Immediate Influence of Nutrition Education on Families with Home Gardens in the Urban Areas in Morogoro, Tanzania

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by

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To my parents & Priyanca and Jan

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and referenced all text passages that are derived literally from or are based on the content of published or unpublished work of others, and all information that relates to verbal communications.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

Date: December 2015

Aarati G. Pillai

Table of Contents

List of Tables iii

List of Figures v

Acronyms vii

1 Introduction 1

1.1 Home Gardens 1

1.2 Tanzania and Home Gardens 2

1.3 Nutrition Education 3

1.4 Objectives 4

2 Materials and Methods 5

2.1 Study Setting and Sample 5

2.2 Data Collection 6

2.3 Nutrition Education 7

2.4 Statistical Analysis 8

3 Results and Discussion 9

3.1 Effect of Nutrition Education on the Knowledge Scores of Urban Households with Home Gardens in Morogoro, Tanzania 9

Introduction 10

Materials and Methods 11

Results 14

Discussion 16

Constraints and Recommendations 19

Conclusion 20

3.2 Perceptions of Home Gardening Among Low Income Households in Morogoro, Tanzania 22

Introduction 22

Materials and Methods 23

Nutrition Education 26
Data Analysis 26
Results 27
Discussion 34
Conclusion 36
Acknowledgements 37
3.3 Additional Results and Discussion 38
Household Dietary Diversity Score 38
Vegetable Variety Score 39
Cluster Analysis of Food Groups 39

4 Conclusion **43**
4.1 Household characteristics 43
4.2 Home Garden 44
4.3 Household Dietary Diversity Score 44
4.4 Cluster Analysis 46
4.5 Correlations between Food Groups 48
4.6 Knowledge Scores 49
4.7 Qualitative Observations 50

5 Limitations and Recommendations **53**

Summary **55**

Zusammenfassung **59**

References **63**

A Appendix **73**
A.1 Baseline Questionnaire 74
A.2 Endline Questionnaire 89

Acknowledgements **107**

List of Tables

Table 1.1 Home gardens in different continents[2,3] 2
Table 3.1 Nutrition education sessions 13
Table 3.2 Household characteristics at baseline 15
Table 3.3 Nutrition education sessions 26
Table 3.4 General observations from FGD 28
Table 3.5 Fruits and vegetables grown during the long and short rains 31

List of Figures

Figure 2.1 Map of Tanzania and location of study 6
Figure 2.2 Focus group discussions 7
Figure 2.3 Nutrition education sessions 8
Figure 3.1 Knowledge on vitamin A. Estimated marginal means for 5th and 95th centiles 16
Figure 3.2 Knowledge on iron. Estimated marginal means for 5th and 95th centiles . . 16
Figure 3.3 Knowledge scores of respondents grouped in categories for vitamin A 17
Figure 3.4 Knowledge scores of respondents grouped in categories for iron 17
Figure 3.5 Design for the qualitative study 25
Figure 3.6 Advantages of a home garden 29
Figure 3.7 Challenges faced while cultivating a home garden 32
Figure 3.8 Household dietary diversity score 38
Figure 3.9 Vegetable variety score 40
Figure 3.10 Clusters of households based on food groups 41
Figure 4.1 Home Gardens 45

Acronyms

FAO Food and Agriculture Organization

FFQ Food Frequency Questionnaire

FGD Focus Group Discussions

GDP Gross Domestic Product

HDDS Household Dietary Diversity Score

HG Home Gardens

HH Households

NE Nutrition Education

UNDP United Nations Development Program

USD United States Dollar

VVS Vegetable Variety Score

Chapter 1 | Introduction

1.1 Home Gardens

Home gardens (HG) are an ancient agricultural practice found in all countries[1–3]. It played a key role in food security, fuel, fibre, materials and even controlling land when people changed from a hunting gathering lifestyle to a settled life[3]. It is a small area of land near or within walking distance of the household (HH) providing easy access to fruits and vegetables[2,4]. HG are a combination of the physical, economic and social functions on land around the house[3]. Ninez[5] defined home gardens as "The household garden is a small scale production system supplying plant and animal consumption and utilitarian items either not obtainable, affordable, or readily available through retail markets, field cultivation, hunting, gathering, fishing and wage earning. Household gardens tend to be located close to dwelling for security, convenience, and special care. They occupy land marginal to field production and labor marginal to major household economic activities. Featuring ecologically adapted and complementary species, household gardens are marked by low capital input and simple technology." Forming a part of small scale subsistence farming they are also known as homestead, kitchen, mixed, backyard or compound gardening. Some common characteristics of HG across different continents are highlighted in Table 1.1.

Rapid urbanization has resulted in an increase in food and fuel prices and rural to urban migration has increased pressure on the limited available urban resources[6–8]. Greater opportunities to earn a livelihood is the main motivating factor for the low socio economic classes to move from the rural to urban areas[4,7–9]. In an accelerating economy, HG play a key role in food production[6,7,10]. Establishing home gardens using local seeds and indigenous crops helps make cities more sustainable, at the same time providing the low socio economic classes with opportunities in terms of work and access to healthy and fresh food[10]. The United Nations Development Program (UNDP) approximated that one-third of the produce in urban areas comes from urban HG[3]. HG can be established with very little inputs and products obtained are a way of entering and maintaining social networks[8,11] In urban areas HG can be found along drains, roads and temporarily empty plots of land[3]. A well planned HG will be able to provide the family with not only staple but also non-staple foods all through the year[7,11]. Once the primary purpose of

food consumption has been met, a variety of other HH needs can be met through a HG, such as selling excess produce and generating a supplemental source of income[12]. It also helps in improving dietary diversity and nutritional status of a HH and in empowering women[3,3,6,13–16]. Decisions on where and which crops should be grown are determined by each HH independently considering HH preferences, dislikes and market value of the crop[7,11]. In developing countries, agricultural interventions like HG have been found to show an increase in food consumption, better dietary diversity leading to an improved nutritional status to food security along with empowerment of women[12,14,17].

Table 1.1: Home gardens in different continents[2,3]

Asia	Africa	Latin America
Preserve aesthetic and cultural values	Multi storied and diverse in humid areas, less complex and diverse where rainfall declines	Evolved from range of pre-Columbian influences
Production for family nutrition	Strategic insurance against draught and total crop failure	Essential source of nutrition, strategy against food inflation
Primary source of non-staple food (vegetables and fruit) and reserve supply of staple food (wheat, maize, sorghum, millet)	More staple foods grown (cassava, groundnut, sorghum, yam, oils)	Crops like potatoes, onions, garlic, tomatoes, chard, beans and maize for year-round consumption and sale
Pigs, ducks, goats and hens are common poultry	Goats, chicken graze freely	Guinea pigs and rabbits are commonly kept
Across all continents, HG are the responsibility of women		

1.2 Tanzania and Home Gardens

Tanzania is one of the largest countries on the East African coast with a growing economy where agriculture contributes to 45% of the gross domestic product GDP. Majority of the population (75%) depend on it for their income[18,19]. In the last thirty years, the rate of urbanization has increased to 38%, with numbers increasing as people migrate to big cities for greater opportunities of earning an income[19].

Morogoro is a town which lies 169 km west of Dar-es-Salaam, the main financial hub of Tanzania. It has a total population of 2,218,492 people and the municipality is divided into nineteen wards[20,21]. The climate is bi-modal, with a dry period from January to April and rainfall between November-May. The Uluguru mountains situated at the edge of this town experience a heavy

rainfall of 2800mm/year[20].

In the Morogoro municipality, one third of the farms are small (less than three hectares), located within five km of the residence and cultivated mainly for HH food consumption purposes[20]. HG are considered as a link between rural and urban HH forming an important part of the HH structure, especially in Africa[15,19]. In Tanzania and Senegal, at the start of urban-rural transition, urban households would barter with the rural for "rural goods and products" unavailable in urban areas and vice versa; this system suited both, rural and urban HH[8]. Most urban and rural HH in Tanzania have a HG where the primary aim is to cultivate crops for subsistence[9,12]. Majority of urban poor are those who have migrated and have limited access to food and other necessities due to lack of financial resources. Under such circumstances, HG in urban areas can help a HH in being subsistent and food secure[4,7–9,20]. Ensuring that urban poor families are food secure, both quantitatively and qualitatively, can be a major challenge and HG can be a key factor in being the first access point for food[22].

1.3 Nutrition Education

Nutrition education (NE) has been defined as "any combination of education strategies, accompanied by environmental supports, designed to facilitate voluntary adoption of food choices and other food and nutrition-related behaviours conducive to health and well-being; nutrition education is delivered through multiple venues and involves activities at the individual, community, and policy levels." It comprises of three phases: a motivational phase, an action phase and an environmental component[23]. Studies show that focusing on action or behaviour change is more effective than just focusing on an improvement in knowledge[23,24].

NE is a tool which offers a potential solution in helping to alleviate nutritional deficiencies[25]. Micronutrient deficiencies are a growing problem in developing countries and put pressure on the health, economic and social systems. Non diversified diets with large amounts of starchy foods and very little micronutrient rich fruits and vegetables leads to malnourishment[26]. Effects of malnourishment start right from pregnancy for mother and child, poor cognitive growth and development, increased risk of infections, anaemia lead to a reduced capacity for work and all together these factors lead to an increased risk of mortality and morbidity[25,27,28].

In Nepal, NE linked with a HG intervention allowed a HH better access to micronutrient rich vegetables and improved the quality of HH diets[25]. NE is beneficial especially to those from the

low socio-economic class, through which they can be taught to eat a balanced and diversified diet[23].

Involving women in NE resulted in a better nutritional status of the HH[4,12,14,17]. When women are allowed to participate in the decision making process of a HH, they are more likely to invest in health of HH members, thus improving health and nutritional status of the HH[4,14,29]. A population consuming healthy food, has a better health and nutritional status, will help to reduce pressure on a country's resources and help break the nutritional deficiency-poverty circle[30].

Studies show that, when HG interventions had a nutrition education element, the outcome of the interventions was better rather than either one alone[4,12,25].

1.4 Objectives

So far, studies have been carried out on HG and their effects on income and nutritional status of HH. NE has also been conducted by studies, though each differing from the other and with different focuses. This project attempted to understand the best possible way in which to conduct NE to bring about behaviour change and improving the diet quality of HH by making use of locally available foods from HG.

The main objective of the study was to improve diet quality of families with home gardens through nutrition education. This objective was divided into the following smaller objectives:

- To understand the level of nutritional knowledge and awareness with regard to home gardens.
- To understand the perception towards nutrition with regards to home gardens.
- To understand the food regimes and patterns with reference to the home gardens.

For this study, a HG was defined as an area around or close to the HH where crops are planted in the ground mainly for HH consumption. The minimum number of crops in a HG was defined as one.

Chapter 2 | Materials and Methods

2.1 Study Setting and Sample

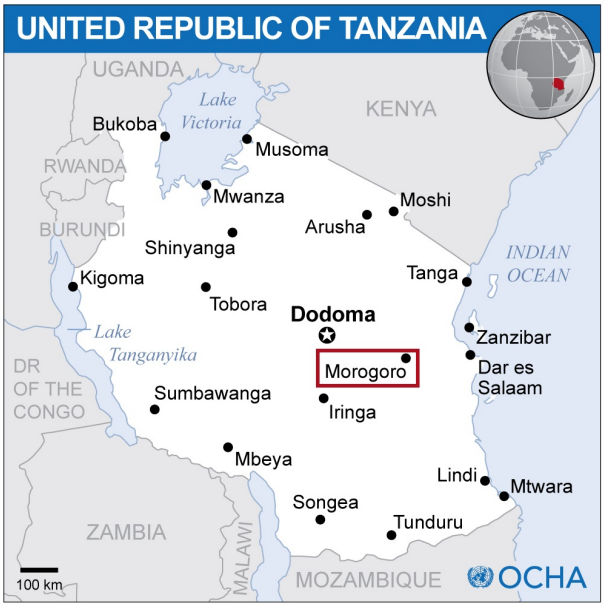
The study site was Morogoro, a town lying 169 km west of Dar es Salaam, Tanzania. The municipality of Morogoro is divided into nineteen wards, of which the two wards of Kichangani and Chamwino were selected as the study sites. These two areas were purposively chosen based on the inclusion criteria, which was as follows:

- Households residing in the urban area, within the municipal limits of the town.
- Households possessing a home garden primarily for household consumption purposes
- Households with a low socio economic status, in this study defined as as earning an annual income of 150,000 - 200,000 Tanzanian Shillings (at the time of the study, 1 USD= 1607 Tanzanian Shillings).

The areas for the study were selected in consultation with staff at the Department of Food Science, Sokoine University of Agriculture in Morogoro. In this study, a home garden was defined as an area around or close to the house where crops are grown in the ground mainly for household consumption. The minimum number of crops in a home garden was defined as one.

Taking into consideration budget constraints, time and man power available to conduct the study, a sample size of forty families was decided. From each ward, twenty families were randomly chosen from a list of names provided by the Ward Extension Officer. Additional households were also identified in case of non availability or refusal of the pre-selected HH. Care was taken to ensure that the families included were not enrolled in any other programme or study. This was done by asking the families themselves and cross checking with the Ward Office. Participation in the study was voluntary and there was no disadvantage to those who did not participate. The HH were informed on all aspects of the study and also of their right to withdraw from the study at any point. Oral consent was obtained from the participants prior to collecting data.

The permission to conduct the study was obtained from the Morogoro Municipality Office.



Map Sources: ESRI, UNCS.
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Map created in Sep 2013.

Figure 2.1: Map of Tanzania and location of study

2.2 Data Collection

A mixed method approach was used to collect data. The study was designed as repeated cross sectional surveys with an intervention period in between the surveys. The baseline nutrition survey was conducted between October - November 2013 and endline survey in May - June 2014. The intervention was conducted in December 2013.

Semi-structured questionnaires were used to collect quantitative data on HH characteristics, HG practices, food consumption habits, knowledge, attitudes and practices of food habits of the HH. The interview also consisted of a vegetable frequency questionnaire and a 24-hour dietary recall. The 24-hour dietary recall was collected for three consecutive days, ensuring that there was no festival, a sick day or a weekend.

Qualitative data was collected through Focus Group Discussions (FGD) and a simulation game. HH cooking practices were also observed. The interviews, FGD and simulation game were all conducted in Kiswahili, the national language. The questionnaire was initially prepared in English, translated into Kiswahili and then back translated into English in order to ensure that the questions were understood correctly and correct information was gathered. The FGD and game were also conducted in Kiswahili and recorded digitally. The recordings were then transcribed into English.

The main respondents to the questionnaire and FGD were women from participating HH, as HG were part of their HH responsibilities.

The data was collected by an enumerator who had completed her B.Sc in Nutrition from the Sokoine University of Agriculture. The enumerator was trained before data collection at baseline and a refresher training was done prior to data collection at endline. She was also trained preceding the FGD.

Figure 2.2: Focus group discussions

2.3 Nutrition Education

The intervention was three interactive nutrition education sessions conducted weekly in the month of December 2013. The topics were chosen based on feedback from baseline survey data and FGD conducted at baseline. The three sessions were:

- Home gardens in helping to improve dietary diversity.
- Importance of vitamins (with a special focus on vitamin A, B and C).
- Iron intake from food and its importance.

Details of these sessions are presented in Table 3.1. The sessions were conducted in Kiswahili and at the Ward Office (when possible), or in an open shaded area. Location and time of the sessions was decided based on convenience and availability of the women. The materials for

these sessions were primarily prepared using the FAO book “Improving Nutrition through Home Gardens - A training package for preparing field workers in Africa” as the main guideline. The enumerator who collected the data also conducted the nutrition education sessions after being trained by the author.

(a) NE session at a Ward Office (b) Participatory sessions (c) Balanced meal and dietary diversity

Figure 2.3: Nutrition education sessions

2.4 Statistical Analysis

The data was entered into Microsoft Excel and then transferred to SPSS where further analysis was done. Basic descriptive statistics were run on the data. A knowledge score was created for questions related to nutritional knowledge. Improvement in nutritional knowledge was assessed using repeated measurements ANOVA with education level of the respondent and participation in nutrition education sessions as covariates in the model. The significance level was set at 5%. Wilcoxson signed rank test was also used to rank the knowledge scores to understand if there was an improvement in the scores. The Household Dietary Diversity Score (HDDS) was calculated from the 24 hour dietary recalls. This score is based on the 12 food groups and as is recommended by FAO[31]. Paired samples T-test was used to determine if seasonality had an effect on HDDS at the two time points. Repeated measures ANOVA was used to measure a change in the HDDS from baseline to endline. Education level of the respondent, monthly income of the HH and at endline the number of nutrition sessions attended were used as covariates in the model.

The materials and methods are described in detail in the two manuscripts.

Chapter 3 | Results and Discussion

3.1 Effect of Nutrition Education on the Knowledge Scores of Urban Households with Home Gardens in Morogoro, Tanzania

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Abstract

Background: Home gardens are an old agricultural practice playing a key role in household food security and diversity. The proximity of gardens to the home facilitates easy access to food and reduces household expenditure. Home gardens combined with nutrition education, could improve household diets both, quantitatively and qualitatively. The objective of this study was to assess the effect of a nutrition education intervention on families with home gardens in Morogoro, Tanzania.

Method: Two cross sectional nutrition surveys were conducted at different time points, the baseline in October-November 2013 and endline in May-June 2014. Between the surveys, an intervention consisting of three interactive nutrition education sessions was conducted in December 2013. The study targeted forty households owning home gardens in urban areas of Morogoro municipality. Mixed methods were used to collect data, including semi-structured questionnaires for quantitative data and focus group discussions for qualitative data.

Results: The estimated marginal means showed small statistically non-significant improvements in knowledge scores for vitamin A (P=0.145, partial η^2= 0.065) and iron (P=0.403, partial η^2 = 0.022). There were more positive scores observed for both nutrients at endline compared with baseline. Composite knowledge scores calculated for participants, showed improvements in the category with scores between 3-6 points, for both nutrients.

Conclusion: While a statistically significant improvement in knowledge scores was not observed, an increase in number of positive scores and composite knowledge scores, indicate an improvement in nutrition knowledge among participants. These results show that families having home gardens and who are provided with nutrition education can improve the

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quality of their household diets. Nutrition education in combination with other agricultural interventions could be a potential tool to improve nutritional status and should be integrated into public health programs and strategies.

Key words: Home gardens, nutrition education, vegetables, knowledge scores

Introduction

Since pre-historic times, home gardens are part of small scale subsistence agricultural systems and play a central role in household food security[3,7].

A home garden consists of a small area used for cultivation near the household which provides easy access to vegetables and fruits. The produce from a home garden can be easily harvested and contributes to household food security[2,4]. The crops grown in a home garden depends on the needs and preferences of a household and sometimes may also be related to medicinal use[7]. Diets lacking in adequate quantities of vegetable and fruit have been listed as one of the top ten reasons for mortality. Home gardens have been associated with an increase in fruit and vegetable consumption which could be also associated with an improvement in the nutritional status[13]. Poor nutrition is associated with a low resistance to illness and poor disease outcomes[32]. Consequences that start right from pregnancy for both mother and child, poor growth and development, poor cognitive development, reduced immunity, anaemia results in a reduced capacity to work, all these factors lead to an increased risk of mortality and morbidity[25] Greater opportunities to earn an income in urban areas have resulted in a migration of a majority of people from rural to urban areas[8,33]. With an increase in urbanisation, it is imperative to ensure urban food security. In urban areas, home gardens are usually classified under “urban agriculture”. They are becoming increasingly common and play a central role in food security of a household[8]. For the low socio economic class, ensuring enough food is the main motivating factor to cultivate a home garden and is often a survival strategy[20]. Though, cultivating a home garden only is not sufficient to tackle the issue of undernutrition; besides the production of nutritious food other activities are required, such as proper harvesting and storage techniques, gender empowerment and nutrition knowledge and capabilities[34]. According to the country profile of Tanzania, in 2012, the population was 44.9 million of which 33% are categorized as undernourished and the rate of urbanization, in the past three decades, increased by 38%[19,21]. In the current study, we assessed the immediate influence of nutrition education on families

with home gardens in the urban area of Morogoro, Tanzania. This study was conducted as part of collaboration between Justus Liebig University, Germany and Sokoine University of Agriculture, Morogoro, Tanzania.

Materials and Methods

Study Setting and Sample

Morogoro is a town located 169 km west of Dar es Salaam, Tanzania. The study was conducted in the urban area of Morogoro, i.e., within the municipal borders. The municipal area is divided into nineteen wards; of which two wards (namely Kichangani and Chamwino) were purposely selected as the study area. The study area and sample were chosen after consultation with the faculty at the Department of Food Science and Technology at Sokoine University of Agriculture, Morogoro. In this study, a home garden was defined as an area around or close to the house where crops are grown in the ground mainly for household consumption. The minimum number of crops grown in a home garden is one.

Households living in the urban area, i.e., within the municipal borders of the town were selected to be part of the survey. The main criteria for inclusion in the study were residence in the urban area, possessing a home garden primarily for household use and a low socio economic status. The latter was, defined as, earning an income of 150,000-200,000 Tanzanian Shillings (1 USD = 1607 T.Shs) at the time of the study.

Based on the time frame, man power and budget considerations, a sample size of forty households was decided to be used for the survey. Since two wards were chosen, the forty households were divided into twenty from each ward. The families were randomly selected from a list of names provided by the Ward Extension Officers. A number of additional households were also identified for being prepared in case of refusal or non-availability of the pre-selected households. Care was taken to ensure that the households selected were not enrolled in any other study or project by asking the families themselves and cross checking with the Ward Office. Participation in the study was voluntary. Participating households were informed about all aspects of the study including their right to withdraw their acceptance at any time.

The permission to conduct the study was obtained from the Morogoro Municipality Office. The study was designed as two cross sectional surveys with an intervention period between the

two surveys. The baseline was conducted in October/November 2013 and endline in May/June 2013. The intervention was conducted in December 2013.

Data Collection

Semi-structured questionnaires were used to collect data on household characteristics, home gardening practices, food consumption habits, as well as knowledge, attitudes and practices of the selected households. The interview also included a vegetable frequency questionnaire and a 24-hrs dietary recall. The questionnaire was prepared in English, translated into the local language, Kiswahili, and was back translated into English to ensure correct information to be gathered. Data was collected by a trained enumerator. Quantitative and qualitative data were collected from all the participating households. This paper focuses on the findings from the quantitative data only.

Nutrition Education Sessions

After the baseline survey, three nutrition education sessions were conducted with the study participants in December 2013. The topics for nutrition education sessions were determined based on the responses obtained in the baseline survey. Details are outlined in Table 3.1. The materials for the sessions were prepared with reference to the FAO resource book, "Improving Nutrition through Home gardens - A training package for preparing Field Workers in Africa" [15]. Contents for the session on vitamin A were the role, function and importance of the vitamin in the body, fruits and vegetables rich in provitamin A, and enhancers of absorption for example, the consumption of orange fleshed sweet potato and the addition of fats /oils to the meal. Same details were provided for iron via a short video presentation in Kiswahili followed by a discussion. A cooking demonstration contributes to a "hands-on" experience which helps in better retention of the information provided. Nutrition education sessions were conducted at the Ward Office when possible and/or in open shaded areas.

Effort was made to ensure that all respondents present participated equally in the sessions by question-and-answer sessions, quizzes and games. Each session was rolled out for sixty minutes. At the end of each session, the main messages were highlighted. During the following session, the previous lecture was reviewed, and only then was the new topic presented. The nutrition education was conducted by the same enumerator who administered the questionnaires at

Table 3.1: Nutrition education sessions

Session and Topic	Key messages	Materials and Resources
1. Home gardens can help to provide balanced meals by improving household dietary diversity	Understand the concept of a balanced and complete meal. Understand how to diversify the diet. Understand how the home gardens can help in diversifying and achieving a complete meal.	Flipchart. Pictures of fruits & vegetables. Discussion. Questions and answers.
2. Importance of vitamins (with a focus on vitamins A, B and C)	Understand the benefits of vitamins. Preparation of green leafy vegetables to get maximum nutritional benefit. Hygienic cooking practices.	Flipchart. Pictures. Cooking demonstration. Local food resources. Discussion. Questions and answers.
3. Iron intake from food and its importance	Understand the importance of iron as a micronutrient.	Video clip. Laptop. Flipchart. Discussion. Questions and answers.

baseline. She had completed her BSc studies in nutrition and was also trained by the author prior to starting the nutrition education. The nutrition education was conducted in the local language, Kiswahili and sessions were held weekly.

Statistical Analysis

The data was entered in MS-Excel and was analysed using the SPSS package version 22.0 (SPSS Version 22.0, IBM Corp, New York). Descriptive analysis was done on the data. A knowledge scale was developed based on the questions related to knowledge on vegetables and fruits, vitamin A and iron. For each correct response, a point was awarded and for every wrong answer, a point was deducted and the total score was computed. The possible nutrition knowledge score ranged from 0-8. The questions covered the importance of consuming vegetables and fruits, knowledge about the existence of vitamin A and iron as well as, foods rich in these two nutrients and why these nutrients are important. Respondents were asked to rate the importance on a scale of 1-5 with 1 being “not at all important” and 5 being “very important”. For the household data, namely, the number of household members, average age of the respondent, education, income, marital status and the occupation, descriptive statistics were run, frequency tables generated and the means with standard deviation and percentages are reported respectively. Descriptive statistics were also run on variables like the motivation to start a home garden,

benefits of a home garden and the crops presently being cultivated as well as for the knowledge questions. Improvement of the knowledge score was evaluated using repeated measures ANOVA controlling for participation in the nutrition education sessions and educational level of the respondent, estimated marginal means are reported. The significance level was set at 5%. The knowledge scores were also ranked using the Wilcoxon signed rank test to understand if there was an improvement or a decrease.

Results

Household Characteristics

Women from forty households participated in the baseline survey. Four of the respondents were lost at endline; three of them had travelled to their respective home towns while one family had shifted from Morogoro to Dar es Salaam. Therefore, for this analysis a cohort of thirty six households was used. The general household characteristics are listed in Table 3.2. The mean amount of money spent by households in a week on purchasing vegetables was 3,825.00 Tanzanian Shillings at baseline and 4,605.56 at endline. In our study, half of the households food purchase decisions were made by the respondents themselves (55%), the other half indicated that their husbands, the grandmothers, mother-in-laws or the main bread winner in the family made the decisions. Home gardens were under the responsibility of the women and children, occasionally other family members helped out. It was observed that 80% of the households owned a mobile phone and 77.5% owned their house. These houses were small and simple, built from bricks with a tin roof, with no electric wiring or toilet facilities. The latrines were usually outside the houses.

Home Garden Details

The number of crops cultivated in a home garden ranged from 1-7 at baseline and 1-6 at endline. Most commonly consumed foods from the home gardens were sweet potato leaves, pumpkin leaves, amaranth, cowpea leaves and cassava leaves. Other crops cultivated were okra, African nightshade, Chinese cabbage, and spinach. The most common reason for cultivation of a home garden was the felt need to provide vegetables to the family (55%). One respondent also expressed the opinion that having a home garden also was traditional for an African household.

Table 3.2: Household characteristics at baseline (N=36)

Variable	Value
Average size of HH (mean value(SD))	5.4 (1.8)
Average age of respondent (years, mean values (SD))	40.75 (16.12)
Marital status	
Single/Widowed/divorced/separated	42.5%
Married/living with partner	57.5%
Education level	
Illiterate/no formal schooling	20.0%
Few years of primary/ completed primary school	72.5%
Secondary school and above	7.5%
Occupation	
Farmer	35.0%
Private or business employee	32.5%
Housewife	22.5%
Daily wage labourer	5.0%
Other	5.0%
Mean expenditure on vegetables per week (T.Shs)	3825.00

The women indicated “more food to eat” (63.9%) and an “added source of income” (33.3%) as the main benefits of having a home garden, other benefits included improved health of family members and other reasons. No significant correlation was observed between number of crops grown in the home garden and number of people in the household and the household income and the motivation to start a home garden.

Knowledge Scores

At baseline, four respondents said it was important and thirty two respondents found it very important to consume vegetables; while at endline, these numbers were eleven and twenty five respectively. For fruits, at baseline, six respondents revealed consumption of fruit was important and thirty said it was very important and at endline these numbers were ten and twenty five, respectively. Repeated measures ANOVA does not show any statistically significant effect of the nutrition education on the knowledge scores between baseline and endline. Number of nutrition education sessions attended and education level of the respondent were used as covariates. For vitamin A, the estimated marginal means shows that there was a slight but not significant improvement in the mean knowledge scores from 4.76 (SEM=0.470) to 5.65 (SEM=0.410) and for iron from 2.05 (SEM=0.309) to 2.49 (SEM=0.378). These small improvements did not reach statistical significance for both the nutrients; vitamin A (P=0.15 and η^2=0.065) and for iron (P=0.40 and η^2=0.022)(Fig 3.1 and 3.2). When the knowledge scores for each nutrient were

observed individually, it was seen that for vitamin A, seventeen respondents improved their scores, sixteen reduced their scores at endline and three respondents did not change their scores. For iron, eleven respondents improved their scores, seven decreased and eighteen respondents scored the same as at baseline. Looking at the components of the scores for each of the nutrients individually, for vitamin A, we see that the number of respondents who had heard about or who knew about vitamin A increased from 29 respondents to 32 respondents. For iron, the number of respondents who had heard about iron was 14 at baseline and this increased to 25 at endline. Respondents were asked the reason for the importance for both the nutrients, these were randomly answered, both correct and incorrect, at baseline and at endline. The same was observed for the question related to foods rich in vitamin A and iron. The knowledge scores were grouped into categories; low, including those respondents with a score of 0-2, medium, those respondents with a score of 3-6 and high, those respondents with a score of 7-8 (Fig 3.3 and 3.4). For vitamin A, we see that participants in the middle category showed better improvement as compared with the other two categories. For iron, number of respondents in the low category went down and those in the middle category improved while the high category showed small changes only.

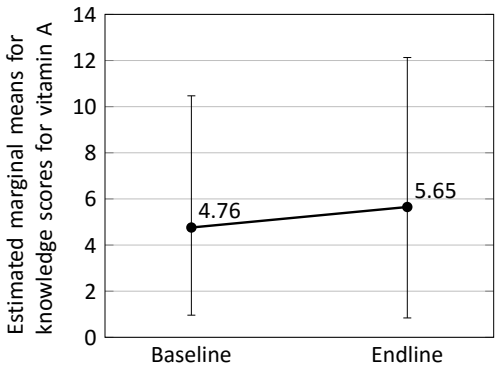

Figure 3.1: Estimated marginal means for 5th and 95th confidence interval for knowledge on vitamin A

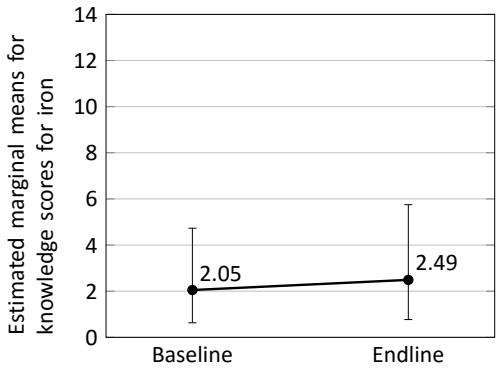

Figure 3.2: Estimated marginal means for 5th and 95th confidence interval for knowledge on iron

Discussion

The current study assessed the influence of a short nutrition education on the knowledge of women residing in households with home gardens. Most home garden studies have been done in Asia and Africa, and among households with low socio economic status, low education

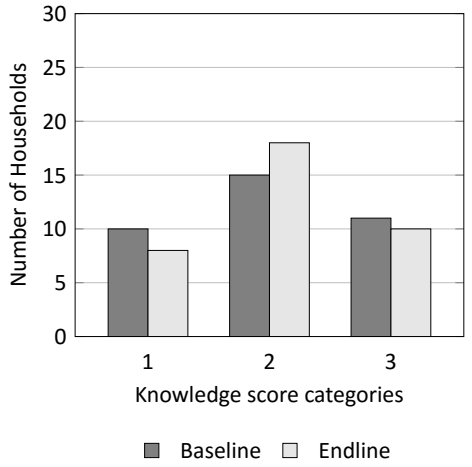

Figure 3.3: Knowledge scores of respondents grouped in categories for vitamin A (N=36).
1 = Knowledge scores (0-2), 2 = Knowledge scores (3-6), 3 = Knowledge scores (7-8)

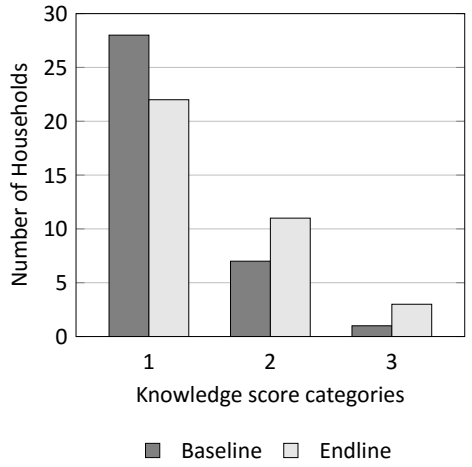

Figure 3.4: Knowledge scores of respondents grouped in categories for iron (N=36).
1 = Knowledge scores (0-2), 2 = Knowledge scores (3-6), 3 = Knowledge scores (7-8)

level, and living in rural areas[25,30,35–37]. Most studies have been done in rural areas, this study intended to understand if families with similar characteristics in urban areas could improve their nutrition knowledge via nutrition education sessions. In the long run, an improvement in nutrition knowledge is expected to lead to better nutrition outcomes[14,25,38,39].

Home gardens are a crucial part of the household, especially in populations with a high risk of food insecurity. It provides the family with an easy access to fresh vegetables and fruits[15,26]. The "need to provide vegetables for the household" was the primary motivation for cultivation of a home garden by 55% of the participants in this study. An observation which is in agreement with other studies[16,37]. Under poverty conditions in developing countries, the role of women is usually limited to taking care of the household, children and farm; they do not wield much power in purchase decisions. If the home garden contributes to the household's income by selling of the excess produce it can help in alleviating the women's role in the household by enabling them to make decisions on how this income is spent. Research has shown that when women have some control or are able to take part in the decision making process they tend to use the money to purchase other foods and/or fulfil other household needs and in general, invest better in the nutrition, health and well-being of the household as compared to men[7,14,40]. A study in Bangladesh showed that home gardens are a source of empowerment for women and the extra income generated by selling the excess produce adds to the household income[38]. Empowering the women with nutrition knowledge will lead them to make better choices and

eventually would lead to better nutrition outcomes for household members[7,14,41]. Apart from selling the excess produce from the home garden we observed that in some cases women bartered the home garden produce with other women for vegetables or fruits they did not produce themselves. The basis of this exchange was a preference for greater food diversity. This approach was a cost effective and resourceful way of increasing variety in the diet and therefore commendable.

In this study, the number of respondents who indicated that vegetable consumption was important increased from four at baseline to eleven at endline, while for fruits this number went from six to ten respondents. When women participate in training programs and gain better nutrition knowledge, there is an improvement in the nutrition of the household[14,37,42–44]. Though the nutrition education in our study did not result in a statistically significant effect on the overall nutrition knowledge scores, there was a tendency towards improvement in some respondents, as observed by the estimated marginal means (Fig 3.1 and 3.2). Education level of the respondent and number of nutrition sessions attended did not have any effect on the nutrition knowledge scores. This observation is contrary to the findings of Faber[37] and Osei[45] but the nutrition education in their studies was conducted over a longer period of time. In another study demonstration plots were used which focused mainly on vitamin A rich plants[44]. The composite nutrition knowledge scores were grouped into categories to understand the changes in scores, respondents in the medium category, with knowledge scores of 3-6, showed an improvement for both the nutrients (Fig 3.3 and 3.4). The knowledge scores, for vitamin A and iron, for each respondent at baseline and endline was compared to ascertain if a pattern could be detected. There was no clear trend except that the number of respondents with positive scores at endline was higher as compared to baseline. The individual components of the knowledge score for each of the nutrients were further examined detecting an increase in the number of respondents who knew of vitamin A and iron. This increase was more pronounced for iron than for vitamin A, indicating that even at baseline, there was greater awareness of vitamin A as compared to iron. Eventually, this could be attributed to previous programs and studies focused on vitamin A[13,37,44,46]. Some respondents in the low and high categories for knowledge about vitamin A and iron were found with lower scores at endline. Reasons for that could be 'not attending the nutrition education session' or lack of attention. At endline, some respondents were in a hurry to complete the interview as they had either to look after their

child or elders at home, or to go to work in a factory or fields. All of these factors could lead to reduction in scores at endline. The reasons why the respective nutrients are important were inconsistently mentioned, correctly and incorrectly, at baseline and at endline: no clear pattern could be identified. These results are similar to results from an earlier study in Tanzania[47]. Another study in Tanzania indicated that the mothers considered vegetable and fruit consumption important and the participants could better name foods rich in vitamin A as compared to iron rich foods (Ludwig C., unpublished data, 2009). Here, the respondents improved their practical knowledge, in terms of being better able to name foods rich in the respective nutrients. This is in accordance with studies which showed that practical nutrition knowledge played a greater role in the nutrition outcomes as compared to the education level of the mother[24,48]
Along with positive scores, it is also necessary to acknowledge that some respondents decreased their scores while some remained in the same group. Those who answered in negative of knowing vitamin A and iron were given a score of zero, answering the reasons or foods rich in the respective nutrients wrong resulted in negative marking, all of which could have reduced the scores. Some respondents were in a hurry to complete the interview, while some answered randomly or could not remember; all of which could have been factors resulting in negative marking and a decrease in the scores.

Constraints and Recommendations

For several reasons; budgetary, time and manpower constraints this study could not apply some of the strengths contributing to the success of nutrition education such as the combination of a demonstration home garden plot, monthly nutrition education sessions, and child growth monitoring for a longer period of time as done by others They also employed local nutrition monitors whom the mothers could ask for advice. Studies, by Faber[44] and Laurie[49], focused only on vitamin A rich vegetables which could also be another factor adding to their strength. In a similar study in Nepal, nutrition education sessions were held monthly but the nutrition education monitors provided additional training to smaller groups of women emphasizing the same information. The reiteration of the same messages helped in retention of knowledge[25]. The review by Berti and colleagues showed that the home gardening components which did not include a nutrition education component were not as successful as those with a nutrition education component[4].

As compared to other studies, a small sample size resulted in reduced power in knowledge scores. As compared to other studies, a small sample size resulted in reduced power in knowledge scores. Another shortcoming was the lack of a control group. Little is known about the number of nutrition education sessions required to achieve sustained improvements. In our study, we conducted three interactive nutrition education sessions still; we found a tendency towards a positive change of the nutrition knowledge scores. Based on the design of this study the required number of participants would be 300[50] for showing a statistically significant improvement. For further studies, an adequately calculated sample size and a control group is recommended to overcome the challenges of interpreting our data, as has also been suggested by Webb[29]. Appointing "nutrition monitors" could be a way in which women help to correct and boost each other's nutrition knowledge. These nutrition monitors could be those respondents who have improved their knowledge scores over time and are active in the community. The study also suggests focusing on using locally available foods, especially those from the home garden to enhance understanding and eventually improve nutritional intake and thus nutritional outcomes.

Conclusion

The study assessed the influence of a small scale and short nutrition education program on families living in an urban area and having home gardens. We found more positive scores at endline as compared to baseline. The improvement in scores could be due to the interactive learning sessions and the small group size which allowed for more active involvement of participants during the sessions as well as the focus on locally grown vegetables from home gardens. Still, a statistically significant change in the knowledge scores could not be demonstrated.
With all its limitations, this study contributed to a better understanding of facilitating and impeding factors in the improvement of nutrition knowledge. In conclusion, more research on nutrition education with larger groups, more sessions, and a longer intervention and observation period could help to prove its effect on knowledge scores and nutrition outcomes. Ultimately, nutrition education on the benefits from home gardens and their improved vegetable supply should be integrated into continuous programmes of health and nutrition promotion.

Acknowledgement

This study was conducted as part of the collaboration between Justus-Liebig University, Giessen and Sokoine University of Agriculture, Tanzania and supported by the DAAD, Bonn, Germany.

3.2 Perceptions of Home Gardening Among Low Income Households in Morogoro, Tanzania

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Submitted to paper XXX

Abstract

Objective: To assess the effect of nutrition education sessions in the urban areas of Morogoro, Tanzania.

Method: Baseline and endline nutrition surveys, focus group discussions and participatory rural activity were undertaken between October-November 2013 and May-June 2014 respectively with forty families in Morogoro. Nutrition education sessions, were held in December 2013.

Results: Advantages were easy access, reduced household expenses and improved consumption of fruits and vegetables and challenges were water shortage, domestic animals, increased workload and lack of finances. The main factor guiding the crops cultivated were household preferences; post the nutrition education, nutritional value was also considered. There was an improvement in the nutritional knowledge of the respondents observed after the nutrition education.

Conclusion: The advantages outweighed the challenges, resulting in the continued practice of home gardening. Nutrition education sessions helped in making respondents aware of the nutritional value of fruits and vegetables and in making better food choices.

Key words: Home gardens, advantages, challenges, nutrition education

Introduction

Home gardens are an old time tested strategy requiring little input and support and are used widely by many communities for purposes of food production, primarily for the household[7]. In urban areas, it falls under the category of "urban agriculture" and contributes to the subsistence of the household, especially in families with lower socio-economic status[6,8]. Home gardens not only ensure food availability, but are also a way of improving the consumption of fruits and vegetables[13,15,25,51]. The WHO recommends an intake of 400g per day of fruits and vegetable

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and in developing countries like Africa, this recommendation is not met[52,53]. It also contributes to household income when the extra produce is sold usually by women allowing them to obtain money thus, it is one strategy for enhancing women's empowerment too[13,14,25,54,55]. Nutrition education (NE) is defined as "a combination of educational strategies being, accompanied by environmental support and, designed to facilitate the adoption of better food choices and other food and nutrition related behaviours which are conducive to health and well-being; NE can be delivered through multiple venues and involves activities at the individual, community, and policy levels"(modified from Contento)[23,56]. It is a potential tool which can be used in helping families with home gardens improve the quantity and quality of their diets[57,58]. Studies involving home gardens along with a component of nutrition education showed an improvement in diet quality and nutritional status of a household[4]. In the current study we assessed the effect of NE on families with home gardens and tried to understand the advantages and challenges.

Materials and Methods

Study Setting and Sample

The study was conducted in the town of Morogoro, 169 km west of Dar es Salaam in Tanzania. The Morogoro municipality is divided into nineteen wards, of which two wards, namely Kichangani and Chamwino were selected for the study. These areas were selected based on the inclusion criteria, as follows: households in an urban area, having a home garden mainly for household consumption, having a low socio-economic status, defined in this study, as earning an income less than or equal to 150,000.00 Tanzanian Shillings (= 68.00 USD, as of September 2015). The study sample and wards were selected after consultation with the faculty at the Department of Food Science and Technology at Sokoine University of Agriculture, Morogoro. The permission to conduct the study was obtained from the Morogoro Municipality Office.

Data Collection

A convergent parallel mixed method approach was used to collect data for the nutrition survey, where qualitative and quantitative data was merged to give a comprehensive understanding of the data being collected[59]. Repeated cross sectional nutrition surveys were conducted with an intervention period between the surveys. The baseline survey was conducted in October-

November 2013 and endline data in May-June 2014. Intervention was three nutrition education sessions with the participants during December 2013.

For the quantitative data, a semi structured questionnaire was used to collect information on household characteristics, education, home garden practices and knowledge, attitudes and practices. The questionnaires were prepared in English and translated to the local language, Kiswahili. To ensure correct information was gathered, they were back-translated from Kiswahili to English by another translator. After a pre-test in the field, changes were made as required.

Focus group discussions (FGD) and a simulation game were used to collect qualitative data on the perceptions, advantages and challenges faced by the families in cultivating their home gardens, both at baseline and endline. Participation in the FGD was voluntary too. Oral consent was obtained after all the information about the FGD and simulation game was given. The FGD were conducted in the local language, Kiswahili, in an open shaded area and at a time convenient for all the participants. Smaller groups facilitated better interaction and allowed for a deeper insight into the perceptions, advantages and challenges faced by the respondents while practising home gardening (Fig 3.5, 25). All the FGD were digitally recorded and later transcribed.

A total of forty households were selected to participate in the study. This number was decided based on the time available for the baseline and endline surveys and nutrition education, the manpower available to conduct the surveys and nutrition education sessions and budget available for the study.

For each ward, twenty households were randomly selected from the list of households provided by the Ward Extension Officers. Ten additional households were selected in case of non-availability or refusal from the households primarily selected. Participation was fully voluntary; the households were informed on all aspects of the study, including their right to withdraw from the study at any time. After all information was given, oral consent was then obtained from the women of the respective households.

These women were also invited to be part of the FGD, as they were the main respondents for the quantitative survey and the home garden was part of their household responsibilities.

The simulation game was also conducted as part of the FGD, participants were divided into groups. Each group consisted of two to three respondents. After distribution of a a sheet of paper and play money. The participants were asked to purchase fruit and vegetable seeds

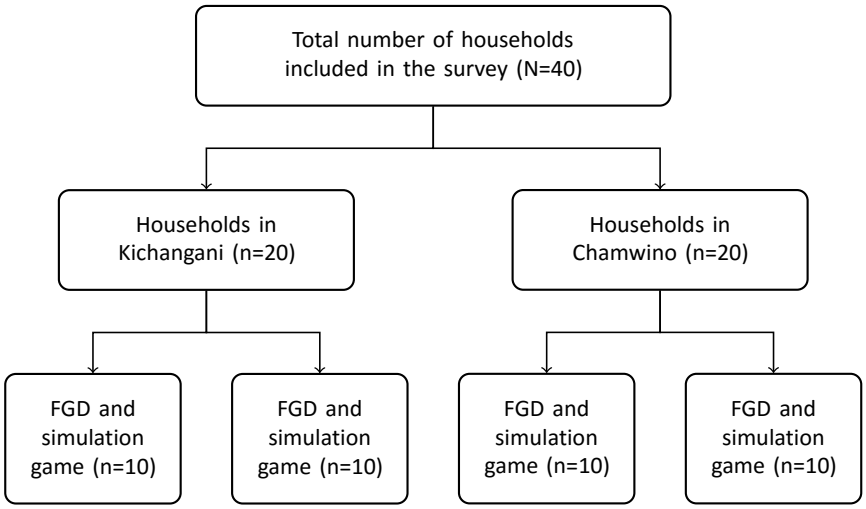

Figure 3.5: Design for the qualitative study

provided in the form of pictures and cultivate the fruit and vegetable crops in their home gardens, which was a 6 * 6 inch plot drawn on paper. The crops were then harvested for meal preparation, which entailed indicating which vegetables would be used for cooking and other components of the meal. For the meal preparation, participants were instructed to only purchase oil, salt, onion and tomatoes when needed.

The FGD and simulation game were designed to elicit information on the advantages and challenges faced by families practising home gardening, the vegetable preferences and dislikes of the households, their opinions on the importance of fruit and vegetable consumption, the health complaints and illnesses faced by the respondents, the taboos, beliefs and cultural practices in the society and the seasons of food availability and shortage.

The FGD and simulation game were conducted by the same enumerator who had administered the quantitative questionnaire. The enumerator held a B.Sc in Nutrition from the Sokoine University of Agriculture, Morogoro and was trained by the author prior to both, quantitative and qualitative data collection.

Quantitative results from this study, focusing on knowledge scores and influence of nutrition education are presented in another article; this paper focuses solely on the qualitative data gathered from the focus group discussions and simulation game.

Nutrition Education

The baseline survey conducted in October-November 2013 provided the necessary feedback to determine the topics to be covered during the NE sessions. NE sessions were conducted in December 2013. Three sessions, details for which are provided in Table 3.3 (26) (also submitted for publication), were interactive. The sessions were held weekly and each lasted for sixty minutes. The education materials were prepared using the FAO resource book, "Improving Nutrition through Home gardens - A training package for preparing Field Workers in Africa", as the guideline[15] The interactive sessions allowed for the participation of all attending participants. At the end of each session, the main messages were highlighted and the sessions always started with a recap of the previous lecture before the new topic was introduced.

Table 3.3: Nutrition education sessions

Session and Topic	Key messages	Materials and Resources
1. Home gardens can help to provide balanced meals by improving household dietary diversity	Understand the concept of a balanced and complete meal. Understand how to diversify the diet. Understand how the home gardens can help in diversifying and achieving a complete meal.	Flipchart. Pictures of fruits & vegetables. Discussion. Questions and answers.
2. Importance of vitamins (with a focus on vitamins A, B and C)	Understand the benefits of vitamins. Preparation of green leafy vegetables to get maximum nutritional benefit. Hygienic cooking practices.	Flipchart. Pictures. Cooking demonstration. Local food resources. Discussion. Questions and answers.
3. Iron intake from food and its importance	Understand the importance of iron as a micronutrient.	Video clip. Laptop. Flipchart. Discussion. Questions and answers.

Data Analysis

The quantitative data was entered into Microsoft Excel and then analysed using SPSS Version 22.0 (IBM SPSS Statistics for Windows, 2013). The qualitative data was analysed using QDA Miner Lite Version 1.4.1 (Provalis Research, 2014). For the qualitative data analysis a code tree was created based on the responses. There were two levels within the code tree; the first level or main code addressed the theme of the questions and second level or sub code

were key words or particular codes related to the first level theme. There were fourteen main codes, having a minimum of two sub codes and a maximum of six sub codes. First level codes were created by deductive reasoning and second level codes by inductive reasoning, where responses from participants guided the formulation these codes. The audio recordings were transcribed verbatim from Kiswahili into English in MS-Word and then analysed. Translating verbatim, however well done, results in loss of certain data when translating directly even if it is placed in syntax. Another limitation is that the non verbal forms of communication are usually the contents lost when transcribing the audio information into written text[56] The direct translations from Kiswahili into English could have resulted into the loss of some data when translating and transcribing directly. To analyse the data, content analysis was employed, as decribed by Contento[23]. The code tree was entered into the analysis software and transcripts were coded accordingly. Once all the transcripts were coded, they were re-read without the codes to create general themes. These were then compared to the codes and changes were made wherever it was necessary. This was done in order to ensure that the transcripts were correctly coded.

Results

The home gardens and dietary diversity session was attended by 75% of the respondents, the second session on the importance of vitamins was attended by 69% while the third session on iron and anaemia was attended by 61% of the respondents. The other women could not participate due to their workload in the homes and farms. Each FGD was conducted for a mean of 60 to 70 mins with an average of seven to eight households participating. Details of the location, number of participants, duration and general comments and observations from each FGD are presented in Table 3.4 (28).

The main or first level codes were advantages of a home garden, reasons for choosing the vegetable and/or fruit, likes and dislikes, health reasons for eating vegetables, meal prepared, grow vegetables through the year, challenges, importance of fruit and vegetable, health conditions or concerns, cultural beliefs, food availability, main caretaker of home garden, workload challenges, change after nutrition education. These codes were analysed separately and the results are presented below.

Table 3.4: General observations from FGD

FGD No	Location	Attendees	Duration	General comments and observations
Baseline				
1.	Kichangani	9	90 mins	Initially the women were a little reluctant to put forth their views but later they felt comfortable sharing their opinions. They were curious about the simulation game.
2.	Chamwino	10	75 mins	Some respondents were more forth coming than others while answering and respondents who were quiet were also nervous during the simulation game.
3.	Chamwino	7	70 mins	The women were more open and willing to voice their opinions. Respondents were interested and curious during the simulation game.
4.	Kichangani	7	70 mins	Open exchange and discussion between the participants, though some participants tended to dominate the discussion.
5.	Kichangani	6	75 mins	The women were comfortable in sharing their ideas and discussing.
6.	Chamwino	6	70 mins	The participants were in a rush to complete the FGD and simulation game and return to their households.
Endline				
7.	Kichangani	6	80 mins	The participants looked forward to relating their experiences after the NE and were more active during the simulation game.
8.	Kichangani	6	75 mins	This group actively participated in the simulation game and discussions.
9.	Chamwino	6	70 mins	Some participants were not available to attend the FGD since they had gone to work in the farms. The women present were interested in discussing and sharing their experiences about changes they made after the NE and challenges they faced.
10.	Chamwino	7	70 mins	During the simulation game, they discussed for longer while choosing the vegetables and were more open to ideas and suggestions by the other group members.

Advantages of a Home Garden

The main advantages of a home garden were food security, in terms of, household food consumption, reduced expenses and easy accessibility of fruits and vegetables for the household. Once the household consumption was met, the excess produce was sold in order to add onto the household's income. This income allowed the respondents, mainly women, to purchase

other household necessities and was perceived as another advantage. After the NE, the women reported that consumption of vegetables was good for the health of their families. They reported that eating vegetables helped themselves to improve and maintain their health. The percentages of the advantages, representing the number of times each sub code appeared in the transcript, are presented for baseline and endline in Fig 3.6 (29).

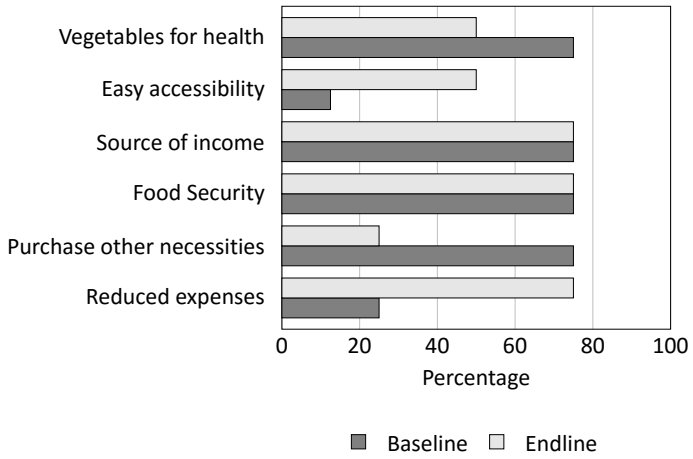

Figure 3.6: Advantages of a home garden

Reasons for Choosing the Vegetable and/or Fruit for Cultivation and Likes and Dislikes

The household taste preference and dislike for a vegetable or a fruit played an important role in the selection of the crop to be cultivated in the home garden. As stated by one of the respondents, “Basically it is the taste which governs the like and dislike of a vegetable” (mother, 21 years). Familiarity and the vegetable being part of the weekly food habits were the other factors taken into consideration while selecting the vegetables to be cultivated.

Another selection criteria was that the vegetable should be easy to grow; those with a short cultivating period, longer harvest, not requiring any special care or maintenance and surviving the harsh environmental conditions were preferred. Sweet potato leaves, amaranth, African nightshade, cowpea and pumpkin leaves were some of the vegetables liked and cultivated. Cocoyams were preferred since children liked them much better than cassava. Kale and Chinese cabbage, although requiring extra care and pesticides, were also cultivated by some respondents since those vegetables had a higher market value. Vegetables like spinach and bitter herb were not liked by some respondents, especially by children since they had an unpleasant smell and bit-

ter taste. The respondents said that the palatability and method of preparation were factors governing the acceptance and preference of a vegetable.
Vegetables like pumpkin, cocoyams and cassava were regarded nutritious and easy to prepare. They were consumed just after boiling with water and a little salt. The leaves of these vegetables were also eaten as a relish; hence respondents found it beneficial to grow such vegetables.

Importance of Fruit and Vegetable and Health Reasons for Eating Vegetables

Some participants reported that consumption of fruit and vegetable was important in the baseline survey already. In the FGD, respondents highlighted that vegetables like carrots and pumpkins were "good for the eyes" and green leafy vegetables "increased the blood". Vegetables were perceived as providing the body with energy, vitamins, and minerals and helping to prevent illnesses by improving the immunity. After the NE, respondents mentioned that staples like cassava, cocoyam and sweet potato provide satiety and energy.

Health Conditions

When asked about health and illnesses, the women reported malaria, diarrhoea, coughs and colds as common diseases. They were reluctant to talk about or discuss any personal illness, although it was explained that we would like to know only about illnesses faced in general. They responded by saying it was culturally not acceptable to talk about diseases. Most of the women still associated illness with HIV/AIDS and a deep rooted stigma towards HIV/AIDS was observed. Research shows that most of the talks about HIV/AIDS is usually coded by different wording[60]. Hence, the health issues could not be discussed in further detail.

Growing Vegetables Through the Year and Food Availability

The respondents indicated that the season of optimal food availability was from March/ April to October/November. The period from November/December to April was the period when they felt that there was a food shortage. The list of fruits and vegetables commonly grown in home gardens during the long and short rains is presented in Table 3.5(31).

Table 3.5: Fruits and vegetables grown during the long and short rains

Season	Vegetables	Fruits
Short rain	Amaranth, okra, pumpkin leaves, African eggplant, sweet potato leaves, African nightshade, cassava leaves, Chinese cabbage	Papaya, oranges, cucumber, pineapple and watermelon
Long rain	Amaranth, tomatoes, pumpkin leaves, sweet potato leaves, jute mallow, cowpea leaves, bitter herb	Jackfruit and mango

Cultural Beliefs

Cultural beliefs were mainly related to religious beliefs with regard to consumption or non-consumption of a particular food. Muslim participants reported that it is against their religious rules to consume pork (pig meat). Otherwise the respondents, did not mention any food taboos. The decision if, when and how often a particular food was not eaten, was due to the food being expensive and hence not affordable. At a celebration, pilau (rice cooked with meat) and mtori (banana cooked with meat) were commonly eaten. When a person is ill, he or she was usually given soft foods like porridge, soup, boiled Irish or sweet potatoes and plantains; since these foods were easy to cook, soft to eat, easy to swallow and were providing energy. Respondents believed that bitter herbs, Mchunga (rabbit milk weed) and Mwidu (both indigenous wild herbs) helped to cure malaria. They also thought that eating African eggplant during pregnancy results in a child born with skin infection and rashes. To enhance milk production, a lactating woman ate porridge and milk. Further probing to understand the reasons for these beliefs and practices revealed that the information was passed down from one generation to the next.

Challenges

Along with the advantages, the home garden also presented some challenges. The majority of the respondents reported being dependent on rains. Lack of land and water shortage, especially during the dry season, made it difficult for the women to maintain the garden. Though, some respondents allow the water from domestic activities like washing of utensils and clothes to flow into the home garden, thereby, watering fruits and vegetables. Participants also said that the lack of water resulted in lower yields from the gardens. Domestic animals like chicken and goats, also presented problems; since they were allowed to roam freely, they pecked the seeds from the ground or fed on the young shoots and leaves. During the dry season, insects and locusts attack the crops and reduce the yield. Especially, green leafy vegetables, like cassava

leaves, was reported to develop a bitter taste once they get attacked by locusts. Lack of financial resources, affects the ability of the respondents to take care of their home gardens. Seeds and pesticides are expensive; hence even though the respondents may want to plant more crops or use pesticides to prevent insect or locusts attacks, they cannot afford to purchase them. To overcome the challenge of obtaining seeds, it was suggested that the seeds from the previous harvest be preserved. These suggestions came from the respondents themselves as part of the discussions. Some participants also recommended sun drying the seeds from African eggplant, maize, amaranth, pumpkin, cowpeas and kidney beans and storing them in an air tight container. Others suggested mixing ashes from sesame or rice stalks with the seeds because the ash is believed to have anti-insect properties. In markets and local stores, owners rub rice grains with oil to prevent insects from attacking the grains. Another issue was the lack of storage space and equipment, preventing families from keeping stocks of grains, vegetables or fruits in large quantities. The main challenges and percentage of households facing those challenges are presented in Fig 3.7(32).

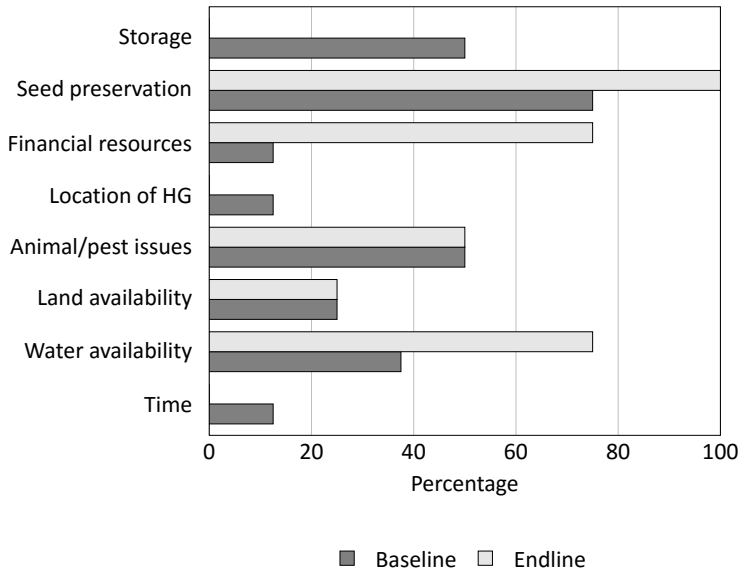

Figure 3.7: Challenges faced while cultivating a home garden

Caretaker of Home Garden and Workload Challenges

The women in the households were responsible for the home garden. One respondent said, “Most African women, have(ing) a great work load, it is a part and parcel of their work and they hardly complain(ed) about it” (mother, 30 years). Sometimes, children helped in the upkeep

after school. Young children were were carried by the women on her back while working in the garden, or the mothers had to ask someone to look after the child. Occasionally, other family members helped out with the work in the home garden. During the planting season, the workload increases, as the plots must be prepared by weeding, removing old plants and then replanting. During the dry season, shortage of water required the respondent to fetch extra water for the garden.

Still the respondents stated that even though the home garden required some work and they needed to make time to do it, they were happy to do it since it benefited the household.

Challenges After Nutrition Education

The respondents reported learning the importance of eating vegetables and fruits to improve their own and their families' health. Eating a variety of fruits and vegetables, that is, diversifying their diets, would ensure that they got all the vitamins and minerals. Participants also mentioned practices like addition of oil to vitamin A rich vegetables and green leafy vegetables which helped in improving the availability of the vitamin in the body. Respondents stated dark green leafy vegetables, fish and meat were rich sources of iron and addition of lemon juice or eating a fruit rich in vitamin C helped in absorption of iron. The women said that refraining from drinking tea or coffee with a meal helped in vitamin absorption. Respondents stated that washing vegetables before chopping was important, since by chopping first and then washing; as practised previously; resulted in nutrient losses. Hygiene practices like washing hands before cooking, before and after a meal, after using the toilet were some of the positive changes reported by the women. Although, the respondents were unable to make some changes such as consuming meals in separate bowls or plates. It was observed that the entire family ate their meals from the same plate, including children. The participants stated this as part of their culture and also dividing the small amounts of food cooked was difficult.

Participatory Rural Activity/ Simulation Game

At baseline, the criteria for choosing vegetables to be cultivated, were preferences and dislikes of the family, ease of cultivation and market value. At endline, besides these factors, the nutritional value of the crop was also important. The participants mentioned green leafy vegetables, like amaranth, cowpea, pumpkin leaves and vegetables like pumpkin and carrots as

being rich in vitamin A. Green leafy vegetables were also rich in iron. Cocoyam and cassava were staples providing energy. They reported that consumption of these crops, helped in improving the family's health. At baseline and endline, the vegetables were prepared in a simple way with onions and tomatoes, which were used in small amounts mainly as condiments. At endline, the respondents tried to include carrots and green peppers whenever possible while cooking the vegetables. Commonly prepared relishes were sweet potato leaves cooked with onion, amaranth and other green leafy vegetable relish or kidney beans cooked with onions and tomatoes and occasionally carrots. These were served with ugali (stiff maize porridge) and rice. "Mlenda", a popular dish, was a combination of African eggplant, sweet potato leaves and okra; another popular dish was "Makande", a combination of kidney beans, maize, potatoes, onions, tomatoes, carrots and sometimes meat. Although makande was not made often, as the quantity cooked was not always sufficient for the entire family. The method of preparation of a vegetable played a major role in it being accepted or dislikes, just as one respondent summed it up, "Some people are born bad cooks and some are born good cooks"(mother, 25 years).

Discussion

The primary purpose of a home garden is household consumption also leading to a reduction in the amount of money spent on purchasing vegetables or fruits for the household[6,51,61]. The close proximity resulting in easy accessibility, allows women easy access to vegetables and contributes to an increase in vegetable consumption in the household[61,62]. After meeting household consumption requirements, home gardens can also be an income source, and can help to fulfil other household needs and requirements[6,16,22,54]. As observed in our FGD, the women usually sell the vegetables, providing them with a small income source and thus an opportunity to participate in the decision making process of the household. Studies show that given an opportunity to take part in the household decision making, women tend to invest better in the health and well-being of the family and it is a way of empowering them[7,10,14,54,63]. Selecting vegetables to be cultivated in home garden depends on many factors like; consumption preferences of the household, market value, crops which survive the harsh environmental conditions and perishability and price. These factors are observed especially among those with a lower socio economic status[61]. We observed that respondents focused more on their personal preferences and dislikes as against the perishability or price of the crop. Price played a

role only when some respondents chose to cultivate kale and Chinese cabbage, as these could fetch up to 600 Tanzanian Shillings per 500 gm in the market. Other factors like taste, smell, quality and appeal as reported in the FGD, were in accordance with studies, which show that non-economic factors like familiarity, sensory appeal, personal and food ideology were other important factors which contribute to the likes and dislikes of a vegetable and thus play a role in the selection process of vegetables to be cultivated[52,61,64]. Palatability and method of preparation of a vegetable were also crucial in the acceptance of a vegetable[61,64]. Potatoes, cassava and cocoyam were selected to be grown as they were liked and well accepted, a cheap source of energy and easy to cook[61,65]. Apart from the selection of vegetables, home gardens require basic inputs like space, time, water, seeds and minimal financial resources, many of which were barriers reported by respondents. An easy access to inputs like seeds, fertilizer and pesticide among others is crucial to the sustainability and long term success of these gardens[1,22,61]. Research shows that small spaces are not necessarily a constraint, since an area of approximately 16m2, if well planned, can meet almost all of the vitamin C requirements and up to 40% of the calcium requirements of a household[56]. Secondly, fruit and vegetable cultivation can be labour and water intensive. Access to a regular water supply can be a challenge and most respondents stated that they tended to depend on rain[20,26,30,61]. Food availability depends a lot on aspects like rainfall modality, distinctness of seasons and dry periods[66]. Rainfall (very high and very low) plays a major role in determining food prices and availability[20] The dry period from December to April results in high prices of vegetable and fruit which are of poor quality. Taking all these factors into consideration there is a need for cultivating vegetables which are less labour intense and robust enough to survive the harsh conditions[20,22,26,30,61]. Another obstacle, is the lack of fencing which allows domestic animals to destroy the crops. Fencing a home garden can be expensive and so most people choose not to fence[1,61,67]. To overcome this barrier, locally available material could be used to build a fence around the home garden[67]. Storage space and equipment can be a hindrance for families with a larger plot of land, this usually results in families deciding to grow enough only for their own consumption, helping to ensure regular and an increase in the intake of fruit and vegetable[61]. According to the Tanzania Demographic and Health Survey, in 2010, 35% of women were anaemic, 40% vitamin A deficient while 41% of children were deficient in iron[68]. This increase in the consumption of fruits and vegetables could be one strategy in helping to alleviate micronutrient deficiencies, which is a major problem in most

developing countries[69–71]. Time is another limitation reported by the women since homestead food production is their responsibility along with other household activities like cooking for the family, taking care of the children and looking after the sick[14,20,26,44]. So, apart from devoting time to the household activities the women have to dedicate a certain amount of time to home garden activities[1,14,29]. In traditional societies, cultural values have a major impact on food choices among other aspects and thus can have an impact on health[15,54,70]. FGD revealed that lactating women were not fed certain foods, due to the perceived harm it is thought to have on both mother and child[61]. Studies show that cultural beliefs sometimes interfere with nutrition and micronutrient intake at a susceptible period like pregnancy and lactation[1,61]. For the body to function properly it is essential to consume a variety of foods, especially in poor countries, where a diversified diet would help the community improve its micronutrient status[15,69,72]. In our study, women reported fruit and vegetable consumption to be important and they were able to associate the yellow orange colour and dark green leafy vegetables to vitamin A and iron respectively and could also name sources of the respective nutrients. These changes reported, post NE sessions, could be linked to the NE component which usually targets women and often focuses on vitamin A and iron[44,62,73]. Suggestions like addition of lemon juice to improve iron absorption and avoiding consumption of tea or coffee with meals proposed in NE sessions were being accepted slowly by the respondents[15,44,62]. However, in some cases, cultural practices, did not allow for changes to be made and accepted. In Tanzania, it is common practice for the families to eat from the same plate or bowl[74]. It was suggested that small children be given their own bowl to ensure that they get an adequate share of the food[26]. Respondents were resistant to change this practice and did not accept this recommendation. They stated eating from the same plate/bowl as being part of their culture and dividing a small portion of food into several servings was harder. The women found it easier when everyone including children ate from the same plate.

Conclusion

The FGD and simulation game activities, reveal that despite the challenges families continued practising home gardening due to its many advantages, the main being household food consumption. In urban areas, where the lower socio-economic households find it difficult to meet their daily needs due to financial constraints, home gardens can help bridge this gap. Cultivating

a home garden requires planning and minimal inputs to overcome the challenges and ensure that all household consumption needs will be met. Since home gardens are under the care of the women, they have to divide their time between household activities and tending to the garden, hence vegetables/crops which require little maintenance are preferred. NE sessions were observed to be beneficial, as some changes were accepted and put into practice though some of them were not. The FGD gives us a deeper understanding into factors which support and hinder the changes made by the families. FGD supports and also helps us better understand the changes in the quantitative data. The quantitative research supports qualitative research findings and vice versa. We observed a positive trend in knowledge scores of participants and in the FGD, changes from baseline to endline show that women had implemented many of the suggestions and recommendations made during the NE sessions. FGD helped us understand the reasons why some suggestions made during NE sessions could not be realized. Recently, the use of mixed methods as a research technique is increasing, as compared to, either doing only quantitative or qualitative research. There are not many studies which employ mixed methods to study the relation between nutrition education and home gardening in Tanzania. This study aimed to assess the effect of the nutrition education on families with home gardens, by using a convergent parallel mixed method approach. While we observed small improvements in knowledge scores, it is equally important to understand the challenges faced by families in trying to make or adapt to changes. Results from the convergent parallel mixed method approach adds to the literature in this field of study which will help in designing future research studies and also culturally acceptable nutrition education sessions, which can then be incorporated in public health plans and strategies.

Acknowledgements

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3.3 Additional Results and Discussion

Household Dietary Diversity Score

Houseold Dietary Diversity Score (HDDS) reflects the economic ability of a HH to access a variety of foods[31]. HDDS has not been approved to estimate micronutrient or diet quality, but is used only as a proxy to estimate HH accessibility to food[31,75]. The paired samples T-test showed a small difference between HDDS at baseline and endline (P=0.021, t (35) = 2.41) indicating a small seasonal effect. At baseline mean HDDS was 7.0 (±0.8), while at endline it was 6.6 (±0.9). Repeated measures ANOVA with educational level of the respondent, monthly income of the HH at baseline and number of attended nutrition education sessions at endline as covariates did not show any effect on HDDS .

At baseline and endline, consumption of the food groups vegetable and cereal remained the same. Milk and milk product consumption was minimum at baseline and zero at endline. There was an increase in the consumption of legumes, nuts and seeds as well as fish and other seafood. Intake of fruit and meat reduced at endline. Differences in consumption, between the two time points can be seen in Fig 3.8.

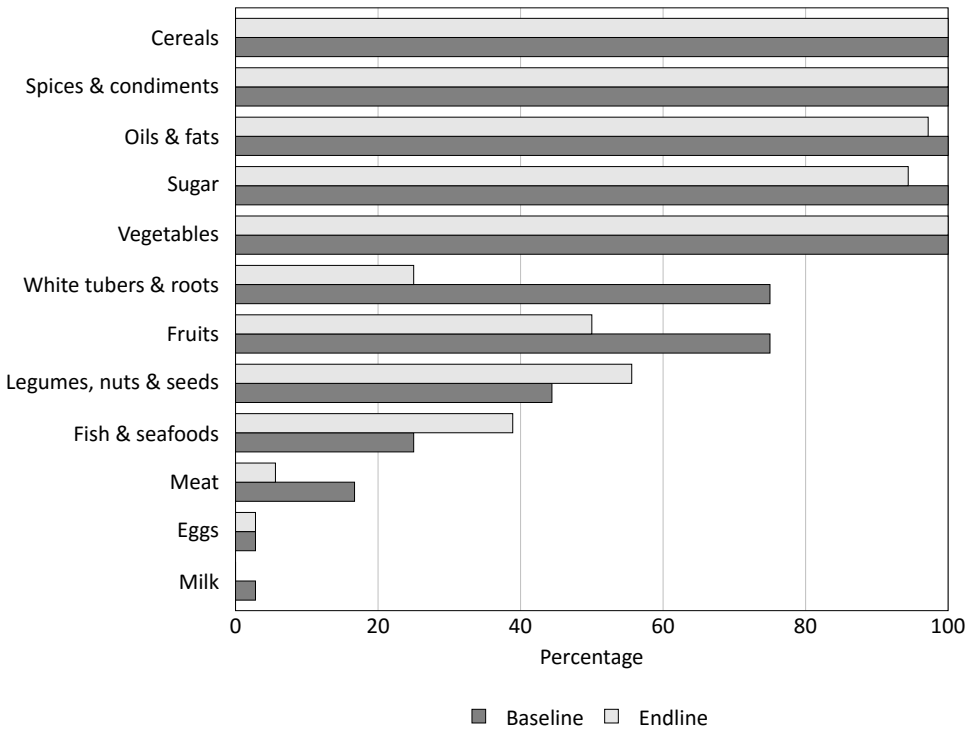

Figure 3.8: Household dietary diversity score

Vegetable Variety Score

Food frequency questionnaire (FFQ)is a simple and cost effective tool used to estimate how often a particular food is consumed in a week[76,77]. For our survey, we modified it to include only vegetables. To find out the variety in vegetables consumed by a household, a vegetable variety score (VVS) was created. VVS is a simple count of vegetables which have been consumed buy the HH over a period of one week. This frequency list consisted of twenty eight vegetables, including roots and tubers, other vegetables and dark green leafy vegetables. It included those vegetables cultivated in HG and purchased from markets. Respondents were asked the number of times they consumed a particular vegetable - daily, weekly, monthly or if they never consumed it.

The number of times a vegetable was consumed by the HH was counted and a weekly average was calculated. Onions and tomatoes were used as condiments daily in the preparation of all relishes, for this reason it was removed from the list while calculating VVS.

No difference was observed in VVS between baseline and endline. The mean at both time points was 23 while the median was 24 (Fig 3.9, 40). At baseline, the minimum VVS was 18 and maximum was 26 while at endline, it was 20 and 24 respectively.

There was no correlation seen between VVS and each of the two study areas, education level of the respondent or income level of the household.

Cluster Analysis of Food Groups

The semi-structured questionnaire, included a 24-hour dietary recall, collected for three days. During data collection, women from participating HH were unable to quantify the amount of food consumed by them individually, they could only quantify the total amount of food cooked, which presented us with the challenge of quantifying foods eaten by an individual. Also, the entire family consumed their meals from the same bowl as it is tradition and common practice, especially in countries like Tanzania[74]. For these reasons, the 24 hour dietary recall was collected for the entire household. From this recall, food groups frequently eaten were examined and cluster analysis was performed to determine food groups which are commonly consumed.

Thirty six HH were used for cluster analysis but to reach a stable cluster solution, one HH was an outlier and was removed from the analysis. Using the Ward method, a stable four cluster

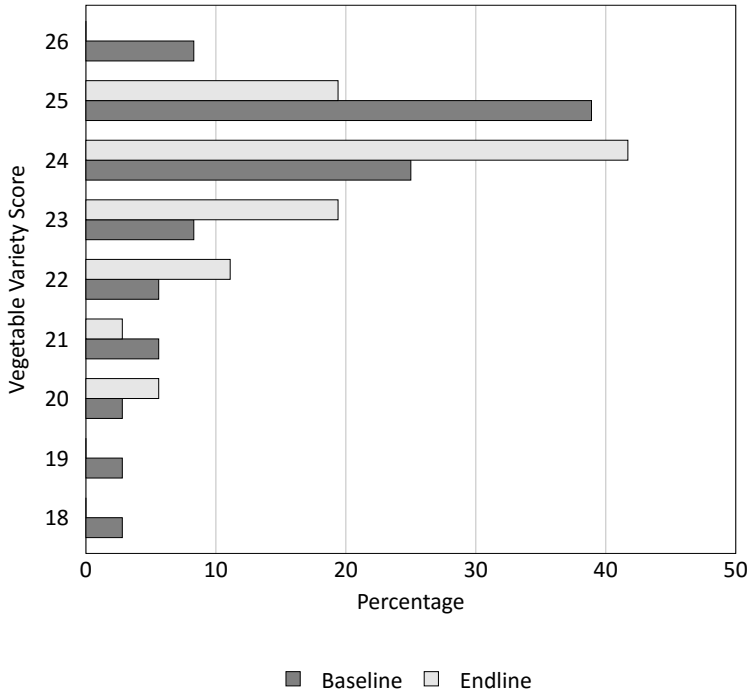

Figure 3.9: Vegetable variety score

solution was established for the remaining thirty five HH (3.1041). The four clusters are as follows:

- Cluster 1: Fruits + meat/fish/eggs + sugar - Meat & fruit group
- Cluster 2: Starchy staples + pulses - Carbohydrate group
- Cluster 3: Vegetable + fruits + oil - Vegetable group
- Cluster 4: Moderate group - Moderate group

The four clusters did not show significant associations with educational level of the respondent nor income level of the HH. Each HH was examined individually to observe if they had changed their cluster from baseline to endline. From the thirty five HH, twenty one were in different clusters as compared to baseline. They redistributed themselves from cluster 3 and 4 into cluster 1 and 2.

Correlation of Food Groups

According to Kolmogorov-Smirnov and Shapiro-Wilk tests for normality and distribution, food groups in these clusters were not normally distributed. To overcome this challenge, the food groups were first ranked. and then correlated. Some of the significant correlations were: Starchy

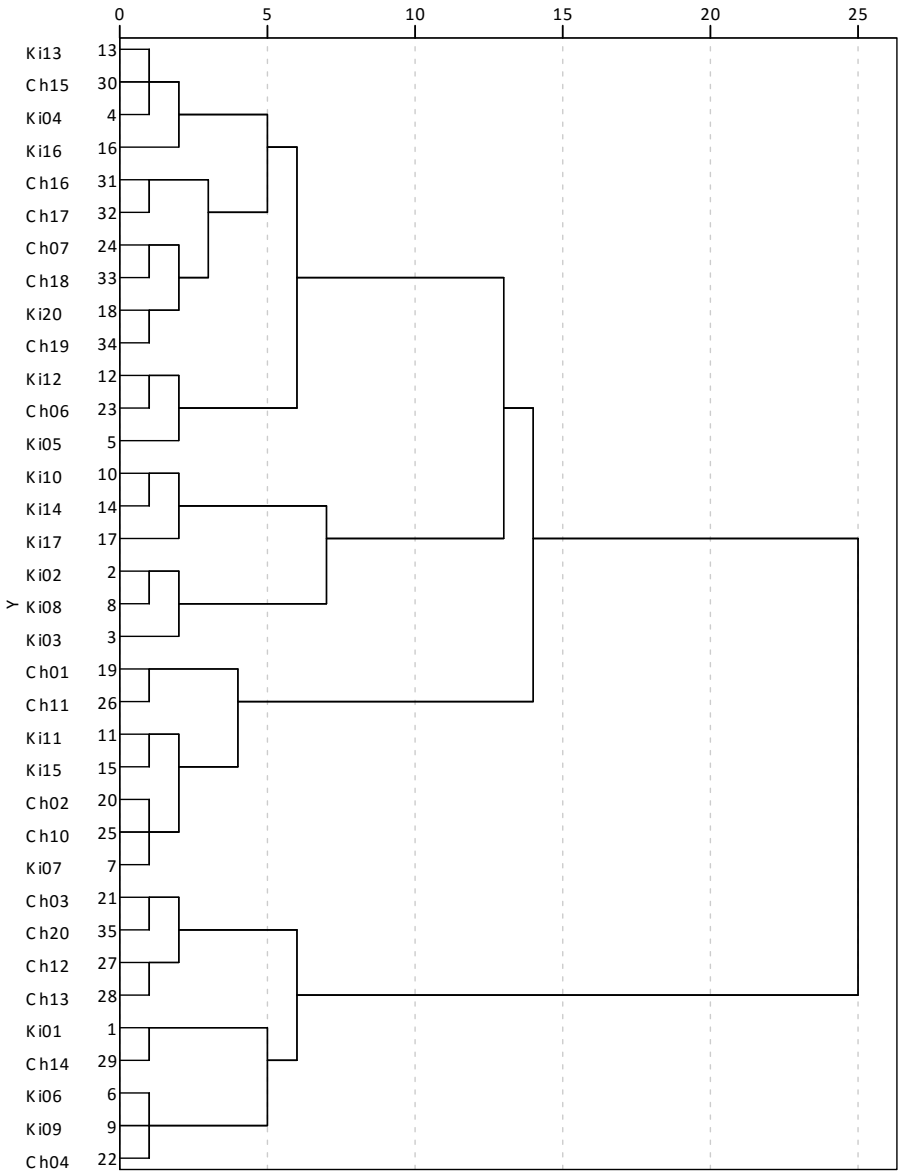

Figure 3.10: Clusters of households based on food groups

staples with meat/fish/eggs (*P*=0.048) and with sugar (*P*=0.002) Fruits correlated with meat/ fish/ eggs (*P*=0.00), vegetables (*P*=0.045) and with sugar (*P*=0.011) Meat/ fish/ eggs correlated with sugar (*P*=0.004) and with vegetables (*P*=0.018) Sugars correlated with fruits (*P*=0.011)

Chapter 4 | Conclusion

Home gardens are a small piece of land on which a HH cultivates fruits and vegetables, making it an important and meaningful part of the homestead[15,22,45]. In food insecure regions, they are a first access point of food for the HH[45]. Food access and availability are primary functions of a HG, thus helping make a HH food secure[6,78]. After fulfilling the fundamental functions, HG can be used to fulfill various other HH functions[7].

4.1 Household characteristics

Totally, women from 40 HH participated in the baseline survey and NE, but at endline there were only 36 families. Of the four families who could not participate, three had travelled to their respective home towns and one family had moved to Dar-es-Salaam. Hence, a cohort of 36 HH was used for analysis. General characteristics of HH are presented in detail in Table 3.215. The mean HH size was 5.4 (±1.8) members with participants having a mean age of 40 (±16.12) years (Minimum age was 19 years). Majority (72%) of respondents had some level of primary schooling and 35% were farmers by occupation.

In a week, mean amount of money spent by a HH on purchasing vegetables was 3825 Tanzanian Shillings (approximately = 1.73 USD, as of October 2013). HH food purchase decisions were made by women (55%) and the remainder indicated that those decisions were made by their husbands, grandmothers or eldest person in the HH. HH characteristics of our study, were similar to those done in developing countries and among HH with a low socio economic status, a low level of education and living in rural areas[13,25,30,35–37,79] Our aim was to understand if HH with similar characteristics but living in urban areas, could improve their nutrition knowledge via NE. In urban areas, HH have better access to health and other basic facilities[20]. Access to nutrition knowledge in urban areas is easier as compared to rural areas due to closeness and easy reach to health clinics and hospitals[80]. If a HH did or did not avail these facilities was not discussed in detail by us. Researchers show that improvement in nutrition knowledge leads to better nutritional outcomes[14,25,38,39].

Tanzania is a growing economy with an increasing number of people moving from rural to urban areas in search of better opportunities[20]. Basic amenities like water, sanitation, electricity and

health services are easily available and accessible in urban areas. HH in our study, though living in urban areas, did not have running water available in their own HH, they were required to fill and collect water from a communal tap, near the homestead. All houses extremely basic; small and simple, built of bricks with a tin roof and no electric wiring or toilet facilities. Even though these HH were in urban areas, we observed poor living conditions with no basic amenities.

4.2 Home Garden

In food insecure places, HG is a critical part of a HH providing a family with food security. HH in our study, grew a maximum number of seven plants at baseline and six at endline; with the minimum being one. Researchers in Nepal, observed that food secure HH were more inclined to have a HG in comparison to food insecure HH[45]. Such HH prefer to consume vegetables from their own HG first as compared to purchasing them from the market like food insecure HH do[45,81]. Women responded that "providing food for the family" (38%) and "supplementing or as a source of income" (50%), while the remaining 12% indicated other reasons as being main motivators for cultivating a HG. After fulfilling the fundamental function of ensuring food for a HH, many HH opted to sell excess produce and supplement the HH income[16]. This money was then used to purchase other HH necessities or pay children's school fees, as was also observed by us[4,14]. In developing countries, role of women is usually limited to looking after homestead and children, they do not have much influence on HH decisions, which was the same as what we observed[14,29]. Selling excess produce from the HG is done by women who then determine how this income is spent. It is a way in which women are empowered and can take part in decision making process of the HH.[14,29]. Women from the participating HH indicated that after selling the produce they had the authority to decide how the money would be used. When women are given the opportunity to be part of and influence HH decisions, they better invest in health and nutritional status of the HH[7,14,29,40] Evidence indicates that empowering women with nutritional knowledge and the ability to influence HH decisions results in better health and nutritional status of the HH[7,14,29,82].

4.3 Household Dietary Diversity Score

HDDS is a good proxy of the economic ability of a HH access to food. A non diversified diet, lacks in micronutrients and can lead to poor health[83]. Measuring dietary diversity can be a challenge occasionally, especially in rural communities or communities where eating food together from

(a) Example of Home Garden 1

(b) Example of Home Garden 2

Figure 4.1: Home Gardens

a bowl/plate is common[83]. We encountered similar challenges, of all family members eating from the same bowl. In such a case, HDDS helped us understand the diversity in food habits of a HH; in terms of the number of food groups eaten and thus we could estimate the qualitative value of the HH diet.

No single food can provide all vitamins and minerals required to sustain a healthy body, hence ensuring a varied diet is essential[72]. A HG can help in increasing and improving the diversity of foods available to a HH[13,38,84,85]. In our study, one of the NE sessions focused on HG and dietary diversity, where the main aim was to encourage and show participants ways in which they could improve dietary diversity using their own HG. An improvement in dietary diversity has been linked to positive health outcomes[51,84]. HH with HG had a higher dietary diversity in relation to those with no HG[4,12,81]. Interventions in Asia Pacific show that HH involved in Helen Keller Institute had an increase in number and variety of vegetables enhancing access and diversity in diets of HH members[30,86].

Seasonality is an important part of food availability, especially in developing countries, since the consequence of seasonal change may mean certain foods become unavailable. People have to adjust their diets, leading to a difference in dietary patterns and consequently a change in nutrient and energy intakes[83]. Researchers who conducted a study in the urban area in North Central Nigeria, found that seasonality was one of the factors which affected food consumption in HH[87]. In our study, we observed a small non significant change in the diets due to the season. At endline, as seen in Fig 3.8, the increase in fish and legume consumption could be a result of seasonal change. End of dry season and just prior to harvest is characterized by poor quality or

often very little vegetables being available to HH. In such cases, families tend to consume more starchy staples or when available opt to eat more fish[74,84]. Most HH choose not to consume milk, even in tea, due to financial constraints. Studies show that in developing countries diets are usually defined by starches with very little of meat, vegetables and fruits or milk and milk products being consumed[74].

Other factors which affect HDDS were education and NE. As co-variates in the ANOVA model, these two factors did not show any statistically significant difference on HDDS. Education plays a crucial role in achieving a favourable nutrition outcome[88]. Contrary to our findings, a study in South Africa showed that education positively correlated with a high dietary diversity[72]. In urban areas of North Central Nigeria a study showed that females had better nutritional knowledge scores than their male counterparts, which could be due to females being targeted during a training and so are made more aware of nutritional benefits of fruits and vegetables[14,82,87]. Using NE to improve dietary diversity via HG, a food based strategy, results in a higher chance of an improved nutritional status[9] In a review by Ruel and colleagues, when women were given training in nutritional knowledge and skills, there was a positive change in the nutritional status of HH[82]. Thus, factors like education, NE and seasonality influence HDDS of a HH.

4.4 Cluster Analysis

"Cluster analysis defines mutually exclusive clusters of individuals. Cluster analysis is based on distance measures between observations of individuals."[89]. To better understand cluster analysis in food and nutrition context, results need to be evaluated descriptively as is recommended by Schulze[89].

The semi-structured questionnaire, included a 24-hour dietary recall, collected for three days. During data collection, we faced the challenge of women, not being able to quantify the amount of food consumed by them, they were able to quantify only the total amount of food cooked. It was traditional for the entire family to eat from the same bowl/plate, which is common practice in countries like Tanzania[74]. For these reasons, 24-hour dietary recall was done for the entire household. Each HH was reviewed individually to examine if they changed their cluster from baseline to endline. From thirty five HH, twenty one were in different clusters as compared to baseline. They redistributed themselves from cluster 3 and 4 into cluster 1 and 2.

Cluster 1 and 2 were starchy staples and carbohydrate groups respectively. At the time of the

baseline survey, many families chose to rely mainly on carbohydrates and a small amount of vegetable or bean relish for their energy intake. The main reason being that a small quantity of starchy staples provided satiety. Considering that participating HH had a low socio economic status, quantities of food cooked were inadequate to ensure all members received a sufficient quantity. Consuming small amounts of staples provided energy to work and earn a living, which was a major motivating factor to cultivate starchy staples in their HG[61,84,90].

At baseline, majority of HH (thirteen out of thirty five) were in cluster 3, vegetable group. This shows that when HH had easy access and could afford they choose to consume vegetables. HG make access to vegetables and fruit easier, thus helping in increasing their consumption in a HH[91]. This is important in developing countries where intakes usually tend to be below the recommended 400g/day[52]. An increased intake of vegetables and fruits can also help in alleviating micronutrient deficiency problem, commonly seen among low socio economic HH in developing countries[34,51].

Studies have successfully shown an improvement in vitamin A status of HH members through increased consumption of vitamin A rich vegetables and fruits grown in their own HG[13,25,37,92]. HG can be helping in alleviating micronutrient deficiency via an enhanced intake of vegetables and fruits[7,93].

The last was Cluster 4, which included seven HH and was the moderate group. All food groups were consumed in moderate quantities, including meat, vegetable and fruits.

The clusters were correlated with income level of the HH and education level of the women, but no correlation was observed. HH access to food depends not only on physical access but also income level[65]. Another study showed that as income level of the HH increased there was an improvement in diversity of foods consumed, but there was also a shift from the complex carbohydrate fibre rich foods to an increase in sugars, meats and milk[64]. These observations differed with respect to our findings, since we did not observe any correlation or shift in dietary patterns.

At endline, some HH moved from cluster 3 and 4 into meat + fruit group (cluster 1) and carbodydrate group (cluster 2). The reason for this change could be seasonality. The endline survey was conducted in May-June, which was end of the dry season and just prior to harvest. During this time period, most HH tended to rely on starchy staples and some leafy vegetables like sweet potato leaves, amaranth and indigenous leafy vegetables which were robust enough to survive

the harsh environmental conditions. These findings are in alignment with the observations in our study. Seasonality plays an important role in price, availability and eventually consumption of vegetables[51,90]. Usually, indigenous vegetables are those which grow best during off-season as they can grow year round and survive the high temperatures and humidity[51,90] As compared to purchasing poor quality vegetables which are expensive during the dry season, most HH preferred to purchase and consume sardines or small fish, which were relatively cheap. A study in Bangladesh found that during a "vegetable-scarce" period, low-income HH preferred to consume more fish, which was cheap and easily available as a source of micronutrients[84].

4.5 Correlations between Food Groups

Pearson's correlations between food groups showed that starchy staples positively correlated with meat and sugars. We observed that starchy staples formed the main portion or basis of a meal and relish was a small amount of green leafy vegetables, beans or meat/fish stew. Correlation of starchy staples with sugars could be due to quantity of sugar added in tea taken along with meals or the amount of sugar present in starches itself. A study in Tanzania showed that the amount of starchy staples prepared was greater in quantity as compared to relish and that carbohydrates played a notable role in diets of Tanzanian people[74].

Meats correlated with fruits, vegetables and sugars, indicating that some HH along with meat also included more fruits and vegetables in their diets. The sugar content and correlation could be due to sugar added in tea or natural sugars present in fruits. The 24-hour dietary recall showed that meat was cooked together with vegetables, like a stew and served with a staple like ugali (Stiff maize porridge) or rice or potatoes. In urban areas, meats and fish were consumed more often as compared to in rural areas and especially during the dry season when vegetables and fruits were more expensive and of a poor quality[74,84].

As we observe that sugar correlated with starchy staples and meats, it is essential to explain that in Tanzania tea is a prominent "food" or snack in Tanzania, especially in poor HH where the quantity of food cooked may not suffice the entire HH. It is also commonly taken along with meals and quantity of sugar in tea was seen to be higher in urban as compared to rural areas[74]. This could be a possible explanation of the high quantities of sugars consumed in HH and correlations with other food groups.

4.6 Knowledge Scores

At baseline and endline, women were asked questions to estimate their level of knowledge with regard to importance of vegetables and fruits. At endline eleven respondents indicated vegetable consumption was important as against four at baseline. Ten women said that fruit consumption was important as compared with four at baseline. An improvement in nutrition knowledge of women was observed at endline, although this improvement was not statistically significant. In developing countries, a woman's role is usually limited to looking after the HH, sick, elderly and children[4,7,14,40]. Considering they are the main caretakers of the HH, most NE programs target women since it is seen that when women have the opportunity to participate in nutrition education trainings, there is an improvement in nutritional status of the HH[14,37,42–44,82,85]. Even though, we did not observe statistically significant changes, the slight improvement as evidenced by the difference in estimated marginal means indicates that there is a general tendency towards improvement in knowledge scores.

Studies show a significant improvement in the nutritional knowledge score among women attending a NE program and having HG[37,45]. The success of these interventions could be due to NE sessions being conducted for longer and with a demonstration HG plot.

No clear trend could be detected since some participants increased their scores, some lowered and some remained the same. Scores were examined individually to understand if a trend could be observed, but no trend was seen; only that the number of positive scores was higher at endline as compared with baseline. To better understand these changes, we grouped the composite knowledge scores into categories: low, medium and high. For both nutrients, vitamin A and iron, there was an improvement in the medium category, as is seen in Fig 3.3 and Fig. 3.4. To further understand a change in scores, each component was analysed individually, here again no clear trend was detected, but there was an increase in the number of participants who knew or had heard about vitamin A and iron. This increase was more evident for vitamin A as compared to iron. The main reason could be that many studies usually focus on vitamin A as compared to iron thus leading to a better awareness of vitamin A[4,13,37,44,46,69,74]. Reasons why those nutrients were important resulted in mixed responses from participants, some answered correctly and some incorrectly, no clear direction was observed. Foods rich in the respective nutrients were answered better at endline as compared with the initial survey. A study in Tanzania shows mothers being able to answer foods rich in vitamin A more easily as compared

with iron[80]. Most mothers have more exposure to vitamin A as compared to iron; HH is the main responsibility of women and a large number of programs which aim at educating women and promote vitamin A rather than iron[12]. Being able to answer foods rich in a particular nutrient shows an improvement in practical knowledge, which some studies show is better and more important rather than just an improvement in theoretical knowledge[24,48]. In summary, education level of the participant is a factor which needs to be considered since education does have a bearing on understanding and awareness and also helps in improving the practical knowledge.

It is also necessary to make note of those respondents who reduced their scores along with those who improved. Participants not knowing or having heard of vitamin A and iron, were scored a zero, those who answered reasons of importance and food rich in the nutrients wrong were given a negative marking, which consequently meant in a reduced score. Some respondents wanted to complete the interview and get to work or go to their field while some randomly answered wrong and some could not remember the correct answers at all. All these aspects consequently result in negative marking and a reduced score.

4.7 Qualitative Observations

FGD and a simulation game were conducted to collect qualitative data. Women from all participating HH were invited to be part of discussions and simulation game. Main advantages of a HG, as stated by our study group participants were food security, easy access to fruits and vegetables and HG being an income source leading to reduced expenses. Studies show the primary purpose of a HG is ensuring HH food consumption leading to a reduction in the amount of money spent by the HH on purchasing food[6,51,82]. Easy access to HG allows women to easily avail of fresh vegetable to prepare for HH meals[61,62]. They do not need to spend extra time or money purchasing vegetables to prepare for mealtimes. Quick access to a HG also leads to a HH increasing its intake of vegetables and fruits[61,62]. HH elect to use their own produce first, making HG an economically viable option. After all HH members have consumed food, excess produce can then be sold[6,16]. This is done by women as was observed by us and in other studies[4,14,51,63]. A simple activity like selling extra produce helps in making women independent by giving her the capability of earning income which she can choose to spend as she wishes[14]. Women tend to invest in improving health and nutritional status of HH members[4,14,29]. HG

is a woman's responsibilities as it is considered a part of the HH. Women were expected to take care of the HH, cook and take care of children and elderly[14,20,26,44]. Time was a constraint reported by women during FGD, devoting time for working in HG was a challenge[1]. At endline, most women indicated that even though they needed to devote extra time to HG, they were more inclined to it because of the benefits. Choosing vegetables to cultivate in HG were mainly dependent on family's preferences and dislikes though at endline, nutritional importance of vegetable and/or fruit was also considered. For HH with low socio economic status; consumption preferences, market value and those crops which could survive the harsh environmental conditions, price and perishability played a greater role than nutritional value[61]. We observed that respondents gave priority to their preferences as against perishability or price. These two factors were considered for green leafy vegetables like kale and Chinese cabbage which could be sold for approximately 600 Tanzanian Shillings (approximately = 0.27 USD, as in November 2013). Non economic, sensory factors like taste and smell are in agreement with other studies which show that food ideology, familiarity, taste and smell all contribute to likes and dislikes of a vegetable and thus play a role in selection process[52,61]. Women stated that method of preparation was also an important factor which eventually affected the likes and dislikes of a vegetable. These were in accordance with studies which show that palatability and cooking methods were crucial determinants in acceptability[52,64]. Hence, potatoes, cassava and cocoyam were often chosen to be cultivated in HG, since they fulfilled all requirements along with being able to be stored for long and withstanding the severe weather conditions, apart from it also being a well accepted and liked cheap source of energy and easy to cook[61].

Space, time, water, seeds and minimal financial inputs were listed as basic necessities for a HG, but these were listed as the main barriers by respondents in our study. Ensuring a HH can access these facilites as and when required is crucial to the sustainability and long term success of gardens[1,61]. A small space (approximately 16m^2) if well planned can help contribute up to 40% of a HH calcium and almost all of vitamin C requirements[20]. Ensuring a regular water supply for a HG is important in sustainability[82]. Cultivating vegetables and fruits can be demanding in terms of labour and water, since most respondents stated that a regular water supply was a challenge they usually depended on rains. Availability of food depends a lot on dryness or wetness of seasons, and rainfall modalities; very high or low rains affects crops and plays a role in perishability and price[20,66]. During the dry period from December to April, poor quality

vegetables are available and this leads to an increase in the prices. Taking all these factors into consideration, it is essential to have less labour demanding and robust varieties of vegetables which will survive the harsh conditions[20,26,30,61]. Indigenous vegetables grow best and are also easier to cultivate, as they are well adapted to the environmental and climatic condition[63]. The other common challenge faced was that of freely grazing domestic animals. None of the HG in study area had a fence. Most HH do not fence their gardens since purchasing material for fencing is expensive[1,61]. A study in Guatemala showed that HH protected their gardens by planting seeds in elevated wooden beds or they surrounded young crops with spiny orange tree twigs or small stones or rocks[67]. HH included in our study cultivated enough to meet HH consumption, some women said that if they had a bigger space they would cultivate more crops and store them if possible[61]. Increased cultivation of vegetables and fruits would lead to the HH increasing their consumption of fruits and vegetables, helping to mitigate micronutrient deficiencies[69,70]. Food related taboos were discussed and women said that in a traditional society like theirs; food related taboos and cultural values play a big role in influencing food choices and in turn health[15,70]. Foods like African eggplant were not fed to a lactating women because of the perceived harm to mother and child[61]. During pregnancy a women requires a higher amount of nutrients and food taboos and cultural beliefs can interfere with food intake at such times, as is often seen in traditional and cultural societies[1,61].

Chapter 5 | Limitations and Recommendations

The main findings are presented in the two papers, highlighted below along with recommendations, forming the main structure of this thesis. In our study, we assessed the effect of NE on families with HG to improve their diet quality via HG and attempt to understand factors which foster and hinder families in making changes to their diet.

For several reasons, this study faced restrictions which prevented us from being able to apply the strengths which contributed to the success of NE in other studies. Different studies differed in their approaches like combining NE with a HG demonstration plot, child growth monitoring, monthly NE sessions, conducting NE for a longer period of time or having "nutrition monitors". Some studies focused only on vitamin A rich fruits and vegetables, which could be another advantage[44,49]. Focusing on only one type of nutrient could be viewed as an advantage since participants have to focus only on learning the importance of one nutrient and those foods associated with it. This strategy encourages better retention of knowledge but may not necessarily promote dietary diversity. Conducting NE regularly over a longer time period promotes a better recall of knowledge and encourages exchange of ideas and thoughts among participants. In our study, due to a small sample size there could have been a reduced power of knowledge scores and absence of a control group was another shortcoming. A large sample size could have resulted in a higher power of knowledge scores and a significant difference in the statistical analysis. There are no particular standards set for the number of NE sessions, how long they should be and other details in order to maintain progress. To show a statistically significant result with the same study design as ours, a sample size of 300 is required[50]. For future studies and as has been suggested, we recommend an adequately calculated sample size and a control group along with interactive NE sessions[29].

We also suggest appointing "Nutrition monitors" to support and encourage women in making better nutrition choices. They can be appointed together in consultation with other participants. Selecting "nutrition monitors" from among peers, ensures that participants are comfortable enough to ask questions to their peers. These "monitors" are those individuals who have improved their knowledge scores and are active in the community.

A mixed method approach, allows for better understanding of obstacles and supporting factors

of changes that can and cannot be made by respondents. FGD and simulation games, like in our study, supported interpretation of the quantitative data. FGD conducted prior to the NE sessions helped in creating a bond between respondents which allowed for a better interaction and more participation during NE sessions. The simulation game was well accepted and encouraged women in being more aware while preparing or purchasing food. At endline, the FGD and simulation game revealed that women had an improved nutritional knowledge and made more informed and better choices all of which are directed towards improving dietary diversity, better diet quality and at the end leading a healthier life.

A HG also helps in encouraging and promoting use of locally grown foods. This is not only an economically viable option but also aids in strengthening local agrobio-diversity. This way also ensures that HG inputs are kept to a minimum and crops robust enough to thrive the rough environmental conditions and give produce all year round are cultivated. NE can help families make more informed and aware choices, be it in selection of crop or food preparation. Thus, HG linked with NE could be a way in which even low socio economic HH can improve their diet quality and eventually their nutritional status.

To get a comprehensive picture of all factors which enable and hinder behaviour changes and improvement in knowledge we suggest a combination of qualitative and quantitative data. This helps us to understand the finer details and eventually develop better NE strategies. Providing families who already have a HG with NE will encourage them to sustain practising home gardening and enable them to improve their nutritional status.

Combining NE with other agricultural strategies like HG is observed to be beneficial to HH and it would be advantageous to include and incorporate NE in public health programs.

Summary

This study was conducted in the urban areas of Morogoro, Tanzania, among households with a low socio-economic status owning a home garden. The objective was to assess the effect of nutrition education on nutritional knowledge among participants and to improve the household dietary diversity.

The study was designed as two cross sectional surveys with an intervention period in between the two surveys. Two wards within the Morogoro municipality were included, namely, Kichangani and Chamwino. These wards were selected in consultation with the Department of Food Science and Technology of the Sokoine University of Agriculture based on inclusion criteria of the study. The inclusion criteria were: (1) households residing in urban areas, (2) having a home garden primarily for household consumption purposes, (3) with a low socio-economic status, defined as an annual income of 150,000-200,000 Tanzanian Shillings. A total of 40 households (20 each) were randomly selected from household lists provided by Ward Extension Officers. The study targeted all women (minimum age 19 years) from the selected households.

The baseline nutrition survey was undertaken in October-November 2013 and endline in May-June 2014. Three interactive nutrition education sessions were conducted with women from the participating households in December 2013. These sessions covered main topics of home gardens and dietary diversity, importance of vitamins (focus on vitamin A) and iron as a micronutrient. A questionnaire was used to collect quantitative data on socio-economic characteristics of households, home garden details and nutrition knowledge of the women. Nutritional knowledge was assessed by a set of questions on importance of consuming fruits, vegetables, vitamin A and iron. To gather qualitative data, focus group discussions and a simulation game were also conducted as part of the baseline and endline surveys. In the simulation game, a participatory rural appraisal technique, women purchased seeds with play money and cultivated a home garden on a 6x6m plot drawn on paper and then prepared a meal from the crops. These activities helped to understand their level of nutritional knowledge, their food habits, preparation and consumption practices and obtain more information related to home gardens.

Statistical analysis included data of participants with complete data sets. To assess nutrition knowledge, knowledge scores were created related to questions on importance of fruit and vegetable consumption, vitamin A and iron. The effect of nutrition education on nutrition knowledge was evaluated using ANOVA, including education level of respondents, income of household and number of attended nutrition education sessions, as covariates in the model. To determine the change in dietary diversity of households, the Household Dietary Diversity Score (HDDS), with 12 food groups, was calculated. Changes in HDDS were evaluated using ANOVA along with income, educational level of respondents and number of attended nutrition education sessions as covariates in the model.

Descriptive statistics from baseline showed that the mean household size was 5.4 (±1.8) members and mean age of respondents was 40 (±16.12) years. Most of the respondents (72.5%) had completed primary schooling and 35% of all respondents were farmers. The majority of women (55%) made household food purchase decisions themselves while the remaining reported that the husband or grandmother were decision makers. At baseline, mean weekly expenditure on vegetables was 3825 Tanzanian Shillings (approximately 1.70 USD) and at endline, 4606 Tanzanian Shillings (approximately 2.18 USD).

The number of crops cultivated ranged from one to seven. Sweet potato leaves, cassava, cocoyams, amaranth and Chinese cabbage were among crops cultivated. These crops are well accepted in the area and can withstand harsh environment alongside the indigenous plants. Quantitative and qualitative data revealed the main motivations to start cultivating a home garden were “need to provide vegetables to the family” and “as a source of income”.

No statistically significant effect on nutrition knowledge of women was observed. Individual components of knowledge scores were examined to detect if scores were moving in a positive or negative direction, but no clear trend was seen. However, estimated marginal means for vitamin A and iron knowledge scores showed an improvement. The knowledge scores for vitamin A and iron were further grouped into categories of low (0-2), medium (3-6) and high (7-8) scores. The medium score category in vitamin A showed more improvements as compared to iron.

ANOVA results showed that HDDS was not influenced by either income or educational level. At baseline, which was conducted at the beginning of the dry season, mean HDDS was 2.32

(±3.3). At endline, which was at the end of the dry season and just prior to harvest, mean HDDS was 2.24 (±3.1) and, significantly lower (paired samples t-test,P=0.021, t (35) = 2.41). During endline, most households felt that access to vegetables was difficult, which was reflected by the lower HDDS.

In the current study, change in seasons was seen to have an effect on food choices made by families. Starchy staples like maize flour, cassava, cocoyams; formed the main component of a meal and were usually eaten with a relish made of green leafy vegetables, other vegetables or beans. At endline, the relish was often made with small fish since they were easily available and cheaper. Further, vegetables in markets were not fresh, dried out and generally of a poor quality and women said that these vegetables were more expensive since it was just prior to harvest. Hence they preferred purchasing small fish.

Women were responsible for maintaining household's home gardens. They had to devote part of their time to maintaining the gardens and occasionally received help from children or other family members. According to focus group discussions and the simulation game, with women, perceived challenges to grow different foods and improve their home gardens were lack of space, water, and financial resources to purchase seeds or fertilizer as well as time. Despite all the above mentioned challenges, they indicated that continuing with home gardening, as they have always been practising, was beneficial for the household. The simulation game, at endline, indicated that women made more nutritionally informed choices while selecting foods. Other studies have shown that home gardens in combination with nutrition education can improve dietary quality, food habits and preparation practices.

In conclusion, in the current setting nutrition education had no statistical significant effect on nutrition knowledge among women. However, knowledge scores in the medium score range tended to improve. Further, dietary quality did not improve and was rather influenced by seasonality. An effect of nutrition education in a setting where households own a home garden may be improved with the following additions: a demonstration home garden plot, appointing nutrition monitors, longer education periods, using locally accepted foods, identifying locally available nutritious foods during all seasons.

Zusammenfassung

Die vorliegende Studie wurde in den Stadtgebieten Morogoros in Tansania unter Haushalten mit niedrigem sozioökonomischen Status, die in Besitz eines Gartens waren, durchgeführt. Die Studie hatte zum Ziel, den Effekt einer Ernährungsbildung auf das Ernährungswissen der Teilnehmer zu messen und die Ernährungsdiversität der Haushalte zu verbessern.

Die Studie wurde als zwei Querschittserhebungen mit einer Interventionsphase zwischen den Erhebungen konzipiert. Die Erhebung und die Intervention fanden in den zwei Stadtbezirken, Kichangani and Chamwino, innerhalb der Morogoro Gemeinde statt. Diese Bezirke wurden basierend auf den Einschlusskriterien der Studie in Absprache mit dem Institut für Lebensmittelwissenschaften und -technologie der Landwirtschaftlichen Universität von Sokoine ausgewählt. Die Einschlusskriterien waren: (1) Haushalte, die in Stadtgebieten leben; (2) einen Garten hauptsächlich zum Zweck der Selbstversorgung haben, (3) mit einem niedrigen sozioökonomischen Status, hierbei definiert als ein jährliches Einkommen von 150 000-200 000 Tansania-Schilling. Insgesamt wurden 40 Haushalte (20 in jedem Bezirk) von Haushaltslisten, die von Bezirksbeamten bereitgestellt wurden, zufällig ausgewählt. Die Zielgruppe innerhalb der ausgewählten Haushalte beinhaltete alle Frauen (Mindestalter 19 Jahre).

Die Baseline Ernährungserhebung wurde im Oktober und November 2013 und die Abschlusserhebung im Mai und Juni 2014 durchgeführt. Drei interaktive Ernährungsbildungsveranstaltungen mit Frauen der teilnehmenden Haushalte fanden im Dezember 2013 statt. Bei diesen Veranstaltungen wurden Schwerpunktthemen wie Gärten und Ernährungsdiversität, die Bedeutung von Vitaminen (mit Fokus auf Vitamin A) und Eisen als Mikronährstoff behandelt. Ein standardisierter Fragebogen wurde genutzt, um quantitative Daten bezüglich sozioökonomischer Merkmale der Haushalte, Einzelheiten über die Gärten und das Ernährungswissen der Frauen zu sammeln. Ernährungswissen wurde anhand eines Fragenkatalogs bezüglich des Stellenwerts des Konsums von Obst, Gemüse, Vitamin A und Eisen beurteilt. Um qualitative Daten zu sammeln wurden Fokusgruppendiskussionen und ein Planspiel als Teil der Baseline und Abschlusserhebung durchgeführt. In dem Planspiel, eine Participatory Rural Appraisal Methode, erwarben Frauen Saatgut mit bereitgestelltem Spielgeld, erstellten damit einen Garten auf ei-

nem 6x6 Meter Grundstück auf Papier und bereiteten eine Mahlzeit aus den Ernten zu. Die Fokusgruppendiskussionen und Planspiele dienten dazu einen besseren Einblick bezüglich Ernährungswissensstand, Nahrungsgewohnheiten und Zubereitungs und Konsummethoden zu gewinnen, sowie mehr Informationen über Gärten zu erhalten.

Zur statistischen Analyse wurden ausschließlich Daten von Teilnehmern mit vollständigen Datensätzen herangezogen. Zur Erfassung des Ernährungswissens wurden Fragen zum Stellenwert von Obst und Gemüsekonsum, Vitamin A und Eisen gestellt. Hierzu wurde eine Wissens-Punktskala erstellt. Die Auswirkung der Ernährungsbildung auf das Ernährungswissen wurde mittels einer ANOVA untersucht. Als Kovariaten wurden das Bildungsniveau der Befragten, das Haushaltseinkommen und die Anzahl der Ernährungsbildungsveranstaltungen mit einbezogen. Um eine Veränderung der Ernährungsdiversität der Haushalte festzustellen wurde der Household Dietary Diversity Score (HDDS) mit zwölf Lebensmittelgruppen berechnet. Veränderungen des HDDS wurden mittels ANOVA ausgewertet. Als Kovariaten wurden das Bildungsniveau der Befragten und die Anzahl der besuchten Ernährungsbildungsveranstaltungen berücksichtigt.

Die deskriptive Statistik der Baseline Erhebung zeigte, dass die durchschnittliche Haushaltsgröße bei 5,4 (±1,8) Mitgliedern lag und dass das durchschnittliche Alter der Befragten 40 (±16,12) Jahre war. Die Meisten der Befragten (72,5%) hatten die Grundschule abgeschlossen und 35% der Befragten waren Bauern. Die Mehrheit der Frauen (55%) entschied selbstständig über Lebensmitteleinkäufe für den Haushalt, während die restlichen den Ehemann oder die Großmutter als Entscheidungsträger angaben. Zur Zeit der Baseline Erhebung belief sich die durchschnittliche wöchentliche Ausgabe für Gemüse auf 3825 Tansania-Schilling (etwa 1,70 USD). Bei der Abschlusserhebung lag die Ausgabe bei 4606 Tansania-Schilling (etwa 2,18 USD).

Die Anzahl angebauter Feldfrüchte variierte von eins bis sieben. Darunter waren Blätter der Süßkartoffel, Kassava, Yams, Blätter des Amarants und Chinakohl. Diese Lebensmittel sind in der Region allgemein akzeptiert und können, neben den einheimischen Pflanzen, die raue Umgebung tolerieren. Quantitative und qualitative Daten ergaben folgende Gründe für die Motivation einen Garten zu bewirtschaften „es ist nötig die Familie mit Gemüse zu versorgen“ und „es ist eine Einkommensquelle“.

In der Abschlusserhebung wurde keine statistisch signifikante Auswirkung auf das Ernährungs-

wissen der Frauen beobachtet. Einzelne Komponenten der Wissens-Punktskala wurden untersucht um festzustellen, ob sich die Punktskalen in eine positive oder negative Richtung bewegten. Es konnte jedoch keine klare Tendenz aufgezeigt werden. Allerdings zeigten die geschätzten Randmittelwerte der Vitamin A und Eisen Punkteskalen eine Verbesserung. Die Skalen für Vitamin A und Eisen wurden zusätzlich in die Kategorien niedrig (0-2), mittel (3-6) und hoch (7-8) gruppiert. Die mittlere Kategorie für Vitamin A wies im Vergleich zu Eisen eine höhere Verbesserung auf.

Die Ergebnisse der ANOVA zeigten, dass HDDS weder vom Einkommen noch vom Bildungsniveau beeinflusst wurde. Zur Zeit der Baseline Erhebung, die zu Beginn der Trockenzeit durchgeführt wurde, lag der durchschnittliche HDDS bei 2,32 (±3,3). Bei der Abschlusserhebung, die am Ende der Trockenzeit und kurz vor der Erntezeit stattfand, betrug der durchschnittliche HDDS 2,24 (±3,1) und war signifikant niedriger (t-Test für verbundene Stichproben, (P=0,021), t(35)=2,41; r=6,38). Während der Abschlusserhebung empfanden die meisten Haushalte den Zugang zu Gemüse als schwierig, dies spiegelte sich in dem leicht niedrigeren HDDS wider.

In der vorliegenden Studie konnte beobachtet werden, dass ein Wechsel der Jahreszeiten Auswirkungen auf die Lebensmittelauswahl der Familien hatte. Stärkehaltige Nahrungsmittel wie Maismehl, Kassava und Yams bildeten den Hauptbestandteil einer Mahlzeit und wurden für gewöhnlich mit einer Soße aus grünblättrigem Gemüse, anderem Gemüse oder Bohnen gegessen. Zur Zeit der Abschlusserhebung wurde die Soße oft aus kleinen Fischen zubereitet, da diese leicht verfügbar und günstig waren. Außerdem war zu dieser Zeit Gemüse vom Markt nicht frisch, ausgetrocknet und generell von schlechter Qualität. Die Frauen berichteten, Gemüse sei teurer, da die Erntezeit kurz bevor stand. Daher kauften sie die kleinen Fische.

Innerhalb des Haushaltes, waren es die Frauen, die für die Instandhaltung der Gärten verantwortlich waren. Dafür mussten sie einen Teil ihrer Zeit aufwenden und erhielten gelegentlich Hilfe von ihren Kindern oder anderen Familienmitgliedern. Laut den Fokusgruppendiskussionen und dem Planspiel lagen die Herausforderungen für die Frauen verschiedene Lebensmittel anzubauen und ihre Gärten zu verbessern im Mangel an Platz, Wasser, Zeit und finanziellen Ressourcen, um Saatgut und Dünger zu kaufen. Trotz der zuvor genannten Herausforderungen, deuteten sie an, dass ein Fortführen der Gärten, wie sie es schon immer gehandhabt haben, vorteilhaft für den Haushalt sei. Das Planspiel während der Abschlusserhebung ließ erkennen,

dass die Frauen sachkundigere Ernährungsentscheidungen bei der Auswahl von Lebensmitteln trafen als zu Beginn. Andere Studien haben gezeigt, dass Gärten in Kombination mit Ernährungsbildung die Qualität der Ernährung, Nahrungsgewohnheiten und Zubereitungsmethoden verbessern können.

Schlussfolgernd aus der Studie zeigte sich kein signifikanter Effekt der Ernährungsbildung auf das Ernährungswissen der Frauen. Jedoch tendierten die Wissens-Punkteskalen in der mittleren Kategorie zu einer Verbesserung. Des Weiteren fand keine Verbesserung der Ernährungsdiversität statt. Die Diversität unterlag eher saisonalen Schwankungen im Angebot der Lebensmittel. Die Auswirkung von Ernährungsbildung, in einer Umgebung in der Haushalte einen Garten besitzen, könnte durch folgende Ergänzungen verbessert werden: ein Vorführgrundstück, Benennung von Ernährungsbeobachtern, längere Lehrphasen, der Gebrauch von lokal akzeptierten Lebensmitteln und das Identifizieren von zu jeder Jahreszeit lokal verfügbaren nährstoffreichen Lebensmitteln.

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Appendix A | **Appendix**

A.1 Baseline Questionnaire

Questionnaire Code: | | | |

Nutrition Education and Home Gardens Questionnaire

Date: _____ Questionnaire Code: | | | |

Enumerator Name: _____

District		DIST
Ward		WARD
Contact No		CNTCTNO

SECTION 1: RESPONDENT DETAILS

1.	Name of the respondent		NAMERESP	
2.	Age		AGERESP	
3.	Date of Birth	Date | Month | Year	DOB	
4.	Sex	1= Male 2= Female	SEXRESP	
5.	Which tribe do you belong to?		RTRIBE	
6.	What is your marital status?	1= Single 2= Married 3= Separated 4= Divorced 5= Widowed 99= Other (specify) _____	RMAR	
7.	What is the religion of this household?	1= Hindu 2= Christian 3= Muslim 4= Traditionalist 99= Others (specify) _____	RREL	
8.	Total number of members in the household (including self)		NOHHMEMB	
9.	How many children are there in your household?	0 - 5 years _____ 5 - 18 years _____	NOCHILD	

Questionnaire Code: | | | |

SECTION 2: SOCIO-ECONOMIC DETAILS

10.	What is the sex of the household head?	1= Male 2= Female	HHHEAD	☐
11.	What is your relation to the head of the household?	1= Mother 2= Father 3= Husband 4= Wife 5= Son 6= Daughter 7= Brother 8= Sister 9= Father in law 10= Mother in law 11= Myself	RELFAMHEAD	☐
12.	What is your main occupation?	1= Housewife 2= Government employee 3= Private /Business employee 4= Artisan / Self-employed 5= Daily wage labourer 6= Farmer 99= Other (specify) _____	RMAINOCCU	☐
13.	Do you have any other sources of income other than the one mentioned above?	No = 0 →***go to 14*** Yes = 1	ROTHRINC	
13a.	If yes, please mention which other sources	1. _____ 2. _____ 3. _____	ROTHRINCSOURCE	☐

Questionnaire Code: | | | |

14.	Who in the household decides which foods are to be purchased?	1= Myself 2= Mother 3= Father 4= Husband 5= Wife 6= Son 7= Daughter 8= Father in law 9= Mother in law 10= Grandmother	HHPURCHDEC	
15.	What is the approximate monthly income for the household? (in Tanzanian Shillings)	1= 10,000 - 50,000 2= 50,000 - 100,000 3= 100,000 - 150,000 4= 150,000 - 200,000 5= 200,000 - 250,000 6= 250,000 - 300,000 7= >300,000	MNTHLYINCOME	
16.	Did you spend money to buy vegetables and fruits last week or previous to that?	No = 0 →***go to 17.*** Yes = 1**.**	PURCHFOOD	
16a.	Approximately how much did you spend on buying vegetables last week?	T.Sh: _____	MNYPURCHVEG	
16b.	Approximately how much did you spend on buying fruits last week?	T.Sh: _____	MNYPURCHFRUT	
17.	Do you own any of the following ***Enter:*** ***0= No*** ***1= Yes***	1= Mobile phone	MOBPHONE	
		2= Television	TELE	
		3= Refrigerator	FRIDGE	
		4= Bicycle	CYCLE	
		5= Motorbike	MTRBIKE	
		6= Car	CAR	
		7= Computer	COMP	
		8= House	HOUSE	
		9= Land	LAND	

Questionnaire Code: | | | |

SECTION 3: EDUCATION DETAILS

18.	What is your level of education?	1= Illiterate 2= No formal schooling but can read and/or write ***(Test using a written Sentence)*** 3= Few years of primary school 4= Completed Primary school 5= Few years of secondary school 6= Completed secondary school 7= College /University	REDU	
19.	Is there anyone in your family more educated than you?	No = 0 Yes = 1 →***go to 19a.***	RMOREEDU	
19a.	What is your relation to them?	1= Mother 2= Father 3= Husband 4= Wife 5= Son 6= Daughter 7= Father in law 8= Mother in law	RRELEDU	

SECTION 4: HOME GARDENS AND FOOD HABITS

20.	What was the motivation to start cultivating a home garden?	1= Receive training from an organisation →***go to 20a.*** 2= Hear and/or see your neighbours' home garden 3= Need to provide vegetables for family 4= Due to lack of income 99= Others (specify) _____	MOTHG	
20a.	Please name the organisation that gave you training to start a home garden		NAMEORG	

Questionnaire Code: | | | |

21.	When did you start growing vegetables in your home garden ***(Approximate year/month of cultivation)***	_____ Year _____ Month	STARTHGVEG	
21a.	How many types of vegetables do your cultivate in your home garden at present?	_____	NUMBVEGHG	
22.	When did you start growing fruits in your home garden ***(Approximate year/month of cultivation)***	_____ Year _____ Month	STARTHGFRUITS	
22a.	How many types of fruits do your cultivate in your home garden at present?		NUMBFRUITHG	
23.	Is the home garden located next to your house?	No = 0 ***→go to 23a*** Yes = 1	LOCATHG	☐
23a.	If away from house, how far is it?	1= Less than 10 minutes 2= 10-20 minutes 3= 20-40 minutes 4= 40 minutes to 1 hour 5= More than 1 hour	DISTFRMHOUSE	☐
24.	Did you harvest any vegetables in the month of ***Enter*** ***No = 0*** ***Yes = 1***	December	HRVSTDEC	
		November	HRVSTNOV	
		October	HRSVTOCT	
		September	HRVSTSEPT	
		August	HRVSTAUG	
		July	HRVSTJULY	
		June	HRVSTJUN	
		May	HRVSTMAY	
		April	HRVSTAPRL	
		March	HRVSTMAR	
		February	HRVSTFEB	
		January	HRVSTJAN	

Questionnaire Code: | | | |

25.	What are the main uses of vegetables grown in your home garden?	1= Mainly for own consumption 2= Mainly for sale →***go to 25a***. 3= For both (in approximately equal amounts) 4= For own consumption and exchange with neighbours for other vegetables →***go to 25b***. 99= Others (specify) _____	HGVEGUSAGE	☐
25a.	What is the main reason for selling the vegetables? ***(If respondent answers to improve the income, probe to understand the reason for the improving the income)***	1. _____ 2. _____ 3. _____ 4. _____	REASSELVEG	
25b.	Why do you exchange vegetables with your neighbours?	1= Only when vegetables in your garden is in excess 2= Taste preference 3= To increase variety of vegetables cooked 99= Others (specify) _____	EXCHNGVEGOFT	☐
26.	Do you think having a home garden is beneficial?	No = 0 →***go to 26b.*** Yes = 1 →***go to 26a.***	BENEFTHG	☐
26a.	How is the home garden beneficial?	1= More food to eat 2= Improving income 3= Health of household members has improved 4= Children attend school regularly 99= Others (specify) _____	YESBENEFTREAS	☐

Questionnaire Code: | | | |

26b.	Why do you think the home garden is not beneficial?	1. _____ 2. _____ 3. _____	NOBENEFTREAS	
27.	How long does it take you to walk to the nearest food market?	1= 5 minutes 2= 15 minutes 3= 30 minutes 4= 45 minutes 5= 1 hour 6= More than 1 hour	TIMEMARKT	☐
28.	What is the approximate distance from the closest food market to your household?	1= Less than1 km 2= 1-5 km 3= 5-10 km 4= More than 10 km	DISTMARKT	☐
29.	Do you collect wild vegetables growing in your community?	No = 0 →***go to 30.*** Yes = 1	COLCTINDVEG	☐
29a.	Name the wild vegetables that you collect	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	NMEINDVEG	
29b.	How often do you collect them?	1= Daily 2= Weekly 3= Monthly 4= Depending on season 5= When not available from HG 6= Only when not available from market 99= Other (specify) _____	COLCTINDVEGOFT	☐

Questionnaire Code: | | | |

SECTION 5: AGRICULTURAL ASPECTS (SOIL, WATER AND SEED)

30.	Do you use manure for the soil before you plant the seeds?	No = 0 Yes = 1 →***go to 30a.***	SOILTRT	☐
30a.	If yes, what do you use as manure?	1= Cow dung 2= Chicken manure 3= Compost manure 4= Fertilizer 5= Tobacco residue 99= Others (specify) _____	TRTMTHD	☐
31.	Do you water your home gardens?	No = 0 Yes = 1 →***go to 31a.***	WTRHG	☐
31a.	Which source of water do you use to water your home gardens?	1= Water from the tap 2= Waste water from washing of utensils and/or clothes 3= Hand pump and /or well 4= Irrigation facilities 99= Others (specify) _____	SRCWTRHG	☐
32.	What is the source of the seeds that you plant at your home garden?	1= Purchased from the market →***go to 32a.*** 2= Purchased from an organisation at a lower cost →***go to 32a and 32b.*** 3= Given free of cost →***go to 32c.*** 4= Exchange with other families 5= Preserve from previous harvest →***go to 32d.*** 99= Others (specify) _____	SRCSEEDHG	☐

Questionnaire Code: | | | |

32a.	If you purchase the seeds, how much money do you spend?	T.Sh_____	MNYPURCHSEED	
32b.	Name the organisation giving seeds at a lower cost	_____	NMEORGANSEED	
32c.	If the seeds are given, Please give the name of the institution	_____	SEEDGIVEBY	
32d.	Which method do you use to preserve the seeds?	_____ _____ _____	MTHDPRESVSEED	
33.	Usually which seeds do you purchase?	1. _____ 2. _____ 3. _____ 4. _____	NMEPURCHSEED	
33a.	What is the approximate quantity of the seeds that you purchase?	1. _____ 2. _____ 3. _____ 4. _____	QTYSEED	

SECTION 6: KNOWLEDGE, ATTITUDE AND PRACTICES

34.	How important do you think it is to eat vegetables?	1= None/ not at all 2= Low 3= Medium 4= High 5= Very High ***→go to 34a.***	IMPVEG	☐
34a.	Do you think it is important or very important because ***Enter:*** ***False = 0*** ***True = 1***	1= Vegetables helps you stay healthy and fit	VEGHEALT	
		2= Vegetables makes you look younger	VEGYOUNG	
		3= If you eat vegetables you are poor	VEGPOOR	
		4= Eating vegetables makes you fall sick	VEGSICK	

Questionnaire Code: | | | |

35.	How important do you think it is to eat fruits?	1= None/ not at all 2= Low 3= Medium 4= High 5= Very High ***→go to 35a.***	IMPFRUT	☐
35a.	Do you think it is important or very important because ***Enter:*** ***False = 0*** ***True = 1***	1= If you eat fruits you are poor	FRUTPOOR	
		2= Eating fruit is good for health	FRUTHEALT	
		3= Eating fruits makes you weak	FRUTWEAK	
		4= Fruits are a good source of nutrients	FRUTNUTR	
36.	Do you heard about or do you know about Vitamin A?	No = 0 ***→go to 37.*** Yes = 1 ***→go to 36a.***	KNOWVA	☐
36a.	How important do you think it is?	1= None/ not at all 2= Low 3= Medium 4= High 5= Very High ***→go to 36b.***	SCLIMPVA	☐
36b.	Why is Vitamin A important? ***(Please state at least 1 reason)***	1. _____ 2. _____	REASVA	
36c.	Do you know which vegetables and /or fruits are rich in Vitamin A? ***(Please state at least 2)***	1. _____ 2. _____ 3. _____	VARICHFOOD	
36d.	How often do you consume vegetables and/or fruits rich in vitamin A?	1= Daily 2= Once a week 3= Twice a week 4= 4times a week 5= Once in 15 days	EATFOODVA	☐
37.	Have you heard about or do you know about Iron?	No = 0 ***→go to 38.*** Yes = 1 ***→go to 37a.***	KNOWIR	☐

Questionnaire Code: | | | |

37a.	How important do you think it is?	1= None/ not at all 2= Low 3= Medium 4= High 5= Very High ***→go to 37b.***	SCLIMPIR	☐
37b.	Why is it important? (Please state at least 1 reason)	1. _____ 2. _____	REASIR	
37c.	Do you know which vegetables and /or fruits are rich in Iron? ***(Please state at least 2)***	1. _____ 2. _____ 3. _____	IRRICHFOOD	
38.	Have you received any nutrition education?	No = 0 ***→go to next section 7.*** Yes = 1 ***→go to 38a.***	RECEIVNE	☐
38a.	Who conducted the nutrition education sessions? ***(please give the name of the organisation)***		WHOGAVENE	
38b.	When did you receive nutrition education?		WHENRECEIVNE	

Questionnaire Code: | | | |

SECTION 7: VEGETABLE FREQUENCY TABLE

Instructions: Please tell me how often you consume the following vegetables.

Vegetable	Daily	Weekly	Monthly	Never
Roots & Tubers				
Potatoes				
Sweet potato				
Cassava				
Cocoyam				
Carrot				
Other vegetables				
Onions				
Tomatoes				
Cauliflower				
Cabbage				
Aubergine/eggplant				
Cucumber				
Pumpkin				
Sweet pepper				
Okra				
Gourds				
Chinese cabbage				
African eggplant				
Fresh Spices				
Chillies				
Ginger				
Garlic				
Leafy vegetables				
Spinach				
Lettuce				
Sweet potato leaves				
Amaranth				
Cowpea leaves				
Pumpkin leaves				
African nightshade				
Cassava leaves				

Questionnaire Code: | | | |

SECTION 8: 24 HOUR FOOD RECALL

24 Hour Food Recall - Day1

Date:

Date	Month	Year

Name of the Food 1= Tea (no milk only sugar) 2= Tea (Tea + Sugar +milk) 3= Mandazi 4= Chapati	Ingredient *(List all the ingredients used in each item)*	Source of ingredients 1= purchased from market 2= from home garden	Type of processing 1= Steamed 2= Boiled 3= Frying 4= Cooking 5= Roasting	Amount consumed Pieces, Handful, Large bowl, Small bowl, 1 Teaspoon, 1 Tablespoon
Breakfast				
Snack				
Lunch				
Snack				
Dinner				
Snack				

Questionnaire Code: | | | |

SECTION 8: 24 HOUR FOOD RECALL

24 Hour Food Recall - Day2

Date:

Date	Month	Year

Name of the Food 1= Tea (no milk only sugar) 2= Tea (Tea + Sugar +milk) 3= Mandazi 4= Chapati	Ingredient *(List all the ingredients used in each item)*	Source of ingredients 1= purchased from market 2= from home garden	Type of processing 1= Steamed 2= Boiled 3= Frying 4= Cooking 5= Roasting	Amount consumed Pieces, Handful, Large bowl, Small bowl, 1 Teaspoon, 1 Tablespoon
Breakfast				
Snack				
Lunch				
Snack				
Dinner				
Snack				

Questionnaire Code: | | | |

SECTION 8: 24 HOUR FOOD RECALL

24 Hour Food Recall - Day3

Date:

Date	Month	Year

Name of the Food 1= Tea (no milk only sugar) 2= Tea (Tea + Sugar +milk) 3= Mandazi 4= Chapati	Ingredient *(List all the ingredients used in each item)*	Source of ingredients 1= purchased from market 2= from home garden	Type of processing 1= Steamed 2= Boiled 3= Frying 4= Cooking 5= Roasting	Amount consumed Pieces, Handful, Large bowl, Small bowl, 1 Teaspoon, 1 Tablespoon
Breakfast				
Snack				
Lunch				
Snack				
Dinner				
Snack				

Thank you for your time and participation.

A.2 Endline Questionnaire

Questionnaire Code: | | | |

Nutrition Education and Home Gardens Questionnaire

Date: _____ Questionnaire Code: | | | |

Enumerator Name: _____

District		DIST
Ward		WARD
Contact No		CNTCTNO

SECTION 1: RESPONDENT DETAILS

1.	Name of the respondent		NAMERESP	
2.	Age		AGERESP	
3.	Date of Birth	Date / Month / Year	DOB	
4.	Sex	1= Male 2= Female	SEXRESP	
5.	Which tribe do you belong to?		RTRIBE	
6.	What is your marital status?	1= Single 2= Married 3= Separated 4= Divorced 5= Widowed 99= Other (specify) _____	RMAR	
7.	What is the religion of this household?	1= Hindu 2= Christian 3= Muslim 4= Traditionalist 99= Others (specify) _____	RREL	
8.	Total number of members in the household (including self)		NOHHMEMB	
9.	How many children are there in your household?	0 - 5 years _____ 5 - 18 years _____	NOCHILD	

Questionnaire Code: | | | |

SECTION 2: SOCIO-ECONOMIC DETAILS

10.	What is the sex of the household head?	1= Male 2= Female	HHHEAD	
11.	What is your relation to the head of the household?	1= Mother 2= Father 3= Husband 4= Wife 5= Son 6= Daughter 7= Brother 8= Sister 9= Father in law 10= Mother in law 11= Myself	RELFAMHEAD	
12.	What is your main occupation?	1= Housewife 2= Government employee 3= Private /Business employee 4= Artisan / Self-employed 5= Daily wage labourer 6= Farmer 99= Other (specify) _____	RMAINOCCU	
13.	Do you have any other sources of income other than the one mentioned above?	No = 0 →***go to 14*** Yes = 1	ROTHRINC	
13a.	If yes, please mention which other sources	1. _____ 2. _____ 3. _____	ROTHRINCSOURCE	

Questionnaire Code: | | | |

14.	Who in the household decides which foods are to be purchased?	1= Myself 2= Mother 3= Father 4= Husband 5= Wife 6= Son 7= Daughter 8= Father in law 9= Mother in law 10= Grandmother	HHPURCHDEC	
15.	What is the approximate monthly income for the household? (in Tanzanian Shillings)	1= 10,000 - 50,000 2= 50,000 - 100,000 3= 100,000 - 150,000 4= 150,000 - 200,000 5= 200,000 - 250,000 6= 250,000 - 300,000 7= >300,000	MNTHLYINCOME	
16.	Did you spend money to buy vegetables and fruits last week or previous to that?	No = 0 →***go to 17.*** Yes = 1***.***	PURCHFOOD	
16a.	Approximately how much did you spend on buying vegetables last week?	T.Sh: _____	MNYPURCHVEG	
16b.	Approximately how much did you spend on buying fruits last week?	T.Sh: _____	MNYPURCHFRUT	
17.	Do you own any of the following ***Enter:*** ***0= No*** ***1= Yes***	1= Mobile phone	MOBPHONE	
		2= Television	TELE	
		3= Refrigerator	FRIDGE	
		4= Bicycle	CYCLE	
		5= Motorbike	MTRBIKE	
		6= Car	CAR	
		7= Computer	COMP	
		8= House	HOUSE	
		9= Land	LAND	

Questionnaire Code: | | | |

SECTION 3: EDUCATION DETAILS

18.	What is your level of education?	1= Illiterate 2= No formal schooling but can read and/or write ***(Test using a written Sentence)*** 3= Few years of primary school 4= Completed Primary school 5= Few years of secondary school 6= Completed secondary school 7= College /University	REDU	
19.	Is there anyone in your family more educated than you?	No = 0 Yes = 1 →***go to 19a.***	RMOREEDU	
19a.	What is your relation to them?	1= Mother 2= Father 3= Husband 4= Wife 5= Son 6= Daughter 7= Father in law 8= Mother in law	RRELEDU	

SECTION 4: HOME GARDENS AND FOOD HABITS

20.	What was the motivation to start cultivating a home garden?	1= Receive training from an organisation →***go to 20a.*** 2= Hear and/or see your neighbours' home garden 3= Need to provide vegetables for family 4= Due to lack of income 99= Others (specify) _____	MOTHG	
20a.	Please name the organisation that gave you training to start a home garden		NAMEORG	

Questionnaire Code: | | | |

21.	When did you start growing vegetables in your home garden ***(Approximate year/month of cultivation)***	_____ Year _____ Month	STARTHGVEG	
21a.	How many types of vegetables do your cultivate in your home garden at present?	_____	NUMBVEGHG	
22.	When did you start growing fruits in your home garden ***(Approximate year/month of cultivation)***	_____ Year _____ Month	STARTHGFRUITS	
22a.	How many types of fruits do your cultivate in your home garden at present?		NUMBFRUITHG	
23.	Is the home garden located next to your house?	No = 0 →***go to 23a*** Yes = 1	LOCATHG	☐
23a.	If away from house, how far is it?	1= Less than 10 minutes 2= 10-20 minutes 3= 20-40 minutes 4= 40 minutes to 1 hour 5= More than 1 hour	DISTFRMHOUSE	☐
24.	Did you harvest any vegetables in the month of ***Enter*** ***No = 0*** ***Yes = 1***	December	HRVSTDEC	
		November	HRVSTNOV	
		October	HRSVTOCT	
		September	HRVSTSEPT	
		August	HRVSTAUG	
		July	HRVSTJULY	
		June	HRVSTJUN	
		May	HRVSTMAY	
		April	HRVSTAPRL	
		March	HRVSTMAR	
		February	HRVSTFEB	
		January	HRVSTJAN	

Questionnaire Code: | | | |

25.	What are the main uses of vegetables grown in your home garden?	1= Mainly for own consumption 2= Mainly for sale →***go to 25a***. 3= For both (in approximately equal amounts) 4= For own consumption and exchange with neighbours for other vegetables →***go to 25b***. 99= Others (specify) _____	HGVEGUSAGE	☐
25a.	What is the main reason for selling the vegetables? ***(If respondent answers to improve the income, probe to understand the reason for the improving the income)***	1. _____ 2. _____ 3. _____ 4. _____	REASSELVEG	
25b.	Why do you exchange vegetables with your neighbours?	1= Only when vegetables in your garden is in excess 2= Taste preference 3= To increase variety of vegetables cooked 99= Others (specify) _____	EXCHNGVEGOFT	☐
26.	Do you think having a home garden is beneficial?	No = 0 →***go to 26b.*** Yes = 1 →***go to 26a.***	BENEFTHG	☐
26a.	How is the home garden beneficial?	1= More food to eat 2= Improving income 3= Health of household members has improved 4= Children attend school regularly 99= Others (specify) _____	YESBENEFTREAS	☐

Questionnaire Code: | | | |

26b.	Why do you think the home garden is not beneficial?	1. _____ 2. _____ 3. _____	NOBENEFTREAS	
27.	How long does it take you to walk to the nearest food market?	1= 5 minutes 2= 15 minutes 3= 30 minutes 4= 45 minutes 5= 1 hour 6= More than 1 hour	TIMEMARKT	☐
28.	What is the approximate distance from the closest food market to your household?	1= Less than1 km 2= 1-5 km 3= 5-10 km 4= More than 10 km	DISTMARKT	☐
29.	Do you collect wild vegetables growing in your community?	No = 0 →***go to 30.*** Yes = 1	COLCTINDVEG	☐
29a.	Name the wild vegetables that you collect	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	NMEINDVEG	
29b.	How often do you collect them?	1= Daily 2= Weekly 3= Monthly 4= Depending on season 5= When not available from HG 6= Only when not available from market 99= Other (specify) _____	COLCTINDVEGOFT	☐

Questionnaire Code: | | | |

SECTION 5: AGRICULTURAL ASPECTS (SOIL, WATER AND SEED)

30.	Do you use manure for the soil before you plant the seeds for your home garden?	No = 0 Yes = 1 →***go to 30a.***	SOILTRT	☐
30a.	If yes, what do you use as manure?	1= Cow dung 2= Chicken manure 3= Compost manure 4= Fertilizer 5= Tobacco residue 99= Others (specify) _____	TRTMTHD	☐
31.	Do you water your home gardens?	No = 0 Yes = 1 →***go to 31a.***	WTRHG	☐
31a.	Which source of water do you use to water your home gardens?	1= Water from the tap 2= Waste water from washing of utensils and/or clothes 3= Hand pump and /or well 4= Irrigation facilities 99= Others (specify) _____	SRCWTRHG	☐
32.	What is the source of the seeds that you plant at your home garden?	1= Purchased from the market →***go to 32a.*** 2= Purchased from an organisation at a lower cost →***go to 32a and 32b.*** 3= Given free of cost →***go to 32c.*** 4= Exchange with other families 5= Preserve from previous harvest →***go to 32d.*** 99= Others (specify) _____	SRCSEEDHG	☐

Questionnaire Code: | | | |

32a.	If you purchase the seeds, how much money do you spend? (Probe: money spent in a year)	T.Sh_____	MNYPURCHSEED	
32b.	Name the organisation giving seeds at a lower cost	_____	NMEORGANSEED	
32c.	If the seeds are given, Please give the name of the institution	_____	SEEDGIVEBY	
32d.	Which method do you use to preserve the seeds?	_____ _____ _____	MTHDPRESVSEED	
33.	Usually which seeds do you purchase?	1. _____ 2. _____ 3. _____ 4. _____	NMEPURCHSEED	
33a.	What is the approximate quantity of the seeds that you purchase?	1. _____ 2. _____ 3. _____ 4. _____	QTYSEED	

SECTION 6: KNOWLEDGE, ATTITUDE AND PRACTICES

34.	How important do you think it is to eat vegetables?	1= None/ not at all 2= Low 3= Medium 4= High 5= Very High ***→go to 34a.***	IMPVEG	☐
34a.	Do you think it is important or very important because ***Enter:*** ***False = 0*** ***True = 1***	1= Vegetables helps you stay healthy and fit	VEGHEALT	
		2= Vegetables makes you look younger	VEGYOUNG	
		3= If you eat vegetables you are poor	VEGPOOR	
		4= Eating vegetables makes you fall sick	VEGSICK	

Questionnaire Code: | | | |

35.	How important do you think it is to eat fruits?	1= None/ not at all 2= Low 3= Medium 4= High 5= Very High **→*go to 35a.***	IMPFRUT	☐
35a.	Do you think it is important or very important because ***Enter:*** ***False = 0*** ***True = 1***	1= If you eat fruits you are poor	FRUTPOOR	
		2= Eating fruit is good for health	FRUTHEALT	
		3= Eating fruits makes you weak	FRUTWEAK	
		4= Fruits are a good source of nutrients	FRUTNUTR	
36.	Do you heard about or do you know about Vitamin A?	No = 0 **→*go to 37.*** Yes = 1 **→*go to 36a.***	KNOWVA	☐
36a.	How important do you think it is?	1= None/ not at all 2= Low 3= Medium 4= High 5= Very High **→*go to 36b.***	SCLIMPVA	☐
36b.	Why is Vitamin A important? ***(Please state at least 1 reason)***	1. _____ 2. _____	REASVA	
36c.	Do you know which vegetables and /or fruits are rich in Vitamin A? ***(Please state at least 2)***	1. _____ 2. _____ 3. _____	VARICHFOOD	
36d.	How often do you consume vegetables and/or fruits rich in vitamin A?	1= Daily 2= Once a week 3= Twice a week 4= 4times a week 5= Once in 15 days	EATFOODVA	☐
37.	Have you heard about or do you know about Iron?	No = 0 **→*go to 38.*** Yes = 1 **→*go to 37a.***	KNOWIR	☐

Questionnaire Code: | | | |

37a.	How important do you think it is?	1= None/ not at all 2= Low 3= Medium 4= High 5= Very High ***→go to 37b.***	SCLIMPIR	☐
37b.	Why is it important? (Please state at least 1 reason)	1. _____ 2. _____	REASIR	
37c.	Do you know which vegetables and /or fruits are rich in Iron? ***(Please state at least 2)***	1. _____ 2. _____ 3. _____	IRRICHFOOD	
38.	Other than us, have you participated in a nutrition education program conducted by other organisations or persons?	No = 0 ***→go to 40.*** Yes = 1 ***→go to 38a.***	RECEIVNE	☐
38a.	Can you remember who conducted the nutrition education sessions? ***(please give the name of the organisation/person)***		WHOGAVENE	
38b.	In which month since October, 2013 were the nutrition education programs conducted by other organisations/persons?		WHENRECEIVNE	
39.	Which were the topics discussed during the nutrition education sessions conducted by other organisations/ persons?	1._____ 2._____ 3._____	TOPICNUTROTHR	
39a.	Which key message did you learn from the nutrition education sessions conducted by other organisations/ persons?	1._____ 2._____ 3._____	KEYMSGNUTROTHR	

Questionnaire Code: | | | |

40.	Did you attend any of the sessions of the nutrition education programme conducted by us in the month of December, 2013?	No = 0 →***go to 41.*** Yes = 1 →***go to 40a.***	ATTENDNE	
40a.	If yes, which sessions did you attend?	1= Home gardens & Dietary Diversity 2= Vitamins 3= Iron →***go to 40b.*** 4= none →***go to 41***	ATTENDHOW-MANY	
40b.	Which were the most interesting sessions for you? ***(Probe: specify which session /part of the session or sessions)***	1._____ 2._____ 3._____ 4._____ 5._____ 6._____ 7._____	INTERESTSESION-WHICH	
41.	If no, what were the reasons which prevented you from attending the nutrition education program sessions?	1._____ 2._____ 3._____	NOTATTENDWHY	
41a.	Did you talk to or did anyone discuss the nutrition education sessions, conducted by us, with you?	No = 0 →***go to 42.*** Yes = 1 →***go to 41b.***	DISCUSSESSION	☐
41b.	What was the main message that you learnt about the nutrition education sessions?	1._____ 2._____ 3._____	YESDISCUSS	
42.	Have you attended any agricultural training program?	No = 0 →***go to 43.*** Yes = 1 →***go to 42a.***	AGRITRAINPRGM	☐

Questionnaire Code: | | | |

42a.	If yes, what did you learn in those sessions?	1= water management 2= pest management 3= soil management 4= increasing the yield 5= seed preservation 6= agrobiodiversity 99= Other (please specify) _____	LEARNAGRITRAIN	☐
42b.	Was the training related to home gardening?	No = 0 →***go to 43.*** Yes = 1 →***go to 42c.***	TRAINHGRELATE	☐
42c.	What did you learn from the agricultural training program in relation to home gardening?	1._____ 2._____ 3._____	LEARNAGRIHG	

SECTION 7: BEHAVIOUR CHANGE

43.	For how long do you cook vegetables (especially green leafy vegetables?)	1= < 10 mins 2= 10-15 mins 3= 15-30 mins 4= 30-60 mins 5= > 60 mins	COOKTIME	☐
43a.	Is this time different from the time you used to cook vegetables before the NE sessions were conducted in December, 2013?	No = 0 →***go to 43c.*** Yes = 1 →***go to 43b.***	CHNGECOOKTIME	☐
43b.	If yes, in what way has it changed? ***(Probe: cooking time, cooking and cleaning methods, addition of oil etc)***	1._____ 2._____ 3._____	YESCHNGECOOK	
43c.	If no, what are the reasons that you were unable to change it?	1._____ 2._____ 3._____	NOCHNGECOOK	

Questionnaire Code: | | | |

44.	Are you able to eat/ cook a variety of vegetables daily?	No = 0 →***go to 44b.*** Yes = 1 →***go to 44a.***	DIVERSEFOODEAT	☐
44a.	If yes, what do you think it is important to eat/cook a variety of vegetables daily?	1._____ 2._____ 3._____	YESDIVRSFOODEAT	
44b.	If no, what are the reasons that you were unable to eat/cook a variety of foods?	1._____ 2._____ 3._____	NODIVERSEEAT	
45.	Please indicate if the following statements are true or false ***Enter:*** ***False = 0*** ***True = 1***	Incorporating a variety of foods in a meal is important for good health	DIETDIVERSITY	☐
		Quantity of the vegetables+ relish should be as much as the quantity of the staple consume	QTYVEGTOSTAPLE	☐
		Washing vegetables before chopping reduces vitamin losses	WASHVEGCUT	☐
		Adding fat/oil to green leafy vegetables/ food while cooking will improve vitamin A availability	ADDOILVA	☐
		Combining foods rich in vitamin C (eg lime) with iron rich foods will improve the absorption of iron	ADDVCTOIRON	☐

Questionnaire Code: | | | |

SECTION 8: VEGETABLE FREQUENCY TABLE

Instructions: Please tell me how often you consume the following vegetables.

Vegetable	Daily	Weekly	Monthly	Never
Roots & Tubers				
Potatoes				
Sweet potato				
Cassava				
Cocoyam				
Carrot				
Other vegetables				
Onions				
Tomatoes				
Cauliflower				
Cabbage				
Aubergine/eggplant				
Cucumber				
Pumpkin				
Sweet pepper				
Okra				
Gourds				
Chinese cabbage				
African eggplant				
Fresh Spices				
Chillies				
Ginger				
Garlic				
Leafy vegetables				
Spinach				
Lettuce				
Sweet potato leaves				
Amaranth				
Cowpea leaves				
Pumpkin leaves				
African nightshade				
Cassava leaves				

Questionnaire Code: | | | |

SECTION 9: 24 HOUR FOOD RECALL

24 Hour Food Recall - Day1

Date:

Date	Month	Year

Name of the Food 1= Tea (no milk only sugar) 2= Tea (Tea + Sugar +milk) 3= Mandazi 4= Chapati	Ingredient *(List all the ingredients used in each item)*	Source of ingredients 1= purchased from market 2= from home garden	Type of processing 1= Steamed 2= Boiled 3= Frying 4= Cooking 5= Roasting	Amount consumed Pieces, Handful, Large bowl, Small bowl, 1 Teaspoon, 1 Tablespoon
Breakfast				
Snack				
Lunch				
Snack				
Dinner				
Snack				

Questionnaire Code: | | | |

SECTION 9: 24 HOUR FOOD RECALL

24 Hour Food Recall - Day2

Date:

Date	Month	Year

Name of the Food 1= Tea (no milk only sugar) 2= Tea (Tea + Sugar +milk) 3= Mandazi 4= Chapati	Ingredient *(List all the ingredients used in each item)*	Source of ingredients 1= purchased from market 2= from home garden	Type of processing 1= Steamed 2= Boiled 3= Frying 4= Cooking 5= Roasting	Amount consumed Pieces, Handful, Large bowl, Small bowl, 1 Teaspoon, 1 Tablespoon
Breakfast				
Snack				
Lunch				
Snack				
Dinner				
Snack				

Questionnaire Code: | | | |

SECTION 9: 24 HOUR FOOD RECALL

24 Hour Food Recall - Day3

Date:

Date	Month	Year

Name of the Food 1= Tea (no milk only sugar) 2= Tea (Tea + Sugar +milk) 3= Mandazi 4= Chapati	Ingredient *(List all the ingredients used in each item)*	Source of ingredients 1= purchased from market 2= from home garden	Type of processing 1= Steamed 2= Boiled 3= Frying 4= Cooking 5= Roasting	Amount consumed Pieces, Handful, Large bowl, Small bowl, 1 Teaspoon, 1 Tablespoon
Breakfast				
Snack				
Lunch				
Snack				
Dinner				
Snack				

Thank you for your time and participation.

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