	⌊⌋
	Availability	FTCHFRCH2	⌊⌋
	Taste	FTCHFRCH3	⌊⌋
	Freshness	FTCHFRCH4	⌊⌋
	Colour	FTCHFRCH5	⌊⌋
	Texture	FTCHFRCH6	⌊⌋
	99= Others (Specify)_____	FTCHFRCH7	⌊⌋⌋
8d.	If no, why don't you feed your child any fruits? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**		
	Children cannot eat fruits	FTCHFNO1	⌊⌋
	Texture is not appropriate for children	FTCHFNO2	⌊⌋
	Taste is not appropriate for children	FTCHFNO3	⌊⌋
	It is too expensive	FTCHFNO4	⌊⌋
	It is not available	FTCHFNO5	⌊⌋
	99= Others (Specify)_____	FTCHFNO6	⌊⌋⌋
9.	Do you currently feed your child any <u>animal source foods</u>? 1= yes 2=no → **Q9d** 88=don't know	FDCHPR	⌊⌋⌋
9a.	If yes, which animal source foods do you feed your child?	List all the responses	TYANFDCH
		1.	
		2.	
		3.	
		4.	
		5.	
9b.	Why do you feed your child animal source foods? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**		
	I was told by the health worker	REFDANFD1	⌊⌋

	Everybody does it	REFDANFD2	⌊⌋
	It is good for my child	REFDANFD3	⌊⌋
	I do not know	REFDANFD4	⌊⌋
	99=Others (specify)_____	REFDANFD5	⌊⌋⌊⌋
9c.	What factors do you consider when feeding your child animal source foods? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1= yes, 2= no**		
	Price	FTCHANFD1	⌊⌋
	Availability	FTCHANFD2	⌊⌋
	Taste	FTCHANFD3	⌊⌋
	Colour	FTCHANFD4	⌊⌋
	Texture (softness)	FTCHANFD5	⌊⌋
	99= Others (specify)_____	FTCHANFD6	⌊⌋⌊⌋
9d.	**<u>If no</u>**, why don't feed your child any animal source foods? ***Do not read out the list, probe for further responses. More than one answer is possible.*** **RECORD 1=yes, 2= no**		
	Texture is not appropriate for children	FTCHVNO1	⌊⌋
	Culture / taboo	FTCHVNO2	⌊⌋
	Religious reason	FTCHVNO3	⌊⌋
	Too expensive	FTCHVNO4	⌊⌋
	Availability	FTCHVNO5	⌊⌋
	99= Others (Specify)_____	FTCHVNO6	⌊⌋⌊⌋

KNOWLEDGE ABOUT NUTRITION AND HEALTH

10.	In the past 6 months, did you see or hear any message or participate in any training on complementary feeding?	1= yes 2= no→ **Q14**	CFMSG	⌊⌋
11.	If yes, where did you see or hear the messages about complementary feeding? **Do not read out the answers, probe for further responses. More than one answer is possible. RECORD 1=yes, 2=no**			
	Health Institution (Health centre, dispensary, hospital, clinic etc)		SORCFMSG1	⌊⌋
	Mass media (Radio, TV etc)		SORCFMSG2	⌊⌋
	Community Health Workers/ outreach in the village		SORCFMSG3	⌊⌋
	Training sessions/ workshops etc		SORCFMSG4	⌊⌋

	99=Other (specify) _____		SORCFMSG5	
12.	If you participated in any teachings or demonstrations as just mentioned, where or who gave the teachings on complementary feeding?	***Record the responses*** _____ _____ _____ 88= do not know	SORCFDEM	
13.	What were the topics covered during the teachings (What were you taught?)	***Record the responses*** _____ _____ _____ 88=do not know	TOPICS	
14.	Have you ever seen the food circle? ***Show the respondent the picture of the food circle***	1=yes 2=no→ **Q 16**	KNFDCR	
15.	If yes, what does it communicate (tell us)?			
	Eat a balanced diet everyday		KNFDCR1	
	Eat a variety of foods/ different foods every day		KNFDCR2	
	Different food and the nutrients they provide		KNFDCR3	
	Different food groups		KNFDCR4	
	99=Other (Specify) _____		KNFDCR5	
	88= Do not know		KNFDCR6	
16.	Have you heard about the importance of feeding on a "diverse diet"?	1= yes 2= no→ **Q 18**	KNDVDT	
17.	If yes, where did you hear about the importance of feeding on a "diverse diet" ***Do not read out the list, probe for further responses. More than one answer is possible.*** ***RECORD 1=yes, 2=no***			
	Health Institution (Health centre, dispensary, hospital, clinic etc)		SOKNDVDT1	
	Mass media (Radio, TV, news papers etc)		SOKNDVDT2	
	Community outreach in the village, CHWs		SOKNDVDT3	
	Training/Workshop/Seminar etc		SOKNDVDT4	
	99=Other (specify) _____		SOKNDVDT4	
18.	Have you been able to feed (name of child) a diversified diet? ***(foods from the different food groups every day)***	1= yes 2= no→ **Q 21** 88= Do not know	FDCHDVDT	
19.	If yes, what types of food would you give (name of child) in one day so that it is diverse?	*Record the response*: _____ _____ _____ 88=do not know	TYPFDDVDT	

20.	Why do you think it is important for (name of child) to consume a diversified diet (different types of foods) every day	***Record the response*** _____ _____ 88=do not know	IMPFDDVDT	⌊⌊⌋⌋
21.	What are some of the challenges you face when trying to feed (name of child) a diversified diet (different types of foods)? ***Do not read out the list, probe for further responses. More than one answer is possible.*** ***RECORD 1=yes, 2=no***			
	Foods are not available → **Q22**		CHFDCHDVDT1	⌊⌊⌋⌋
	Lack of money to buy the different foods		CHFDCHDVDT2	⌊⌊⌋⌋
	Lack of time to prepare the foods		CHFDCHDVDT3	⌊⌊⌋⌋
	Do not know how to prepare some foods		CHFDCHDVDT4	⌊⌊⌋⌋
	99=Other (Specify)_____		CHFDCHDVDT5	⌊⌊⌋⌋
22.	If "Foods are not available": Which foods are not available? ***More than one answer is possible. Please specify the type of foods. RECORD 1=yes, 2=no***			
	Food group	**Type of foods**		
	1 = Staples		FDNOAVAL1	⌊⌋
	2 = Vegetables		FDNOAVAL2	⌊⌋
	3 = Fruits		FDNOAVAL3	⌊⌋
	4 = Pulses, nuts, seeds		FDNOAVAL4	⌊⌋
	5 = Animal source foods		FDNOAVAL5	⌊⌋
	6 = Fats and oils		FDNOAVAL6	⌊⌋
23.	Do you usually add any other foods/ingredients to the foods/meals that you have been preparing for (name of child) to improve its quality/make it more nutritious?	1=yes 2=no→ **Q25**	ENRCHFD	⌊⌊⌋⌋
24.	What foods/ingredients have you been adding to the foods/meals of (name of child) to improve its quality/make it more nutritious?	***Record the responses*** _____ _____ _____ _____	INGENFD	
25.	How many main meals and snacks do you usually give (name of child) each day?	***No. of meals per day***	NOMEAL	⌊⌋
		No. of snacks	NOSNKS	⌊⌋
		Total no. of meals	TOTMEALS	⌊⌋
26.	What type of snacks do you usually buy/give (name of child) between meals?	***Record the responses*** _____ _____ _____	TYPSNKS	

27.	Please describe/name some of the local wild foods (plant or animal!) that are found in your village and that you prepare and feed (name of child)? ***Ask the mother the season the wild foods are available in the village and how often they are fed to (name of child).***				
	Name of wild food	***Season available*** *(name months)*	***How often fed*** 1= < 1 per week 2= 1-3 times/week 3= 4-6 times/week 4= every day		
					⌊⌋
					⌊⌋
					⌊⌋
					⌊⌋
					⌊⌋
28.	After you received new information about complementary feeding/infant and young child feeding, have you changed anything in the way you prepare food and feed (name of child)?		1= yes 2= no→**Q31**	CHFDPR	⌊⌋
29.	If yes, what have you changed in the way you prepare food for (name of child)?		***Record the responses*** _____ _____	CHFDPRCH	
30.	If yes, what have you changed in the way you feed (name of child)?		***Record the responses*** _____ _____	CHFDCH	
31.	If no, what has prevented you from changing the way you prepare food and feed (name of child)? ***Do not read out the list, probe for further responses. More than one answer is possible. RECORD 1=yes, 2=no***				
	Foods are not available			RENOCHFDPR1	⌊⌋⌋
	Lack of money to buy the different foods			RENOCHFDPR2	⌊⌋⌋
	Lack of time to prepare the foods			RENOCHFDPR3	⌊⌋⌋
	Do not know how to prepare some foods			RENOCHFDPR4	⌊⌋⌋
	Training was not convincing/ understood			RENOCHFDPR5	⌊⌋⌋
	99=Other (Specify)_____			RENOCHFDPR6	⌊⌋⌋
32.	Have you heard about the nutrient called vitamin A?		1=yes 2=no →**Q35**	KNVITA	⌊⌋
33.	Please name three good food sources of vitamin A.		***Record the foods*** _____ _____ 1= able to name 1 correct food only 2= able to name 2 correct foods only 3= able to name 3 correct foods 4= able to name 1 correct food + 1 incorrect food 5= able to name 1 correct food + 2 incorrect foods 6 = able to name 2 correct foods + 1 incorrect food 7= all answers incorrect 88=do not know	FDVITA	⌊⌋⌋
34.	Why is it important to feed (name of child) foods rich in vitamin A?		***Record the responses*** 1= able to name 1 correct answer only 2= able to name 2 correct answers only 3= able to name 3 correct answers 4= able to name 1 correct + 1 incorrect answer 5= able to name 1 correct + 2 incorrect answers 6 = able to name 2 correct + 1 incorrect answer 7= all answers incorrect 88=do not know	IMPTVITA	⌊⌋⌋

35.	Have you heard about the nutrient called iron?	1=yes 2=no →**Q38**	KNIRON	⌊_⌋
36.	Please name three (3) good food sources of iron?	***Record the foods*** _____ _____ _____ 1= able to name 1 correct food only 2= able to name 2 correct foods only 3= able to name 3 correct foods 4= able to name 1 correct food + 1 incorrect food 5= able to name 1 correct food + 2 incorrect foods 6 = able to name 2 correct foods + 1 incorrect food 7= all answers incorrect 88=do not know	FDIRON	⌊_⌋⌊_⌋
37.	Why is it important to feed (name of child) foods rich in iron?	***Record the responses*** 1= able to name 1 correct answer only 2= able to name 2 correct answers only 3= able to name 3 correct answers 4= able to name 1 correct + 1 incorrect answer 5= able to name 1 correct + 2 incorrect answers 6 = able to name 2 correct + 1 incorrect answer 7= all answers incorrect 88=do not know	IMPTIRON	⌊_⌋⌊_⌋
38.	Have you heard about the nutrient called vitamin C?	1=yes 2=no → **Q41**	KNVITC	⌊_⌋
39.	Please name three (3) good food sources of vitamin C?	***Record the foods*** _____ _____ _____ 1= able to name 1 correct food only 2= able to name 2 correct foods only 3= able to name 3 correct foods 4= able to name 1 correct food + 1 incorrect food 5= able to name 1 correct food + 2 incorrect foods 6 = able to name 2 correct foods + 1 incorrect food 7= all answers incorrect 88=do not know	FDVITC	⌊_⌋⌊_⌋
40.	Why is it important to feed (name of child) foods rich in vitamin C?	***Record the responses*** 1= able to name 1 correct answer only 2= able to name 2 correct answers only 3= able to name 3 correct answers 4= able to name 1 correct + 1 incorrect answer 5= able to name 1 correct + 2 incorrect answers 6 = able to name 2 correct + 1 incorrect answer 7= all answers incorrect 88=do not know	IMPTVITC	⌊_⌋⌊_⌋
41.	Have you heard about the nutrient called proteins?	1=yes 2=no	KNPRTN	⌊_⌋
42.	Please name three (3) good food sources of protein?	***Record the foods*** _____ _____ _____ 1= able to name 1 correct food only 2= able to name 2 correct foods only 3= able to name 3 correct foods 4= able to name 1 correct food + 1 incorrect food 5= able to name 1 correct food + 2 incorrect foods 6 = able to name 2 correct foods + 1 incorrect food 7= all answers incorrect 88=do not know	FDPRTN	⌊_⌋⌊_⌋
43.	Why is it important to feed (name of child)	***Record the responses*** _____	IMPTPRTN	⌊_⌋⌊_⌋

	foods rich in protein?	_____ 1= able to name 1 correct answer only 2= able to name 2 correct answers only 3= able to name 3 correct answers 4= able to name 1 correct + 1 incorrect answer 5= able to name 1 correct + 2 incorrect answers 6 = able to name 2 correct + 1 incorrect answer 7= all answers incorrect 88=do not know		

24-HOUR RECALL FOR THE MOTHER

Please describe everything that you (alone) ate yesterday during the day or night, whether at home or outside the home. Was the food item processed and where did you get it from?

a) Think about when you first woke up yesterday. Did you eat anything at that time? If Yes, please tell me everything you ate at that time. *Probe: Anything else? Then continue to question b)*

b) What did you do after that? Did you eat anything at that time? If yes, please tell me everything that you ate at that time. *Probe: Anything else? Probe for any meals/snacks not mentioned*

Continue through the day, ***repeating question b until respondent indicates she went to sleep*** *until the next day. If respondent mentions a mixed dish like a porridge, relish or stew, ask about all ingredients that went into the dish, including added oil, sugar or condiments. When the recall is complete, fill in the food groups based on the foods mentioned during the recall. For any food groups not mentioned, ask:* "Yesterday during the day or night, did you eat any foods such as (read examples of food group items)?"

Food item	**Ingredients**	**Species, sub-species, type, cultivar, breed etc.** *(If the type (local name) is not known, ask for a description, especially the colour)*	**Amount consumed** (*Piece, handful, cup, table spoon, tea spoon etc.; if piece show the pictures and specify small, medium, large*)	**Source** 1 = purchased 2 = produced 3 = collected 4 = gift 5 = other (specify)	**Processing** 1= boiled 2= fried 3= raw 4= steamed 5= other (specify)

DIETARY DIVERSITY FOR THE MOTHER

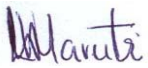
After completing the past 24h, ***Record in the column on the far right whether or not the food from the food group was consumed.***		**Past 24h** 1= yes 0= no	
Cereals	Porridge, bread, rice, noodles, spaghetti, or other foods made from grains like sorghum, millet, rice, wheat etc.	WDD1	⌊⌋
Vitamin A rich vegetables and tubers	Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside	WDD2	⌊⌋
White roots and tubers	White potatoes, white yams, manioc, cassava, or any other foods made from roots	WDD3	⌊⌋
Dark green leafy vegetables	Any dark green leafy vegetables including wild green vegetables like cassava leaves, amaranth, bean leaves, pumpkin leaves, rape mustard, kales,Sarat, Nderema, Miro, Mrere, Terere,	WDD4	⌊⌋
Vitamin A rich fruits	Ripe mangoes, ripe pawpaw, or other local vitamin A rich foods	WDD5	⌊⌋
Other vegetables and fruits	Any other fruits or vegetables like cabbage, eggplant, tomatoes, onions, green pepper, green beans, mushrooms, oranges, lemons, tangerines, banana, loquats, guava, passion fruits, Zambarau, goose berries,	WDD6	⌊⌋
Organ meat (iron rich)	Liver, kidney, heart, or other organ meats.	WDD7	⌊⌋
Flesh meats	Any meat, such as beef, pork, lamb, goat, chicken, rabbit, duck, turkey, dove	WDD8	⌊⌋
Eggs	Eggs from any kind of birds	WDD9	⌊⌋
Fish	Fresh or dried fish, shellfish, or seafood	WDD10	⌊⌋
Legumes, nuts and seeds	Any foods made from beans, ground beans, peas, lentils, soya beans, green grams, nuts, mbande, sesame seeds or other seeds	WDD11	⌊⌋
Foods made with Groundnut	Any foods made with groundnuts	WDD12	⌊⌋
Milk and milk products	Cheese, cream, yogurt or other milk products	WDD13	⌊⌋
Oils and fats	Any fat, oil or butter or foods made with any of these	WDD14	⌊⌋
Sweets	Any sugary foods such as chocolates, sugar, honey, sweets, candies, pastries, cakes, biscuits, soda etc.	WDD15	⌊⌋
Spices, condiments, beverages	Condiments for flavour, such as chillies, pepper, ginger, spices, herbs, salt or fish powder	WDD16	⌊⌋
Insects	Insects (termites, grasshoppers, crickets), grubs	WDD17	⌊⌋

Statutory Declaration

I declare that I have completed this dissertation without unauthorized help of a second party and only with the assistance acknowledged therein.

I have appropriately acknowledged and referenced all text passages that are derived literally from or are based on the content of published or unpublished work of others, and all information that relates to verbal communications.

I have abided by the principles of good scientific conduct laid down in the charter of the Justus Liebig University, Giessen in carrying out the investigation described in the dissertation.



Lydiah M. Waswa

Giessen, October, 2015






édition scientifique
VVB LAUFERSWEILER VERLAG

VVB LAUFERSWEILER VERLAG
STAUFENBERGRING 15
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ISBN: 978-3-8359-6461-7