Agriculture to Nutrition (ATONU): Evaluation of Integrated Agriculture and Nutrition-Sensitive Interventions for the African Chicken Genetic Gains (ACGG) Programme in Tanzania - Baseline Data

ATONU BASELINE REPORT - TANZANIA

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EXECUTIVE SUMMARY

In recent years, agricultural investment in sub-Saharan Africa has increased, leading to increased food production. However, despite increased food production, malnutrition rates are still high. This is because agricultural programmes have traditionally focused on increasing the availability of food rather than promoting consumption and improving nutrition status. The Agriculture to Nutrition (ATONU): Improving Nutrition Outcomes Through Optimized Agricultural Investments Project which is being implemented by the Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN) and partners will implement tailored nutrition-sensitive agriculture programmes targeting women of child-bearing age and children in the first 1,000 days of life (i.e., from conception to two years). ATONU is focusing on improving the nutrition of smallholder farm families to grow and buy the right type and amount of food they need to be healthy in an effort to break the intergenerational cycle of under nutrition among poor households in Sub-Saharan Africa. ATONU’s approach is to work with existing agriculture development projects to integrate nutrition-sensitive interventions (NSI), implement the interventions, evaluate their impact and provide evidence of what agriculture can do to deliver positive nutrition outcomes. To date, ATONU is implementing NSIs in the African Chicken Genetic Gains (ACGG) project, which is being implemented by the International Livestock Research Institute (ILRI) in the two countries Ethiopia and Tanzania.

The overall aim of the baseline survey was to generate data for assessing the effectiveness of nutrition-sensitive interventions being implemented in selected ATONU/ACGG villages. The overall objective of the survey was to establish the baseline values of key indicators of the project before implementation of nutrition-sensitive interventions so that the magnitude of change could be estimated in a final survey to be carried out at the end of implementation. The key indicators included dietary diversity and nutritional status (HAZ, WAZ, WHZ and BMI) of children and women of reproductive age. Specifically, the baseline survey assessed production patterns of crops and livestock in the surveyed areas; assessed nutritional knowledge of women from the surveyed areas, identified factors influencing nutrition knowledge; assessed current dietary practices and consumption patterns of households and individuals; assessed nutritional status of infants and young children aged below five years and women of child-bearing age using anthropometry; and examined knowledge, attitude and decision-making practices around budgeting and expenditure as influenced by gender.

The baseline survey was conducted in three agro-ecological zones, namely Central semi-arid, Eastern sub-humid and Southern Highlands from 15th November to 3rd December 2016. Selection of the agro-ecological zones, regions, districts and villages was based on participation in the ACGG project. The households were selected based on production of chickens provided by the ACGG project and also having a woman of reproductive age with a child aged 0 – 5 years. A sample size calculation aimed to detect a difference in the dietary diversity of 10% between the intervention and control treatment arms after at least eight months of intervention was determined by applying a statistical significance of p = 0.05 and a power of 80%. Interviews were carried out at the respondent’s residence. Face to face interviews with an adult woman responsible for food preparation (preferably husband and wife together) were carried out using a structured questionnaire to collect information on demographic characteristics, land and asset ownership, crop/livestock production, marketing of crops/livestock, hygiene and sanitation practices, vegetable production and preparation and food consumption patterns. Questionnaires were checked before and after the day of the survey to ensure completeness and accuracy. After the interviews, mother/caregiver, father/partner and children were referred to a makeshift centre for anthropometric measurements. Weight of children was measured to the nearest 0.1 kg or 100 g using a SECA electronic bathroom scale (SECA, Germany). The height of women and that of children above two years of age were measured using a stadiometer. For children under two years old, length was measured using a length board. Food consumption was assessed using a food frequency questionnaire (FFQ) and 24 hour dietary recall to obtain women/household dietary diversity scores (W/HDDS).
Data collected through the structured questionnaire were analysed using SPSS version 20. Child anthropometric data were analysed using WHO Anthro by computing Z-scores and generated nutritional indices as well as categories and later exported to SPSS for further analysis. A total of 1,762 households in the selected areas participated in the survey.

**Household Characteristics:** Mean size for the surveyed households was 5.5 persons. This was slightly higher than the national average of 4.9 persons per household (TDHS-MIS, 2015-16). The proportion of females in all surveyed areas was 49.5% and that of males was 50.5%. The household size varied distinctly between treatment arms and zones. About 78% of the respondents had attained primary level of education (Grade 7) and 8% of the respondents had never had access to formal education. No differences in educational attainment were observed between treatment arms and zones. Most (73%) of the interviewed respondents were married and 83% of them were engaged in farming as their most important occupation. Slight differences in level of participation in various occupations were noted among treatment arms, whereby 86% in Control, 82% in ACGG+ATONU and 80% in ACGG only, were engaged in farming. The most common owned household assets included hand hoe (94%), cell phone (93%), table (81%), cooking stove (69%), radio (67%), and bicycle (56%). The least owned assets were tractors, cars, motor bikes, fridge/freezer and grain mills. The main source of income for most of the households was from sale of crops. Other sources included sale of chicken and off-farm activities.

**Housing characteristics:** Housing construction materials included walls built with cement bricks (11%), sun dried and baked bricks (81%) and roofs made of iron sheet (95%) or thatched grass (4%). About 98% of households had access to a cell phone network. The main types of energy for lighting in the surveyed areas were solar (40%), battery (27%); electricity (21%) and paraffin (11%); while firewood and charcoal were the most important sources of energy for cooking and heating in the surveyed areas, with 84% of households using firewood as their main source of energy for cooking.

**Crop, vegetable and fruit production:** A high diversity of types of crops was grown in the surveyed areas. These included maize, rice, cassava, millet and sorghum, as well as an assortment of vegetables, legumes and fruits. Maize was the most produced crop by 82% of all households in the surveyed areas. Other crops produced included bulrush millet (30%) and paddy (23%), legumes (43.7%), and sunflower (41.5%). Zonal differences were apparent in terms of dominant crops that were produced, which varied with agro-ecological climate.

**Livestock production:** Livestock of importance in the surveyed areas included chicken, cattle, goats and pigs. About 54% of the surveyed households kept chickens, 17% kept cattle, 12% kept goats and 10% kept pigs.

**Food availability:** The main foods that were available in the surveyed areas included maize (75%), rice (13%), vegetables (3%), groundnut (3%) and bulrush millet (2.3%).

**Food accessibility:** Rice, maize, beans and vegetables are the food items that were mainly accessed by households through purchase but not all the time. There were variations by seasons and time of the year. However, meat and fish were only accessed through purchase throughout the year.

**Food security:** 70% of the households in the surveyed areas were worried that their food would run out before they got money to buy more food, which was an indication of very low food supply and about 25% of these households experienced this situation often. Only 40% of the households surveyed had never experienced this situation. Similarly, 66% of the surveyed households could not afford to eat balanced meals for a continuous period of twelve months and 29% of them experienced this situation often. However, for the questions that were related to insufficient quality (including variety and
preferences of the type of food) and insufficient food intake and its physical consequences, many households in the surveyed areas had not experienced such a situation.

**Nutrition knowledge:** Various definitions for nutrition were provided by respondents; some (39%) related nutrition to the type of foods given to children and few related nutrition with eating a balanced diet or a state of good health, while 9% defined nutrition as the knowledge of various nutrients and their functions in the body. This is a clear evidence that there is still a lot of misunderstanding and inadequate knowledge about the meaning of nutrition and malnutrition in the communities. Although malnutrition is always associated with deficiencies, it was interesting to note that some respondents defined malnutrition as being obese.

**Source of nutrition information:** The most important source of nutrition information, especially on maternal and child nutrition, was from health workers at clinics and hospitals. Many respondents did not know the functions of various foods on maternal and child nutrition.

**Child feeding frequency:** The proportion of respondents feeding their children three meals per day increased with age of children. At age 6-11 months (60%) and 12-59 months (70%) of the respondents fed their children three meals per day. Feeding children two meals per day was common during the younger age, where 11%, 10% and 9% of the respondents were from Control, ACGG only and ACGG+ATONU treatment arms, respectively. Most of the respondents did not give any reasons for not feeding their children more than three meals per day. There is a possibility that some women would increase meal frequencies for their children if they understood the reasons for that. About 78% of the respondents had no exposure to nutrition knowledge.

**Vegetable preparation:** About 78% of the respondents cooked their vegetables within one hour after picking and most of the households prepared vegetables before the staple, contrary to the ideal sequence of cooking vegetables after the staple so that vegetables are consumed immediately while still fresh and hot. More than 70% of the respondents in all surveyed areas cooked vegetables in less than 15 minutes. There were no significant differences (P = 0.995) between zones and treatment arms (Non-ACGG+ ATONU, ACGG only and Control) in terms of duration of cooking vegetables. Vegetable processing was practiced by 43% of the households. The main processing methods include direct sun drying (63%) and shade drying (37%). About 40% of households practiced shade drying in ACGG + ATONU arm, 37% in ACGG only and 35% in Control, and the differences were non-significant.

**Dietary diversity and food consumption pattern:** 54% of the respondents consumed less than four food groups, 30% consumed from 4 to 5 food groups and 16% consumed 6 or more food groups. Mean household/women dietary diversity score (H/WDDS) was 3.5 (SD 1.7); the most consumed food group was cereals, reported by 93% of the households, followed by vegetables (80%) and oils and fats (74%). Based on treatment arms, the ACGG+ATONU treatment had a higher proportion of households who scored lowest DDS (58%) compared to 52% for ACGG only and Control treatment arms.

**Water availability:** Access to clean and safe water is still a problem in many areas surveyed. In the present survey, it was observed that the main source of drinking water for rural households is from the public taps in all surveyed areas. The proportion of households that obtain water from public taps was 41% during the dry season and 35% during the wet season. Adult women featured most as household members who collect water for the household on day to day basis. With regard to water quality, more than 62% and 64% of the respondents in the ACGG+ATONU treatment arm were satisfied with the quality of water during the wet season and dry seasons, respectively. The proportions of respondents in other treatment arms were 58% in ACGG only and 56% in the Control.
**Hygiene and sanitation:** 80% of the respondents (n=1,762) reported that they washed their hands with soap and water. In the ACGG only treatment arm more respondents (83%) reported that they washed hands with soap compared to 79% and 77% in the Control and ACGG+ATONU treatments arms, respectively. The same trend was observed in the surveyed zones; with the central zone leading in that 83% of the respondents washed hands with soap. Although many households practiced hand washing, 33% of all respondents wash their hands to remove dirt, 30% before eating food and 29% after using the toilet. The proportions of respondents who had hand washing facilities near the latrine were 61%, 56% and 54% in ACGG only, Control and ACGG+ATONU treatment arms, respectively. Almost 30% of all the respondents reported that they had never heard any message related to hygiene. The most delivered message was basically on the use of latrines after every three months.

Most households owned toilets (99% N = 1,762), The main types were open pit latrine with slab (36%), open pit without slab (32%) and flush/pour flush to septic toilet (20%). The proportion of households with various types of latrines did not differ much among treatment arms.

**Decision making and women empowerment:** Gender and women empowerment was assessed in terms of women’s knowledge and practices on budgeting and expenditure, involvement in household decision making such as planning and budgeting, community decisions and on ownership of various assets. About 90% of the women reported that household budgeting was important to them and that they were able to plan their day-to-day budgets. Decision making on household income and food expenditure was done jointly (husband and wife) for almost 50% of the respondents. In terms of ability of women to speak in public as a measure of women empowerment, more than 25% of women indicated that they have no confidence to speak in public, particularly on issues which involve decision making for the community.

**Nutritional status (HAZ, WAZ, WHZ and BMI):** The nutritional status of members in the surveyed households, especially children under age of five years, is an important indicator of health of members of the household. The prevalence of stunting was 42%; much higher (8% points) than the national average of 34%. The prevalence of underweight was 27%, again much higher (13 points) than the national average of 14%. The prevalence of wasting (4%) was slightly lower (1% point) than the national average of 5% The prevalence of stunting in the treatment arms was 43% in the ACGG+ATONU, 42 % in ACGG only and 41% in Control testament arm. There was no significant difference between treatment arms (P=0.560). The prevalence of underweight was 27%, 26.3% and 26.3% in ACGG+ATONU, ACGG only and Control treatment arms, respectively and that of wasting was 4.6% in ACGG only, 4.3% in ACGG+ATONU and 4.3% in and Control treatment arms. Prevalence of underweight among children aged between 6 and 19 years was 9.1% and that of overweight and obesity was 9.2%. This shows clearly that the problems of underweight and overweight co-exist in these communities. The nutritional status of adults (BMI) showed that the prevalence of overweight (31%) and obesity (13%) was high and that of underweight was very low (3%) in surveyed areas.

**Conclusion and recommendations:** Low dietary diversity was observed in all the surveyed areas and there were no differences by zones or treatment arms. Almost all households consumed cereal staple and vegetables or legumes. There was limited knowledge on food preparation for nutrient retention. Knowledge on dietary diversity and food preparation methods should be included in planning of interventions, especially for interventions that will address the issue of information and knowledge/skills on food preparation. The main source of nutrition information was the health care providers at the clinic/hospitals; but the information shared was basically of breastfeeding and grossly limited in all other aspects of food consumption, hygiene, sanitation and care. Generally, there is limited knowledge on nutrition, and causes and ways to reduce malnutrition. There is a need to impart food and nutrition knowledge to the personnel of Reproductive and Child Health clinics (RCHC) as these interact most with mothers/caretakers from pregnancy, delivery and postpartum. They are well
positioned to impart consistent knowledge in a sustainable manner. In addition, nutrition information and or education to ameliorate a number of malpractices in communities and households, should be provided using various channels and platforms such as working with religious leaders, political leaders, influential persons, nutrition experts, media practitioners and mobile technology companies.

The importance of budgeting for household expenditure was important to most of the households. Joint planning of expenditures was a common practice in many households and this needs to be strengthened. Women empowerment and involvement in decision making in the household is an important aspect in improving nutrition status of households. Many women participate in farming and income generation at household level, therefore, they should be involved in planning, budgeting, and decisions on food expenditure as well as use of household income and other resources.

The nutritional status of children below five years of age across zones and treatment arms was sub-optimal. Prevalence of stunting was very high and in some treatment arms it exceeded the regional and national averages. Prevalence of wasting has to be monitored closely, especially in some treatment arms where the prevalence is unacceptably high.

*Children and adolescents*

The nutritional status of this group of children is also suboptimal and something should be done to reach them. Many of the nutrition initiatives/interventions in most developing countries have focused on children and women, neglecting adolescent boys and girls and adult males. Addressing the nutrition needs of adolescents could be an important step towards breaking the vicious cycle of intergenerational malnutrition, chronic diseases and poverty.

*Adults*

The nutritional status of both male and female adults has shown a significant shift from a tendency for underweight to that of overweight and obesity. This clearly shows the double burden of malnutrition, whereby in the same household there could be an underweight child/adult and an overweight child/adult. This trend has to be reversed by informing people on the health consequences of this trend and advising them on the advantages of physical exercise/activities, in addition to promoting consumption of diversified diets.
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACGG</td>
<td>African Chicken Genetic Gains</td>
</tr>
<tr>
<td>ATONU</td>
<td>Agriculture to Nutrition</td>
</tr>
<tr>
<td>BCC</td>
<td>Behavior Change Communication</td>
</tr>
<tr>
<td>BMI</td>
<td>Body Mass Index</td>
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<tr>
<td>BMIA</td>
<td>Body Mass Index for Age</td>
</tr>
<tr>
<td>DLFDO</td>
<td>District Livestock and Fisheries Development Officer</td>
</tr>
<tr>
<td>FANRPAN</td>
<td>Food, Agriculture Natural Resources and Policy Network</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>HAZ</td>
<td>Height for Age Z-scores</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>Human Immunodeficiency Virus-Acquired Immune Deficiency Syndrome</td>
</tr>
<tr>
<td>KAP</td>
<td>Knowledge, Attitude and Practices</td>
</tr>
<tr>
<td>MoHCDGEC</td>
<td>Ministry of Health, Community Development, Gender, Elderly and Children</td>
</tr>
<tr>
<td>MUCHALI</td>
<td><em>Mfumo wa Uchambuzi wa Chakula na Lishe</em></td>
</tr>
<tr>
<td>NBS</td>
<td>National Bureau of Statistics</td>
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<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
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<tr>
<td>NSI</td>
<td>Nutrition-sensitive Intervention</td>
</tr>
<tr>
<td>TDHS</td>
<td>Tanzania Demographic and Health Surveys</td>
</tr>
<tr>
<td>TDHS-MIS</td>
<td>Tanzania Demographic and Health Survey and Malaria Indicator Survey</td>
</tr>
<tr>
<td>WASH</td>
<td>Water, Sanitation and Hygiene</td>
</tr>
<tr>
<td>WAZ</td>
<td>Weight for Age Z-scores</td>
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<tr>
<td>WHZ</td>
<td>Weight for Height Z-scores</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
</tbody>
</table>
1. BACKGROUND

1.1 ATONU Project

In recent years, agricultural investment in sub-Saharan Africa has increased, leading to an increase in food production. However, despite this increase in food production, malnutrition rates are still high. Agricultural programmes have traditionally focused on increasing the availability of food rather than promoting consumption and improving nutrition status. Africa has the highest malnutrition rates in the world, with 17 countries having stunting rates above 40% and 36 countries above 30% (UNICEF, WHO & WB 2014). Sub-Saharan Africa carries a high burden of under-nutrition, with 33% of childhood deaths linked to under-nutrition. It is, therefore, vital that agricultural programmes start to take nutrition into consideration if they are to provide long-term nutrition security. The barriers to good nutrition, amongst others, are a lack of knowledge about which food crops are nutrient-rich, insufficient harvesting, poor storage and farmers’ inaccessibility to markets, all of which can prevent food reaching the people who need it most. Women’s lack of empowerment partly contributes to the problem. It is generally agreed that when women are able to decide what to grow, what to consume and how household budgets are spent, nutrition at household level improves.

The Agriculture to Nutrition (ATONU): Improving Nutrition Outcomes Through Optimized Agricultural Investments Project, which is being implemented by the Food, Agriculture and Natural Resources Policy Analysis Network (FANRPRAN) and partners, seeks to break the intergenerational cycle of under nutrition with tailored nutrition-sensitive agriculture programmes targeting women of child-bearing age and children in the first 1,000 days of life (i.e., from conception to two years). These nutrition-sensitive interventions are implemented through smallholder farm families and poor households in Sub-Saharan Africa. ATONU is focusing on improving the nutrition of the target groups by smallholder farm families to grow and buy the right type and amount of food they need to be healthy. ATONU has developed frameworks to select and provide technical support to agricultural projects for integrating nutrition-sensitive interventions, identifying and selecting nutrition-sensitive interventions and evaluating their impact.

ATONU works with existing agriculture development projects to integrate NSIs, implement the interventions, evaluate their impact and provide evidence of what agriculture can do to deliver positive nutrition outcomes. To date, ATONU has selected two pilot countries, Ethiopia and Tanzania, and one pilot project, the African Chicken Genetic Gains (ACGG), which is being implemented by the International Livestock Research Institute (ILRI) in the two countries. The following interventions have been selected to be integrated into the ACGG project:

1. Introduction of chickens into an agricultural system as a nutrition-sensitive intervention.
2. The ATONU NSI package made up of the following components that are being delivered to participating households:
   i. Behaviour change communication (BCC) on nutrition education and hygiene to increase consumption of eggs and chicken meat;
   ii. BCC to increase expenditure on nutritious food through income generated from sale of eggs and chicken;
   iii. BCC for women empowerment to influence changes in women’s time use and participation in decision making within the household; and
   iv. Promotion of home gardens to increase vegetable production for improving dietary diversity.

This study hypothesizes that both ACGG and ATONU can improve women’s and children’s diets via the following three pathways: food production for own consumption, increased income expenditure on additional nutrient dense foods, and women’s empowerment, all working in concert. Specifically, ACGG can increase production of chicken meat and eggs, which can increase access to these products for household consumption. These products can also be marketed, providing a source of income that
can be used in part for improving diets. ACGG’s efforts to target women can also lead to greater engagement and participation by women in household decision-making on chicken production and marketing, which could, in turn, empower them and improve their status within the household. BCC on nutrition education and hygiene can encourage household consumption of chicken products and other nutrient-dense foods, especially by women and children. BCC on household budgeting can encourage use of income from chicken production, specifically for the purchase of other foods that cannot be produced by the household but provide nutrients that are missing in the household diet. Interventions addressing gender dynamics within the household can further empower women in chicken production and other aspects of household life. Household members’ adoption of appropriate Water, Sanitation and Hygiene (WASH) behaviors could decrease harmful exposure to poultry droppings, thereby decreasing morbidity among children and improving food and nutrient utilisation. Given that chicken products provide a good source of animal protein and essential amino acids and micronutrients, it is expected that infants and young children would have better growth, women would be less likely to be underweight, and both women and children would have a reduced risk of anaemia.

1.2 ACGG Project

The African Chicken Genetic Gains (ACGG) is an Africa-wide livestock collaboration project led by ILRI. It started in November 2014, and is aimed at providing improved and tropically adapted chickens to smallholder farmers in Africa for two reasons: first, for income generation and second, for producing meat and eggs for household consumption. This project is part of the wider “LiveGene” initiative, which ACGG is piloting to make available high-producing, farmer-preferred genotypes that will help to increase smallholder chicken productivity in Africa. The programme intends to use new genetics to improve chicken productivity and production, combined with enhanced delivery systems such as provision of vaccines. In Africa and Tanzania in particular, chicken production is an integral component of the farming system in nearly all rural smallholder households. Chickens produce meat and eggs for home consumption and they are a source of income. In Tanzania, ACGG is implemented in five sub-national Zones: Central Semi-arid, Eastern Sub-humid, Southern Highlands, Lake, and Southern Humid Zones. The project is testing at least five strains in Tanzania: Black Australorp, Koekoek, Kuroiler, Sasso and local strains. A total of 20 districts, 80 villages and 3,200 households are targeted by ACGG in Tanzania.

https://africacgg.net

Map 1: ACGG implementing sites in Tanzania
1.3 The Nutrition Situation in Tanzania

1.3.1 Administration

The Tanzanian mainland is divided into 26 administrative regions and 113 districts with 145 councils. Each region comprises three to eight districts; each district has 4-5 divisions; each division is composed of 3-4 wards and each ward comprises 5-7 villages. There are about 11,000 villages in Tanzania. The region is responsible for coordination, supervision, and providing technical support to districts, capacity building and monitoring of services. The region also ensures effective translation of national policies and guidelines into quality services accessible to the whole population within its jurisdiction. Government activities within districts and wards are managed by Local Government Authorities through Councils.

1.3.2 Population

The population of Tanzania was estimated to be 55,155,472 people in 2016, with the following age structure: 0-14 years: 44.1% (male 50.5%/female 49.5%), 15-24 years: 19.7% (male 50%/female 50%), 25-54 years: 29.7% (male 50.2%/female 49.8%), 55-64 years: 3.5% (male 43.7%/female 56.3%) and above 65 years: 3% (male 42.5%/female 57.5%) (NBS, 2016 (est.)) (Fig. 1). The population is very young as 44% of Tanzanians are below 15 years of age. (Source: NBS, 2016)

Figure 1: Population Pyramid of Tanzania

1.3.3 Agriculture and economic status

In Tanzania, the Gross Domestic Product (GDP) per capita was USD 934 or 1,921,420/= TZS in 2015 and the GDP is expected to grow by 7.2% in 2017 and 7.1% in 2018 (BOT, 2017). Agriculture is the main contributor to the value of Tanzania’s economy, contributing nearly 30% to its GDP and 67% to total occupation. In favourable seasons, agriculture production provides more than 100% of the domestic food sufficiency. Most Tanzanians are involved in agriculture, hence this sector plays a big role in the efforts to generate wealth and alleviate poverty. Tanzania’s agriculture sector grew at a rate of 3.2% in 2016. The main food crops grown in Tanzania include maize, sorghum, millet, rice, wheat, beans, cassava, round and sweet potatoes, bananas and plantains. Tanzania’s crop production increased at a rate of 3.4% in 2016. This growth was mainly attributed to maize, paddy, sorghum, beans, and round potatoes. Tanzania’s livestock production recorded a growth rate of 2.5%. This was attributed to an increase in livestock sold for slaughter and sales of animal products such as milk, skins and hides.

1.3.4 Nutrition situation

In Tanzania, malnutrition, especially under-nutrition, is a contributing factor to an estimated death rate of 130 children every day (UNICEF, 2014). Children die because their immune systems are weakened.
through lack of essential nutrients. Consequently, they easily succumb to common childhood diseases. In addition, there are millions of children who fail to reach their potential because they have been deprived of essential nutrients for healthy growth and mental development. Undernourished children perform poorly at school, and are less productive in adult life, making it difficult for poor households to generate wealth and escape from poverty. This is due to a combination of factors, including maternal malnutrition, poor infant feeding practices, and a low quality of health care and poor hygiene. Breastfeeding is widely practiced but exclusive breastfeeding is not widespread, while complementary feeding practices are inadequate. Fifty-nine percent of infants below six months of age are exclusively breastfed in Tanzania. Exclusive breastfeeding declines rapidly with age. At age 0-1 month, 84% of infants are exclusively breastfed. The rate declines to 59% of infants at age 2-3 months and only 27% of infants at age 4-5 months (TDHS-MIS, 2015-16). Exclusive breastfeeding among children below six months of age has been increasing, from 26% in 1991-92, to 41% in 2004-05, to 50% in 2010 and 59% in 2015-16 (TDHS-MIS, 2015-16) an increase of 33 percentage points over a period of 25 years (at 1.3 percentage point per year).

**Under-nutrition in children:** One-third (34%) of children below five years of age are stunted (short for their age); 5% are wasted (thin for their height); 4% are overweight and 14% are underweight (thin for their age). Tanzania ranks third in Sub-Saharan Africa in the burden of stunting after Ethiopia and the Democratic Republic of Congo. The high levels of stunting in Tanzania constitute a silent emergency because the effects are hidden and the threats to health and survival are not immediate. This is why stunting does not receive the same attention as acute malnutrition or underweight in Tanzania. It must be noted that the consequences of stunting are serious and long-lasting. Height at the age of two years is being considered as the strongest predictor of future quality of human capital. The prevalence of stunting is very high in the Southern Highlands (45%) and South West Highlands (43%) zones. Rukwa (56%), Njombe (49%) and Ruvuma (44%) regions have the highest prevalence of stunting, while Dar es Salaam region (15%) has the lowest rate of stunting. The Southern Highland regions (Iringa, Mbeya, Njombe and Rukwa) have high food sufficiency (high food availability) but are still affected by chronic malnutrition (stunting), with prevalence surpassing 50%. Furthermore, regions with frequent food insecurity (Tabora and Singida) are less affected by chronic malnutrition. The common assumption that increasing agriculture and food production will automatically lead to improvements in nutrition is, therefore, not applicable. Iringa, Mbeya, Njombe and Rukwa are among the five regions with the highest prevalence of stunting and are all areas with high food production. In fact, they are considered as the food basket of Tanzania (Map 2). The trend of under-nutrition shows that the rates have been declining at a slow pace (Fig. 2). Overall, stunting has declined from 50% in 1991 to 34% in 2015/16; wasting from 8% to 5% and underweight from 25% to 14% during the same period. However, the rate of decline is not the same in all regions. In some regions, the prevalence of stunting has either increased or remained the same. For example, in Rukwa region the prevalence of stunting has increased from 50% in 2010 to 56% in 2016, and in Kagera region it has declined from 43.6% to 42%.
Map 2: Prevalence of stunting in 26 regions of Tanzania
Source: Tanzania Demographic and Health Survey and Malaria Indicator Survey (TDHS-MIS) 2015-16. Dar es Salaam, Tanzania, and Rockville, Maryland, USA: MoHCDGEC, MoH, NBS, OCGS

Figure 2: Trends of under nutrition (stunting, wasting and underweight) in Tanzania

Anaemia in children: About 58% of children aged 6-59 months were found to be anaemic, with haemoglobin less than 11.0 g/dl (TDHS-MIS, 2015-16). Anaemia prevalence among children varies with age and area of residence; it was lower among older children than among children under age 24 months. The lowest anaemia prevalence was observed in the Southern Highlands (44%). In Tanzanian regions, the prevalence of anaemia ranged from 37% in Singida and Njombe to 71% in Shinyanga.
region. Children whose mothers have at least secondary education had lower prevalence of anaemia (54%) compared to children whose mothers have no education (66%).

**Nutritional status of women:** The nutrition situation of adolescent girls and women in Tanzania is also not impressive. About 40% of women aged 15-49 years are deficient in iron, vitamin A and iodine. About 10% of women aged 15-49 years are underweight, 18% are overweight and 10% are obese. Overall, 45% of women aged 15-49 in Tanzania are anaemic; 33% are mildly anaemic, 11% moderately anaemic and 1% severely anaemic. Data on nutritional status of other household members, e.g. adolescent boys and men, are not available.

2. **BACKGROUND AND GEOGRAPHICAL CHARACTERISTICS OF THE SURVEYED AREAS**

In Tanzania, three agro-ecological zones were selected: Central Ecological Zone (Dodoma and Singida); Eastern Ecological Zone (Morogoro, Mvomero and Kilombero); and Southern Ecological Zone (Mbeya and Njombe) as described in Table 1 and as shown in Map 3. It should be noted that during the baseline survey, Mbeya region was divided into two regions; namely Mbeya and Songwe. The total sample size for the ATONU-NSI impact assessment study was 1,800 households, with 1,200 receiving treatment and 600 as a Control arm. Annex 1 presents a detailed list of selected villages, randomization and allocation of treatments.

**Table 1: Summary of the study sites**

<table>
<thead>
<tr>
<th>Agro-ecological Zone</th>
<th>Southern Highlands</th>
<th>Central Semi-arid</th>
<th>Eastern Sub-humid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Districts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mbeya Rural</td>
<td>Chamwino</td>
<td>Morogoro Municipality</td>
<td></td>
</tr>
<tr>
<td>Njombe Rural</td>
<td>Iramba</td>
<td>Mvomero</td>
<td></td>
</tr>
<tr>
<td>Wanging’ombe</td>
<td>Manyoni</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Villages</td>
<td>24 villages</td>
<td>24 villages</td>
<td>12 villages</td>
</tr>
<tr>
<td>Number of Households</td>
<td>720 households</td>
<td>720 households</td>
<td>360 households</td>
</tr>
</tbody>
</table>

The sample contained 20 villages per treatment arm, each village with a total of 30 participating households, giving a total of 1,800 households. The selection of these arms was made in collaboration with the ACGG staff based in the zones where chickens had been supplied to farmers.
2.1 Central Ecological Zone

Dodoma Region

Dodoma Region is located in the Central part of the country on Latitude: -6° 00' 0.00" S and Longitude: 36° 00' 0.00" E. It is primarily semi-arid and covers an area of 41,311 square kilometres. The region is administratively divided into seven districts (Map 3). The region is bordered by Manyara Region to the north, Singida Region to the west, Iringa Region to the south, and Morogoro Region to the southeast. Dodoma has the highest proportion of households with very low food access (38%). Food consumption is poorest in the Central regions of Tabora (64% of households), Singida (62%) and Dodoma (48%). Kongwa, Bahi and Chamwino are the three least food-secure districts in the Region. Failure of rainfall results in crop failure, significantly reducing food production. In all the surveyed villages of Chamwino and Bahi, food harvested can only suffice for 6–9 months of the year. Food insecurity is acute from December to February. The Rapid Vulnerability Assessment done by the Ministry of Agriculture, Livestock and Fisheries established that Bahi District is among the 28 district councils from 12 regions of Tanzania which were likely to be generally food insecure between November 2010 and January 2011 (MUCHALI, 2010).
Singida Region

Singida is the capital of the municipality of Singida. The region is bordered to the North by Shinyanga Region, Simiyu Region and Arusha Region, to the Northeast by Manyara Region, to the East by Dodoma Region, to the Southeast by Iringa Region, to the Southwest by Mbeya Region and to the West by Tabora Region. It is one of the poorest regions in Tanzania. Singida region is located below the equator between latitudes 3°52’ and 7°34’. Longitudinally, the region is situated between 33°27’ and 35°26’ east of Greenwich. The region forms part of the semi-arid Central zone of Tanzania, which experiences low rainfall and often erratic short rainy seasons. Total rainfall ranges from 500 mm to 800 mm per annum, with high geographical, seasonal and annual variation. There are two seasons, the short rainy season during the months of December to March or sometimes goes to April, and the long dry season from April to November. The region is administratively divided into six districts (Map 5).
2.2 Eastern Ecological Zone

Morogoro Region
Morogoro Region is administratively divided into six districts, namely Morogoro, Mvomero, Kilosa, Kilombero, Ulanga and Gairo. The Region lies between latitude 5°58" and 10°0" to the South of the Equator and longitude 35°25" and 35°30" to the East. It is bordered by seven other Regions: Arusha and Tanga regions to the North, the Coast Region to the East, Dodoma and Iringa to the West, and Ruvuma and Lindi to the South. The economy of the Region is dominated by agriculture and related activities. The major activities include: (i) Small scale farming (food and cash crop production and subsistence farming) (ii) Cattle keeping (mainly indigenous livestock) (iii) Plantations and estates (sisal, sugar). There is, however, growth of a small capital intensive urban sector whose main activities include: (i) Manufacturing and (ii) Provision of services - offices, hotels, petty trading. (iv) Traditional fishing along the Kilombero and Wami rivers as well as Mindu dam. Maize and paddy are the major staple food crops. Other food crops in the region include sorghum, sweet potatoes, beans, cassava, millet, groundnuts, tomatoes, fruits and vegetables.
2.3 Southern Ecological Zone

Mbeya Region
Mbeya Region is located in the South Western Corner of the Southern Highlands of Tanzania. The region lies between Latitudes 7° and 9°31' South of the Equator, and between Longitudes 32° and 35° East of Greenwich. The area lies at an altitude of 475 metres above sea level, with high peaks of 2,981 metres above sea level at Rungwe higher attitudes. It is divided into seven administrative districts (Map 7).

Mbeya shares borders with Zambia and Malawi to the immediate South; Rukwa Region to the West; Tabora and Singida Regions to the North; while Iringa Region lies to its East, with Tunduma and Kasumulu in Mbozi and Kyela districts, respectively, being the main entries and/or exits into the neighbouring countries of Malawi and Zambia

In the Highlands (1,500 to 2,400 metres above sea level), the cultivated food crops include, maize, groundnuts, beans, wheat, potatoes and bananas. In the Midland zone (800 to 1500 meters above sea level) people prefer cultivating maize, sorghum, finger millet, cotton, cowpeas, groundnuts, cassava, beans and some paddy. Cattle and goats are also common in the zone. Several crops thrive well in the Lowlands zone (400 to 800 meters above sea level), for example, tobacco, maize, sorghum, finger millet, cassava, groundnuts, cocoa, cashew nuts, palm oil, paddy and bananas. Cattle, goats and sheep are reared as well.
Njombe Region

Njombe Region was established in March 2012, when it was split from Iringa Region. The region's capital is Njombe town. The Region has an area of 24,994 km$^2$ and is divided into four Administrative Districts (Map 8). The region borders Iringa Region in the North, Morogoro Region in the East and Ruvuma region in the South. It also borders the Republic of Malawi via Lake Nyasa and part of Mbeya Region in the north-west and West. It lies between latitude 08°40’ and 10°32’ south of the equator and between longitude 33°47’ and 35°45’ east of Greenwich. The main economic activities of the people of Njombe include cultivation of food crops. Njombe is one of the largest producers of Irish (round) potatoes, maize and beans.
Map 8: Njombe region showing administrative districts
3. NUTRITION SITUATION OF REGIONS PARTICIPATING IN ATONU PROJECT

The nutritional data in the ensuing sections were taken from the TDHS-MIS (2015-16) report.

3.1 Nutritional Status of Children Below Five Years of Age

Njombe Region had the highest prevalence of stunting (49%) compared to other regions (Figure 3). This was higher than the national average of 34% (TDHS – MIS 2015-16). Dodoma region had the highest prevalence of underweight (17%) children. This was higher than the national average of 14% (TDHS – MIS 2015-16). The regions are at different nutritional status, which suggests that there could be inherent factors contributing to the situation. These need to be identified so as to allow appropriate interventions to be instituted to correct the situation.

![Figure 3: Nutritional status of children below five years of age in the surveyed areas](image)

3.2 Nutrition Status of Women

The nutrition situation of women varies among the regions that are implementing ACGG and ATONU interventions. Njombe had the highest proportion (7%) of women who have a short stature of below 145 cm (Figure 4). In addition, the Body Mass Index (BMI) of women in the surveyed regions was within the normal range (21-24.5 Kg/H²). Women in Morogoro region had high BMI (24.2 Kg/H²), followed by Njombe Region (23.9 Kg/H²). Women in Singida, Dodoma and Mbeya had BMI of 22 Kg/H² (Figure 5). Women in Njombe Region have a combination of short stature and high BMI, which are considered risk factors for development of non-communicable diseases and reproductive challenges.

![Figure 4: Nutrition status of women in the surveyed regions](image)
3.3 Prevalence of Anaemia among Women of Reproductive Age

The prevalence of anaemia was high in all the participating regions, ranging between 25% and 47% (Figure 6). However, Morogoro had the highest prevalence of anaemia (47%) and Dodoma had the highest prevalence of severe anaemia (1.3%).

3.4 Level of Education of Mothers and Nutritional Status of Children

Results presented in Figure 7 suggest that there is a link between level of education of mothers and nutritional status of children. Mothers who had attained secondary education tend to have children who have better nutritional status compared to children of mothers who have no formal education. A high prevalence of stunting was observed among children of mothers who have no formal education (39.3%) or have not completed primary education (39.5%). However, it is not clear what influences the level of nutrition among mothers who have been to school, considering that not much nutrition is taught in schools. It could probably be related to the level of understanding and ability to use information by the mother to improve the nutrition situation of children. The trend is similar for other indicators such as underweight and wasting.
Figure 7: Level of education of mothers and nutritional status of children

Key:
H/A: Height for age
W/H: Weight for height
W/A: Weight for age
4. OBJECTIVES OF THE BASELINE SURVEY

4.1 Overall Aim

The overall aim of the baseline survey was to generate data for assessing the effectiveness of nutrition-sensitive interventions to be implemented in selected ATONU/ACGG villages.

4.2 Objectives of the Survey

The overall objective of the survey was to establish the baseline values of key indicators of the project before implementation of nutrition-sensitive interventions so that the magnitude of change could be estimated in a final survey to be carried out at the end of implementation.

The specific objectives of the baseline survey were to:

i. Assess production patterns of crops and livestock in the surveyed areas;

ii. Assess nutritional knowledge among men and women from the surveyed areas;

iii. Identify factors influencing nutrition knowledge;

iv. Assess current dietary practices and consumption patterns of households and individuals;

v. Assess nutritional status of infants and young children aged below 5 years and women of child-bearing age using anthropometry; and

vi. Examine knowledge, attitude and decision-making practices around budgeting and expenditure as influenced by gender norms and beliefs.
5. METHODOLOGY

5.1 Impact Assessment Study Approach

Impact evaluation is an assessment of how the intervention being evaluated affects outcomes, whether these effects are intended or unintended. The proper analysis of impact requires a counterfactual of what those outcomes would have been in the absence of the intervention. The impact assessment study will use the double difference approach: the difference in the output(s) or outcome(s) of (i) before versus after the intervention, and (ii) between comparison groups (i.e., double difference). The use of before and after comparison is not a good impact measure as it fails to control for other factors; while the single difference comparison fails to allow for differences between the two groups which may have existed prior to the intervention. The double difference method takes care of these two problems. Therefore, to enable counterfactual analysis, the comparison approach will be two pronged, using the “before-and-after” and “with-and-without” approaches as follows:

- “before-and-after” approach refers to the outputs and outcomes with the intervention (the factual), which are compared with the outputs and outcomes ‘without’ the intervention (the counterfactual) to determine the impact of the intervention. This is to identify if nutrition-sensitive interventions (within the ACGG and ATONU treatment group) are working or not. The difference will be observed between baseline data and end-line data.
- “with-and-without” approach refers to the difference in outcomes between the beneficiaries of the nutrition-sensitive interventions (the ACGG and ATONU treatment arms) and the comparison group (Control). The difference will be observed between the baseline and end-line data in the two arms.

5.2 Impact Assessment Study Design

The impact assessment study uses a cluster randomized design to evaluate the interventions implemented by ACGG and ATONU compared to Control villages. For the impact evaluation, Control villages were randomly selected to form a third arm that will serve as a Control arm receiving none of the interventions. In the selection of the programme villages, ACGG created a sampling frame of villages in their programme arms that met the criteria of geographic diversity, poultry producing capacity, and number of smallholder households producing chicken. The Control villages that will participate in the evaluation were randomly drawn from the same sampling frame but no interventions will be implemented in these villages. However, the control households will be provided with the same standard of care of agricultural and health services by public agricultural and health extension personnel.

In ACGG villages, participating households are those that are already participating in the ACGG programme, have at least one household member who is a woman of reproductive age (18-49 years at recruitment) and provide informed consent. In non-ACGG (Control) villages, in addition to meeting the evaluation criteria of having at least one household member who is a woman of reproductive age and providing informed consent, participating households also met ACGG’s criteria for participation in the programmes: (1) having produced chickens for at least two years, and (2) currently keeping not more than 50 chickens, with interest to expand production in the future.

The sampling frame was the ACGG participating regions in the selected agro-ecological zones whereby two districts were chosen from each region. Sixty villages were selected for all three zones as follows: forty villages were set for intervention and twenty villages set for Control. The thirty households that met inclusion criteria were randomly selected from each village and these were the households that were interviewed. The Control villages selected were based on the advice given by ACGG that fulfilled their inclusion criteria but not randomly selected to participate in the intervention (Figure 8).
5.3 Sampling and Sample Size

A sample size calculation aimed to detect the difference in dietary diversity of 10% between the intervention and Control groups after at least eight months of intervention was determined by applying a statistical significance of \( p = 0.05 \) and a power of 80%. The aim was to find the minimum number of clusters (villages) to detect a specified difference between the mean treatment (intervened individuals) groups and the Control group (non-intervened individuals). Under individual randomization comparing two groups, the sample size was given by:

\[
 n = \frac{(\sigma_T^2 + \sigma_C^2) [z_{\alpha/2} + z_{\beta}]^2}{\Delta^2}
\]

Where:
- \( n \) = Number of individuals
- \( \sigma_T^2 \) and \( \sigma_C^2 \) (1.63 and 1.61) are the variation of individual food diversity scores in the treatment and Control group, respectively;
- \( z_{\alpha/2} \) and \( z_{\beta} \) (1.96 and 0.842) are the z values usually at 5% and 80% levels representing the level of significance and the power of the test respectively;
- \( \Delta^2 \) is the detectable difference 2.99 and 2.56;

Given a sample of size \( n \) under individual randomization, the number of clusters needed is given by:
\[ K = \frac{(\sigma_T^2 + \sigma_C^2)[z_{\alpha/2} + z_{\beta}]^2[1 + (m - 1)\rho]}{m\Delta^2} \]

Where:

- \( K \) = the number of clusters;
- \( \rho \) = the inter-cluster correlation coefficient (ICC) equal to 0.1; and
- \( m \) = the average cluster size (number of households in a village) which is 40 villages.

\[ K = \frac{(1.63^2 + 1.61^2)[1.96 + 0.842]^2[1 + (40 - 1)0.1]}{40(2.99 - 2.56)^2} \]

\( K = 28 \approx 30 \) clusters

5.4 Sample Description and Distribution

In the three agro-ecological zones, the sample was distributed as shown in Table 2. Four districts were selected in the Central and Southern Highlands zones and 2 districts in the Eastern zone; each having the respective interventions, that is, ACGG alone, ACGG+ATONU and Control. However, the actual households that were interviewed were 1,762.

Table 2: Sample distribution

<table>
<thead>
<tr>
<th>Agro-ecological Zone</th>
<th>District</th>
<th>ACGG</th>
<th>ACGG + ATONU Interventions</th>
<th>Control</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Villages</td>
<td>HH</td>
<td>Villages</td>
<td>HH</td>
<td>Village</td>
</tr>
<tr>
<td>Central semi-arid</td>
<td>4</td>
<td>8</td>
<td>240</td>
<td>8</td>
<td>240</td>
</tr>
<tr>
<td>Southern Highlands</td>
<td>4</td>
<td>8</td>
<td>240</td>
<td>8</td>
<td>240</td>
</tr>
<tr>
<td>Eastern sub-humid</td>
<td>2</td>
<td>4</td>
<td>120</td>
<td>4</td>
<td>120</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>20</td>
<td>600</td>
<td>20</td>
<td>600</td>
</tr>
</tbody>
</table>

5.5 Data Collection Approach

During the survey, the mixed method approach was used for collecting both quantitative and qualitative data. The survey central premise was that the use of quantitative and qualitative approaches in combination provides a better understanding of the research problem than either approach alone. Different types of questions were used; for example, open and closed, single and multiple responses, ranking and rating.

5.6 Preparatory Processes

5.6.1 Research permission procedure

The procedure to obtain permission to carry out the baseline survey involved the Vice Chancellor of Sokoine University of Agriculture who submitted a request on behalf of researchers to respective Regional and District Authorities to conduct research in their arms. At the district level the District Executive Director (DED) authorized researchers by an official letter and instructed the District Livestock Development Officer (DLFDO) to issue a letter to the village authority to support researchers to conduct the survey and assigned one officer to accompany researchers to the villages. The letter from the district was intended to inform the Village Executive Officer about the research and tentative dates for the activity.
5.6.2 Reconnaissance visit
Three supervisors travelled to respective zones and visited all selected districts to deliver the University permit and to introduce the survey to the respective Districts/Town/Municipal Directors. Discussions were held with the directors and DLFDOs about the preparation for the survey on all logistics that will be involved. In addition, a list of selected households that would participate in the baseline survey was shared with the DLFDOs so as to inform/notify them prior to the survey dates. Permission was granted to conduct the survey in all zones visited and the reconnaissance teams were well received.

5.6.3 Tools development
The survey data collection tool was a questionnaire which was developed in collaboration with the team at FANRPAN. This involved formulation of questions to cover all aspects indicated in the objectives of the baseline survey. The survey tool was structured into 11 sections as follows: Section 1: Household Description; Section 2: Agricultural Production; Section 3: Household Income; Section 4: Market; Section 5: Household Expenditure; Section 6: Food Availability; Section 7: Knowledge and Practice on Nutrition; Section 8: Food Consumption and Utilization; Section 9: Water, Sanitation and Hygiene; Section 10: Gender and Women Empowerment; and Section 11: Anthropometric Measurements.

5.6.4 Mobilization and training of enumerators
Enumerators were selected from a pool of personnel with experience in quantitative surveys. The minimum qualification of the enumerators was a Bachelor of Science degree as depicted in Table 3. Twenty-seven enumerators were trained in the data collection tool, how to conduct interviews and anthropometric measurement techniques for three days. The survey team was trained on how to use the survey instruments by going through all the questions in the questionnaire at Sokoine University of Agriculture. Questions that were not clear were modified accordingly. This ensured consistency and accuracy during data collection. The technicians, although experienced, were also trained on procedures and use of equipment for measurements of weight, height/length and mid-upper arm circumference. The training was conducted by experienced and qualified supervisors from Sokoine University of Agriculture.

Table 3: Qualification of enumerators

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhD</td>
<td>2</td>
</tr>
<tr>
<td>M.Sc.</td>
<td>12</td>
</tr>
<tr>
<td>B.Sc.</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
</tr>
</tbody>
</table>

5.6.5 Pre-testing of the tool and equipment
The questionnaire was pre-tested on 24 households located in a community close to Sokoine University of Agriculture and adjustments on the questionnaire were made accordingly in a plenary session after each enumerator had shared experiences of pre-testing the tool. Equipment for anthropometry was also tested by taking measurements of women and children in the 24 households that were interviewed. The measurements included weight, length/height and mid-upper arm circumference.

5.7 Data Collection
5.7.1 Survey teams
A total of 35 individuals allocated to three teams conducted the survey. This included 24 enumerators, three technicians for anthropometric measurements (distributed as shown in Table 4), three team supervisors, one main supervisor, and four drivers.
Table 4: Survey team

<table>
<thead>
<tr>
<th>Zone</th>
<th>Enumerators</th>
<th>Zone Supervisors</th>
<th>Drivers</th>
<th>Main supervisor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central zone</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Eastern Zone</td>
<td>7</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Southern Highlands</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

5.7.2 Logistics for field work

Five vehicles were hired for field work, two vehicles each for the Central and Southern Highlands zones, and one vehicle for Eastern Humid zone. Tablets for use in the field were supplied by from South Africa by FANRPAN. Printing and photocopying of the tools were completed. Teams departed for field work on 15th November 2016. Teams were assigned zones to be covered by each team and travelled to respective zones on the same day on various vehicles. Village offices, schools or health centres/dispensaries were used to set up an examination centre where all participants and their children participating in the survey would come for anthropometry measurements.

In the respective zones, arrangements were finalised before the arrival of the teams. In some arms, however, things were not as smooth as expected.

5.7.3 Interviews with selected respondents

The baseline survey was conducted in all selected zones from 15th Nov to 3rd December 2016. Interviews were carried out at the respondent’s residence. Face to face interviews with an adult woman responsible for food preparation (preferably husband and wife together) were carried out using a structured questionnaire (Figure 9). Questionnaires were checked before the day of the survey to ensure that all pages were included. After the interviews, the questionnaires were checked for completeness and accuracy by enumerators and supervisors.

![Figure 9: Interviews being carried out at homesteads](image)

5.7.4 Anthropometric measurements

Anthropometric measures offer a historical perspective on physical development, capturing accumulated changes in body size caused by dietary intake, physical activity, infection and other factors. To determine these characteristics all respondents were directed through a referral system (Figure 10) to go to a centralised makeshift centre for measurements.
After obtaining referral from the enumerator at the household, parents/guardian and children were weighed and measured for height in all of the households in the sample. Weight measurements were obtained with an electronic SECA 874 flat scale (SECA, Vogel & Haike, Hamburg Germany) designed for mobile use. The scale had a double display to facilitate accurate recording of weight and could be turned on with a toe tap. For the weighing of very young children, the mother or caretaker was weighed first. The mother or caretaker was then weighed again while holding the child. An automatic two-in-one adjustment button allowed the mother’s stored weight to be deducted, which left the baby’s weight displayed on the scale. Height was measured with a Shorr measuring board (Shorr Productions, Perspectives Entreprises & Portage, Missouri USA). Children younger than 24 months or shorter than 85 cm were measured lying down on the board (recumbent length), while standing height was measured for older or taller children and adults. The measurement was recorded while the subject was standing without shoes, on a horizontal flat plate attached to the base of the height metre with heels together; and stretched upwards to a full extent and the head in the Frankfurt plane. The subject was closely observed to ensure that the heels remained on the ground and that the head was in an upright position during the measurement (Figure 11).

5.7.5 Ethical considerations
The research protocol was explained to the responsible authorities and the research team obtained appropriate authorization from the region, district, ward and village leaders through clearance requested by the Vice Chancellor in lieu of NIMR ethical clearance. However, documentation for the NIMR ethical clearance were submitted to NIMR for review and authorisation and Ethical Clearance Certificate was issued, reference NIMR/HQ/R.8a/Vol. IX/2554. Participants were informed about the objectives and activities of the baseline survey. Participation in the survey was voluntary and informed written/oral consent to participate was sought from the participants. Caregivers and or children who were identified by the researchers as malnourished and those who were reported to be ill during the
survey were advised to report to the health facilities where they would normally receive standard treatment and/or rehabilitation.

5.8 Data Management and Analysis

Data were entered on tablets and loaded in Excel software. The data were later exported to the Statistical Product and Service Solutions (SPSS) software version 18 that aided running descriptive and inferential statistics. All analyses were carried out at 95% confidence interval. The key indicators assessed included socio-demographic, nutritional status using indicators height for age Z-score (HAZ), weight for Age z-score (WAZ), weight for height z-score (WHZ) and body mass index (BMI). Other indicators included women/household and child dietary diversity score, hunger score and Household Food Insecurity Access Scale and effect of gender dynamics on expenditure and income. Information about agricultural production and food consumption patterns, vegetable production, preparation and processing, water availability/accessibility and hygiene practices as well as the sanitary situation was also collected.
6. RESULTS
6.1 Household Characteristics

6.1.1 Household size and composition
Mean size for the surveyed households was 5.5 persons. This was slightly higher than the national average of 4.9 persons per household (TDHS-MIS, 2015-16). The proportion of females in all surveyed areas was 49.5% and that of males was 50.5%. The household size varied slightly between zones. Central zone had higher household size (5.7) compared to Eastern (5.4) and Southern Highlands (5.3). The proportion of females was much higher (53%) in the Eastern zone than in the Central and Southern Highlands. Mean household size in ACGG and ACGG+ATONU treatment arms was 5.7, slightly higher than the mean household size in the Control arms (5.5). Children aged 0-19 years were a total of 4143 (52.4%) (2058 females (49.7%) and 2085 males (50.3%). Adults above 20 years old were a total of 3760 (47.6%) (1857 female (49.4%) and 1903 males (50.6%). There was a slight difference over the number of individuals in participating zones. The proportion of children 0-19 years in ACGG+ATONU, ACGG only and Control treatment arms were as follows: a total of 1390 [(33.5%) (693 females (49.8%), 697 males (50.2%)], 1423 [(34.3%) (716 females (50.3%), 707 males (49.7%)], 1330 [(32%) (649 females (48.8%), 681 males (51.2%)], respectively. In addition, the proportion of adults above 20 years old was 1234 [(32.8%) (611 females (49.5%), 623 males 50.5%)], 1275 [(34%) (635 females (49.8%), 640 males (50.2%)] and 1251 [(33.2%) (614 females (49.1%), 637 males (50.9%)] adult in ACGG+ATONU, ACGG only and control treatment arms, respectively. Children 0-19 years in Central, Eastern and Southern Highlands zone were 1820 [(43.9%) (866 females (47.6%), 954 males (52.4%)], 787 [(19%) (428 females (54.4%), 359 males (45.6%)], 1536 [(37.1%) (764 females (49.7%), 772 males (50.3%)], respectively. Similarly, the total adults above 20 years old in the zones was 1513 [(40.2%) (755 females 49.9%), 758 males (50.1%)], 853 [(22.7%) (434 females (50.9%), 419 males (40.1%)] and 1394 [(37.1%) (668 females (48%), 726 males (52%)] in Central, Eastern and Southern Highlands zone, respectively.

6.1.2 Education
About 78% of the respondents (n=1762) had attained primary level of education (Grade 7) and 8% of the respondents had never had access to formal education (Figure 12a). These results indicate that most of the respondents had completed primary education and this may have implications on the level of knowledge and practices with regards to maternal and child feeding. Mother’s education has been shown to have a significant influence on nutritional status of children (TDHS-MIS, 2015-16). This is because education provides people with knowledge and skills to enable them to manage their environment adequately and provide their families with appropriate foods to improve nutrition. Figure 12b presents attainment of education of respondents by treatment arms. The highest level of education attained by 77% of the respondents in all treatment arms was primary level education. About 7%, 7% and 9% of the respondents in ACGG+ATONU, ACGG only and Control treatment arms, respectively, had not been to any formal education. Other levels attained by respondents are shown in Figure 12b. Attainment of education by zones showed that 80% of households in the Central zone had attained primary education compared to 78% and 74% in the Southern Highlands and Eastern zones, respectively. Attainment of higher level education was very low, ranging between 0.8% for university, 0.9% for Advanced (A) level and 10.3% for Ordinary (O) level education (Figure 12c).
Marital status can have a significant influence on dietary pattern, food security and nutritional status of household members. A study by Mboho and Bassey (2013) observed a significant influence of marital status on the nutritional status of children. In the present survey information was collected on marital status among women and men of between 15 and 49 years of age. About 73% of the respondents in the surveyed areas were married and 3% of the couples were cohabiting. About 24% of the respondents
were living alone, either as divorced (1.6%), separated (3.5%), widows (4.3%) or unmarried (14%) (Figure 13a). There were no differences in marital status by surveyed treatment arms, i.e., ACGG only, ACGG+ATONU and Control treatment arms. Seventy five percent of the households from the Control arm were married compared to 74% in the ACGG only and 71% in ACGG+ATONU treatment arms. The proportions of households in the other marital status categories were almost the same among the treatment arms (Figure 13b). Slight differences were observed in the various zones. Central zone had a high proportion of married couples (76%) compared to 72% and 71% for the Eastern and Southern Highlands zones. The Southern Highlands zone had a slightly high proportion of respondents that were single (Figure 13c).

![Figure 13a: Marital status of participating households in the surveyed areas](image)

![Figure 13b: Marital status of participating households in the surveyed areas by treatment arms](image)
6.1.4 Occupation

Eighty-three percent of the participating households (N = 1762) were engaged in farming as their most important occupation (Figure 14a). Other engagements included self-employment (7.3%) and formal employment (3.3%). The pattern was the same for all treatment arms and zones (Figure 14b,c). However, 86% of households in the Control treatment arm were farmers compared to 81.5% of the ACGG+ATONU households and 80% of ACGG only households (Figure 14b). Similarly, there were more self-employed, in business and formal employment in ACGG households compared to Control households (Figure 14b).

Figure 13c: Marital status of participating households in the surveyed areas by zones

Figure 14a: Occupation of respondents in the surveyed areas
Figure 14b: Occupation of respondents in the surveyed areas by treatment arms

![Figure 14b: Occupation of respondents in the surveyed areas by treatment arms](image)

Figure 14c: Occupation of respondents in the surveyed areas by zones

![Figure 14c: Occupation of respondents in the surveyed areas by zones](image)

6.2 Household assets and income

6.2.1 Household assets

The most common owned household assets included hand hoe (94%), cell phone (93%), table (81%), stove (69%), radio (67%), and bicycle (56%) (Table 5a). The Control treatment arm had a slightly higher proportion (94%) of households that owned a hand hoe compared to 93% in the ACGG+ATONU and 93% in the ACGG only treatment arms. The assets owned by respondents in the surveyed zones included cell phone, which was owned by 81% of the respondents in the Central zone, 87% in Eastern and 89% in Southern Highlands; radio by 65%, 69% and 68% of the respondents in Central, Eastern and Southern Highland zones, respectively. A hand hoe was owned by 93% of the respondents in Central zone, 94.5% in Eastern and 93.5% in Southern Highlands, respectively (Table 5b). Availability of cell phones and radios in the surveyed areas presents an opportunity that can be used to disseminate nutrition information or messages.
The average size of land owned by households in the surveyed areas was 1.71±1.94 hectares. This agricultural land was mainly used for crop cultivation. However, there were households that had no land, while others had over 20 hectares. The situation was not very different when the data were disaggregated by zones and treatment arms. There was no difference between ACGG only, ACGG+ATONU and Control villages in terms of land size and use.

### 6.2.2 Main source of income for households

There were several sources of income in the surveyed areas as depicted in Figure 15a. Sale of harvested crops was observed to be the main source of income. Other important sources of income included sale of chickens, off-farm activities such as sale of charcoal and crafts. Remittances and donations played the least role as a household source of income. The pattern did not differ much in the treatment arms and zones (Figures 15b and 15c). However, sale of chickens was high in the ACGG

---

**Table 5a: Household assets by the treatment arms**

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACGG + ATONU</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Car/ Van/Truck</td>
<td>17</td>
<td>2.9</td>
<td>97.1</td>
<td>18</td>
<td>3.2</td>
<td>96.8</td>
<td>13</td>
<td>2.2</td>
</tr>
<tr>
<td>Motorbike/ Scooter</td>
<td>119</td>
<td>20.2</td>
<td>79.8</td>
<td>94</td>
<td>16.5</td>
<td>87.</td>
<td>1.1</td>
<td>8.4</td>
</tr>
<tr>
<td>Tractor</td>
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<td>67.3</td>
<td>32.7</td>
<td>367</td>
<td>64.5</td>
<td>35.5</td>
<td>202</td>
<td>35.5</td>
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<tr>
<td>TV</td>
<td>155</td>
<td>26.3</td>
<td>73.7</td>
<td>181</td>
<td>31.8</td>
<td>68.2</td>
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<td>31.5</td>
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<td>Cellphone</td>
<td>471</td>
<td>81.1</td>
<td>18.9</td>
<td>466</td>
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<td>18.1</td>
<td>503</td>
<td>81.8</td>
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<td>Sewing machine</td>
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<td>478</td>
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<td>80.1</td>
<td>19.9</td>
<td>478</td>
<td>80.1</td>
<td>19.9</td>
<td>501</td>
<td>80.1</td>
</tr>
<tr>
<td>Tractor drawn farm implements</td>
<td>10</td>
<td>1.7</td>
<td>98.3</td>
<td>13</td>
<td>2.3</td>
<td>97.7</td>
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<td>Oven</td>
<td>106</td>
<td>18.4</td>
<td>81.6</td>
<td>164</td>
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<td>88.9</td>
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<td>88.9</td>
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<tr>
<td>Wood barrows</td>
<td>48</td>
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<td>91.9</td>
<td>68</td>
<td>12.0</td>
<td>86.0</td>
<td>501</td>
<td>81.2</td>
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<tr>
<td>Hoe</td>
<td>549</td>
<td>93.1</td>
<td>6.9</td>
<td>528</td>
<td>92.8</td>
<td>7.2</td>
<td>572</td>
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<td>Rake</td>
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<td>18.8</td>
<td>81.2</td>
<td>114</td>
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<tr>
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<td>48.0</td>
<td>52.0</td>
<td>265</td>
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<td>53.4</td>
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**Table 5b: Household assets by zones**

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<td>1.7</td>
<td>98.3</td>
<td>33</td>
<td>4.6</td>
</tr>
</tbody>
</table>

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The average size of land owned by households in the surveyed areas was 1.71±1.94 hectares. This agricultural land was mainly used for crop cultivation. However, there were households that had no land, while others had over 20 hectares. The situation was not very different when the data were disaggregated by zones and treatment arms. There was no difference between ACGG only, ACGG+ATONU and Control villages in terms of land size and use.

### Table 5c: Household assets by zones

- **CENTRAL ZONE**
- **EASTERN ZONE**
- **SOUTHERN ZONE**

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### 6.2.2 Main source of income for households

There were several sources of income in the surveyed areas as depicted in Figure 15a. Sale of harvested crops was observed to be the main source of income. Other important sources of income included sale of chickens, off-farm activities such as sale of charcoal and crafts. Remittances and donations played the least role as a household source of income. The pattern did not differ much in the treatment arms and zones (Figures 15b and 15c). However, sale of chickens was high in the ACGG

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### Table 5b: Household assets by zones

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29
only and ACGG+ATONU treatment arms, both recording a proportion of 26.7% of the households surveyed.

**Figure 15a: Source of household income in the surveyed areas**

**Figure 15b: Source of household income in the surveyed areas by treatment arms**
6.2.3 Housing construction materials

The main materials used for construction of walls in the surveyed areas included mud bricks and cement bricks. About 81% of the households used mud bricks to construct walls and only 11% used cement bricks (Figure 16a). The materials and types of walls were not different between treatment arms (Figure 16b) and zones (Figure 16c). Very few houses had walls that have been constructed using other materials such as stick and mud (6.4%), mud bricks and cement mortar (1.3%).

Figure 15c: Source of household income in the surveyed areas by zones

Figure 16a: Materials used for construction of walls in all the surveyed areas

Figure 16b: Materials used for construction of walls in the surveyed areas by treatment arms
The main materials used for construction of house roofs in the surveyed areas were iron sheets; whereby 95% of the houses had iron sheet roofs and 4% thatched grass roofs. A very small proportion of households used other materials for roof construction, which included asbestos and tiles (Figure 17a). In general, the materials used in all areas were similar.
Figure 17c: Materials used for construction of roofs in the surveyed areas by zones

6.2.4 Utilities and services

About 98% of households had access to a cell phone network (Figure 18a). Access to the networks did not differ much among treatment arms and zones (Figures 18b & c). This can be a useful channel for communicating nutrition messages and other information.

Figure 18a: Utilities and services in the surveyed areas

Figure 18b: Utilities and services in the surveyed areas by treatment arms
6.2.5 Type of energy for lighting

The main types of energy for lighting in the surveyed areas were solar (40%), battery (27%); electricity (21%) and paraffin (11%) (Figure 19a). Households in ACGG only, ACGG+ATONU and Control treatment arms also showed slight difference in terms of the source of energy for lighting. About 41% of the households in the Control treatment arm used solar power as a source of energy for lighting compared to 39% of the households in ACGG arm and 38.5% for ACGG+ATONU treatment arm. About 29% of the households in ACGG+ATONU arm used battery power as a source of energy for lighting compared to 24% of the households in Control and 26% of ACGG only households (Figure 19b). Use of solar power was more prominent in the Central zone (44%) compared to the other zones, Eastern (39%) and Southern Highlands (35%). In addition, use of battery powered light was more common in the Southern Highlands (31%) and Eastern (29%) zones. The use of electricity did not differ among zones (Figure 19c).
6.2.6 Type of energy for cooking and heating

Firewood and charcoal were the most important sources of energy for cooking and heating in the surveyed areas. About 84% of households used firewood as their main source of energy for cooking (Figure 20a). Charcoal was used by only 15% of the households in the surveyed areas (Figure 20a). The use of electricity for cooking was generally less common and was limited to only 0.1% of the households. There was no difference in the type of energy used for cooking by treatment arms (ACGG only, ACGG+ATONU and Control) (Figure 20b) and by zones (Figure 29c).
6.3 Crop, vegetable and fruit production

Agriculture plays a dominant role in the economy of the surveyed areas. About 90% of agricultural production in these areas is mainly from smallholder farming. There was high diversity of types of crops being grown in the surveyed areas. These included maize, rice, cassava, millet and sorghum, assortment of vegetables, legumes and assortment of fruits. Maize production accounted for 82% of all
crops grown in the surveyed areas. Other crops produced included bulrush millet (30%) and paddy (23%), legumes (43.7%), sunflower (41.5%) and a number of fruits and vegetables (Figure 21a).

![Chart showing percentage of households growing various crops](chart.png)

**Figure 21a: Major crops grown in the surveyed areas**

The main crops grown by households in the Control treatment arm were maize (85%), beans (57%) and sunflower (25%). There were no significant differences (p<0.247) in the crops grown by treatment arms. However, the ACGG only and Control households had slightly lower production of all crops, except for tomatoes and okra, than in the ACGG+ATONU households (Figure 21b).

![Chart showing percentage of households growing various crops by treatment arm](chart2.png)

**Figure 21b: Major crops grown in the surveyed areas by treatment arms**

Due to agro-ecological differences, there were major variations in terms of the dominant crops that are grown in the various zones. Maize production was dominant in the Southern Highlands, whereby 98% of the households surveyed produced maize compared to 73% in the Central and 66% in the Eastern
zones. Similarly, bulrush millet production was dominant in the Central zone (72%) compared to 5% in the Southern Highlands and none in the Eastern zone. Paddy production was dominant in Eastern zone (66%) compared to Central zone (21%) and Southern Highlands (2%). The Southern Highlands zone was also famous for production of beans (78%), Chinese cabbage (48%), sunflower (46%), radish (33%) and tomatoes (25%). The Central zone was also famous for the production of sunflower (55%), pumpkin leaves (56%), groundnuts (34%) and beans (25%) (Figure 21c).

Figure 21c: Major crops grown in the surveyed areas by Zones

6.4 Food Availability

The main foods that were available in the surveyed areas included maize (75%), rice (13%), vegetables (3%), groundnut (3%) and bulrush millet (2.3%) (Figure 22a). There was no significant differences (p<0.754) in terms of availability of food items among treatment arms (Figure 22b). Availability of maize was higher in the Central zone (82%) compared to Southern Highlands (71%) and Eastern (69%) zones (Figure 22c). Availability of rice was slightly higher in the Southern zone (18%) than in Eastern (15%) and Central (8%) zones (Figure 22c). In addition, the level of availability of other food items was not different among the surveyed zones.
Figure 22a: Availability of food in the surveyed areas

Figure 22b: Availability of food in the surveyed areas by treatment arms

Figure 22c: Availability of food in the surveyed areas by zones
About 66% of the surveyed households indicated that they had food crops from their own production all year round. Only 34% of the households indicated that they had food crops during either the wet (20%) or dry seasons (14%) (Figure 23a) but not year round, implying that they were getting food from other sources.

![Figure 23a: Duration of availability of food items in the surveyed areas](image)

There were no differences in terms of availability of food items at different periods of the year for the treatment arms (Figure 23b). About 76% of the households in the Control arm, 78% in the ACGG only arm and 79% in the ACGG+ATONU arm indicated that they had food available from own production throughout the year (Figure 23b).

![Figure 23b: Duration of availability of food items in the areas by treatment arms](image)

Zonal differences were minimal as most of the households ranging between 65% and 67% in the various zones indicated that they had food crops from own production all year round (Figure 23c).
6.5 Food Accessibility

Rice, maize, beans and vegetables are the food items that were accessed by households through purchase. The results further show that meat and fish were accessed through purchase only as no households reported production of own meat and fish in the surveyed areas (Figure 24a). The same pattern was observed in the different treatment arms (Figure 24b). Although a high proportion of households produced their own maize, there was a small proportion (19%) of households that accessed maize through purchase. About 22% of the households in Southern Highlands accessed maize through purchase. This was a bit strange considering that Southern Highlands regions are major producers of maize. Moreover, 48% of the households in Eastern and 47.5% in the Central zones accessed rice through purchase, which was more than that of households in the Southern Highland zone where only 44% (Figure 24c) accessed rice through purchase.
For households that accessed food items through purchase, 77% of the households reported to have done so all the year-round (Figure 25a). No differences were observed in accessibility through purchase by treatment arms (Figure 25b). The Southern Highlands had a high proportion (80%) of the households that accessed food items through purchase all the year-round. About one fifth of the households in Central and Eastern zones accessed food items through purchase during the dry season only (Figure 25c). A very small proportion (3%) of households accessed food items through purchase during the wet season only.
Figure 25a: Food accessibility through purchase in the surveyed areas

Figure 25b: Food accessibility through purchase in the surveyed areas by treatment arms

Figure 25c: Food accessibility through purchase in the surveyed areas by zones
6.6 Food Aid

Food aid was not a common practice in the surveyed areas. Only 4.8% of the households (n=1762) indicated that they obtained food aid in form of beans (0.2%) and maize (4.6%). Most of those who received food aid were from the Central zone (51%) (Figure 26a) and they obtained both maize and beans. In the other zones, food aid recipients obtained only maize.

![Figure 26: Recipients of food aid in the surveyed areas](image)

6.7 Markets

The presence of proper food market physical structures where households could go and buy food items is necessary to facilitate accessibility of food by households. In the present survey, 54% of the households indicated that there were no food markets in their areas (Figure 27a). There were no significant differences (p=0.982) between ACGG only (54%), ACGG+ATONU (54.4%), and Control (53.9%) treatment arms in terms of availability of markets in the areas (Figure 27b). The indicated proportions are for households that responded negatively to availability of markets in their areas. However, more than half of the households in the Eastern zone had no access to physical food markets (Figure 27c).

![Figure 27a: Availability of food markets in the surveyed area](image)
Most food markets (63%) in the surveyed areas operated on a daily basis (Figure 27d) and only a few (21%) on a weekly basis. A significant difference (p<0.009) was observed on the frequency of operations of market by treatment arms (Figure 27e). There were small variations between zones; whereby 67% of the respondents in the Eastern zone indicated that markets are operated on a daily basis and 65% in the Southern Highlands and 59% in the Central zone (Figure 27f).
6.8 Livestock Production

On average, 17% of the households in the surveyed areas kept livestock of various types. However, the livestock of importance in the surveyed areas included chicken, cattle, goats and pigs. About 54% of the
surveyed households kept chickens, 17% cattle, 12% goats and 10% pigs (Figure 28a). The level was slightly lower than the national average of 78% for chickens. This shows that chickens are an important livestock type in the surveyed areas. Most of these households kept indigenous chickens which have the potential to contribute about 100% of chicken meat and 20% of eggs consumed in rural households. Despite the contribution of chicken in livestock production, not much of it was consumed in the surveyed rural households. There was no major variation between zones in the type of livestock production. The same pattern was observed for the three treatment arms (ACGG only, ACGG +ATONU, and Control). However a higher proportion of ACGG+ATONU households (97%) kept chickens compared to 73% of the ACGG only households and 81% of the Control households. However, these differences were not statistically significant (p < 0.347). For the other livestock, there were no differences among treatment arms (Figure 28b). Chickens still ranked the highest in all zones; with the Southern Highlands zone having a slightly higher proportion of households (86%) keeping chicken compared to 83% in Eastern and Central zones (Figure 28c). The Eastern zone had a higher proportion of households (33%) that kept cattle compared to Central (27%) and Southern Highlands (20%).

Figure 28a: Livestock production in the surveyed areas

Figure 28b: Livestock production in the surveyed areas by treatment arms
6.9 Food Security

In 1996 the World Food Summit defined food security as follows: “Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (World Food Summit, 1996). The FAO definition of household food security states that “a household is considered to be food secure when it has access to adequate food needed for a healthy life of all its members (adequate in terms of quality, quantity, and safety and culturally acceptable). It also includes the situation when the household is not at undue risk of losing such access for all or part of its members” (FAO, 2006). The Household Food Insecurity Access Scale (HFIAS) (Coates, Swindale & Bilinsky, 2007) measures anxiety, among others, of household members about food insecurity. Therefore, in the present baseline survey respondents were asked to indicate whether their households had experienced food insecurity over a period of 12 months prior to the survey. In this baseline survey, characteristics of households with very low food security were assessed based on the three levels of food insecurity: (i) anxiety and uncertainty about the household food supply; (ii) insufficient quality (includes variety and preferences of the type of food); and (iii) insufficient food intake and its physical consequences:

- **anxiety and uncertainty about the household food supply**
  - Members of household (mainly adult) worried that their food would run out before they got money to buy more.
  - Food they bought/produced just didn’t last and they didn’t have money to get more.

- **insufficient quality**
  - They couldn’t afford to eat balanced meals have to rely on inexpensive non-nutritious food.
  - An adult had to cut the size of meals or skipped meals because there was not enough money for food.

- **insufficient food intake and its physical consequences**
  - They had eaten less than they felt they should because there was not enough money for food.
  - They had been hungry but did not eat because they could not afford enough food.
  - They had to acquire food through socially unacceptable means such as charitable assistance, buying food on credit etc.

The frequency of occurrence of food insecurity situations in the surveyed areas is presented in Figures 29 to 32. About 70% of the households in the surveyed areas were worried that their food would run out before they got money to buy more food. The survey was carried out in November in all the targeted zones. November is considered the beginning of a full production season in Southern Highlands and Central zones, but is the short production season for Eastern zone. Therefore, the prevalence of food
insecurity of 70% of the households is an indication of very low food supply and about 25% of these households experienced this situation often. In addition, 60% of the households indicated that the food they had produced did not last for long and they did not have money to buy more food. About 17% of these households experienced this situation often, but 43% did so sometimes. Only 40% of the households surveyed had never experienced this situation. Two thirds (66%) of the surveyed households could not afford to eat balanced meals for a period of twelve months; 29% often and 36% sometimes. This is a major proportion of the households. What is not very clear from these responses is what do the household’s respondents understand by a balanced meal? This is something that has to be investigated further considering that the dietary diversity score in many of the surveyed areas was low. However, for the questions that are related to insufficient quality (includes variety and preferences of the type of food) and insufficient food intake and its physical consequences, many households in the surveyed areas had not experienced such a situation. For example, 65% of the households had never stayed without eating for the whole day due to lack of money to buy food. Similarly, 63% of the households had never cut meal size of children due to lack of enough food in the house and 60% of the households indicated that they had never experienced a situation whereby they felt hungry and could not eat because there was not enough food. Nevertheless, the proportion of households that often (8-29%) or sometimes (27-44%) experienced these situations is cause for alarm.

![Figure 29: Frequency of occurrence of food insecurity situation in the surveyed areas](image)

Similarly, there was not much difference observed between treatment arms, i.e. ACGG + ATONU, ACGG only and Control villages (Figure 30).
Anxiety and uncertainty about the household food supply and insufficient quality were observed in the surveyed zones but there was not much variation by zones and the responses ranged from 35-46%. The highest proportion of households (46%) was observed on the responses related to worries of food stocks running out before the next harvest season. On the question about “worries that the produced food would not last for a long time”, about 42% and 17% of the households expressed that anxiety occurred sometimes and often, respectively. Unaffordability of a balanced meal was experienced sometimes by 36% and often by 28% of the households. More households in the Central zone (33%) than in the Southern (28%) and Eastern (25%) zones indicated that they experienced that situation often (Figure 31).

About 37% of the households in all surveyed zones indicated that they sometimes experienced hunger but did not eat because there was not enough food in the household. The proportion of households that experienced this scenario often was 16%. Many households (64%) did not experience food shortage due to lack of money to buy food. About 26% and 7% households experienced this scenario sometimes and often, respectively. About 28% of the households indicated that they sometimes cut children’s meal size because of shortage of food in the household and 8% do that often. There were no major differences among zones (Figure 32).
6.10 Knowledge and Practice on Nutrition

6.10.1 Nutrition knowledge

Nutrition knowledge and information contribute to a better understanding about food and choices for attainment of better nutrition outcomes. The respondents were asked to define or state the meaning of nutrition from their own perspective and understanding. There were various definitions provided and not all respondents could provide a correct definition of nutrition. About 25% of the respondents did
not know the definition or meaning of nutrition (Figure 33a). In addition, 39% of the respondents related the word nutrition to types of foods for children and 18% related the word nutrition to the act of eating a balanced diet or state of good health (9%). Only a small proportion of respondents (9%) defined nutrition as the knowledge of various nutrients and their functions in the body. This clearly shows that there is still a lot of misunderstanding, misinterpretation and inadequate knowledge about the meaning of nutrition in the communities.

Figure 33a: Meaning of nutrition by respondents in the surveyed areas

There were slight variations in relation to the responses given by respondents from the three treatment arms regarding their understanding of the meaning of nutrition. About 26% of the respondents in ACGG only treatment arm did not know the meaning of nutrition compared to about 24% in the ACGG+ATONU and 24% in Control treatment arms (Figure 33b).

Figure 33b: Meaning of nutrition by respondents in the surveyed areas by treatment arms
The level of knowledge on the meaning of nutrition was the same in all surveyed zones (Figure 33c).

Figure 33c: Meaning of nutrition by respondents in the surveyed areas by zones

6.10.2 Meaning of malnutrition
The respondents were also asked to define or give the meaning of the word malnutrition. Close to 28% of the respondents reported that they did not know the meaning of malnutrition and 34% associated malnutrition with the state of being unhealthy. Only 10% of the respondents could associate malnutrition to emaciation and 24% to obesity. It is encouraging to note that people now associate obesity to malnutrition and not a state of wellbeing and wealth (Figure 34a).

Figure 34a: Meaning of malnutrition as reported by respondents in the surveyed areas

About 30% of the respondents in the ACGG+ATONU treatment arm did not know the meaning of malnutrition. The proportion was slightly lower for the respondents in the Control treatment arm (28%) and ACGG only treatment arm (25%). Other responses on the meaning of malnutrition are presented in Figure 34b and included state of being unhealthy (34%, 33% and 35%); state of being obese (25%, 26% and 22%); and state of being emaciated (9%, 12% and 11%) for ACGG+ATONU, ACGG only and Control, respectively. There were no differences between the treatment arms in the proportion of respondents’ definition of malnutrition.
There was no major difference between zones in terms of the proportion of respondents who indicated that they do not know the meaning of malnutrition. However, 29% of the respondents in the Eastern zone indicated that malnutrition is the state of being unhealthy, compared to 36% and 34% in Southern Highlands and Central zones, respectively (Figure 34c).

**Figure 34c: Meaning of malnutrition as reported by respondents in the surveyed areas by zones**

6.10.2 Awareness of malnutrition in the area

A high proportion (72%) of the surveyed households was not aware of the existence of malnutrition in their area (Figure 35a). Only 28% of the respondents were aware about malnutrition in the area.
Similarly, the responses on awareness of malnutrition showed no major differences between treatment arms (Figure 35b). In all the treatment arms, about 72% of the respondents were not aware and only 28% of the respondents were aware of malnutrition in the area.

Figure 35c shows the level of awareness of malnutrition by the surveyed zones. Central zone had a slightly lower level (69%) of households or respondents who were not aware of malnutrition in the area compared to Southern Highlands and Eastern zones, which had 74% of the respondents who were not aware of the existence of malnutrition in areas. This could be related to limited knowledge of the respondents about malnutrition and what conditions constitute malnutrition.
6.10.3 Awareness of the causes of malnutrition

Malnutrition can be caused by a number of factors. In this survey, the level of understanding and knowledge about the causes of malnutrition were assessed. Respondents were required to indicate one or more causes of malnutrition. About 27% of the respondents indicated that they did not know the causes of malnutrition. For those who responded affirmatively to the question, some indicated that malnutrition is caused by food insecurity (33%), poor food preparation (12%), lack of knowledge to prepare balanced meals (9%) and low purchasing power (7%). Other causes that were mentioned included diseases, taboos, traditional beliefs and poor hygiene (Figure 36a).

Figure 36a: Awareness of the causes of malnutrition in the surveyed area

Figure 36b shows the responses on the question on awareness of the causes of malnutrition in the respective areas presented by treatment arms, i.e. ACGG only, ACGG+ATONU and Control. About 24% of the respondents in the ACGG only treatment and 28% in ACGG+ATONU and 28% Control were not aware of the causes of malnutrition. Food insecurity was considered as the most important cause of malnutrition in the treatment arms. However, the responses were slightly different between the treatment arms. For example, about 36% of the respondents in ACGG only, 32% in ACGG+ATONU and 31% in the Control treatment arms indicated that food insecurity is the cause of malnutrition. The difference was not significant (p = 0.387). Other causes of malnutrition as indicated by the respondents were not different among the treatment arms.
When the responses were examined by zones, the proportion of households who did not know the causes of malnutrition was 27% for the Eastern and Central zones and 26% for the Southern Highlands zone. In the Eastern zone, food insecurity was mentioned by 37% of the respondents compared to 33% and 31% in the Central and Southern Highland zones, respectively. Other factors such as poor food preparation were mentioned by 14% of the respondents in the Central zone compared to about 12% in the other zones. Generally, there were no major differences among zones (Figure 36c). Overall, the baseline survey results have shown that food insecurity was considered as one of the main causes of malnutrition in the surveyed arms in all agro-ecological zones.

![Figure 36b: Awareness of the causes of malnutrition in the surveyed areas by treatment arms](image)

![Figure 36c: Awareness of the causes of malnutrition in the surveyed areas by zone](image)

**6.10.4 Awareness of ways to reduce malnutrition**

Overall, 46% of the respondents were not aware of ways to reduce malnutrition in their areas. The interventions which will be implemented in the treatment arms should consider aspects to address this need. However, 22% of the respondents were aware that diet diversification could be used to reduce malnutrition. Other ways to reduce malnutrition included hands-on practices on food preparation and planning a balanced meal (11%) and nutrition education on HIV/AIDS (5%) (Figure 69). Ways such as education on gender division of labour and decision making, education on family planning/child spacing, fortification of staple diets and knowledge on food and water safety, were lowly ranked because not many people are aware of the link between these factors and malnutrition.
More than 40% of the respondents from the three treatment arms indicated that they did not know of ways to reduce malnutrition in their areas (Figure 37b). Other ways to reduce malnutrition included diet diversification. The ACGG only treatment arm had a higher proportion (27%) of respondents who indicated that diet diversification could be one of the ways to reduce malnutrition compared to ACGG+ATONU (20%) and Control (18%) treatment arms (Figure 37b).

When the response on awareness of ways to reduce malnutrition was disaggregated by zones, a high proportion of respondents in the Central zone (48%) were not aware of ways to reduce malnutrition. In other zones the proportions were 45% for Southern Highlands and 42% for Eastern zones. However, there were no significant differences between zones ($p = 0.290$). In the Eastern zone, 26% of the respondents were aware of the use of diet diversification as a way to eradicate malnutrition; but in the Central and Southern Highlands about 21% and 20% of the respondents, respectively were aware of the use of diet diversification to reduce malnutrition. Food preparation and planning of a balanced diet were mentioned by 12%, 11% and 10% of the respondents in Central, Eastern and Southern highland zones, respectively (Figure 37c). Ways such as education on gender division of labour and decision making, education on family planning, fortification of staple diets and knowledge on food and water safety were ranked lowly because not many people were aware of the link between these factors and malnutrition. However, respondents in the Southern Highlands were more aware about the use of education on vegetable production and fortification as ways to reduce malnutrition compared to respondents in other zones.
Figure 37c: Awareness of ways to reduce malnutrition by zones

6.11 Maternal and Child Feeding Knowledge and Practices
Respondents were asked to indicate whether in the last three months, prior to the survey, they had heard any information about diets of pregnant and lactating women. About 72% of the respondents in all the surveyed areas indicated that they had not heard of any diet information for pregnant and lactating women. Only 28% said that they had heard information about diets for pregnant and lactating women in the last three months prior to the survey.

Responses on the question whether respondents had heard any information about maternal diets in the treatment arms is presented in Figure 38b. About 74% in the ACGG+ATONU, 72% in the Control and 71% in the ACGG only treatment arms had not heard of any information about maternal diets. No significant differences were observed among the treatment arms (p = 981).

Figure 38a: Information about diets of pregnant and lactating women in the surveyed areas by treatment arms

Most of the respondents who had not heard information about diets for pregnant and lactating women were from the Southern Highlands (74%). The proportions in other zones were 71% of respondents in Central zone and 70% in the Eastern zone (Figure 38c).
In addition, respondents indicated that the information on diet for pregnant and lactating women was mainly about consumption of green leafy vegetables (32%), maize products (28%), eggs (16%) and balanced diet (10%) (Figure 39a). Information about other food items such as meat, chicken, and sardines was indicated by a small proportion of respondents, that is, 2%, 0.2% and 4%, respectively.

Respondents in the three treatment arms who had heard messages related to diets for pregnant and lactating women indicated that the messages included “eat maize products”, “eat green leafy vegetables”, “eat eggs and eat balanced diets” (Figure 39b). The responses varied among treatment arms, whereby about 33% of the respondents in the Control treatment arm, 26% in the ACGG+ATONU and 24% ACGG only treatment arms indicated that they had heard information about “eat maize products”.

Figure 38b: Information about maternal diets by zones

Figure 39a: Information given about diets of pregnant and lactating women in the surveyed areas
Respondents from Central Zone reported that they had heard messages on eating maize products (29%), green leafy vegetables (30%), eggs (18%), sardines (dagaa) (4.5%) and balanced diet (9%) and those from Eastern Zone received mainly information on eat meat (27%), maize products (28%) and fruits (16%). The Southern highland respondents commonly heard information on eating sesame/ground nuts (14%) and meat (15%) (Figure 39c).

Most of the information about maternal nutrition was accessed through health workers at clinics/hospitals. More than 70% of the respondents indicated that they accessed the information through a health worker at a health facility. Other sources included radio (7.5%) and friend/family members (6%) (Figure 40a). Nevertheless, the health worker is still the most important source of
nutrition information but the kind of information that is provided is not appropriate as indicated in the responses about the types of messages given to women (Figure 40b).

**Figure 40a: Sources of maternal nutrition information in the surveyed areas**

The most important source of maternal nutrition information in different treatment arms included health workers at clinics and hospitals, which was reported by 75% of the respondents in the Control treatment, 72% in the ACGG+ATONU treatment and 64% in the ACGG only treatment (Figure 40b). Other sources included radio (9%) in ACGG+ATONU treatment and short message service (sms)/mobile phone (12%) in ACGG only treatment arm.

**Figure 40b: Sources of maternal nutrition information in the surveyed areas by treatment arms**

The Eastern zone had a higher proportion (73%) of households or respondents who accessed information through health workers and health facilities compared to Southern Highlands and Central zones, which had 70.6% and 70.5%, respectively. Friends and family were also important sources of information for respondents in the Southern Highlands zone (8%) but radio was one of the sources in Central zone (9%) (Figure 40c).
Figure 40c: Sources of maternal nutrition information in the surveyed areas by zones

Frequency of hearing nutrition information: Respondents were also asked to indicate how often they had heard information on maternal nutrition over the past three months prior to the survey. Only 24% of the respondents indicated that they had heard information about maternal nutrition all the time (Figure 41a); but 31% had heard the information about maternal nutrition once a month, while 43% had heard this information once or twice for the entire period of three months prior to the survey.

Figure 41a: Frequency of hearing nutrition information in the surveyed areas

The frequency of hearing nutrition information by treatment arms is presented in Figure 41b. Close to one third of the respondents in the Control treatment arm heard nutrition information all the time. In other treatment arms the proportion of households who heard nutrition information all the time was 27% for ACGG only and 21% for ACGG+ATONU treatments arms (Figure 41b). Forty four percent of the respondents in ACGG+ATONU treatment area had heard nutrition information rarely (once or twice only). This was a slightly higher proportion of respondents compared to the ACGG only (40%)
and Control (37%) treatment arms. For respondents who had heard nutrition information sometimes (i.e. once a month), 32% were in the ACGG only and 32% in Control treatment arm and 31% in the ACGG+ATONU treatment arm.

![Bar chart showing frequency of hearing nutrition information in the surveyed areas by treatment arms]

**Figure 41b:** Frequency of hearing nutrition information in the surveyed areas by treatment arms

About 50% of the respondents in Eastern zone had rarely (once or twice) heard the information on nutrition and only a small proportion of respondents had heard information all the time (21.5%) and sometimes (23%). In other zones, 24.6% respondents in Southern Highlands and 24% in Central zones had heard nutrition information all the time. Nevertheless, there was a high proportion of respondents who had rarely heard nutrition information (44% and 38% in Southern and Central zones, respectively) (Figure 41c).

![Bar chart showing frequency of hearing nutrition information in the surveyed areas by zones]

**Figure 41c:** Frequency of hearing nutrition information in the surveyed areas by zones

**Functions of various foods on maternal nutrition**

Many respondents did not know the functions of various foods on maternal nutrition. This was more pronounced for foods such as sugar (99%), oil (98%), milk (88%), beans (86%), fish and eggs (85%) and meat (74%). The respondents did not know about the functions of most of the animal source foods. For respondents who knew about functions of nutrients on maternal nutrition, 45% and 14% indicated that cereals and roots and tubers are sources of energy, respectively. As for the source of iron in maternal nutrition; 14% and 5% of the respondents indicated that vegetables and fruits respectively, are
sources of iron. Meat (12%), eggs (7.5%), fish (7%), beans (7%) and milk (5%) were mentioned as sources of protein. A very small proportion of respondents knew about the function of these foods on maternal nutrition. Clearly this shows that the nutrition information that is shared with mothers is not providing the basics of nutrition, that is, about nutrients and functions of these nutrients in the body, especially during pregnancy.

6.12 Child Feeding Knowledge and Practices

Child-feeding practices are considered to be significant determinants of children's nutritional status. Some of the feeding practices include type and consistency of food given to children, responsive feeding and feeding frequency. In this survey the types of foods given to infants and children 6–23 months of age were identified. The main food given to children of age 6-23 months was porridge; 50% of respondents gave their children porridge made from mixed cereals and 47% from maize flour (Figure 42a). This shows that starchy-based foods are the main sources of nutrients for infants and children 6-23 months, in addition to breast milk for infants and children who are still breastfeeding.

![Figure 42a: Proportion of respondents who fed their children different types of food items](image)

The main foods given to children in the different treatment arms included maize porridge, which was reported by 47% of the respondents in ACGG+ATONU, 46% in ACGG only and 47% in the Control treatment arms. Mixed cereal porridge was fed to 51% of the children in ACGG only, 50% in ACGG+ATONU and 49% in Control arms (Figure 42b).

![Figure 42b: Proportion of respondents who fed their children different foods by treatment arms](image)
The situation was not different in the various surveyed zones. Maize porridge and mixed cereals porridge were the main foods given to infants and children below two years (Figure 42c). Maize porridge was given to 49% of the children in the Eastern zone, 47% in Central and 45% in Southern Highlands. Likewise, 52% of the children in the Southern Highlands zone, 49% from the Central zone and 47% from the Eastern zone were given porridge made from mixed cereals (Figure 42c).

**Figure 42c: Proportion of respondents who fed their children different foods by zones**

Given the types of foods given to children by mothers in the surveyed areas, mothers were asked to indicate factors that influence the choice of food that was given to children. About 53% of the respondents indicated nutritious food (53%), availability (27%), accessibility (10%) and appearance (7%) as the main factors that influenced types of foods given to children (Figure 43a). Other factors such as cost, taste, and preparation time were not significant factors influencing the choice of food given to children.

**Figure 43a: Factors influencing choice of food types given to children in the surveyed areas**

When the data were disaggregated by treatment arms, a similar pattern was observed and the same factors influenced the choice of food for children. Nutritious food was a factor for 53% of the respondents in the ACGG+ATONU and ACGG only treatments and 52% in the Control treatment (Figure 43b). Availability was a factor for 29%, 27% and 25% of the respondents in ACGG+ATONU, ACGG only and Control treatments arms, respectively.
Respondents in the surveyed zones had the same responses, with slight differences among zones. For example, 56% of the respondents in Southern Highlands zone, 56% in Eastern zone and 49% in Central zone were influenced by the nutrient content of the foods; i.e., the food is nutritious. Other influencing factors included availability, accessibility and appearance as shown in Figure 43c.

**Information on infant and child feeding over the last three months**
Exposure to information on infant and child feeding was assessed in the surveyed areas by asking respondents whether they had heard information about child feeding during the period of three months prior to the survey. A high proportion (78%) of the respondents indicated that they had not heard information about child feeding three months prior to the survey. Only 22% of the respondents had heard information about child feeding (Figure 44a).
A higher proportion of respondents (80%) from the ACGG+ATONU treatment had not heard information about child feeding during the period of three months prior to the survey compared to other treatment arms such as Control (78%) and ACGG only (75%). Conversely, the ACGG+ATONU treatment arm had the lowest proportion of respondents who had received information about child feeding compared to ACGG only (25%) and Control (22%) treatment arms (Figure 44b).

The proportion of respondents who had not received information about child feeding was 79% and 76% in the Central and Eastern zones and Southern Highlands, respectively. Only 24%, and 21% in the Southern Highlands and Central and Eastern zones, respectively, had received information about child feeding (Figure 44c).
These results clearly show that there is limited exposure to nutrition information about child feeding in all the surveyed areas. On average, only 22% of the respondents in all surveyed areas had exposure to nutrition information during the period of three months prior to the survey. This could have implications on the overall feeding and nutrition status of household members and more specifically that of children.

**Type of information:** For respondents who had received information about child feeding (22%), 41% of them indicated that the type of information that they had received was on “breastfeed on demand” (Figure 45a). Other types of information included “feed your child eggs” (20%), “balanced meal” (10%), and “green leafy vegetables” (7%). There was limited information on other animal source foods such as milk (3.6%) and fruits (2.8%).

![Figure 44c: Responses to whether respondents had received any information about feeding child (aged 6 to 23months) in last 3 months by zones](image)

![Figure 45a: Types of nutrition information given to respondents on child feeding in the surveyed areas](image)
Figure 45b: Types of nutrition information given to respondents on child feeding in the surveyed areas by treatment arms

The Central zone had a higher proportion (52%) of respondents who had received information on breastfeeding children on demand compared to 37% and 34% of the respondents in Southern Highlands and Eastern zones, respectively (Figure 45c). Information on “feed your children eggs” was received by almost the same proportion (20%) of respondents in all surveyed zones and information on feeding children a balanced diet was received by 17% of the respondents in the Eastern zone, 11% in the Southern Highlands and 6% in the Central zones. The information on “feed your child with sesame and groundnuts” was reported by 12% of the respondents in the Eastern zone, 6% in the Southern Highlands and 5% in the Central zone. Information on “feed your children with milk” was received by 4% of the respondents in Central and Southern Highlands zones and none in the Eastern zone. Information on feeding children animal source foods and fruits was limited in all the surveyed zones.

Figure 45c: Types of nutrition information given to respondents on child feeding in the surveyed areas by zones

Source of information: The information on feeding children was obtained from various sources, including health workers in clinics/hospitals (68%), health workers in the community (11%) and friends/family (10%). Other sources were radio (4%) and NGO staff (2.5%). Therefore, health workers
in clinics/hospitals remain the most important source of information on child feeding in all study areas (Figure 46a).

![Diagram: Sources of information on child feeding in the surveyed areas](image)

**Figure 46a: Responses about sources of information on child feeding in the surveyed areas**

Health workers in clinics and hospitals were the most important sources of information on child feeding in the treatment arms, although there were variations. About 70%, 69% and 66% of the respondents in the Control, ACGG+ATONU and ACGG only treatment arms, respectively, indicated that they obtained information about child feeding from health workers in clinics/hospitals. Community health workers provided information to 14% of the respondents in ACGG+ATONU treatment arms, 12% in ACGG only and 7% in the Control treatment arms. Other sources of information about child feeding are shown in Figure 46b.

![Diagram: Sources of information on child feeding by treatment arms](image)

**Figure 46b: Responses about sources of information on child feeding in the surveyed areas by treatment arms**

Figure 46c presents data on sources of information on child feeding information by zones. About 70% of the respondents in Central and Eastern zones received information from health workers in clinics/hospitals and 66% of the respondents in Southern highland zone. Community health workers provided information about feeding to 13%, 11% and 10% of the respondents in Eastern, Central and Southern Highlands, respectively. Friends/family members were a source of information for 12% of the respondents in Southern Highlands compared to Eastern (9%) and Central (7.5%) zones.
The respondents were also questioned to establish how frequently they received the information on child feeding during the period of three months prior to the survey. Thirty two percent of the respondents indicated that they had received information all the time, 40% sometimes and 28% rarely (Figure 47a).

The proportion of respondents from the treatment arms who had received information about child feeding all the time was 30% for ACGG+ATONU, 33% for ACGG only and 32% for Control treatment arms. The respondents who had received information about child feeding sometimes was 39% for ACGG+ATONU, 40% for ACGG only and 42% for Control treatment arms. Respondents from the ACGG only treatment arm that received information rarely was 28%, the proportion of respondents from the Control treatment arm was 28% and 31% from the ACGG+ATONU treatment arm (Figure 47b).
Figure 47b: Frequency at which respondents had received information about child feeding in the surveyed areas by treatment arms

The Central zone had a higher proportion (34%) of respondents who had received information on child feeding all the time compared to 31% and 28% in the Southern Highlands and Eastern zones, respectively. Similarly, the Southern Highlands zone had a higher proportion of respondents (33%) who had received information rarely compared to 27% and 21% in the Central and Eastern zones, respectively. For respondents who had sometimes received information on child feeding, 51% were from the Eastern zone, 40% from the Central zone and 36% from the Southern Highlands zone. This clearly shows that the Eastern zone had limited frequency of receiving information on child feeding (Figure 47c).

Figure 47c: Frequency at which respondents had received information about child feeding in the surveyed areas by zones

**Infant and child feeding practices**

Infant and child feeding practices were also assessed by looking at the number of meals being fed to children per day. A high proportion of infants and children were fed three meals per day in all age categories. About 61%, 72% and 75% of respondents reported that their children received three meals per day at age 6-11, 12-23 and 24-59 months of age, respectively. The proportion of respondents whose children were fed three meals per day increased with age of the infants/child. However, the proportion of children who were fed four or more meals per day decreased with age. The proportion of respondents who fed their children four or more meals per day was 28% at age 6-11 months, 22% at 12-
23 months and 19% at age 24-59 months. Similarly, respondents who fed their children two meals per day was 10% at age 6-11 months, 6% at age 23-24 months and 5% at age 24-59 months. Therefore, feeding infants and children three times per day was highly practiced in all surveyed areas (Figure 48a).

![Figure 48a: Frequency of feeding (number of feeds) infants/children per day by age in the surveyed areas](image)

When the data were disaggregated by treatment arms, a similar pattern was observed; whereby the proportion of respondents feeding their children three meals per day increased with age. However, there were slight variations among treatment arms. For example, 62% of the respondents in ACGG+ATONU, 61% in ACGG only and 60% in Control treatments arms fed their children of age 6-11 months three meals per day. No significant differences were observed among treatment arms (p = 0.651) (Figure 48b). At age 12-23 months the proportion of respondents who fed their children three meals per day increased to 74% in the ACGG only treatment arm and 71% in ACGG+ATONU and 71% in Control treatment arms. Likewise, at age 24-59 months the proportion of the respondents who fed their children three meals per day was 76% in ACGG only, 75% in ACGG+ATONU and 74% in Control treatment arms. The practice of feeding children more than four meals per day declined gradually with age, with slight variations among treatment arms. At age 6 – 11 months, about 28% of the respondents in all treatment arms fed their children more than four meals per day; but the proportion of respondents decreased to 19% in ACGG only and 23% in ACGG+ATONU and Control treatment arms. At age 24 – 59 months, the proportion of respondents feeding more than four meals per day decreased to 20% in ACGG+ATONU and Control treatment arms and 17% in ACGG only. Feeding two meals per day was common during the younger age, where 11%, 10% and 9% of the respondents were from Control, ACGG only and ACGG+ATONU treatment arms (Figure 48b).
At age 6-11 months the proportion of respondents who fed their infants three meals per day was higher in Eastern zone (67%) than in Southern (62%) and Central (56%) zones. At age 12-23 months the proportion of respondents was higher in the Southern Highlands (75%) than in Eastern (74%) and Central (68%) zones. However, at age 24-59 months, 81% of the respondents in Eastern, 72% in Southern Highlands and 75% in Central zones fed their children three meals per day. The Central zone showed a higher proportion of respondents who fed their children with more than four meals per day at all age categories (33% for 6-11, 25% for 12-24, 20% for 24-59 months) compared to other zones (Figure 120).

To assess the level of understanding by mothers with regard to the number of meals fed to infants and children, mothers were asked to give reasons as to why they had fed their children the number of meals per day or to explain about the practice. The results of the responses to this question are presented in Figure 49a. About 23% of the respondents did not know why they needed to feed their children the indicated number of meals per day. In addition, 32% of the respondents had no explanation as to why they fed their children the number of meals per day. This shows that 55% of the respondents did not know the right number of meals per day that the children of different age categories should be fed. The reason given by mothers on feeding frequency was that the “child is still growing” and this was reported by 45% of the respondents. The proportion of respondents who indicated that the “child is still
"growing" was 47% for the age category 6-11 months, 44% for the age category 12-23 months and 43.5% for the age category 24-59 months.

Figure 49a: Reasons given by respondents for the feeding pattern of children in the surveyed areas

The proportion of respondents who responded that they “had no reason” or “did not know” about the pattern of feeding their children varied slightly by age categories and treatment arms (Figure 49b). For the age category 6-11 months, the proportion of respondents who “had no reason” or “did not know” the reason for the number of meals they were feeding their children per day was 52% for ACGG+ATONU and Control treatment arms and 54% for the ACGG only. The proportion of respondents for the same response increased slightly for the age category 12-23 months and was 59% for the ACGG+ATONU treatment arm and 57% for the Control and ACGG only treatment arms. For the age category 24 – 59 months, the proportion of respondents who had “no reason” or “did not know” was 59%, 58% and 53% for the Control, ACGG only and ACGG+ATONU treatment arms, respectively. About 20-26% of the respondents in the treatment arms responded to the question by indicating that the “child is still growing” as the reason for the observed pattern of infant feeding in terms number of meals per day (Figure 49b).

Figure 49b: Reasons given by respondents for the feeding pattern of children in the surveyed areas by treatment arms
The proportion of respondents who indicated that they had “no reason” or “did not know” about the reason for the number of meals they fed their children per day for the age category 6-11 months was 59%, 52% and 51% in the Eastern, Southern Highlands and Central zones, respectively. For age categories 12-23 months and 24 – 59 months the results are presented in Figure 49c. The Eastern zone had a higher proportion of respondents in all age categories that had “no reason” or “did not know” the reason for the child feeding pattern compared to the other zones. For example, for the age category 24-59 months, it was 62% in the Eastern zone and 56% for the Central zone and 54% for the Southern Highlands, respectively.

Figure 49c: Reasons given by respondents for the feeding pattern of children in surveyed areas by zones

6.12 Vegetable Processing
Vegetables, especially traditional ones, are highly consumed in Tanzania (4.9 times a week; Njelekela et al., 2003; Weinberger and Swai, 2006) and one would expect to see their significant contribution to micronutrient status. However, preparation and processing methods are known to affect the micronutrient content of vegetables. In this survey and as part of ATONU interventions, the intention was to find out how vegetables are prepared and processed at household level so as to assess if these methods could have a significant effect on the nutrient content of the cooked vegetables. The variables assessed under this topic included how soon vegetables were prepared after picking, the sequence of preparing vegetables and staples, methods and duration of cooking vegetables, sequence of washing vegetables and processing methods for preservation.

A large proportion of households (78%) indicated that they usually cook vegetables within an hour after picking. This ensured freshness and significant amounts of micronutrients. However, a small proportion of households (21%) indicated that they usually cook vegetables an hour to twelve hours after picking (Figure 50). This group of respondents is a target for interventions.
It was also recognised that if vegetables were cooked and left to stay for a long time before consumption, they tend to lose some of the nutrients. In this survey, it was observed that 78% of the households prepared vegetables before the staple (Figure 51). The ideal sequence would be to cook vegetables after the staple so that vegetables are consumed immediately while still fresh and hot.

Vegetables prepared at household level are either picked from home gardens/fields or purchased from markets and street vendors. It is, therefore, necessary to wash vegetables to remove dirt and other contaminants. It is advisable to wash vegetables before cutting them into small pieces so as to avoid leaching of nutrients into the washing water. About 86% of the households interviewed indicated that they wash vegetables before cutting. Some vegetables have to be cut into pieces to hasten cooking and consumption. Cutting vegetables into large pieces reduces the extent of destruction of nutrients on exposure to air, heat and water. Apparently, 58% of households cut vegetables into small pieces. This tends to create a large surface area of interaction between the vegetable contents and the environment such as water and oxygen, leading to more destruction of nutrients. Only 14% of the households cut vegetables into large pieces (Figure 52).
Figure 52: Size of vegetable when cut for cooking in the surveyed areas

In most households (97%), washing of vegetables is done in a container and very few households (3%) use running water to wash vegetables (Figure 53). Using a container does not allow adequate removal of all contaminants from the vegetables.

Fig. 53: Practice of washing vegetables in the surveyed areas

Respondents reported various methods used for cooking vegetables in the surveyed areas. These included boiling, steaming, stewing and stir-frying. Stir frying was practiced by 49% of the households in the surveyed areas. The other cooking methods used by households included boiling (26%), stewing (14%) and steaming (11%) (Figure 54).

Figure 54: Methods of cooking vegetables in the surveyed areas
The duration of cooking also tends to influence the nutrient content of the cooked vegetables. If vegetables are exposed to a long duration of heating, the heat labile nutrients are destroyed and, therefore, the final quality of the vegetables is reduced. In the present survey, 75% of the households cooked vegetables for less than 15 minutes, which is considered to be a good practice. However, about 3% of the respondents cooked vegetables for 31 minutes to one hour (Figure 55). This is long enough to cause significant destruction of the nutrients.

![Bar chart showing duration of cooking vegetables in the surveyed areas.](image)

**Figure 55a: Duration of cooking vegetables in the surveyed areas**

There were no significant differences (P = 0.995) between zones and treatment arms (Figure 56) (Non-ACGG+ ATONU, ACGG only and Control) in terms of duration of cooking vegetables.

![Bar chart showing duration of cooking vegetables by treatment.](image)

**Figure 55b: Duration of cooking vegetables in the surveyed areas by treatment**

Vegetable processing was practiced by 43% of the households. The main processing methods included direct sun drying and shade drying. About 63% of the households practiced direct sun drying, whereby vegetables are spread in direct sunlight, and 37% practiced shade drying (Figure 56a).
Figure 56a: Vegetable processing methods in the surveyed areas

About 40% of households practised shade drying in ACGG + ATONU arm, 37% in ACGG only and 35% in Control (Figure 56b). Sun drying has been shown to reduce some nutrients, especially minerals and vitamins (A and C) and this affects the nutritional quality of the vegetables (Ukegbu and Okereke, 2013). It is likely that vegetables processed using this method have low levels of the stated nutrients. This could be one of the contributing factors to the high prevalence of anaemia observed in the study areas. This is aggravated by the inadequate quantities of vegetables consumed, low consumption of animal source foods and low dietary diversity.

Figure 56b: Vegetable processing methods in the surveyed areas by treatment arms

About 44% of the households in the Southern Highlands practised shade drying and 56% practiced direct sun drying. Households in the Eastern and Central zones practiced more direct sun drying (72.7% and 63.6%, respectively) than shade drying (27.3% and 37%, respectively) (Figure 56c).
6.13 Food Consumption and Utilisation

Household/women dietary diversity score (H/WDDS), defined as a total count of different food groups consumed in the past 24 hours, is used as a proxy for measuring the socioeconomic status of the household (FAO, 2007). It was estimated using 24-hour dietary recall where foods consumed were grouped into 12 food groups. A score of 1 was assigned if a certain food group was consumed and 0 for the foods that were not consumed, depending on the nutrient content of specific foods in the Food Composition Table (Lukmanji et al., 2008). More than half of the surveyed households (54%) consumed less than four food groups, 30% consumed 4 to 5 food groups and 16% consumed 6 or more food groups. Mean HDDS was 3.5 (SD 1.7). The most consumed food group was cereals as reported by 93% of the households, followed by vegetables (80%) and oils and fats (74%). Only 4% of the households consumed eggs and 12% consumed meat and meat products during the period of 24 hours prior to the survey (Figure 57a).

Consumption of vegetables, eggs, meat and meat products was the same in treatment arms. This is similar to what was reported in other studies conducted in rural Tanzania (Mbwana et al 2016, Kinabo et al 2016). Based on treatment arms, the ACGG+ATONU treatment had a higher proportion of households who scored lowest DDS (58%) compared to 52% for ACGG only and Control treatment arms (Figure 57b). Similarly, the proportion of households with medium HDDS was lower in the ACGG+ATONU area than in ACGG only and Control (33%). However, the proportion of households...
that scored high HDDS was 17% in ACGG+ATONU and 15% in Control and ACGG only treatment arms.

Figure 57b: Household dietary diversity score in the surveyed areas by treatment arms

The same applied for the zones in that Eastern zone had the highest proportion of households that scored high HDDS (Figure 57c).

Figure 57c: Household dietary diversity score in the surveyed areas by zones

The observed HDDS shows that there were low diversified diets in the surveyed households, which was lower than what has been reported in other studies done in rural Tanzanian communities (Kinabo et al., 2016, Mbwana et al., 2016). This could be attributed to seasonal variations in food consumption in the surveyed areas. Since the baseline survey was carried out in November and December, this period is usually characterised by a high level of activities in field preparation in Southern Highlands and Central zones and food shortage in all zones might be imminent.

The food groups consumed by households in various HDDS categories are presented in Table 10. The lowest HDDS of less or equal to three groups of foods comprised two or three groups of foods; cereals and legumes or vegetables or cereals + legumes + vegetables. Moderate HDDS (4 to 5 food groups) comprised the following groups: vegetables, cereals, legumes, oils/fats and sugar/honey. In general, oils and fats were used in food preparation and sugar or honey was used in teas or porridge. High HDDS comprised 6 to 8 food groups and these included cereals, legumes, vegetables, oils/fats, sugar/honey, roots and tubers, fish and fruits. The highest HDDS comprised more than 8 food groups and these included cereals, legumes, vegetables, oils/fats, sugar/honey, roots and tubers, fish, fruits, milk and milk products meat and meat products, eggs and spices/condiments. Most consumed foods were cereals, legumes and vegetables because they were consumed by all categories of households.
### Table 6: Types of food groups consumed at different HDDS levels

<table>
<thead>
<tr>
<th>Food groups</th>
<th>Lowest dietary diversity score (HDDS≤3 food groups)</th>
<th>Moderate dietary diversity (HDDS = 4 to 5 food groups)</th>
<th>High dietary diversity (HDDS = 6 to 8 food groups)</th>
<th>Highest dietary diversity (HDDS ≥ 8 food groups)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereal</td>
<td>Cereal</td>
<td>Cereal</td>
<td>Cereal</td>
<td>Cereal</td>
</tr>
<tr>
<td>Legumes</td>
<td>Legumes</td>
<td>Legumes</td>
<td>Legumes</td>
<td>Legumes</td>
</tr>
<tr>
<td>Vegetables</td>
<td>Vegetables</td>
<td>Vegetables</td>
<td>Vegetables</td>
<td>Vegetables</td>
</tr>
<tr>
<td>Oil and fats</td>
<td>Oil and fats</td>
<td>Oil and fats</td>
<td>Oil and fats</td>
<td>Oil and fats</td>
</tr>
<tr>
<td>Sugar and honey</td>
<td>Sugar and honey</td>
<td>Sugar and honey</td>
<td>Sugar and honey</td>
<td>Sugar and honey</td>
</tr>
<tr>
<td>Roots &amp; tubers</td>
<td>Roots &amp; tubers</td>
<td>Fish</td>
<td>Milk and milk product</td>
<td>Milk and milk product</td>
</tr>
<tr>
<td>Milk and milk product</td>
<td></td>
<td></td>
<td>Fish</td>
<td>Fish</td>
</tr>
<tr>
<td>Meat and meat product</td>
<td></td>
<td></td>
<td>Fruits</td>
<td>Meat and meat product</td>
</tr>
<tr>
<td>Fish</td>
<td></td>
<td></td>
<td></td>
<td>Fish</td>
</tr>
<tr>
<td>Eggs</td>
<td></td>
<td></td>
<td></td>
<td>Eggs</td>
</tr>
<tr>
<td>Fruits</td>
<td></td>
<td></td>
<td></td>
<td>Fruits</td>
</tr>
<tr>
<td>Spices and condiments</td>
<td></td>
<td></td>
<td></td>
<td>Spices and condiments</td>
</tr>
</tbody>
</table>

Food consumption score (FCS) is a composite score based on dietary diversity, food frequency and relative nutritional importance of different food groups. Computation of food consumption scores showed that 13% of the households showed poor consumption and 49% had acceptable food consumption levels.

### 6.14 Water, Sanitation and Hygiene

#### 6.14.1 Water availability and access

Improved drinking water sources are essential to prevent water borne disease and contamination. Access to clean and safe water is still a problem in many areas (rural and urban) in the country, but more so in rural areas than in urban areas. In Tanzania, about 61% of households get their drinking water from improved sources. About 52% of the Tanzania mainland rural households obtain their drinking water from unimproved sources (TDHS-MIS, 2015-16). In the present survey, it was observed that the main source of drinking water for rural households is from the public taps in all zones. The proportion of households that obtain water from public taps was 41% during the dry season and 35% during the wet season (Figure 58a). A small reduction in the proportion of households accessing water through public taps could be explained by an increased proportion of households who access water through rain water harvesting during the wet season. Almost a quarter of the population harvest rain water during the wet season and use it for drinking. Access to water from unprotected dug wells increase during the dry season compared to the wet season. During the dry season about 13% of all households obtained their drinking water from unprotected dug wells (Figure 58a). No significant difference (P=0.118) was observed between treatment arms (Figure 58b) (ACGG+ATONU, ACGG only and Control) and zones (Figure 58c).
In the surveyed zones, many households obtained water from public taps and rainwater harvesting during the wet season but public taps and surface water was used by most households as depicted in Figure 58b. The Eastern zone had the highest proportion (47%) of households that accessed water from public taps compared to the Central (33%) and Southern Highlands zones (29%) (Figure 58c). This could be due to the fact that most of the surveyed villages of Eastern zone are located close to the Municipality where provision of services such as water and health is a lot better compared to remote villages of the Southern Highlands and Central zones.
Figure 58c: Main sources of drinking water by season in the surveyed areas by zones

Location of water point was either on-site or off-site and households that had a water source within the dwelling or plot were very small. Only about 18% and 17%, respectively, of the households accessed water within their dwellings or plots (onsite) and may account for the little time spent on accessing water. This means 83% of the household accessed water from offsite water points. Since water was mainly obtained from public taps, this meant that the person responsible for water collection had to walk or use transport to get to the water point. The majority of households spent up to 30 minutes to go to the water source during both the wet and dry seasons (Figure 59a).
Figure 59a: Time taken to fetch water from source in the surveyed areas

A higher proportion of respondents in ACGG only and Control treatment arms (55% and 54.4%) spent 0-5 minutes to fetch water during the wet season compared to respondents in ACGG+ATONU treatment arm (51.5%) (Figure 59b).

Figure 59b: Time taken to fetch water from source in dry and wet seasons in the surveyed areas by treatment arms

Similarly, 57% of the respondents in Central zone spent 0-5 minutes to fetch water during the wet season compared to respondents in Eastern (54%) and Southern Highlands (50%) (Figure 59c). In the Southern Highlands, 47% of the respondents spent between 6 and 60 minutes to fetch water. During the dry season, more households spent more than 30 minutes to fetch.
As expected, in more than 80% of the households, adult women were responsible for fetching water. Only a small fraction was contributed by other members of the household, e.g. adult men (5.4%), male child (4%) and female child (2%) (Figure 60a).

Similarly, with the treatment arms, adult women featured most (about 90%) in water collection as it was observed in the analysis of all surveyed areas (Figure 60b).
Figure 60b: Persons responsible for water collection in the surveyed areas by treatment arms

In both Eastern and Southern Highlands zones, 90% of the respondents indicated that women were responsible for water collection and only 86% in Central zone, which also had a slightly higher proportion of respondents (6.4%) who said that adult men were responsible for water collection. Male children were more involved in water collection in both the Central (4.7%) and Eastern zone (5%). Only 3% of the respondents in Southern Highlands indicated that male children were involved in water collection (Figure 60c). The contribution of adult males in water collection was higher in Central zone (6.4%) compared to Southern Highlands (5.6%) and Eastern zone (3%). There is a need to encourage other members of the household to contribute towards water collection to reduce the workload on adult females.

Figure 60c: Persons responsible for water collection in the surveyed areas by zones

Because water was obtained from off-site locations, many households stored water for drinking and other uses in the households. About 96% of the respondents reported that they stored water in the household. Therefore, when water is collected it is usually stored in various containers at household level. This means that even households that have water within dwellings do store water for drinking and other uses. About 75% of the households stored water in clean and covered containers (Figure 61a). Other containers included clay pots (10%) and uncovered containers (14%).
Storage containers did not differ much among respondents from different treatment arms. More than 50% of the respondents stored water in covered containers in ACGG, ACGG+ATONU and CONTROL arms, followed by households who used clean and covered containers or jar. (Figure 61b).

About 57% of the respondents in Eastern and Southern Highlands stored water in covered containers and only 49% in Central zone stored water in covered containers. Clay pots were mostly used to store water in Central (11%) and Southern Highlands (10%) (Figure 61c).
Although some households obtained water from unprotected wells, most of the respondents (76%) were satisfied with the quality of their drinking water, both during the dry and wet seasons (Figure 61d). However, 24% of the respondents were not satisfied with the quality of drinking water.

Figure 61d: Satisfaction with quality of drinking water by respondents in the surveyed areas

About 62% of the respondents in the ACGG+ATONU treatment arm were satisfied with the quality of water during the wet season and 64% during the dry season, respectively (Figures 61e). The proportions of respondents in other treatment arms were 58% in ACGG only and 56% in the Control treatment arm. Conversely, about 38% of the respondents in ACGG+ATONU, 42% of ACGG only and 44% were not satisfied with the quality of water during the wet season. The proportions of respondents in other treatment arms were 59% in ACGG only and 58% in the Control treatment arm. About 36% of the respondents in ACGG+ATONU, 41% of ACGG only and 42% were not satisfied with the quality of water during dry season and 62% of the respondents in the ACGG+ATONU treatment were satisfied with the quality of water. The same scenario was observed in the zones where more than 50% were satisfied with the quality of water used for drinking in both wet and dry seasons, although there were about 2.5% to 6% who were very unsatisfied in both zones (Figures 61f). However, there were no big differences in the zones between seasons.

Figure 61e: Satisfaction with quality of drinking water by seasons in surveyed treatment arms
While many respondents were satisfied with the quality of drinking water, only 35% of these households treated their water, mainly by boiling (80%). Very few respondents used chemicals and none of the respondents used bottled water as depicted in Figures 62 a and b. Several reasons were mentioned for treating drinking water, including contamination by bacteria (59%), faeces (8%), and almost 25% said they treated water because it was contaminated with dirt (24%). The same methods and reasons for treating water were given in the treatment arms and zones, with slight variations in the proportion of respondents (Figure 62 c and d). The Southern Highlands and Eastern zones had a high proportion of respondents who boil water to make it safe for drinking (Figure 62 e and f).

**Figure 61f: Satisfaction with the quality of drinking water by seasons in surveyed zones**

![Graphs showing satisfaction with water quality by season and zone]
Figure 62: Methods of water treatment and reasons for treating drinking water in surveyed areas (a & b) treatment arms (c & d) and zones (e & f).

6.15 Hygiene
Hygiene practices contribute a lot in the health and nutrition status of members of the households. WHO estimates that the risk for diarrhoeal diseases can be reduced by 28% through improved hygiene and sanitation practices (WHO, 2014). Most (80%) of the respondents (n=1762) reported that they wash their hands with soap and water. More respondents (83%) in the ACGG only treatment arm reported that they wash hands with soap compared to 79% and 77% in the Control and ACGG+ATONU treatments arms, respectively. The same trend was observed in the surveyed zones; with the central zone leading by 83% of the respondents (Figure 63 a and b).
Figure 63a and b: Proportion of respondents who wash hands with soap (Yes) in the surveyed areas by treatment arms and zones

About 65% of the respondents wash their hands to remove dirt and 22% wash their hands to prevent diseases (Figure 64a). There were no significant differences in hand washing practices among treatment arms (P=0.057) (Figure 64b) and zones (Figure 64c). Households in the Central zone washed their hands more often than those in other zones, although the differences were minimal.

Figure 64a: Reasons for washing hands with soap in the surveyed areas
Although many households practiced hand washing, a third of all respondents only washed their hands when they are dirty (33%), 30% washed hands before eating food and 29% washed hands after using the toilet. Less than 3% washed their hands before meal preparation (Figure 65a). The pattern was similar in the treatment arms as well as surveyed zones, with slight variations in the proportion of respondents for various reasons of hand washing. A high proportion of respondents in the Control area (31%) wash their hands before eating compared to 28% and 27% in the ACGG+ATONU and ACGG only treatment arms, respectively (Figure 65b). The proportion of respondents that wash hands before eating was 31%, 30% and 27% in Control, ACGG+ATONU, and ACGG only treatment arms, respectively. Similarly, for the study zones, a high proportion of respondents in the Eastern zone (36%) indicated that they wash their hands to remove dirt compared to 33% in the Central and Southern Highlands zones, respectively (Figure 65c). The proportion of respondents that washed hands before eating was 32%, 28% and 26% in the Southern Highlands, Central and Eastern zones, respectively.
About 55% of these respondents had a specific facility for hand washing in their household and 45% did not have a specific facility for hand washing (Figure 66a). These facilities varied from a cup and basin (57%), tippy tap (28%), and dip and wash using a basin (12%). The pattern was similar in the treatment arms and zones. The proportion of respondents who were using a cup and basin as a hand washing facility was 59%, 57% and 55% in ACGG only, ACGG+ATONU and Control treatment arms, respectively (Figure 66b). Tippy tap was practiced by 28% of the respondents in ACGG+ATONU and Control treatments arms and 27% in ACGG only. The Central zone had a higher proportion of respondents (70%) who used a cup and basin as a facility for hand washing compared to 50% and 45% in the Southern Highlands and Eastern zones, respectively (Figure 66c). Tippy tap was more practiced in the Eastern zone where about 40% of the respondents indicated that they use this facility for hand washing; about 38% of the respondents in the Southern highland zone and 12% in the Central zone used tippy tap facility. The Central zone had the lowest proportion of households that use tippy tap. This low proportion of respondents in Central zone could be related to limited exposure to the technology compared to other zones such as the Eastern zone where this technology has been introduced in the villages by other projects operating in the zone such as Mwanzo Bora.
The hand washing facility was situated near the latrine (57%), kitchen (20%) and in the latrine (18%) for the respective proportion of households (n=1762) in the surveyed areas (Figure 67a). The proportion of respondents who had hand washing facilities near the latrine were 61%, 56% and 54% in ACGG only, Control and ACGG+ATONU treatment arms, respectively (Figure 67b). The proportion was higher for ACGG+ATONU treatment area where the facility was placed in the latrine (22%) versus 19% and 14% in ACGG only and Control arms, respectively. In addition, 25% of the respondents in the Control treatment arm had a hand washing facility situated in the kitchen and only 20% and 15% in ACGG+ATONU and ACGG only, respectively (Figure 67c). The Central zone had a higher proportion of respondents (64%) who indicated that the hand washing facility was located near the latrine, compared to 55% in the Southern Highlands and 47% in the Eastern zone.
Figure 67: Usual location of a facility for hand-washing in the households in the surveyed areas (a), treatment arms (b) and zones (c)

Almost 30% of all the respondents reported that they had never heard any message related to hygiene in all households surveyed (Figure 68a), with similar results when data were presented by treatment arms and zones. For those who indicated that they had heard any message on hygiene, the message was on “use a latrine” in addition to other messages as presented in Figure 68b and c. More than 40% of the respondents had heard messages on using latrines, less than 10% had heard about waste management, good hygiene and drinking safe water. The pattern was the same for treatment arms and zones. The most delivered message was basically on use of latrines.
Figure 68: Type of hygiene messages heard by respondents in the surveyed areas (a), treatment arms (b) and zones (c).

Hygiene messages were obtained through community meetings (30%), village leaders (25%) and a small proportion obtained messages through the radio (11%) (Figure 69a). It is evident that community meetings, village executives, health workers and radio were important sources of messages on hygiene. However, the proportion of respondents for these sources varied with treatment arms and zones. Community meetings were mentioned by more respondents in ACGG only treatment arm (33%) and ACGG+ATONU (32%) compared to Control arm (25%) (Figure 69b). Village executives were mentioned by 28%, 26%, and 23% of the respondents in ACGG+ATONU, Control and ACGG only treatment arms, respectively. Similarly, community meetings were mentioned as one of the sources of
information for 40% of the respondents in Eastern zone, 27% in Southern Highlands and 19% in Central zone (Figure 69c). Village executives were mentioned by 27%, 25% and 18% of the respondents in Southern Highlands, Eastern and Central zones, respectively. However, it is not clear whether the message was provided as an advice or enforcement by executives in community meetings.

Figure 69: Source of hygiene messages heard by respondents in the surveyed areas (a), treatment arms (b) and zones (c)
For those who received hygiene messages, 48% received the messages after every three months and only 30% received the messages on a monthly basis (Figure 70a). Therefore, the frequency of hearing hygiene messages was low. There were no significant differences (P=0.804) in the proportion of respondents in the treatment arms (Figure 70b). In the zones, however, about 58% of the respondents in Central zone indicated that they received hygiene messages after every three months compared to 42% in the Southern Highlands and Eastern zones (Figure 70c). About 41% of the respondents in the Southern Highlands received hygiene messages monthly and the proportions of respondents in other zones were 38% and 28% in the Eastern and Central zones, respectively.

Figure 70: Frequency of hearing hygiene messages by respondents in the surveyed areas (a), treatment arms (b) and zones (c)

6.16 Sanitation
Sanitation practices have a big role in transmission and prevention of food borne diseases, diarrhoea and are also the main route of faecal and/or oral diseases. In the present survey, 99% of all households had latrines. The main reason for not having a toilet was the cost of construction. There were no significant differences (P=0.284) between ACGG only, ACGG + ATONU and Control households (Fig. 71).

Figure 71: Ownership of latrines
These households owned different types of latrines. The main types were open pit with slab (36%), open pit without slab (32%) and flush/pour flush to septic toilet (20%) (Figure 72a). The distribution of households with various types of latrines did not differ much among treatment arms. Open pit without slab was more common in both treatment arms (Figure 72 b). Similarly, open pit without slab was more common in Central zone (35%) compared to other zones, Southern Highlands (32%) and Eastern (27%) (Figure 72c). Pit with slab was common in Eastern and Southern Highlands (32%).

About 23 households in all the surveyed area had no latrines. The main reason for not having a toilet was ‘high cost’ and not having money to construct a toilet (83%) Similar comments were given by all treatment arms (Figure 73a). Other reasons included culture and tradition of open defecation, pit latrines produce too much smell, not important and lack of land ownership. The open defecation as a culture or tradition was reported by about 17% of the households that did not have latrines in the Eastern zone and none in other zones (Figure 73b). “Latrine was not important”, “not thought about it, we are fine the way we do it now” or that “a pit latrine smells too much” was reported by 10% of the households in Central zone and none in other zones.
Figure 73: Reasons for not owning a toilet in the surveyed areas by treatment arms (a) and zones (b)

Most of the infants cannot use the toilet, thus they are usually allowed to defecate in an open area and then the faeces are disposed of in the toilet immediately after. About 70% of the respondents indicated that they disposed the faeces in their own toilets (Figures 74a & b). For those who did not have latrines in their households, they usually disposed the faeces by burying them in the soil or throwing in the forest/bush/water body, in a public latrine, or their neighbour’s latrine. The pattern was the same in all treatment arms and zones during day and night defecation (Figures 74c & d).
Lack of environmental sanitation can be a contributing factor for contamination of foods and water, especially for infants and children. About 58% of the households indicated that the environment had garbage and waste-water in the surroundings and, in some villages, there was a foul smell in the environment. The pattern was the same for the treatment arms and zones (Figure 75a, b).

6.17 Gender and Women Empowerment

Gender and women empowerment was assessed in terms of women’s knowledge and practices on budgeting and expenditure, involvement in household decision making such as planning and budgeting, community decisions and on ownership of various assets.
6.17.1 Budgeting and food expenditure knowledge and practices

About 90% of the women reported that household budgeting was important to them and were able to plan their day-to-day budgets (89%) (Figure 76a). Saving money and planning for expenses was considered very important by most of the women respondents (89%). About 38% of the women had enough money to purchase food in addition to what they produced, while a substantial number of women did not have enough money to purchase food other than what they produced. No significant differences (P=0.531) were observed between treatment arms (Figures 76a, b and zones (Figure 76c, d) for those who responded ‘YES’ and ‘NO’ to different empowerment attributes with respect to budgeting and food expenditure knowledge and practices, respectively.

![Bar chart showing budgeting and food expenditure knowledge and practices](chart.png)

**Figure 76a:** Budgeting and food expenditure knowledge and practices in the surveyed areas
Figure 76b, c: Budgeting and food expenditure knowledge and practices in the surveyed areas by treatment arms
6.17.2 Decision making on household budget and expenditures

Information on household budget and expenditure was collected and analysed. Results revealed that more than 58% of all respondents manage their income jointly between husband and wife (Figure 77a). Conversely, almost a third (29%) of these households managed their incomes separately. A similar trend was observed when data were disaggregated by treatment arms and zones (Figure 77b, c)
Most women (75%) were involved in household budget planning (Figure 78a). However, on decision making on household income, almost half of the entire households decided together and only a third of income decisions in the surveyed areas were made by the husband alone (Figure 78b). Similar trends were observed among treatment arms and zones (Figure 78c).
Figure 78a: Household income decision in the surveyed areas

Figure 78b: Household income decision in the surveyed areas by treatment arms

Figure 78c: Household income decision in the surveyed areas by zones
About 47% of all households decided together on use of their income (Figure 79a). Similarly, slightly more than 50% of the respondents decided together on food expenditure, but a slightly higher proportion of women decided on food expenditure as compared to men (Figure 79b).

![Figure 79a: Participation in decision making on household income in the surveyed areas](image)

![Figure 79b: Participation in decision making on household expenditure in the surveyed areas](image)

Many women contributed to a greater extent (76%) in decisions involving their own income as well as household income and expenditure (Figure 80a). This shows that when women have contributed to the household income, they also become more confident in contributing to decision making on how that income should be spent (Figure 80b). Similar trends were observed in the treatment arms and zones and there was no significant difference (P=0.904) observed between either the three arms or surveyed zones (P=0.786) (Figure 80c).
Figure 80a: Frequency of participating in decision making on income expenditure in the surveyed areas

Figure 80b: Frequency of participating in decision making on income expenditure in the surveyed areas by treatment arms
Figure 80c: Frequency of women participation in decision making on income expenditure in the surveyed areas by zones

More than 70% of all women in these households contributed or decided on which foods to be purchased and where it should be purchased from (Figure 81a). With regards to treatment arms, the analysis showed that about 40% to 43% of the women respondents always made decisions to purchase foods in their households (Figure 81b). However, 74.3% of women from Eastern zone were engaged in decision making about what food to purchase as compared to 73.8% and 71.5% for Central and Southern highland zone, respectively (Figure 81c). No significant differences were observed from different locations (zones) (P=0.070) nor among treatments arms (P=0.209).
In terms of ability of women to speak in public as a measure of women empowerment, more than 25% of women indicated that they have no confidence to speak in public, particularly on issues which involve decision making for the community.

The proportion of respondents who responded with a “yes” varied slightly among treatment arms, whereby about 41% of the respondents in the Control treatment arm indicated that they were
comfortable to speak in public on matters related to the community, compared to 38% in the ACGG+ATONU and 35% in the ACGG only treatment arms (Figure 82b). However, more than 37% of these women reported that they would comfortably speak in public (Figure 82a). For respondents who were not comfortable to speak in public, 28% were from the ACGG only treatment, 26% Control and 24% ACGG+ATONU treatment arms. The differences were not significantly different (P=0.084) among all three arms.

Figure 82b: Women participation in decision making on community issues in the surveyed areas by treatment arms

In Eastern zone, more women were comfortable in speaking in public (39.8%) as compared to 36.6% and 37.9% for Central and Southern Highlands zone respectively, although there was no significance difference (P=0.467) (Figure 82c).

Figure 82c: Women participation in decision making on community issues in the surveyed areas by zones

6.17 Nutritional Status

The nutritional status of members of a household, especially children under five years of age, is an important indicator of the health of members of the household. In this baseline survey, anthropometric data on height and weight were collected to evaluate the nutritional status of household members in the participating villages. These data were used to assess the nutritional status of all household members and can be useful for identifying members who are malnourished. Height/length, weight, and age data were used to calculate three indices: height-for-age, weight-for-height, and weight-for-age for children below five years of age and BMI for children between 6-19 years and adults aged 20 years and above. The sample and age categories of subjects who participated in anthropometry are presented in Table 7.
The total number of children surveyed was 1606 (all age categories and sex) (Table 7) and among these 695 were stunted (43%). Among the stunted children, 44% were from the Central zone, 18% from the Eastern zone and 38% from the Southern Highlands zone. The Central zone contributed a higher proportion of stunted children compared to the contribution from other zones. However, in the Central zone a total of 724 children were surveyed and about 42% of them were stunted; in the Eastern zone 279 children were surveyed and 45% of them were stunted and in the Southern Highlands 603 children were surveyed and 44% of them were stunted. The prevalence of stunting in these zones is above the national average of 34%.

### 6.18.1 Nutritional status of children below five years of age

The nutritional status of children under the age of five years can be an important indicator of children’s health and economic status of a country. It provides an indication about the development and the potential of the child to contribute significantly to economic development of a country. In the present survey, the nutritional status of 1,085 children below five years of age were assessed. The prevalence of stunting was 42%, which was much higher (8% points) than the national average of 34%. The prevalence of underweight was 27%, again much higher than the national average of 14%. The prevalence of wasting (4%) was slightly lower (1% point) than the national average of 5% (Figure 82a).

The height-for-age index (HAZ) provides an indicator of linear growth retardation in children. Children whose height-for-age Z-score is less than -2 SD from the median of the WHO reference population, are considered short for their age (stunted), or chronically malnourished. Equally, children who are less than -3 SD are considered severely stunted. Stunting reflects failure to receive adequate nutrition over a long period of time and is affected by recurrent and chronic illness. Height-for-age, therefore, represents the long-term effects of malnutrition in a population and is not sensitive to recent, short term changes in dietary intake.

The weight-for-height index (WHZ) measures body mass in relation to body height or length and describes current nutritional status. Children with Z-scores below less than -2 SD from the median of the WHO reference population are considered thin (wasted), or acutely malnourished. Equally, children who are less than -3 SD are considered severely wasted. Therefore, wasting represents the current failure to receive adequate nutrition, which may be the result of inadequate food intake or a recent episode of illness causing loss of weight and the onset of malnutrition. Similarly, children who are more than two standard deviations (+2 SD) above the median weight-for-height are considered overweight, or obese.

Weight-for-age (WAZ) is a composite index of height-for-age and weight-for-height. It takes into account both chronic and acute malnutrition. Children with weight-for-age less than -2 SD are classified as underweight. Children with weight-for-age less than -3 SD are considered severely underweight.

The prevalence of stunting in the treatment arms was about 43% in the ACGG+ATONU, 42 % in ACGG only and 41% in Control. There was no significant difference between treatment arms (P=0.560). The prevalence of underweight was 27%, 26 and 26% in ACGG+ATONU, ACGG only and

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<td>24.0</td>
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<td>1903</td>
<td>47.7</td>
<td>3763</td>
<td>47.7</td>
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<td>100</td>
<td>3986</td>
<td>100</td>
<td>7896</td>
<td>100</td>
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Table 7: Age and sex categories of subjects who participated in anthropometry measurements
Control treatment arms, respectively and that of wasting was 4.6% in ACGG only, 4.3% in ACGG+ATONU and 4.3% in and Control treatment arms (Fig. 82b).

Similarly, the prevalence of stunting varied with zones. The prevalence of stunting in the three zones was about 41% in the Central zone, 40% in Eastern zone and 37% in the Southern Highlands zone. The prevalence of underweight was 24.7%, 25.8% and 21.6% in the Central, Eastern and Southern Highlands zones, respectively and that of wasting was 4.3% in the Central zone, 4.8% in Eastern zone and 4.1% in the Southern Highlands zone (Fig. 82c). The children in the Central and Eastern zones are particularly disadvantaged; at least about 40% are stunted, which reflects long-term undernutrition in the zones.

The prevalence of undernutrition in children by age categories in the surveyed areas is presented in Figure 83. Consistently, children below two years of age and older children had higher prevalence of undernutrition compared to the three-year old children. Wasting was higher among children below two years (3.5%) than children between two and three years old (3%) (Figure 83a). The prevalence of wasting in older children 3 - 5 years and 5 – 10 years was 5.5% and 4.8%, respectively. Similarly, the prevalence of stunting was higher in children below two years (38%) old compared to 32% in two to three-year old children (Figure 83b). Stunting increased to 43% in 3 – 5 year-old children and 52% in 5 – 10 year old children. The same pattern was observed for the prevalence of underweight; whereby children below two years of age had a higher prevalence compared to the three-year old children (Figure 83c). For all indicators of undernutrition the prevalence increased with age after a depression at 2 – 3 years of age. These results suggest that children in the first 1000 days of life had relatively poor nutritional status compared to those of 2 – 3 years of age.
**Figure 83:** Prevalence of wasting (a), stunting (b) and underweight (c) by age categories in the surveyed areas

**Stunting**

The prevalence of stunting varied with zones. The total number of children surveyed was 1606 and among these 695 were stunted (43%). Among the stunted children, 44% were from the Central zone, 18% from the Eastern zone and 38% from the Southern Highlands zone. In the Central zone a total of 724 children were surveyed and about 42% of them were stunted; in the Eastern zone 279 children were surveyed and 45% of them were stunted and in the Southern Highlands 603 children were surveyed and 44% of them were stunted. In the treatment arms 46% of the children were stunted and of these 40% were from the ACGG+ATONU, 41% from ACGG only and 55.4% from the Control treatment arm.

**Underweight**

The prevalence of underweight varied with zones. The total number of children surveyed was 1606 and among these 440 were underweight (27.4%). Among the underweight children, 48% were from the Central zone, 18% from the Eastern zone and 35% from the Southern Highlands zone. In the Central zone a total of 724 children were surveyed and about 29% of them were underweight; in the Eastern zone 279 children were surveyed and 28% of them were underweight; and in the Southern Highlands 603 children were surveyed and 25% of them were underweight. The prevalence of underweight in all the zones is above the national average of 14%. The Central zone had a high prevalence and contribution to undernutrition among the three zones. The contribution of underweight children by the Eastern zone was 18%, but the prevalence was 28%, due to the fewer number of children surveyed compared to other zones.

The prevalence of underweight varied with treatment arms. The total number of children surveyed was 1606 and among these, 26% were underweight. Among the underweight children, 31% were from the
ACGG+ATONU, 27% from the ACGG only and 42% from the Control treatment arm. In the ACGG+ATONU a total of 724 children were surveyed and about 24% of them were underweight; in the ACGG only 279 children were surveyed and 22% of them were underweight. In the Control arm 603 children were surveyed and 32% of them were underweight. The prevalence of underweight in all the treatment arms is above the national average of 14%. The Control treatment arm had a high prevalence and contribution to underweight among the three treatment arms.

The results of t-test (t-statistic) show that the nutritional status indices: Height for age z-score (HAZ), weight for age Z-score (WAZ) and weight for height Z-score (WHZ) were not significantly different at 95% in all treatment arms (Table 8).

Table 8: T-Test results of nutritional status of children in treatment arms

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<th>Indices</th>
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<th>n</th>
<th>mean</th>
<th>SD</th>
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<th>P</th>
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<td>3.8315</td>
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6.18.3 Nutritional status of children (6-19 years)

The nutritional status of children of age category 6 to 19 years in the surveyed areas is presented in Figure 84. The prevalence of underweight among children aged between 6 and 19 years was 9.1% and that of overweight and obesity was 9.2%. This shows clearly that the problem of underweight and overweight co-exist in these communities.
The prevalence of underweight and overweight was higher among male children compared to female children (Figure 85).

The prevalence of underweight was slightly higher among subjects in ACGG+ATONU and Control treatment arms (10%) compared to ACGG only (8%) treatment arm. Prevalence of overweight was 7% in ACGG+ATONU and 6% in ACGG only and 5% in the Control treatment arms (Figure 86).
The prevalence of underweight and overweight was not different between sexes and treatment arms (Figure 87). However, prevalence of obesity was slightly higher among female children than male children in all treatment arms.

Prevalence of underweight was higher in the Central zone (10%) compared to Eastern (9%) and Southern Highlands zones (8.6%). Similarly, prevalence of overweight was 10% in Eastern zone, 9% in Central zone and 8.8% in Southern Highlands zone (Figure 88).
Prevalence of moderate underweight was high among female children in all study zones. However, in Central zone, 10% of the female children were moderately underweight compared to those in Eastern (8%) and Southern Highlands. Similarly, prevalence of moderate underweight was higher among male children in Central zone compared to other zones i.e. Eastern and Southern Highlands (6%) (Figure 89). Prevalence of severe acute underweight was almost the same in all zones, except for male children from Eastern zone where there were no cases of severe underweight. Obesity and overweight were also prevalent in the zones. Higher prevalence of overweight and obesity was observed among female children in the Southern Highlands (11%) compared to that of female children in Eastern zone (10%) and Central zone (8%). The prevalence was higher than that of male children in all zones except for the Central zone whereby the prevalence of obesity and overweight was higher (10%) among male children and 8% for female children (Figure 90).

**6.18.2 Nutritional status of adults**

The nutritional status of adults measured by Body Mass Index showed that the prevalence of overweight (31%) and obesity (13%) was high in the surveyed areas. The prevalence of underweight was very low (3%). This is contrary to the general belief that the prevalence of overweight and obesity is low in rural areas. This means that the proportion of people who have acceptable weight for their heights was lower (53%) than what is expected of more than 75% (Figure 90a).
The prevalence of undernutrition was not significantly different (P=0.250) among treatment arms. However, the prevalence of underweight was higher in the ACGG+ATONU treatment arms (6%) compared to 3.2% in ACGG only and Control treatment arms (Figure 84b). The prevalence of overweight was slightly higher in ATONU+ACGG (27%) than in ACGG only (26%) and Control (25%) treatment arms. However, the prevalence of obesity was almost the same in all treatment arms (Figure 90b).

Nutritional status presented by zones shows that the prevalence of overweight did not differ much by zones and so was the prevalence of underweight. The Central zone, however, had a slightly higher prevalence of obesity (15%) compared to the other zones, Eastern (13%) and Southern Highlands (12%) (Figure 90c).
The nutritional status presented by sex categories showed that the prevalence of overweight was higher among females (33%) than among males (26%). The pattern was the same for obesity, whereby the prevalence was 17% among females and 5% among males. However, the prevalence of underweight was a bit higher among males (4%) than females (3%) (Figure 91a).

The prevalence of underweight among males was higher in ACGG+ATONU treatment arm (8.3%) than in other treatment arms (Figure 91b). The lowest prevalence of underweight among males was recorded in the Control treatment arm (2%). There was a significant difference (p=0.027) in the prevalence of underweight among males in the treatment arms. Overall, males had a higher prevalence of underweight than females in the ACGG+ATONU and ACGG only but not in the Control treatment arm. However, the prevalence of overweight was slightly higher among females than males in all treatment arms. The highest prevalence of overweight (29%) was recorded among females in ACGG only treatment arm. In ACGG only and Control treatment arms, the prevalence of obesity was higher among males (14%) than females (11%) and 13%, respectively.
Figure 91b: Nutritional status of adults in the surveyed areas presented by sex categories and treatment arms

The prevalence of overweight among females and males was almost the same in all zones. Males from the Central zone had a slightly higher prevalence of overweight (27%) compared to their counterparts in Eastern and Southern Highlands (25%) (Figure 85c). Females from the Central zone had a prevalence of obesity of about 18% and that of females from other zones was 16%. Males from the Central zone had the lowest prevalence of underweight (2%) compared to 3% for Eastern and 6% for Southern Highlands. Southern Highlands zone recorded the highest prevalence of underweight.

Figure 85c: Nutritional status of adults in the surveyed areas presented by sex categories and by zones
7. CONCLUSION AND RECOMMENDATIONS

Dietary diversity
Low dietary diversity was observed in all the surveyed areas and there were no differences by zones or treatment arms. Almost all households consumed cereal staple and vegetables or legumes. There was limited knowledge on food preparation for nutrient retention. Therefore, knowledge of preparation methods for vegetables and cereals to improve availability of nutrients and on diversification should be included in planning of interventions, especially for those that will address the issue of information and knowledge/skills on food preparation.

Nutrition information
The main source of nutrition information was the health care providers at the clinic/hospitals; but the information shared was mainly on breastfeeding and grossly limited in all other aspects of food consumption, hygiene, sanitation and care. Generally, there is limited knowledge on nutrition, causes and ways to reduce malnutrition. This could be a result of the low level of education as most of the respondents were educated up to primary level as their highest level. There is a need to develop accurate and consistent broad-based messages to ensure that household members receive accurate, reliable and comprehensive nutrition information. Malnutrition was mainly associated with food insecurity. Crop diversification and proper use of available foods, including fruits and vegetables, is important for improvement of dietary intake. Knowledge of nutrition and malnutrition has not been adequately comprehended by most people in the villages. There is need to provide nutrition education, especially emphasizing the use of locally available food sources to improve nutrition status. This will stimulate diversified agricultural production. There is also a need to impart food and nutrition knowledge to Reproductive and Child Health (RCH) clinic personnel as these interact most with mothers/caretakers from pregnancy till postpartum and hence will be in a good position to impart the same knowledge in a sustainable manner.

Household Budgeting
The importance of budgeting for household expenditure was important to most of the households. Joint planning of expenditures was a common practice in many households and these needs to be strengthened. Women empowerment and involvement in decision making in the household is an important aspect in improving the nutrition status of households. Many women participate in farming and income generation at household level and hence they should be involved in planning, budgeting, and expenditure decisions and use of household income and other resources.

Nutritional status (children and adults)
The nutritional status of children below five years of age across zones/ACGG and Control villages was sub-optimal. Prevalence of stunting is very high and in some arms, exceeds the regional and national averages. Prevalence of wasting has to be monitored in some arms where the prevalence is unacceptably high.

Children and adolescents
The nutritional status of this group of children is also suboptimal and something should be done to reach them. Many of the nutrition initiatives/interventions in most developing countries have focused on children and women, neglecting adolescent boys and girls. Addressing the nutrition needs of adolescents could be an important step towards breaking the vicious cycle of intergenerational malnutrition, chronic diseases and poverty.
Adults

The nutritional status of both male and female adults has shown a significant shift from a tendency for underweight to that of overweight and obesity. This clearly shows the double burden of malnutrition, whereby in the same household there could be an underweight child/adult and an overweight child/adult. This trend has to be reversed by informing people on the health consequences of this trend and advising them on the advantages of physical exercises/activities in addition to promoting consumption of diversified diets.

There is potential for reaching a wide audience with nutrition information through the use of various channels and platforms, for example by working with religious leaders, political leaders, influential persons, nutrition experts, media practitioners and mobile technology companies.

There were slight differences among zones and treatment arms in terms of level of understanding of nutrition issues and exposure to nutrition information. This seems to suggest that there could be higher exposure to nutrition information for communities in Central and Eastern zones compared to those in the Southern Highlands zone. There is a need to identify and establish other nutrition programmes being implemented in the respective zones and treatment arms.

REFERENCES


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### Annex 1
Allocation of ACGG Households to ATONU NSI

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<th>District Name</th>
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