Report

Food Systems, Environments, Nutrition: Structured Evidence (FoodSENSE) Framework

Application in Mukono District, Central Uganda

December 2023

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Citation: Caulfield, M., Hammond, J., Omosa, E., Achandi, E., Ahumuza, R., Spray, A., Adyedo, C. Dominguez-Salas, P. and Ouma, E. 2023. *Food Systems, Environments, Nutrition: Structured Evidence (FoodSENSE) Framework. Application in Mukono District, Central Uganda*. Nairobi, Kenya: International Livestock Research Institute (ILRI).

Acknowledgments

This work was conducted as part of the CGIAR Initiative on Sustainable Animal Productivity for Livelihoods, Nutrition and Gender inclusion (SAPLING). CGIAR research is supported by contributions to the CGIAR Trust Fund. CGIAR is a global research partnership for a food-secure future dedicated to transforming food, land, and water systems in a climate crisis.

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Abbreviations and acronyms

ASF	Animal source foods
BMI	Body mass index
COVID	Coronavirus disease
CRP	CGIAR Research Program
DHS	Demographic and Health Survey
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus group discussion
FHI	Family Health International
FIES	Food Insecurity Experience Scale
FNS	Food and nutrition security
FoodSENSE	Food Systems, Environments, and Nutrition: a Structured Evidence framework
GDQS	Global Diet Quality Score
HDDS	Household Dietary Diversity Score
HIV	Human Immunodeficiency Virus
HLPE	High Level Panel of Experts
IDDS	Individual Dietary Diversity Score
ILRI	International Livestock Research Institute
KII	Key informant interview
MACDO	Macdough Foods Uganda Limited
MDD	Minimum Dietary Diversity score
MUAC	Mid-Upper Arm Circumference
NAADS	National Agricultural Advisory Services
NGO	Non-governmental organization
PFA	Polyunsaturated fatty acid
RHoMIS	Rural Household Multi-Indicator Survey
ROTOM	Reach One Touch One Ministries
SACCO	Savings and credit cooperatives
SAPLING	CGIAR Initiative on Sustainable Animal Production
SDG	Sustainable Development Goal
SME	Small and Medium Enterprise
SWOT	Strengths, Weakness, Opportunities, Threats
TLU	Tropical Livestock Unit
TV	Television
UBOS	Uganda Bureau of Statistics
UGX	Uganda Shillings

UN	United Nations
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USD	United States Dollar
VHT	Village health trainer
VIP	Ventilated improved pit
WASH	Water, Sanitation and Hygiene

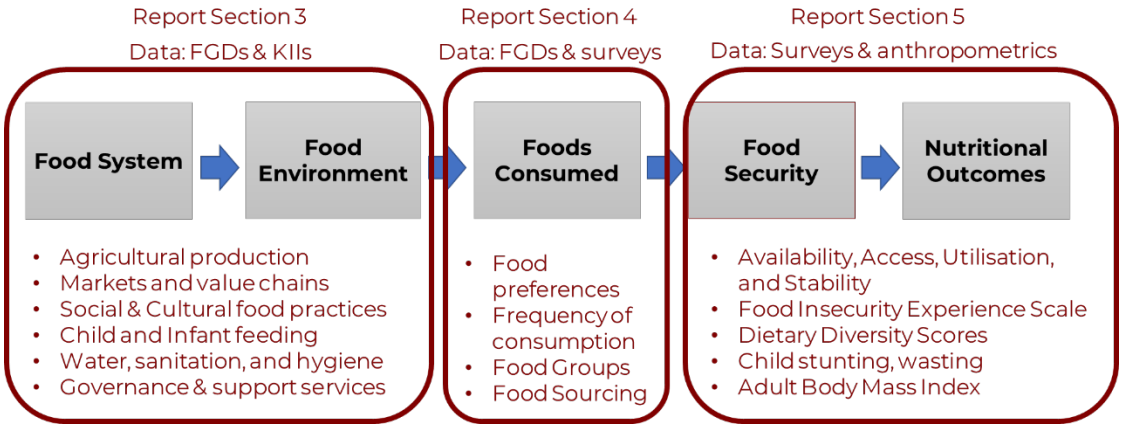
Summary

There is an increasing recognition that achieving food security and good nutrition requires coordinated action between multiple sectors. The causes of food and nutrition insecurity are multifaceted and often interlinked, thus an understanding of the whole food system is important in order to prioritize intervention points. The concept of the "food system" has become an organizing narrative in recent years, with UN agencies and national governments developing food system action plans. There is, however, a gap at the finer-grained spatial levels: there are few guidelines on how to implement food systems thinking at the more local levels and how these could be used to guide local decision-making.

This report presents the first implementation of the Food Systems, Environments, and Nutrition: Structured Evidence Framework (FoodSENSE Framework). The framework is designed to be used at sub-national levels, guiding the description of the food system, food environment, food security and nutritional outcomes. Through application of the framework and a stakeholder engagement process, blockages to improving food and nutrition security can be identified and prioritized, groups of people requiring specific support identified, and potential solutions shortlisted.

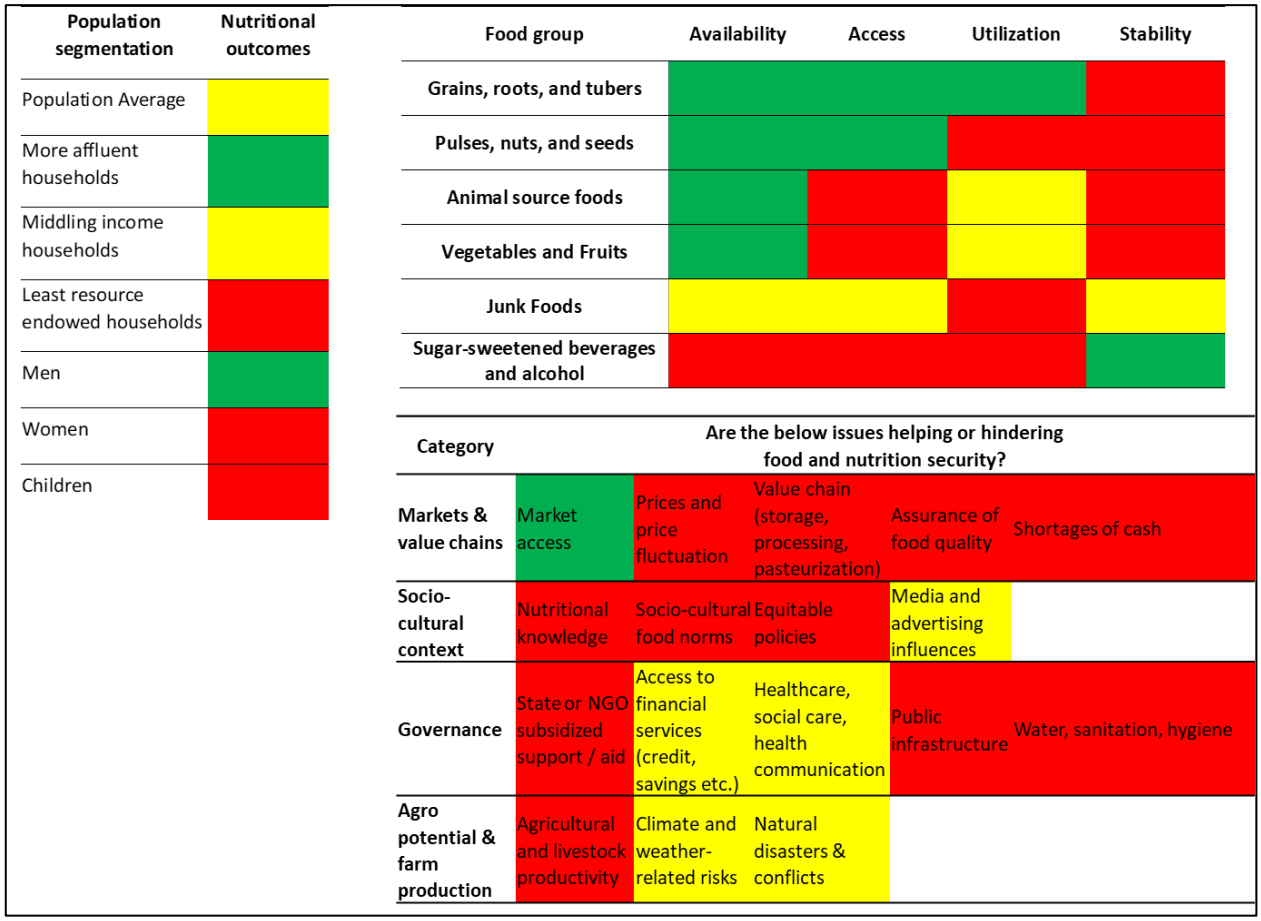
The main issues contained within the framework are illustrated in Figure S1. Information is collected from secondary sources such as household surveys and from primary sources including focus group discussions, key informant interviews, and from stakeholder evaluations during workshops. Information is synthesized into a standardized reporting format, and issues prioritized. An Excel-based tool is used to match challenges with potential food and nutrition-related interventions, which are then put to stakeholders for evaluation. A clear chain of evidence is thus presented for each intervention.

Figure S1. Topics assessed in the FoodSENSE Framework.



This report describes the implementation in Mukono District, specifically in Kasawo and Nakisunga sub-counties. The framework was implemented in three districts of Central Uganda (Mukono, Mpigi, Masaka), under the CGIAR Initiative on Sustainable Animal Production (SAPLING). From the study, bottlenecks hampering food and nutrition security were identified regarding markets and value chains, social and cultural norms, and nutritional knowledge and hygiene. Consumption of nutrient-dense food was low, with stunting evident among children and overweight or obesity prevalent among adults, especially women. Both stunting and being overweight are consistent with over-consumption of low-nutrient density foods. Women, children, and poorer households were particularly vulnerable to food and nutrition insecurity. The ranking of vulnerable groups, food system aspects, and actual food consumption challenges was summarized in a series of score cards (Figure S2).

Figure S2. Three score cards showing assessments of (a) top left, the nutritional situation for different demographic groups; (b) top right, food security assessments regarding four major food groups and two unhealthy food groups; and (c) the status of various aspects of the food system, in terms of degree to which they hamper healthy diets. In each case, red indicates a problem or undesirable situation, yellow indicates cause for concern, and green indicates little or no concern.



To address these challenges, five priority activities were proposed by participants in a workshop comprising key stakeholders from Mukono. These activities included supporting farmers in developing viable income generation ventures coupled with behavioural change communications; the enhancement of agricultural infrastructure to support year-round production; support for the development and strengthening of collective production and marketing; the introduction of price regulations for agro-inputs and outputs; and improving access to low-interest loans. It is expected that by undertaking these activities, multiple inter-connected bottlenecks to food and nutrition security would be addressed. To facilitate this process, stakeholders recommended undertaking a SWOT analysis of farmer cooperatives and map existing rural development programs, projects, and actors. Further follow-up actions on the findings and recommendations will be conducted with local stakeholders.

1. Introduction

The "Food System" concept has become an organizing narrative in recent years, culminating in the UN Food Systems Summit, which was held in 2021[1]. Definitions generally agree that the food system is an integrative concept which "gathers all the elements (environment, people, inputs, processes, infrastructure, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food, and the output of these activities, including socio-economic and environmental outcomes" (HLPE 2014). The concept tends to be used in an instrumental manner aimed at achieving broad sustainability outcomes and improved nutritional and health outcomes (von Braun et al. 2021; Béné et al. 2019). Analyses of food systems tend to stress the interconnection between system elements, internal and external (societal) drivers; the systems may be conceptualized at multiple (nested) levels, from local to global (von Braun et al. 2021).

The UN Food Systems Summit brought together national leaders with international agencies and experts to set the agenda for improving food systems. Over 100 countries signed up to create "national pathways to sustainable food systems" which entails high-level political dialogue and action planning[2,3]. High profile frameworks of food system metrics tend to focus on the national level (e.g. Fanzo et al. 2020), and are intended to support these processes. The FoodSENSE framework serves a different purpose: it is to be used at a relatively local level, where the thinking around system interactions is typically much less advanced and where there is a lack of methods to operationalize food system approaches. It is hoped that this effort will, in due time, connect with the national pathways approach and aid in local level implementation. The FoodSENSE framework acts as a guide on the issues to consider within a local food system, and involves a process which sparks multistakeholder interactions focusing on food security and nutrition within a specific local food system.

1.1 The need for a multi-sectoral approach to tackle food and nutrition insecurity.

There is an increasing recognition that achieving food security and good nutrition requires coordinated action between multiple sectors. The causes of food and nutrition insecurity are multifaceted and often interlinked, thus requiring various actors at different levels. The four pillars of food security – availability, access, utilization, and stability (FAO 2008) – can be seen to play out amongst various sectors of the food system. These include agricultural production, food processing, marketing, cultural knowledge around food and food preparation, as well as managing temporal supply issues and interpersonal equity issues. Environmental factors also play a role in nutrition, including access to clean and safe water, good sanitation facilities and hygiene practices. These can prevent diarrhoeal diseases and infections of the digestive system which limit nutrient absorption (especially among children). Unsafe foods also contribute to food-borne diseases which lead to inadequate nutrient intake and other complications. While poor health can lead to reduced food intake due to loss of appetite and other complications, lack of health services such as micronutrient supplementation of iron, Vitamin A, and folate can lead to poor nutrition outcomes, especially among women and children. Lack of awareness and limited nutrition knowledge by consumers can lead to poor diet consumption even when healthy foods are available and accessible (Fanzo and Pronyk 2011). Similarly, gender barriers and other socio-cultural practices can

[1] https://www.un.org/en/food-systems-summit
[2] https://www.un.org/en/food-systems-summit/news/more-100-countries-sign-develop-national-strategies-transforming-food-systems
[3] https://www.unfoodsystemshub.org/member-state-dialogue/dialogues-and-pathways/en

prevent consumption of healthy foods leading to poor nutrition outcomes. Coordinated collaboration among sectors is therefore necessary as the agricultural sector alone cannot address food and nutrition security challenges (Garrett and Natalicchio 2010; Fanzo and Miachon 2023). Given this interconnectedness, policy interventions designed in consideration of only one dimension of a food system may be ineffectual, or could even lead to undesirable consequences. Hence, there is need to consider the big picture when designing food security and nutrition policies or interventions (Foran et al. 2014).

Against this complex backdrop, it can be difficult to decide which elements of a food system to study and understand. It would be especially difficult to identify the most influential leverage points, where interventions can deliver the desired outcomes. To address this challenge, as part of the CGIAR Initiative for Sustainable Animal Productivity, a decision support framework was developed that brings together elements of the food system and environment. Entitled "Food Systems, Environments, and Nutrition: a Structured Evidence Framework" (FoodSENSE), the framework aims to assess food security and nutrition outcomes in specific locations while taking into consideration the context and trade-offs within the local food system, in order to allow an evidence-based prioritization of challenges and interventions aimed at enhancing food security and nutrition.

1.2 Objectives and content of this report

This report describes the elements of the FoodSENSE framework and reports on its implementation in Mukono, a district within Central Uganda. This includes an analysis of secondary data, primary data collected from key informant interviews and focus groups, and discussions held during a stakeholder workshop. The same procedure was applied in two other sites in Uganda (Masaka and Mpigi districts), for which separate reports are available.

While the description of the food system in Mukono is not spatially comprehensive or based on large-scale novel data, the value lies in the synthesis of the results across multiple sectors of the food system, the prioritization of challenges, and the process of stakeholder engagement and discussion, all intended to inform decision-making. Much of the description of the nutritional situation, and some of the description of the food system, rely upon secondary data from household surveys and anthropometric data, already published elsewhere. The report presents novel, primary data collected via key informant interviews and focus group discussions with community members. These analyses were evaluated and verified as part of the expert stakeholder workshop. Their observations and insights have been used to further refine the relevant sections.

The results section is divided into three: "The Food System and the Food Environment", "Food Consumption", and "Nutritional Outcomes". The section on the Food System and the Food Environment describes the markets and value chains, agricultural production, socio-cultural norms, water, sanitation, and hygiene (WASH), information sources, and governance. The Food Consumption section describes which specific foods are commonly consumed within households and how they are acquired. The foods are aggregated in food groups based on nutritional profile. Seasonality and differences between more and less food-secure households are also considered. The Nutritional Outcomes section presents indicators of nutrition collected from individuals and households within the study area. This is used to evaluate which specific nutritional problems exist within the study area, and if there are differences between men, women, and children; or between wealthier and poorer households.

Two further sections of this report cover the analysis and interpretation. Within the section "Identification of Vulnerable Groups" the characteristics of households who are more and less food-secure are compared, as are the food security status of different classes of individuals – such as women, men, children, or the elderly. The objective is to identify groups of people who are more likely to suffer from poor nutrition and may deserve specifically targeted interventions. The second analysis section "Linking Priority Challenges to Solutions" draws upon the prioritization done in

preceding sections to recommend potential solutions, and reports on the stakeholder discussion around those potential solutions. A long list of potential solutions geared towards the specific challenges was discussed during the stakeholder meeting and the prioritized solutions and next steps are presented.

The report conclusions are summarized towards the end of the document, and various supplementary information including protocols followed, stakeholders engaged, and workshop outputs are included as appendices to the main document.

2. Methodology

This section first describes the logic and theory behind the FoodSENSE framework and the operational principles of the framework. The details of implementation in Mukono, Central Uganda, are then discussed, including site description, data collection and sourcing, plus details of stakeholder engagement.

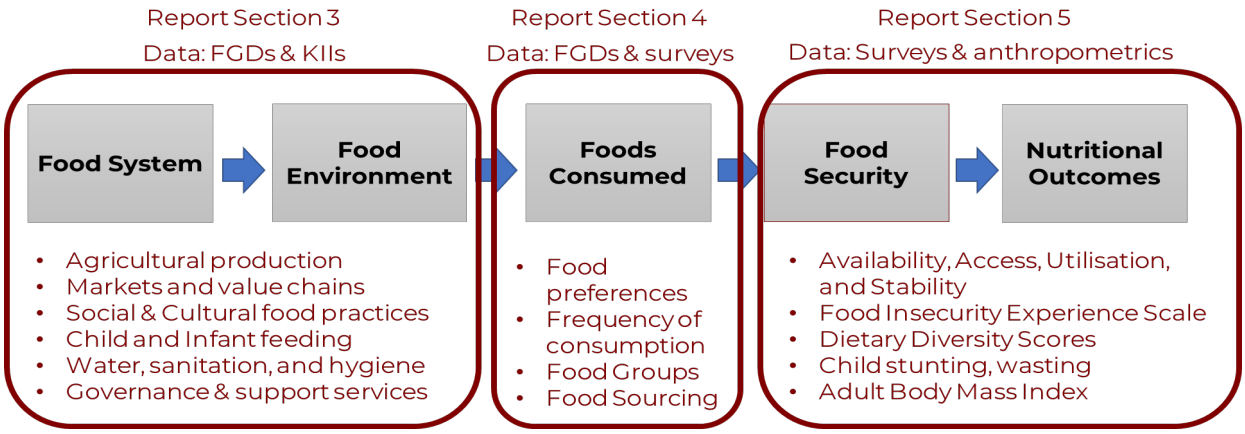
2.1 The FoodSENSE framework

The FoodSENSE framework was developed in 2022 and first trialled in Central Uganda in late 2022 and early 2023. The details of the framework have not yet been published elsewhere, hence are described in the following section of this report. First, the underlying logic and content is briefly summarized, then the process described. After that each major topic is discussed in more detail. This report is also structured so that most sections of the FoodSENSE framework correspond with a section of the report.

2.1.1. The conceptual logic

The conceptualisation of the FoodSENSE framework draws upon the literature of Food Security and Nutrition, and the literature of Food Systems and the Food Environment. From this , a series of topics have been delineated, issues within the topics identified, and indicators used where possible. The logic of the framework is presented in a linear manner in Figure 1, although we acknowledge that in reality these issues are not linear, but interconnected. The logic is as follows: the food system defines what food is created and available, while the food environment defines the space where people make choices around the foods they consume. Foods are then consumed, and depending on who consumes what, an individual or a group may be considered more or less food-secure. All this leads to measurable nutritional outcomes. Improved nutritional outcomes are a goal in themselves (e.g. SDG2), and are widely acknowledged to contribute to other global goals such as good health, equity, and human capacity. Figure 1 also shows the topics and issues covered in the framework. All these are explained in more detail in the following sections.

Figure 1. The basic logic and topics covered in the FoodSENSE framework.



The report sections which contain results are referenced, and source of data described. Note that FGDs refer to focus group discussions, and KIIs refer to key informant interviews.

2.1.2. The components the FoodSENSE framework

The FoodSENSE framework consists of various components. These have not yet been published independently, so are described within this report as fully as is practicable. The framework consists of:

i. An analytical approach drawing on concepts of food systems, food environments, food security, nutrition, plus equity and vulnerability. This is described in the introduction and methods sections.
ii. A list of topics, sub-topics, and suggested indicators to evaluate, with guidance on data sources. These are described in the methods section, as well as in Appendix 3.
iii. Data collection guidelines for focus groups and key informant interviews. These are provided in Appendix 4.
iv. Templates for the participatory evaluation of the main topics and sub-topics. These are the tables using the "traffic light" system to appraise issues at the end of Sections 3, 4, and 6.
v. Reporting templates to write up and structure the findings. This report follows the template structure.
vi. An Excel-based tool to cross-reference food and nutrition interventions against identified challenges and priority demographic groups within a food system. The nutrition interventions were drawn from a study of systematic reviews (World Bank 2021). The Excel-based tool will be made available on the CG Space website, or can be obtained from the authors on request.

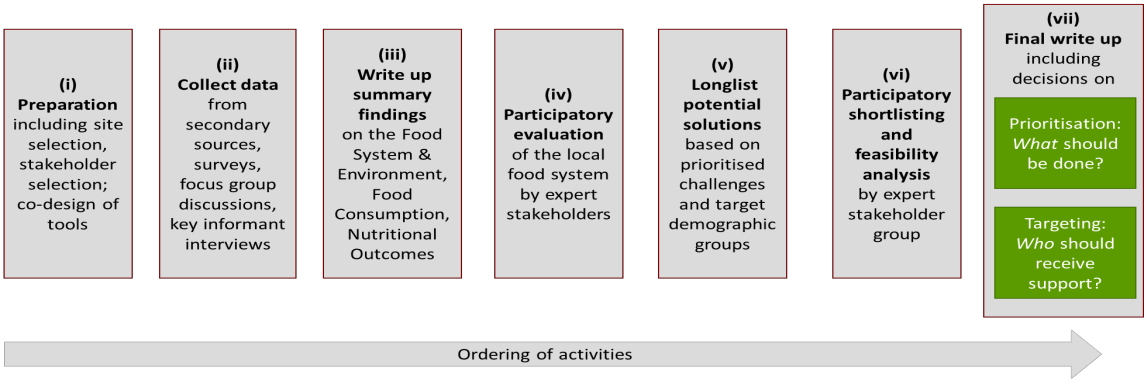
2.1.3. The FoodSENSE framework process

Implementation of the FoodSENSE Framework follows a structured process which is illustrated in Figure 2 and should include the following steps:

i. Preparation
ii. Collection of data
iii. Write-up of initial findings and summaries
iv. Participatory evaluation
v. Longlist of potential solutions
vi. Participatory evaluation shortlisting solutions and feasibility analysis
vii. Final write-up and presentation of results

Each step will be explained in more detail below.

Figure 2. The stepwise process to implement the FoodSENSE framework.



The green shaded boxes at the right-hand side represent the main outputs of the process – guidance on what should be done and for who, to improve the food security and nutrition situation.

Preparation

This includes site selection, stakeholder analysis and selection for inclusion, review and co-design of the topics, sub-topics, and data collection tools. The framework is intended for use at relatively fine jurisdictional levels, three to four levels below national. For example, if a nation is subdivided into provinces, then counties, then districts, then townships, then villages, the framework should be targeted at the level of district or township. Selection of the site may be made in reference to the condition of the food system and nutritional outcomes, presence of engaged stakeholders, and the existence of relevant secondary data. Stakeholder analysis should list relevant stakeholders engaged in the food and nutrition sector who are working within the site, or who have an interest in the site. These may include, but are not limited to, health sector professionals, agricultural support professionals, food producers and producer organizations, food vendors and vendor organizations, non-governmental organizations (NGOs), and research organizations. Listing should be as specific as possible, with the names of individuals identified within organizations.

The entity leading the implementation should prioritize a smaller number of stakeholders (e.g. five) for deeper engagement, including co-design/tailoring of the framework and interpretation of findings. A larger number of stakeholders (e.g. 20) should be engaged during key informant interviews and the participatory evaluation workshops. Review and co-design of the framework topics, sub-topics, data collection tools, reporting templates, and the intervention selection tool should be carried out in order to ensure that the issues are appropriate for the local context. Adaptation of topics and sub-topics must be matched to the intervention selection tool if substantive changes are made, so that the revised topics can be properly cross-referenced with the interventions. Non-substantive changes – for example to the phrasing, order, translation, or guidance provided – can be made as long as the final output remains compatible with the topics covered in the intervention selection tool.

Collection of data

The presence of good quality secondary data will greatly reduce the cost of implementing the framework. Conducting an inventory of available data on nutritional outcomes is recommended, including the indicators covered and the level of disaggregation possible. Data may be available from national statistics, health points, international campaigns such as the Demographic and Health Survey (DHS) program, or research and development projects that address nutritional issues. Stakeholders could advise on useful datasets. It is worthwhile to draw on multiple datasets as the topics covered and level of disaggregation may differ. For example, data from the DHS program may contain useful information on the level of stunting, wasting, or adult BMI across the district of

interest, and permit comparison to other districts; while a local project-specific dataset may permit disaggregation of household dietary diversity scores at household or even individual level. In such a case, the DHS data can provide information on the conditions across the whole site, but the project data could cover inter- or intra-household differences. In cases where no secondary data is available, novel data on quantitative indicators of nutritional outcomes may be collected.

The framework also contains guidelines for the collection of data from focus group discussions (FGDs) and key informant interviews (KIIs). These generally provide information on the conditions within the local food systems and food environment, and allow for the collection of preference data. In addition, the KIIs are asked to provide their expert assessment on salient issues and the historical situation. Key informants maybe drawn from the stakeholder analysis conducted in step (i) and may or may not be invited to take part in the participatory evaluation. Interviews follow a semi-structured format, with the interviewer free to direct the interview according to the interests of the informants. Audio recordings are not essential, but a write-up of the interview (following the topics covered in the guidance document) is. The FGDs should be sex-disaggregated as men and women typically have differing views and experiences relating to food practices, and are likely to express those views more clearly in single sex groups.

Depending on the characteristics of the study site, multiple FGDs may be required. This should be assessed on a case-by-case basis, depending on the major differences between areas within the study site. For example, if there are urban and rural areas with quite distinct food environments, it would make sense to conduct a male and female FGD in both the urban and rural areas. Written summaries of the FGD discussions should be made following the templates provided in Appendix 4.

Write-up of initial findings and summaries

The findings from the analysis of secondary data, focus group discussions and key informant interviews must be synthesized into short and accessible reports. The structure of Sections 3, 4, and 5 provide a template into which the findings fit. There could be a challenge in reconciling conflicting information, and in aggregating information. It may be correct that different information sources conflict, for example if a male focus group reports different food consumption norms to a female focus group. Or in other cases, there may be conflict due to differences in method, or aggregation level. In many cases it is not possible to determine the single true value, in which case all responses should be given, and the conflict identified. In some cases – such as when they represent different experiences – it is not desirable. Aggregation is also a complex matter, as it is both useful to present findings representative of the whole study area, and of individual communities or demographic groups within the study area. These findings can sometimes appear to be in conflict with one another. However, it is important to identify sub-populations with worse a food system experience or with worse nutritional outcomes compared to the population average. This can assist in identification of priority groups for nutrition interventions. Indeed, various elements of the reporting templates encourage demographic groups to be reported separately – the common divisions are individual based e.g. men, women, children; wealth based e.g. very poor, poor, affluent; or community based, e.g. remote village, peri-urban village.

For rapid communication, it is also recommended to provide summary info-notes and a poster in order to communicate the headline findings to stakeholders who are not able to read the full report on initial findings. Examples of these are given in Appendix 1.

Participatory evaluation

The findings from the initial summary should be presented to a stakeholder group for their discussion and prioritization of challenges specific to the local food system. This can be done in the form of a one-day workshop, including a presentation describing the objectives and functioning of

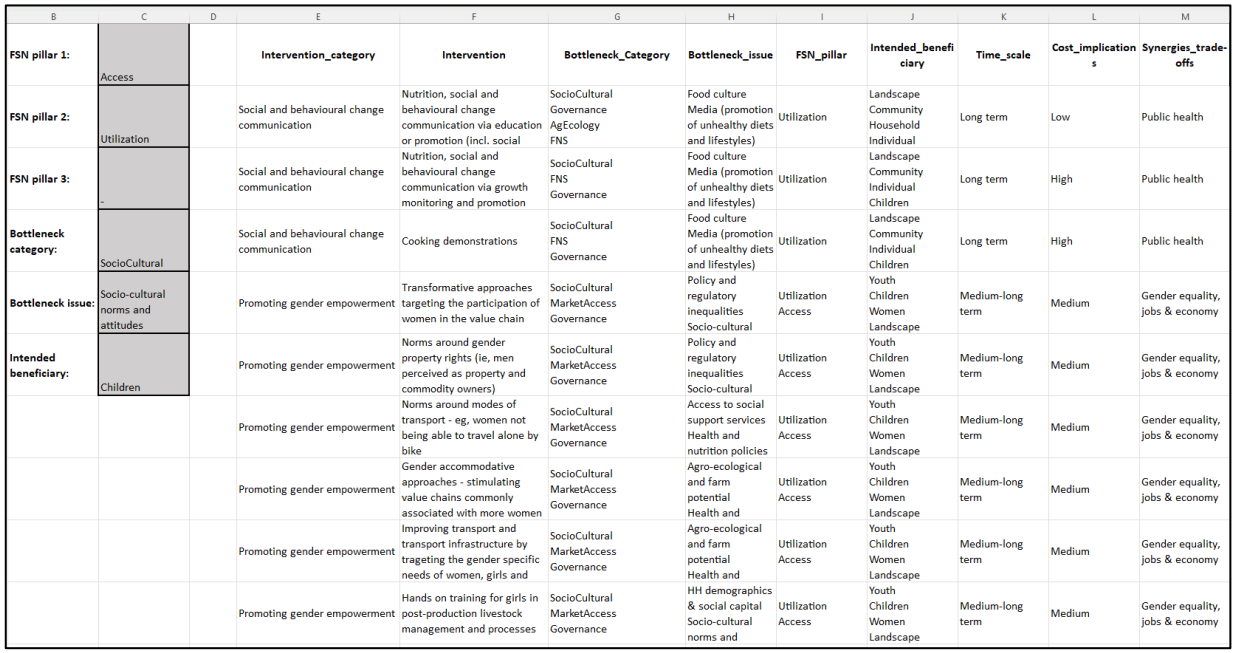
the FoodSENSE Framework. Each major topic can be introduced and discussed in turn: first the food system and food environment, second the foods consumed, and third the nutritional outcomes. Stakeholders may wish to debate or challenge the findings of the study, and they should be encouraged to provide evidence for their observations. Substantiated observations should be included in the final draft of the report. After discussion on each main topic, stakeholders should be invited to record their personal assessment of the status of each sub-topic (seeking consensus is not required). This can be done by sticking a red, yellow, or green dot onto a poster which lists the various topics and sub-topics (see Figure 3). The red dot indicates a bad situation, yellow a concerning situation and green, good or no concern. A similar outcome could be achieved by using coloured counters or by distributing print-outs and participants marking each issue with a score of +1, 0, or -1.

Figure 3. A poster used to collect stakeholder assessments of the nutritional outcomes for different demographic groups, challenges relating to food consumption, and obstacles within the local food system.

Longlist of potential solutions

From the stakeholder evaluation meeting, it should be possible to count the number of "votes" for each challenge within the food system and environment topic, the food consumption topic, and to identify the most vulnerable demographic groups for nutritional outcomes. This informs the prioritization of challenges that need to be addressed within the local food system. Then priority issues can be inputted into the Intervention Recommendation Tool (see Figure 4), providing a long-list of potential solution ideas. These should be screened for relevance by the implementation team, and then presented to the stakeholder group for short-listing.

Figure 4. Screenshot from the Excel-based Intervention Recommendation Tool.



B	C	D	E	F	G	H	I	J	K	L	M
FSN pillar 1:	Access		**Intervention_category**	**Intervention**	**Bottleneck_Category**	**Bottleneck_issue**	**FSN_pillar**	**Intended_beneficiary**	**Time_scale**	**Cost_implications**	**Synergies_trade-offs**
FSN pillar 2:	Utilization		Social and behavioural change communication	Nutrition, social and behavioural change communication via education or promotion (incl. social	SocioCultural Governance AgEcology FNS	Food culture Media (promotion of unhealthy diets and lifestyles)	Utilization	Landscape Community Household Individual	Long term	Low	Public health
FSN pillar 3:	-		Social and behavioural change communication	Nutrition, social and behavioural change communication via growth monitoring and promotion	SocioCultural FNS Governance	Food culture Media (promotion of unhealthy diets and lifestyles)	Utilization	Landscape Community Individual Children	Long term	High	Public health
Bottleneck category:	SocioCultural		Social and behavioural change communication	Cooking demonstrations	SocioCultural FNS Governance	Food culture Media (promotion of unhealthy diets and lifestyles)	Utilization	Landscape Community Individual Children	Long term	High	Public health
Bottleneck issue:	Socio-cultural norms and attitudes		Promoting gender empowerment	Transformative approaches targeting the participation of women in the value chain	SocioCultural MarketAccess Governance	Policy and regulatory inequalities Socio-cultural	Utilization Access	Youth Children Women Landscape	Medium-long term	Medium	Gender equality, jobs & economy
Intended beneficiary:	Children		Promoting gender empowerment	Norms around gender property rights (ie, men perceived as property and commodity owners)	SocioCultural MarketAccess Governance	Policy and regulatory inequalities Socio-cultural	Utilization Access	Youth Children Women Landscape	Medium-long term	Medium	Gender equality, jobs & economy
			Promoting gender empowerment	Norms around modes of transport - eg, women not being able to travel alone by bike	SocioCultural MarketAccess Governance	Access to social support services Health and nutrition policies	Utilization Access	Youth Children Women Landscape	Medium-long term	Medium	Gender equality, jobs & economy
			Promoting gender empowerment	Gender accommodative approaches - stimulating value chains commonly associated with more women	SocioCultural MarketAccess Governance	Agro-ecological and farm potential Health and	Utilization Access	Youth Children Women Landscape	Medium-long term	Medium	Gender equality, jobs & economy
			Promoting gender empowerment	Improving transport and transport infrastructure by trageting the gender specific needs of women, girls and	SocioCultural MarketAccess Governance	Agro-ecological and farm potential Health and	Utilization Access	Youth Children Women Landscape	Medium-long term	Medium	Gender equality, jobs & economy
			Promoting gender empowerment	Hands on training for girls in post-production livestock management and processes	SocioCultural MarketAccess Governance	HH demographics & social capital Socio-cultural norms and	Utilization Access	Youth Children Women Landscape	Medium-long term	Medium	Gender equality, jobs & economy

The priority issues identified can be inputted and are matched to a database of over 200 food and nutrition interventions, resulting in a long list of potential solution ideas.

Participatory evaluation shortlisting solutions and feasibility assessment

A second meeting of stakeholders should be convened for a half-day, to evaluate the proposed long list of food and nutrition interventions. This may be the day following the first evaluation workshop; it is possible to prepare the intervention recommendations within an evening. The Excel-based Intervention Recommendation Tool should be demonstrated to the stakeholders, and the prioritized food system challenges should be reported back. The selected challenges and the resulting intervention recommendations should be presented. Stakeholders should first be given the opportunity to discuss the selection of the priority challenges. They may not agree with the prioritization, or may not agree with one another. It could be possible to generate new recommendations in such a situation. Once the priority challenges are agreed, the potential solutions should be evaluated. First, there should be a "weeding" exercise to remove any which are clearly unsuitable given the local context. Next, there should be a "prioritization" exercise to identify the most promising, in terms of feasibility and in terms of anticipated impact. Some interventions may address multiple challenges, or may be perceived to provide cascading benefits. A shortlist of approximately five priority interventions is a sensible number to aim for. These should be discussed further, identifying the niche within the local food system, the required participants, the level of funding required, and any next steps which could be taken.

Final write-up and presentation of results

Finally, a full report combining the initial assessments and the stakeholder evaluations should be written up. This should also be presented back to key stakeholder groups and used to spur further action. The format of this report can serve as a template for final reports.

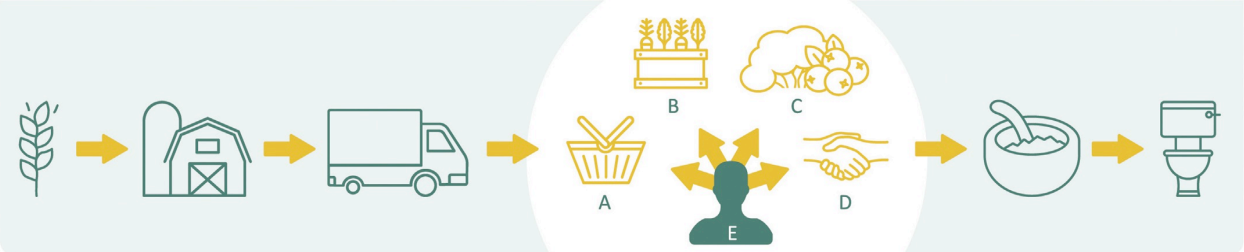
2.1.4. Topics addressed within the framework

The major topics addressed in the framework are described in more detail in this section, with reference to the supporting literature. Those topics include: the food system, the food environment, food consumption, food security, and indicators of nutritional outcomes.

The Food System and the Food Environment

The food system comprises all elements involved in food production, through consumption, to sewage disposal – this includes the people, institutions, environments, infrastructure and activities involved in food production, aggregation, processing, distribution, preparation and consumption, including the outputs of these activities such as socio-economic and environmental outcomes (HLPE 2017). Local food systems can be conceptualized more easily than global or national food systems, but they are still complex. The basic model employed in this framework draws upon Turner et al. (2018) and entails food production; food storage and processing; transport; the food environment, which includes food acquisition from markets and other sources; food consumption; and waste disposal (Figure 5).

Figure 5. A conceptualisation of the main stages in a local food system.



From left to right these are food production; food storage and processing; transport; the food environment, which includes food acquisition from markets and other sources; food consumption; and waste disposal. Source: Turner et al. 2018.

The food environment space in which decisions around food acquisition and consumption are made by individuals, and it influences the health and nutrition outcomes of the consumers (HLPE 2017; Turner et al. 2018; Aggarwal et al. 2018; Kennedy et al. 2021; Flax et al. 2023). The food environment incorporates both external and personal domains. External domains include elements such as food availability, prices, markets and vendors, plus regulation; while personal domain issues include food affordability, accessibility, preferences, food preparation, convenience, and desirability. Food environment typologies differ for given contexts, for example between urban and rural, or formal and informal (Downs and Demmler 2020). In this framework we combine the concepts of the food system and food environment.

The following topics are covered to describe the food system and the food environment: farm production and agro-ecological potential, including small-scale production and the harvesting or hunting of wild foods; markets and other food purchase points, food prices, and the presence of value chains; social and cultural norms around food preferences and food culture, expectations on who should eat what, and child feeding norms; sources of knowledge regarding food preparation and nutrition; the water, sanitation, and hygiene situation, practices, and attitudes; and governance issues, including regulation, and official or unofficial support systems such as health care or food aid. The topics and sub-topics are each defined in Appendix 3 of this report.

The majority of the information regarding the food system and food environment was sourced from focus group discussions with community members (described in more detail below) and from key informant interviews with professionals and experts working in the local communities. However, other data sources could also be valuable, such as official statistics on food production, analyses of

agricultural potential or agricultural plans from official sources, value chain assessments, market surveys, or farm surveys. In this case, pre-existing farm survey data was used to supplement the information on local farm produce.

The topics listed for the food system and food environment are used as headings and sub-headings in Section 3 of this report. The topics were also used as a checklist of issues for stakeholders to consider and prioritize during the participatory evaluation process. Finally, the topics were used as "tags" assigned to food and nutrition interventions, so that interventions could be matched to specific challenges within a food system.

Foods consumed

The foods people actually consume, and why they chose to consume them, is important information to understand the result of the food environment, and to understand the nutritional situation. There are many foodstuffs which can be consumed, and many ways of preparing them. Different people also consume different foods, influenced by personal, cultural, and economic factors. In addition, foods consumed may vary seasonally.

Foodstuffs were grouped into ten main food groups, according to nutritional profiles and conceptual similarity, following the guidelines for the minimum dietary diversity for women indicator (FAO and FHI 360 2016). These were grains, roots, and tubers; pulses; nuts and seeds; dairy; meat, fish, and poultry; eggs; dark green leafy vegetables; vitamin A-rich fruits and vegetables; other vegetables; and other fruits. In addition, three categories were added for sweet snacks, fried or savoury snacks, and beverages.

Food consumption was measured using various approaches. Household survey data which collected the frequency of food group consumption at household-level during a lean month and a flush month (as defined by the respondent), where each food group may be reported as consumed "daily or almost daily", "weekly", "monthly", or "not consumed". Focus group discussions held with community members reported on which foodstuffs (within each food group) were commonly consumed, rarely consumed, preferred, disliked, and commonly self-produced or purchased. Focus groups also reported on foodstuffs especially preferred or disliked/discouraged for different demographic groups. The groups were infants (<3 years), children (3-12 years); male and female youth (13-21 years); pregnant and breastfeeding women; male and female adults (22-59 years); and male and female elderly people (>60 years). Key informants were asked to comment on which foods were over- or under-consumed in the locality; the consumption of unhealthy or junk food; the most important foods from a nutritional point of view; and if there were demographic differences in food consumption.

Food consumption is reported in Section 4. In addition to the survey, focus group, and key informant information, stakeholders were asked to give a participatory evaluation of the food consumption situation. They commented on six food groups, aggregated to permit rapid and participatory evaluation. Those food groups comprised: grains, roots, and tubers; pulses, nuts, and seeds; animal source foods; vegetables and fruits; junk foods; sugar-sweetened beverages and alcohol. Stakeholders were asked to comment on the availability, access, utilization, and stability of each food group.

Food security

Food security is defined as 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. Food security has four pillars: availability, access, utilization, and stability (FAO 2001). Availability addresses the "supply side" – i.e. whether or not the food exists – and is determined by the level of food production, stock levels and net trade. It is possible to have food

available at national level but lack it at household level. Access to food includes the ability to purchase it, or otherwise attain it. Access is influenced by incomes, markets, and food prices. Utilization relates to an individual's consumption and absorption of nutrients, and includes feeding and care practices, food preparation, intra-household distribution of food, and how the nutrients are used in the body. Stability is when the other three pillars are maintained throughout time. External factors such as the economy and prices, climate, and conflict can affect the stability pillar of food security.

There have been calls, yet to be concluded, to update this definition and include two more pillars: agency and sustainability (Clapp et al. 2022). Agency relates to the capacity of individuals and groups to exercise voice and make decisions about their food systems. Sustainability relates to the long-term viability of the ecological and social basis of food systems.

We considered the four food security pillars in the FoodSENSE framework. The four pillars informed the design of the data collection tools, the topics covered under the food system and environment section, the participatory appraisal of food consumption, and the selection of nutritional outcome indicators. As such, the issue of food security is not addressed in isolation, but pervades the entire report. Food and nutrition interventions were "tagged" as addressing specific pillars, and as such could be searched according to particular needs identified within a food system.

Nutritional outcomes

The primary outcome of interest in the FoodSENSE framework is the nutritional status of individuals. A large body of literature exists around assessment of nutritional outcomes. Methods range from relatively light-touch, such as a one-off, ten-minute questionnaire exercise; to moderately invasive, such as taking body measurements of height, weight, and other body parts (e.g. mid-upper arm circumference); to invasive, such as taking monthly blood samples. More invasive methods are typically more precise, but entail higher financial and social costs.

In the FoodSENSE framework, we recommend using the best available data to describe the nutritional outcomes of the target population. However, as the framework is intended for use in lower- and middle-income countries, it is quite possible that indicators will be drawn from the more light-touch end of the spectrum. These are also more feasible to collect on lower budgets if no usable data already exists. Such indicators include the Food Insecurity Experience Scale (FIES) – used to assess household or individual access to sufficient quantity of food (Ballard et al. 2013); various dietary diversity metrics such as the Household Dietary Diversity Score (HDDS; Swindale & Bilinsky 2006), used to measure household economic access to food; and Minimum Dietary Diversity Score for women (MDD-w) to measure women's micronutrient adequacy (Chakona & Shackleton 2018; Rodríguez-Ramírez et al. 2022). There are other diet quality indicators, such as the Global Dietary Recommendation Score (Herforth et al. 2020), Healthy Eating Index (Kennedy et al. 1995), the Diet Quality Index (Patterson et al. 1994), Global Dietary Quality Score (Bromage et al. 2021) among others. Slightly more demanding are anthropometric measurements, such as weight and height, which can be used to determine Body Mass Index (BMI), which gives information on whether adults are underweight, overweight, or healthy weight. Children's anthropometric measurements can also be assessed using height, weight, age, and sex. Metrics include stunting, wasting, and underweight. Mid-Upper Arm Circumference (MUAC) is used as a diagnostic tool to detect wasting in children. Stunting (low height for age) indicates inadequate long-term growth as a result of chronic undernutrition. Wasting (low weight for height) is an indicator of acute undernutrition – i.e. rapid weight loss. Mid-upper arm circumference is used only for children under 5 years, and if the circumference of the upper arm is below threshold it indicates wasting or severe malnutrition.

In this application of the framework, the following have been used as indicators of nutritional outcomes: body mass index for men and for women, reporting the percentage of the population

above the normal weight and below the normal weight. For children, the percentage of underweight, stunted, and wasted. These were sourced from the Uganda Demographic and Health Surveys (DHS; Uganda Bureau of Statistics 2018). In addition, from the DHS surveys, the percentage of households drinking water from unimproved sources and the percentage of children who had diarrhoea in the last two weeks. From another household survey (Caulfield et al. 2021), indicators were calculated for the food insecurity experience scale (FIES, Ballard et al. 2013); an adapted version of the household dietary diversity score, which reports on the frequency of food consumption during a "lean" and "flush" month during the last year (Fraval et al. 2018); individual dietary diversity scores for men and women based on a 24-hour recall, the proportion of households who consumed animal sourced foods in the past 24 hours, and an estimate of potential calorie availability per person per day, considering all on-farm production and incomes combined (Frelat et al. 2015). The count of months with food shortages and the differences between the flush and lean season dietary diversity scores were also reported. Mean indicator scores, standard deviations, as well as the proportion below acceptable thresholds (where such thresholds have been defined), and the links between the indicators and the four pillars of food security are all reported in Section 5.

The nutritional outcome indicators are intended to be used to appraise the degree of success achieved by the local food system, as well as to identify groupings of people who may need to be prioritized for food and nutrition support. Such groups may be defined by sex, age, wealth, location, ethnicity, or other features. Where possible, the nutritional indicators have been reported along the relevant lines of differentiation, and stakeholders were asked to prioritize the food and nutrition situation of different demographic groups as part of the participatory evaluation exercise. It is already acknowledged that the local food system will incorporate agriculture and several key actors in other sectors to address malnutrition problems. The nutritional indicators relating to specific pillars of food security were used to inform prioritization of which pillars to address with interventions. The food and nutrition intervention selection tool allowed input for targeting towards identified priority demographic groups and food security pillars. As such, the nutritional outcome indicators were used to inform the selection of potential interventions.

2.1.5. Analysis and interpretation

This report draws on multiple data sources which entail different methods of analysis, aggregation, and reporting. In addition, sometimes the different data sources produce conflicting results. In those cases this has been highlighted in the text with possible explanations given. However, conflicting results are inevitable as different studies drew from different respondents and none were considered to be wholly representative of the systems studies. The layout of the results section of this report first presents the information from each data source (notably household surveys, focus group discussions, key informant interviews, and stakeholder evaluations), followed by a synthesis section in which the authors of the report attempt to conclude on the most probable balance of facts.

Results from the four focus group discussions were aggregated into two tables per topic – one table for men's focus groups and one for women. In general, the results reported between the study sites (one peri-urban, one rural) were similar, especially regarding food consumption, hence the findings aggregated for presentation. Focus group facilitators were instructed to guide the groups towards agreement of the "common situation" and thus, not to record outlying observations. However, on occasions where conflicting views were given by an approximately equal proportion of respondents, both responses were reported. Thus, in some cases conflicting information has been presented – for example, a specific food may be listed as "preferred" and "disliked" if some respondents liked it and some did not. Where an outlying opinion was expressed and considered to be important or necessary to include, it has been done so with a caveat added to the text. Where differences occurred, these have been noted in the text. Numerical information reported from focus groups sometimes entailed a large range – for example when reporting the prices of foods. In those

situations, an explanation has been given in the table containing the large range – for example, a high degree of seasonal price fluctuation, or dependent upon the quality or size of the item.

Key informant interviews were analysed based on each topic that the interviewees responded to, and assessment of the claim made, or opinions given. Not all key informants responded to all topics. On each topic, the number of agreeing opinions were recorded, with the number of dissenting opinions also recorded. Generally, there was a strong agreement between the key informants, with differences usually due to the specific details respondents chose to comment on rather than direct disagreements. When reporting the results of the KIIs in the text of the report, an indication of the frequency with which specific observations were made is usually given – for example, "almost all key informants observed that…", or "it was occasionally observed that…".

The household survey data sources – DHS and RHoMIS – were analysed for specific indicators and generally reported on a population basis. The DHS data was representative of the general population of Mukono District. The RHoMIS data was representative of farming households in Nakisunga sub-county and Kasawo sub-county (the same sub-counties in which the FGDs and KIIs were conducted). Indicator results from the household surveys are either reported at study population level, or sex- or age-disaggregated. Where thresholds have been defined for those indicators, they are presented in the results section along with the averages and the percentage of population below those thresholds.

For the identification of groupings of households particularly vulnerable to food and nutrition insecurity, two approaches were followed. The two are not directly comparable, but do enable some corroboration and complementary understanding of the differences between more and less food-secure households. The first approach was to ask focus groups to describe the characteristics and prevalence of people or families who typically ate only one, two, or three meals per day. Responses were aggregated into tables. The second approach was to use the RHoMIS household survey data to assign households into terciles of food and nutrition security, and then to describe the average characteristics of those households. The food and nutrition security terciles were defined by creation of a compound indicator based on multiple measures of food insecurity in the same survey. Those measures were potential food availability, FIES, HDDS lean season, HDDS flush season, IDDS-24, and number of months food insecure. To permit aggregation of the six indicators, scores were converted to 0, 1, or 2 depending on thresholds for each indicator (Table 1, see also Hammond et al. 2021). The total score of the compound indicator ranged from 0 (for households who scored very low in all six indicators) to 12 (for households who scored above the "ok" threshold for all six indicators). Amongst the study population, the tercile cut-off values were 7 and 9. Households with a compound indicator score of less than or equal to 7 were therefore in the lowest tercile for food and nutrition security indicators. Those with a score of 8 or 9 were the middle strata, while those with a score of more than 9 were from the highest levels of food and nutrition security. Description of the terciles was done by taking averages of demographic, asset, and livelihood information.

Table 1. Thresholds used to define food and nutrition security terciles from household survey data

Variable	Interpretation
Potential food availability (kCal/person/day if all income was spent on staple foods)	very bad (<2500)
	bad (<5000)
	ok (>=5000)
Food insecurity experience score (0-8)	very bad (>3)
	bad (>1)
	ok (<=1)
Household dietary diversity score, lean season (1-10)	very bad (<4)
	bad (<6)
	ok (>=6)
Household dietary diversity score, flush season (1-10)	very bad (<4)
	bad (<6)
	ok (>=6)
Individual dietary diversity score, 24-hour recall (1-10)	very bad (<4)
	bad (<6)
	ok (>=6)
Months with food shortages (0-12)	very bad (>=4)
	bad (<4)
	ok (<2)

2.2 Implementation of the framework in Mukono

The process described above was followed during the implementation in Mukono. However, some amendments were made due to prevailing local conditions. For example, site selection was based on the presence of existing activities which could facilitate the data collection. The co-design process was not as embedded within local stakeholders as desired, and therefore the two expert stakeholder workshops were combined into a single two-day event. This did not allow the desired time for analysis between the first and second workshops, and may have made it more difficult for stakeholders to attend both workshops. These alterations were due to an outbreak of the Ebola virus during the latter part of 2022, which disrupted the planned activities.

2.2.1. Data acquisition

Data used in piloting the FoodSENSE framework comprised both primary and secondary data. Primary data was collected via focus group discussions and key informant interviews in 2022. Focus groups were sex-disaggregated, and conducted in both rural and peri-urban locations, resulting in four focus groups in total. A facilitator and note-taker implemented the group discussions, and followed a pre-defined template to cover all required topics. They also facilitated written records of the responses (although recordings were also made). Participants were drawn from the local population in consultation with community leaders, with the objective of ensuring a cross-section of the community make-up. Focus groups took between two and three hours each. Information was collected on food consumption; foods favoured or discouraged for specific people; infant and child feeding; food acquisition; food knowledge, information, and choices; cleanliness, hygiene, and food safety; and definition of vulnerable groups regarding food security.

Seven key informant interviews were conducted with professionals in the following roles: senior clinical officer, nutritionist, senior health inspector, senior agricultural officer, the focal person for the prevention of mother-child HIV transmission, and the district health officer. There was an equal split between male and female interviewees. Interviews lasted approximately 45 minutes, and

followed a semi-structured format, whereby a long-list of open-ended questions was adapted based on the interests and knowledge of the key informant. Information was collected on general overview of the food and nutrition situation; food consumption patterns; food production; food acquisition and markets; governance, policy, infrastructure, and social support; water, sanitation, and hygiene; social and cultural norms; plus interventions to address food and nutrition security. The templates for the focus group discussions and the key informant interviews are provided in Appendix 4.

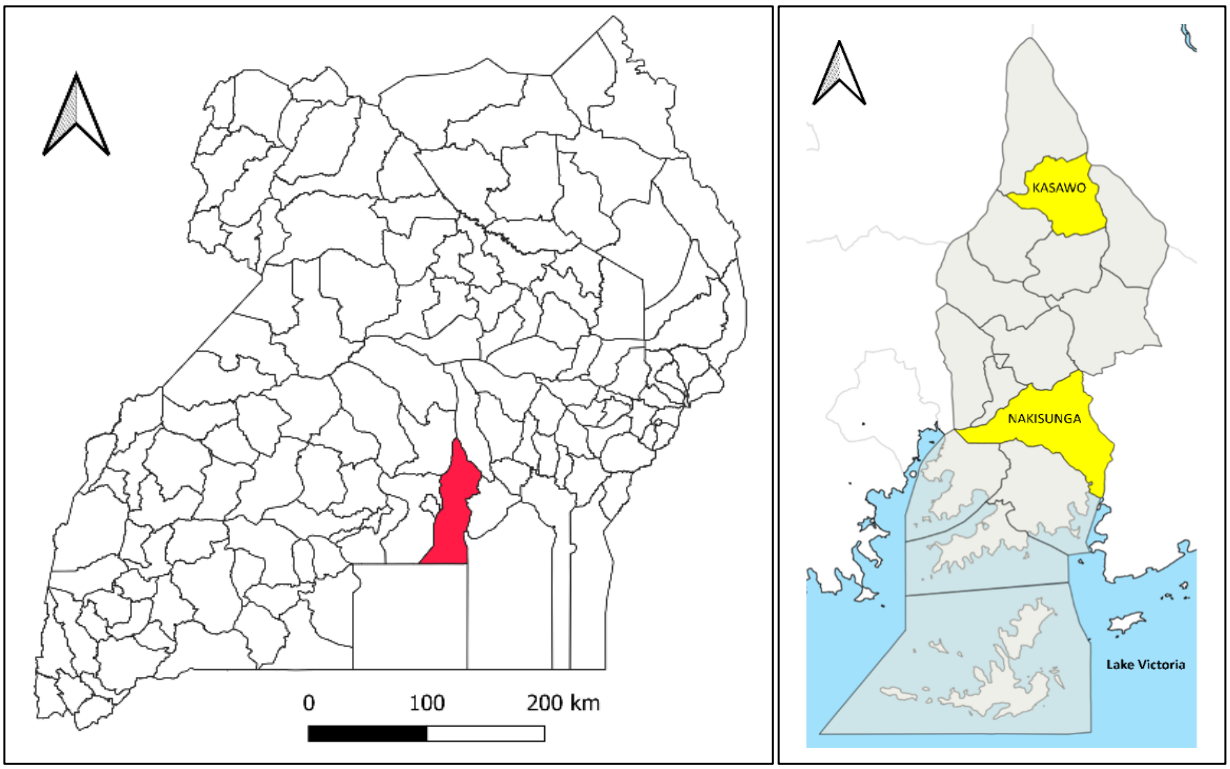
i. Secondary data was harvested from two household survey datasets: the demographic and health survey from 2016 (Uganda Bureau of Statistics 2018) and the Livestock CRP More Pork project baseline survey from 2020, which used the Rural Household Multi-Indicator Survey (RHoMIS) tool (Caulfield et al. 2021). The DHS survey provided anthropometric measurements, as well as information on use of unimproved water sources and frequency of diarrhoea in children. Data collection for the DHS survey took place over six months, from June 2016 until December 2016. In total, 19,588 households were surveyed, of which 1459 were located in Mukono. The RHoMIS data provided information on the food insecurity experience score, as well as measures of household and individual dietary diversity, consumption of food groups, and agricultural production. The RHoMIS survey in Mukono was conducted as part of a larger CGIAR project on the stimulation of the pig value chain under the Livestock and Fish Research Program. It spanned four districts including Masaka, Mpigi, Mukono, and Wakiso and was undertaken between October 2020 and January 2021. Of the total 688 rural household surveys undertaken, 207 of them were located in Mukono.

2.2.2. Stakeholder engagement

A stakeholder workshop was held in April 2023 in Kampala (https://www.cgiar.org/news-events/news/foodsense-offers-new-ways-of-assessing-and-tackling-malnutrition-in-uganda/). The aim was to: (i) stimulate cross-sector dialogue with the objective of improving food and nutrition security; (ii) lay out the evidence from FoodSENSE piloting in a structured manner with regards to the status of food and nutrition security, prioritization of intervention points, potential solutions, and vulnerable groups; and (iii) bring food systems thinking to a finer jurisdictional level than has been done previously. Initial reports from the primary and secondary data analysis were shared and discussed over the course of the two-day workshop. Attendees were from the Ministry of Health; the Ministry of Agriculture; Mukono, Masaka, and Mpigi district health offices; USAID; UNICEF; CGIAR; and national universities. Stakeholders evaluated the conditions in each of the three study sites: prioritizing the severity of blockages in the food system; identifying vulnerable demographic groups, and identifying deficiencies in availability, access, utilization, and stability of major food groups. After the evaluation phase, a long-list of potential interventions was provided, and stakeholders debated the merits of these, resulting in a short-list of prioritized potential interventions.

2.2.3. Site description

Figure 6. Left: a map of Uganda, showing the location of Mukono District (highlighted in red). Right: a map of Mukono District showing the sub-counties in which the studies took place (highlighted in yellow).



Mukono District lies in the central region of Uganda, and it has a total area of 2986 km^2. It shares borders with Buikwe, Kayunga, Luwero, Kampala, and Wakiso in the east, north along River Ssezibwa, northwest, and southwest, respectively. The district also borders Lake Victoria and the islands of Buvuma District in the south. The geographical coordinates of Mukono District are 00°28'50.0"N, 32°46'14.0"E (Latitude:0.480567; Longitude:32.770567). The average annual rainfall is 2015 mm and the temperature is 21.1 °C (Climate Data.org). The district comprises two counties: Mukono and Nakifuma. Mukono contains six sub-counties and two divisions, 55 parishes/wards and 365 villages. Nakifuma contains five sub-counties, 42 parishes/wards, and 242 villages. This study focused on Nakisunga Sub-county located in Mukono County representing a peri-urban locality, and Kasawo Sub-county in Nakifuma County representing a rural locality (see Figure 6).

The administrative centre of the district is situated along the Kampala-Jinja road, 21 km east of Kampala city. This makes the district urbanized as it is part of the Kampala metropolitan area. However, there are parts of the district that are still rural. Proximity to the capital city grants Mukono residents better access to markets. It is comprised of a cosmopolitan population, and the major tribes include the Baganda, Basoga, Bagisu, Bagwere, Bakiga, Banyankole, Banyarwanda, Lugbara, Banyoro, and Batooro. Luganda is the language commonly spoken and English is the official language for communication.

The main source of livelihood is agriculture. The major food crops grown in the district include cassava, sweet potatoes, maize, millet, groundnuts, peas, soya beans, bananas, ´simsim´ (sesame), and yams. Cash crops include cotton, coffee, sugarcane and tea. Fruits and vegetables are also widely grown in Mukono. The common ones include tomatoes, onions, pineapples, vanilla,

passion fruits, cabbage and leafy vegetables (Amaranthus, dodo). Livestock production is also carried out and the species kept are cattle, pigs, goats and chickens (Seaman et al. 2016).

According to the Uganda Demographic and Health Survey 2016, 29% of Ugandan children aged 6-59 months were stunted, 4% were wasted, 11% were underweight, and 4% were overweight. In comparison, children of the same age in Mukono were slightly less likely to be stunted (24%) or underweight (7%), and were very unlikely to be wasted (1.4%). Across Uganda, obesity was more common among women (24%) than men (9%) (Uganda Bureau of Statistics 2018). This gender discrepancy was also evident in Mukono where 29% of women and 15% of men were overweight or obese.

While this report does not assess the micronutrient deficiency in Mukono, Uganda is one of the countries with high micronutrient deficiency. About 53% of children under five years were anaemic in 2017. The figure for women stood at 23%. There are variations in the prevalence of anaemia among women, ranging from 17% in Kigezi sub-region to 47% in Acholi sub-region (Uganda Bureau of Statistics 2018).

3 The food system and the food environment

In the following section, an assessment of the main food system components that influence food and nutrition security is conducted. The topics covered are: "Markets and Value Chains"; "Agro-ecological Potential and Farm Production"; "Social and Cultural Norms"; "Water Sanitation and Hygiene"; "Food Knowledge and Influence"; and "Governance and Institutions". These assessments aim to identify some of the main bottlenecks and challenges to food and nutrition security in Mukono. The findings were evaluated by a workshop of stakeholders, who also prioritized the issues based on their expertise and viewpoints. The section concludes with the authors' synthesis of the issues.

3.1 Markets and value chains

3.1.1 Market access

The key informants reported that market access was good, and that small stalls were frequently used for the purchase of food. Large markets also existed and were also widely used. Some said large markets were worse in terms of hygiene, freshness, and price of food items. The focus groups reported similar findings, with all participants indicating that they lived within easy walking distance of small stalls, small shops, or small markets. Travelling vendors – termed hawkers or hackers – were widely used and considered to be the cheapest and most convenient points for purchasing food, especially for the sale of fresh produce and milk. Direct purchases from farmers or primary producers were also mentioned as a source of food purchases, for example, flour from millers, and milk from dairies and farms. Meat was generally purchased from butcher shops, with pork outlets considered more affordable and accessible than beef butcheries. One key informant mentioned the practice of a group of people pooling their money to buy a whole pig. Fish – particularly small, dried silver fish (mukene) – were widely purchased. The focus groups taking place in more rural and more urban locations reported remarkably similar findings, with the exception of access to larger markets, to which the rural populations had to travel much further.

3.1.2 Product prices

Key informant interviews widely reported that food prices were too high for much of the population to afford healthy diets. Animal source foods such as meat, milk, and fish, or foods perceived as luxurious such as fried items and chips were prohibitively expensive for many. Table 2 presents the prices of some common food items, as collected from focus group discussions. There was little difference between the rural and peri-urban study sites.

Table 2. Comparison of prices of some common food items

Commodity	Price (UGX)	Comments	Seasonal fluctuation in availability or price?
Posho (maize flour)	3600 – 4000/kg	Depends on quality	High fluctuation with seasonality (2500-5000/kg)
Rice	3500 – 7000/kg	Cheaper from mill, high grade rice more expensive	Moderate fluctuation with harvest season
Matooke (green banana)	10,000 – 20,000/bunch	Size of bunch and location	Drought impacts push up prices
Meat (pork/beef)	10,000 – 15,000/kg	Pork is cheaper than beef	Moderate – drought or festive seasons
Fish	3000 – 25,000/fish 16000/kg	Depends on size of the fish	High seasonal fluctuations in availability and price
Beans	2500/kg	Many people grow their own	High fluctuation with seasons, can double in price
Milk	1500-2500/litre	Cheaper from farmer than dairy	Dry season less available

3.1.3 Value chains

The key informants reported that value chains, food processing facilities, and storage infrastructure and capacity is inadequate in Mukono. They mentioned that a few organizations supported horticulture aggregation, grain processing (millers), and yoghurt production (with cold storage), but these were few and inadequate to serve the whole district. No-one was aware of any cold chain infrastructure or storage. It was argued that the pork value chain may be better developed than the beef value chain, given the penetration of pork butcheries and pork eating establishments throughout the district. Most of the fresh food sold locally was produced locally. In contrast to value chain development, the infrastructure for the transport of goods was considered to be of reasonable quality and quantity, especially in urban or peri-urban areas.

3.2 Agro-ecological potential and farm production

The key informant interviews reported generally low total agricultural production levels. This was attributed to population pressure and land fragmentation, urbanization, drought, and high input prices. There were schemes to increase backyard production of vegetables, and support for livestock suitable for small areas (chicken and pig) where desired.

3.2.1 Household and farm production

According to the household survey data, the major crops produced locally were cooking banana (matooke), maize, beans, sweet potato, cassava, and coffee (Table 3). Groundnuts were produced by about a third of the households. Vegetable production in home gardens was widely discussed in focus groups, but was only reported by 10% of households in the RHoMIS household survey data – possibly under-reported. Pigs and chickens were the main livestock kept in Mukono according to participants from the focus groups. About a third of the households kept cattle, and a third kept goats. However, reported collection of milk and eggs was surprisingly low (Table 3).

Table 3. Proportion of households *that* produce agricultural goods

Production category	Name	% of study population
Main field crops	Matooke	83
	Maize	73
	Beans	73
	Sweet potato	80
	Cassava	73
	Coffee	53
	Groundnuts	35
Main horticultural crops	Avocado	1
	Mango	2
	Tomato	9
	Aubergine	3
	Amaranth	0
	Jackfruit	1
	Pumpkin	2
Main livestock production	Pig	100*
	Chicken	40
	Cattle	33
	Goat	32
	Milk	7
	Eggs	1

Drawn from RHoMIS survey in Livestock CRP. *Note that the sample purposively targeted pig farmers.

3.2.2 Other sources of foods

In addition to purchases and production on-farm, there are a few other sources of foods which were mentioned in the focus group discussions. Reciprocity between family and neighbours was frequently mentioned during seasonal gluts, although more so in rural locations. Gifts during festivals and functions such as weddings were also mentioned. School meals were an important source of food for children, usually consisting of a staple carbohydrate and beans. A charitable organization known as Reach One Touch One Ministries (ROTOM) was mentioned in Nakisunga. It provided food to the elderly.

3.3 Social and cultural norms

3.3.1 Food culture

Impressions from the focus group discussions were that strict food consumption taboos were a thing of the past. Taboos related to consumption of one's clan totem animal, however, were still observed (e.g. lungfish, cow, sheep); as was the practice of not consuming pork or alcohol by people of Muslim or Seventh Day Adventist faiths. There were no explicit restrictions in food consumption based on age or sex except for children, pregnant women, and breastfeeding mothers.

For children, some types of yam were believed to delay speech. One respondent asserted that milk and eggs help "build children's brains", but this was not a widely held view. For pregnant women, it was thought that a specific fish (kasulu), was best avoided as it was believed to give the baby a pointed mouth (possibly due to the pointy shape of the fish's mouth). People also believed that sugarcane should be avoided as it was believed to cause excessive drooling in babies. The consumption of sweet potato by pregnant women was believed to cause heartburn and discomfort to the baby. *Kasulubana, ensuma* and white ants were also traditionally discouraged for pregnant women. Food cravings during pregnancy were often mentioned by participants in the focus groups. Most of them believed the mother should eat what she desired during pregnancy. For nursing mothers, it was believed that coffee, sugarcane and alcohol reduced breastmilk production while silver fish, porridge, cow milk, and offal increased breastmilk production.

While strict food taboos have largely disappeared, certain expectations around which foods different people should eat lingered, although they were not strictly imposed. Gender norms were still common, such as women being responsible for domestic care activities, and were alluded to as constraints to accessing animal source foods. It was highlighted that women had mobility restrictions due to household responsibilities and could only access nearby meat stalls or markets or send someone else to purchase food from markets further away. The belief that women should not slaughter animals was also considered a restriction to their access to meat, although this does not apply to milk or eggs. It was reported that there was a commonly held belief that only men should go to the butcheries, again presenting a barrier to women who would wish to access animal source foods. Overall, ingrained gender inequalities in intrahousehold relations meant that animal source foods were shared unequally among family members. For example, it was expected that men should be able to consume the tastiest parts of cooked meat such as the gizzard of a chicken. Existing local sayings such as, "omusajja omu talya nkokokye" (Can't one man eat his own chicken alone?) further exemplify the inequalities in animal source food distribution within the household.

In the focus groups, participants indicated that many people were bored of eating the same staple foodstuff (e.g. cassava, millet, sweet potato, and posho). Adolescents and adult women were reported to be ashamed of eating some of the perceived "lower class" staples such as millet and cassava (Table 4). Adult men and women generally reported consuming staples, vegetables, meat, fish, milk, and eggs, as well as beverages such as sweet milk tea, sodas, energy drinks, beer, and local alcohol. In terms of the importance of foodstuff, men placed a stronger emphasis on meat and beer, while women valued fish, milk, and tea. Women and girls perceived that boys and men required more food. Men also discussed the need for more calories to fuel physical labour, and for sexual energy. Some foods seemed to be more associated with male sexual vigour – such as groundnuts, coffee, matooke, and posho. Another pervasive belief was that delicious food should be "soft", while "hard" food was unappetizing. Linked to this belief, participants also suggested that children and elders should be given soft foods as their teeth were growing or weak. It was also believed that soft foods were easier to digest. Interestingly, in the focus group with men in Nakisunga, the peri-urban setting, chicken, pork, and beef were termed as "social foods" which bring people together. This reflects the often-reported behaviour of men eating outside the homestead. People would pool resources to purchase a pig, slaughter, cook and share (Table 5). These concepts may be useful in nutrition communication messaging.

Table 4. Foods associated with high and low prestige

Prestigious or "high-class" foods	Shameful or "low-class" foods
Fried chicken; gizzard	Cassava, millet, *posho*, sweet potato
Meats (especially beef); bigger portions to be served to men as a sign of respect	Sheep, also mainly slaughtered by witchdoctors for sacrifices Kasulubana fish
Rolex (chapati roll cooked with eggs)	*Tonto/waragi* alcohol for youth
Chips, biscuits Matooke	Eggs in some situations (e.g. for first-time guests) Men not supposed to eat the heads of the chicken (sound would be insulting)

Table 5. Culturally-favoured foods and taboo foods, for different age and sexes

Family member	Culturally-favoured foods	Discouraged foods
Children	Rice, porridge, posho, matooke, sweet potato and Irish potato, fruits, fruit juice, sweet foods, beans, eggs, milk.	White yams and yellow yams (perceived to delay speech), totem foods. Some reported dislike for millet, cassava, and meats, but this was more a matter of taste. Totem foods – e.g. lungfish, kobe, mamba, nsenene, sheep, cattle.
Youth/adolescents	Grains, roots, tubers, beans, eggs, rolex, meats. Chips, chicken, matooke. Kikomando (a Ugandan dish consisting of chapatis and beans).	Millet and hard yam (*karo* and *kakopa*) are shameful. Many are tired of eating cassava, posho, and sweet potato. Totem foods – e.g. lungfish, kobe, mamba, nsenene, sheep, cattle.
Pregnant/nursing women	Vegetables, fruits, fish, grains and matooke. Offal, silver fish (*mukene*), porridges, milk. Consumption of clay soil mentioned for iron. "*Enderema*" is a local climbing vegetable which helps in relaxing the pelvic bones of expectant mothers.	*Kasulu* fish, sugarcane, sweet potato, Irish potato, totem foods. Coffee, alcohol (e.g. *waragi*); white ants were traditionally discouraged. Totem foods – e.g. lungfish, kobe, mamba, nsenene, sheep, cattle.
Adult men	Pork, chicken, beef, matooke, potato, milk, eggs, vegetables. Beer, soda, energy drinks.	Some do not like fruits or sweet foods. Boys were discouraged from eating *enderema* because it was thought that it would make them impotent; Plantain – *gonja* was also discouraged because it was believed that if bent, it would make the boys impotent. Totem foods – e.g. lungfish, kobe, mamba, nsenene, sheep, cattle.
Adult women	Matooke, meats, fish, yam, sweet potato, vegetables, beer, local brew, milk tea with sugar.	Some are tired of eating posho, cassava, and sweet potato. Totem

Family member	Culturally-favoured foods	Discouraged foods
		foods – e.g. lungfish, kobe, mamba, nsenene, sheep, cattle.
Elderly men	Matooke, meat, chicken, milk, yam, alcohol.	Posho, rice, spaghetti considered for children. Totem foods – e.g. lungfish, kobe, mamba, nsenene, sheep, cattle.
Elderly women	Matooke, eggs, vegetables, beef, bread, fruits, sugar, tea.	Lungfish (due to historical taboos). Cassava, sweet potato, fried foods. Totem foods – e.g. lungfish, kobe, mamba, nsenene, sheep, cattle.

3.3.2 Alternative child-feeding strategies

Focus group respondents reported preferring to feed their children soft foods such as porridge with milk, but acknowledged that due to economic difficulties they often feed the children harder foods such as cassava or sweet potato. Posho was viewed by some as a poor food for children. Children were generally permitted to access foods from communal sources not available to adults. These included: collection or stealing of fruits such as jack fruit, pawpaw, and banana; eating with relatives or within the neighbourhood; and eating at functions uninvited (weddings, funerals etc.). At school, children received school meals consisting mainly of carbohydrate foods (maize-based, e.g. posho) with beans. One focus group reported children gathering and selling scrap to buy food.

3.3.3 Socio-cultural behavioural norms (expectations) and attitudes

According to focus group discussions, generally, women and young women did the domestic duties such as cooking and food preparation, while men were more associated with making money and enabling the purchase of food (Table 6). The home garden, although reported to be uncommon, was more of a female space and important for vegetable production. Men held the ultimate decision-making power over choice of meals, and especially over slaughter of animals. However, in practice, food consumption decisions were commonly made by women. Youth contributed to the household by supporting agricultural production and making money to buy food. The spending of money seemed to be associated with personal agency – whoever earned the money could decide how to spend it.

The home was clearly the woman's domain: "women are the keepers of homes, so they are the ones who are in charge of cooking", and there was a degree of shame around men cooking: "men are not supposed to cook or serve food". Within the focus group discussions, gender stereotyping was common, with men saying that women "just wait for us to provide food" and women saying that men "do nothing, just wait for us to prepare the food". This may be a result of the "others' work" being partially invisible. It was reported that boys and male youth were learning to cook. However, it is not clear if male youth would stop cooking once they married, or whether this may be a sign of social change.

Table 6. Roles in management of food within the household by age and gender

Household member	Role in food acquisition	Role in food preparation	Decision-making
Child	Fetching water, errands, help with simple farm tasks, e.g. sowing, weeding, harvesting, collecting fruit.	Washing, learning to cook.	May request or suggest cooking of certain foodstuff.
Teenage boys	Heavier farming tasks – digging, ploughing, planting, harvesting. Transporting food, fetching firewood, water. Paid labour. Food purchase.	Mixed reports about teenage boys cooking – majority said their boys do help with the cooking. Slaughter chickens and rabbits.	Can decide on slaughter and consumption if they have raised or acquired the food, e.g. chickens.
Teenage girls	Lighter farming tasks, especially in the garden – harvesting, digging, but depending on need, may do all farming tasks. Sometimes purchase food if funds are available.	Peeling potatoes, cooking, serving, washing. Take on duties when mother is not around.	May request foods, plan, or decide on meals if mother is away. If have cash can decide.
Adult men	Purchasing food or providing money to purchase food. Less commonly working in the home garden.	Most had no role in food preparation. Some admitted to cooking if women were not around. Slaughter goats and pigs.	Provide cash and have decision-making power.
Adult women	Garden crops; digging, sowing, weeding, harvesting, processing, storing. Buying food. Fetching water	Peeling, cooking, serving. Teaching youth how to cook.	Decision-making on what food to prepare, usually in negotiation with husband. Or sometimes act defiantly by cooking what they want to prepare rather than what they were asked to. Women make decisions regarding food crops to harvest for home consumption.
Elderly men	Provide advice and knowledge, may own the land. If fit, then digging for garden crops. If have money, then buying food.	Do not usually cook or assist in food preparation.	May request/decide, but usually they are served.
Elderly women	Working in the garden, may purchase if able.	Peeling, cooking, serving. Planning, teaching.	Decisions on food preparation with tacit male consent. Decisions on garden crops. Known to teach children culture-appropriate food consumption behaviour. Decisions on garden crops.

3.4 Water, sanitation and hygiene

3.4.1 Water sources

The majority of households could access water within a 15-minute or less walk from their homes. In rural areas, approximately 10% of the focus group participants reported needing to walk between 1 and 2 hours to collect water. There was a fairly even split between households who had water available at their home (rainwater collection tank, piped water, etc.) and households whose primary source was a communal supply, such as a well, borehole, or small reservoir, where the water would be fetched using jerry cans or drums. While households in peri-urban areas were more likely to have access to piped water, this was less common in rural areas. Water shortages were reportedly not experienced by focus group participants.

Fetching water was generally considered a job for teenage boys and women, and the purification of water was firmly considered the woman's responsibility. Purification was mainly through boiling, although it was infrequently done, as participants perceived some water sources as inherently clean (e.g. borehole, well). Filtration was also mentioned when water was visibly contaminated with particles or small creatures. Piped water was chlorinated, and some respondents used "Waterguard" (a chemical purification product).

3.4.2 Toilets

There was a big difference in access to toilets between rural and (peri-)urban areas. The vast majority of focus group respondents used pit latrines or ventilated improved pit latrines (VIP latrines) in peri-urban areas. A minority – around 5% - had flushing toilets. Open defecation was uncommon. In rural areas, toilet facilities were less substantial and uncovered. They often were not adjacent to handwashing facilities. Respondents reported washing the latrines with water and liquid soap, sprinkling ash, and smoking with banana leaves. Washing was done every few days and smoking every few weeks. Nevertheless, it was agreed that the latrines were generally not very hygienic. The female focus groups were much more informative regarding latrine cleaning practices, which underlines their prominent role in this household task.

3.4.3 Water- and hygiene-related disease

In the focus group discussions, diarrhoea, dysentery, typhoid, cholera, and parasites/worms were commonly reported food- and waterborne diseases. Diarrhoea was considered to be the most common disease, more frequent during rainy seasons, and also more likely to affect children. Dysentery was considered less common compared to diarrhoea, and affected all members of the household equally. Some respondents considered it a year-round threat, while others thought it was more common during the rainy season. Both diarrhoea and dysentery were thought to be caused by eating with dirty hands or eating contaminated foods. Typhoid was described as "moderately" common, affecting all people, non-seasonal, and caused by unclean drinking water, including in juices or ice cubes. Cholera was believed to be caused by flies and was most prevalent during the rainy season, affecting all members of the household. Worms and parasites were considered more common during the rainy season, affected children more, but everyone was at risk. Distended stomachs were described as the identifying symptom.

3.4.4 Public awareness and concern regarding hygiene

In most cases, people reported applying high levels of hygiene, but caveated this by suggesting that lower standards were more common in the population. Food purchase decisions were strongly influenced by perceived cleanliness of the sales outlets, especially for meats at butcheries and milk from dairies. The rationale was that contaminated food will make you sick. The indications that food

outlets maintained poor hygiene standards were visible – dirt, flies, dirty containers, and use of dirty water. Contrary to these observations, one participant argued that if there were no flies in butcher shops, then dangerous chemicals may have been used and therefore food from these establishments should be avoided. The cleanliness of foods on sale appears to be considered (at least by some vendors) as part of their marketing approach.

Food washing (with untreated water) was reported to be widely practised for fresh fruits and vegetables which were contaminated with soil. Vegetables which may have had pesticides were also often washed. One respondent mentioned cleaning fish. The overall impression was that washing foods was considered necessary to remove surface matter (dirt) or pesticides.

According to women in the focus groups, handwashing with water was practised by most people, but according to the men, handwashing was rarely practised. All focus groups agreed that soap was very rarely used. This could be due to cost implications. It was noted that people did wash hands to remove soil and larger visible dirt, but the concept of washing to remove pathogens was not mentioned.

Pragmatic responses regarding the cleanliness of the eating environment were given. The ideal of eating in a clean location was commonly expressed, but it was noted that many restaurants, functions, and even homes, could not provide a sufficiently clean environment. Nevertheless, people chose to eat in those environments and often did not have alternatives.

3.5 Knowledge and influences on food and nutrition

Almost all of the key informants noted a lack of nutritional knowledge amongst all levels of the population. The major source of knowledge was considered to be family/relatives. Occasionally community groups, TV, and radio were also mentioned as sources of information. Hospitals and medical care centres were identified as a key contact point between nutritionists/medical professionals and the population. This was the main source of reliable knowledge transfer regarding the health implications of diets, but was generally considered insufficient. A number of key informants recommended that public health awareness campaigns should be implemented via community groups, village health trainers (VHTs), or other organizations. They reported that these campaigns should include messages and advice around hygiene, nutritional and cookery knowledge, as well as horticultural production.

Food pricing information was primarily derived from personal contacts, asking vendors directly, via megaphone marketing, and via advertising such as radio announcements and TV. Food production techniques were learned from family members, fellow farmers, training, and extension workers (including NGO extension). Radio and TV shows were also mentioned as sources of information for food production.

Food safety knowledge was either passed down by parents or came via official training such as from the Ministry of Health or veterinary officers. Media sources were also mentioned. Food safety appears to be understood by some as referring to safe storage rather than hygiene.

3.6 Governance and institutions

According to key informants, governance, support services and social safety nets were generally considered to be weak and inadequate, due primarily to lack of funds. Where regulations existed (mostly in relation to food safety) they were not enforced. Support measures such as subsidized seeds, agricultural inputs, or food were occasional, but insufficient. It was acknowledged that health facilities were accessible for the vast majority of the population, but treatment at the facilities

was generally considered too expensive. Previous official efforts such as the "mwana mugimu" program and school meal provision were mentioned as good examples which may be revived.

Focus group participants indicated that social safety nets were not available. In some instances, it was argued that more resource-endowed households were able to access support mechanisms more than households that needed it most. Voluntary measures such as church groups were mentioned as providing direct aid to impoverished households.

3.7 Stakeholder workshop evaluation

The FoodSENSE framework and associated results from its pilot were presented to stakeholders for feedback and validation. There was broad agreement on the results, although some queries were raised regarding certain methodological issues such as the representativeness of the DHS and RHoMIS datasets at the district level, given that they were not surveys designed for this purpose. While this is indeed correct, it was agreed that the secondary data was at least helpful as an indicative, if not representative insight into the populations at district level.

Interestingly, stakeholders in the workshop did not consider WASH issues to be as salient as described by the key informants or focus groups – which may indicate a blind spot at higher levels compared to the experience of those closer to the communities.

Participants generally accepted the description of the markets and value chains. They also raised the issue of the need to address food waste post-harvest but pre-consumer, especially for perishable foods, given the cost of this to the system. Additional questions were raised on why the study did not look at the sources of animal source foods such as fish landing sites since Mukono had these. It was stated that *mukene*, the most consumed animal source foods in Mukono and other districts, comes from these areas. Notably too, caution was recommended in understanding the fishing communities which are perceived to be heterogeneous – some from the fishing communities are more vulnerable (such as those with no land – mostly comprise migrants) while those on the islands have land and can cultivate food and are therefore less vulnerable. While teenage girls were often responsible for drying fish at home, adult women play an important role in the fish value chain, drying the *mukene* and cleaning the boats. Fishing communities with land grow the best cassava, i.e. in Nkome, an island in Mukono which is a main supplier of food to Kampala.

There were further calls to explore decision-making aspects especially on financial allocations – so such results can be included in assessing Mukono. Notably too, women are increasingly wielding financial power as they are currently involved in several community household savings groups and can decide how to allocate their money. Men, on the other hand, do not have a saving culture.

On the topic of governance and WASH, it was acknowledged that governance systems remain weak. Although infrastructure and mechanisms are in place, their enforcement remains a concern. Also at the health centres, there were inadequate diagnostic equipment, inadequate staffing and inadequate support for mentorship and supervision of staff. WASH issues also require attention and participants agreed that this was so. It was also recommended that extension be included under Governance issues.

Regarding agricultural potential and farm production, it was agreed that prices of agro-inputs remain high, but in addition, extension services require further strengthening to support agricultural potential in the district.

3.8 *Synthesis of the main bottlenecks in the food system and food environment*

Integrating the analysis of the primary and secondary data with the evaluation and verification step of the expert workshops, the following section synthesizes the main bottlenecks in the food system and food environment.

Market and value chains: Access to markets was generally good and not considered problematic for food and nutrition security in Mukono. However, hygiene standards and quality control of food in markets was rather poor, potentially posing food and nutritional health problems. Animal source foods were reported to be prohibitively expensive. Value chains were poorly developed in Mukono and therefore present a key barrier to generating sustainable livelihoods, a key mechanism for achieving improved food and nutrition security.

Agro-ecological potential and farm production: Farm production was reported to be low due to a number of structural issues as well as high input prices, restricting income and home consumption of agricultural products. Households produced many staples, but home gardens were uncommon, indicating a missed opportunity to increase dietary diversity. Pigs and chicken were the most common livestock owned, although milk and egg collection were not common, again indicating a missed opportunity to increase dietary diversity. While little was mentioned in the FGD about dark green leafy vegetables in terms of how they are perceived by the population, where there were home gardens, they were usually cultivated.

Social and cultural norms: Widespread gender imbalances were reported in Mukono with women and children suffering from worse access to nutrient-dense foods. While women were responsible for most of the food-related activities at home, men still made decisions on when the more expensive, nutrient-dense foods (e.g. animal source foods) were consumed. Food taboos were not common in the district. Poor nutritional knowledge was reported to be a major bottleneck to improved food and nutrition security in Mukono. Moreover, key informants suggested that infants were fed low nutrient-density foods from an early age.

WASH: Daily hygiene was considered problematic in the district, with few people washing their hands regularly with soap, and lack of knowledge on hygienic food preparation. Water was usually widely available, but often required a household member (usually an older child or woman) to walk for up to 15 minutes to access it. This water also required treatment before consumption, which was not always done in households. Pit latrines were the most common form of toilets but were reported to be unhygienic. These challenges mean that gastro-intestinal complaints were common, presenting an important challenge to food and nutritional security.

External influences on food and nutrition: Personal contacts with friends and family were the main sources of information about food and nutrition. Mass media, including radio and television, were also mentioned as sources of information, although not to the same extent as friends and family. Hospitals and health centres also provided information on nutrition, but this was considered inadequate.

Governance and support: Enforcement of government policies and regulations related to food hygiene and safety, and quality control was reported to be poor and a challenge to food and nutrition security. Lack of funding and human resources were identified as the reasons for this. Government schemes were reported to exist to support the use of agricultural inputs and provide school meals, but overall, social safety nets to address food and nutrition insecurity were inadequate or non-existent.

Based on this synthesis, and integrating the input from the expert stakeholders' workshop in Kampala, Table 7 presents a summary score card assessing the main bottlenecks to food and nutrition security in Mukono. The score card is a qualitative assessment of the level of severity each issue has in preventing the population of Mukono from achieving greater food security. To simplify this assessment, a colour coding system was developed with red indicating the highest level of

hindrance, yellow, middle hindrance, and green, low or no hindrance.

Table 7. Summary score card assessing the main bottlenecks to food and nutrition security in Mukono

Category	Are the issues below promoting or hindering food and nutrition security?				
Markets & value chains	Market access	Prices and price fluctuation	Value chain (storage, processing, pasteurization)	Assurance of food quality	Shortage of cash
Socio-cultural context	Nutritional knowledge	Socio-cultural food norms	Equitable policies	Media and advertising influences	
Governance	State or NGO subsidized support/aid	Access to financial services (credit, savings etc.)	Health care, social care, health communication	Public infrastructure	Water, sanitation, hygiene
Agro potential & farm production	Agricultural and livestock productivity	Climate and weather-related risks	Natural disasters & conflicts		

Colours indicate the level of hindrance to food and nutrition insecurity, with red indicating the highest level of hindrance, yellow, middle hindrance, and green, low or no hindrance.

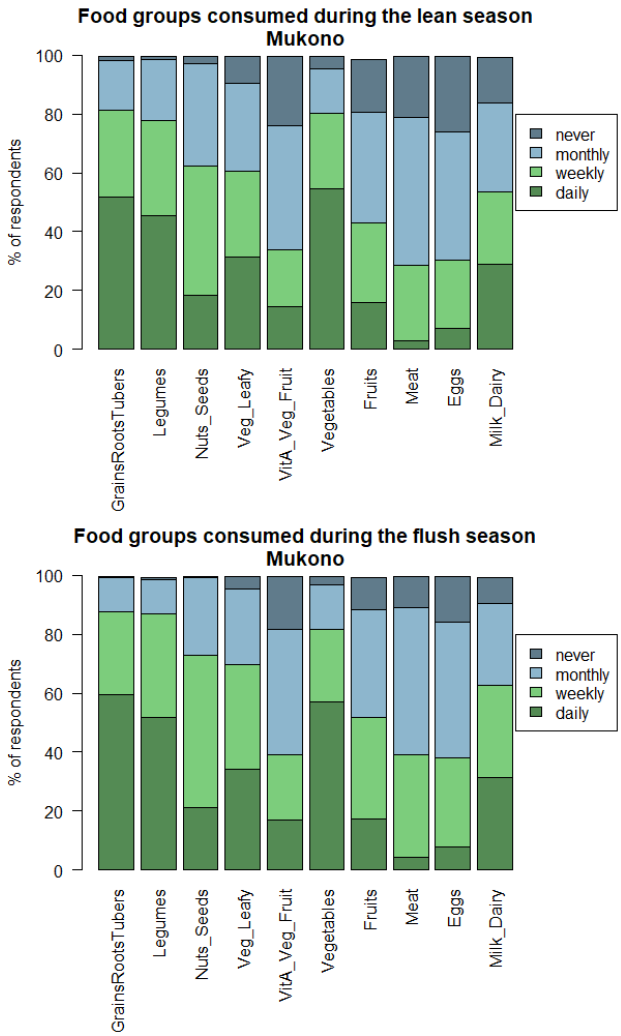
4. Food consumption

This section provides an overview of the patterns of dietary consumption in Mukono by season. Data from the RHoMIS survey (Caulfield et al. 2021) was used to elucidate frequency of consumption of different food groups by season. This is complemented by a qualitative assessment of which foodstuffs are commonly consumed within each food group based on sex-disaggregated focus group discussions. Information on infant diets was provided by key informants. A gap analysis was then conducted to identify the most common foods lacking in the diets of the population of Mukono. All data presented in this section was subsequently verified in a stakeholder workshop where participants broadly agreed with the analysis and conclusions. A glossary of local foodstuffs is provided in Appendix 5.

4.1. Food groups consumed per season: household survey data

The data from the RHoMIS survey revealed that starches, legumes, and other vegetables were widely consumed in Mukono. However, there was low consumption of vitamin A-rich fruits and vegetables, meat and fish, eggs, and other fruits. Specifically, less than half of the population ate fruits, fruit and vegetables rich in vitamin A, and animal source foods (except dairy milk) more than once a month, suggesting a significant gap in the consumption of these foods. Consumption of dairy, leafy vegetables, and nuts and seeds was in between. There was little evidence of seasonal impacts (Figure 7).

Figure 7. Frequency by which food groups were consumed by households during the lean and flush seasons.



Specific foods consumed: focus group discussion

The results in this section are based on sex-disaggregated focus group discussions to assess types of foods commonly consumed, preferred foods, consumed foods that are not preferred, and main food sources in Mukono. Tables 8 and 9 present the results from the focus group discussions. Some foods *fell* into two categories simultaneously (e.g. "preferred" and "consumed but not preferred") because different groups of respondents categorized these foods as such. Similarly, the discussions with participants did not necessarily produce consensus on the categorization of the foods. The staples consumed in Mukono include matooke, Irish potatoes, sweet potatoes, maize, cassava, beans, cowpeas, soybean, groundnuts, bread and rice. Apart from bread, rice and Irish potatoes, the rest are produced on farm. However, most are also purchased due to seasonality. Rice is indicated as expensive and thus rarely consumed. Cowpeas, on the other hand, are commonly consumed *de*spite not being cultivated in the district. There is a variety of dairy products *that are* consumed – *mi*lk, yoghurt, sour milk (´bongo´), ghee. Other animal source foods are preferred but rarely consumed since they are expensive. Animal source foods typically include mukene (small silver fish), tilapia, Nile perch, and beef, chicken and goat meat. "Mukene" (often dried) were the most commonly consumed animal sourced food. Silverfish and sprat ("enkejje") are available and affordable, but not preferred. There are several options of dark green leafy vegetables and vitamin

A-rich fruits and vegetables such as carrots, and other vegetables and fruits such as cabbage, avocado, oranges, and apples.

There were only small differences among rural and urban sites in Mukono. Generally, the "urban" focus group reported more variety within the vitamin A-rich fruits and vegetables and fruits and vegetable category in terms of what is consumed and produced on farm compared to the focus group that took place in a rural location.

Table 8. Results of focus group discussions regarding food consumption patterns in Mukono

Food group	Commonly consumed	Commonly consumed
	Women	Men
Grains, roots, and tubers	Matooke, sweet potatoes, cassava, maize posho, Irish potatoes, yams, maize porridge, millet posho, cassava posho, rice, bread	Matooke, sweet potatoes, cassava, maize flour, rice, bread
Pulses	Beans, cowpeas, soybean	Beans
Nuts and seeds	Groundnuts, oyster nuts	Ground nuts
Dairy	Milk ghee, yoghurt, bongo	Milk
Meat, poultry, fish	Pork, silverfish, tilapia, Nile perch, beef, chicken, goat, rabbit	Pork, silver fish
Eggs	Eggs, rolex	Eggs
Dark green leafy veg	Nakati, amaranth, sukuma wiki, spider plant, yam leaves pumpkin leaves	Amaranth, spider plant leaves
Vit-A-rich fruit and veg	Mangoes, pawpaw, passion fruits, pumpkin, carrots	Mangoes, pawpaw
Other veg	Aubergine, cabbage, garden egg, tomatoes, onions, mushrooms	Aubergine, tomatoes
Other fruit	Sweet bananas, pineapples, avocado, orange, Apple Watermelon, jackfruit, guava, loquat jambula, amatungulu	Orange, jackfruit
Sweet snacks	Biscuit, sweets, cake, ice cream	Biscuit
Fried/savoury snacks	Chapati, mandazi, samosa, pancakes, chips, kabalagala, fried cassava, gorillos	Chips, kikomando
Beverages	Soda, beer, waragi, energy drinks, tea leaves, processed juice	Waragi, black tea, water, processed juice, banana juice, local brew

The men's focus group discussions had shorter lists than the women's for each food category (Tables 9 and 10). Within the fried/savoury snacks category, "kikomando" (chapati and beans) and chips were indicated by the men as commonly consumed, especially among the male youth as it is purchased as a ready meal. Local brew and banana juice were also indicated as common beverages, though mainly used during specific events. The men indicated low preference for beer and sodas as these are preserved using chemicals.

Table 9. Results of focus group discussions regarding food preference patterns in Mukono

Food group	Preferred foods (even if not commonly consumed)		Consume but do not prefer it	
	Women	Men	Women	Men
Grains, roots, and tubers	Matooke, maize posho, Irish potatoes, rice, bread, macaroni	Matooke, cassava, millet posho, rice	Sweet potatoes, cassava, maize posho, yams, millet posho	Sweet potatoes, cassava, maize flour, sweet bananas, yams, bukopa yams
Pulses	Cowpeas, soybean	-	Beans	Beans
Nuts and seeds	N/A	-	Ground nuts	Ground nut sauce
Dairy	Milk, ghee, yoghurt	Milk	N/A	-
Meat, poultry, fish	Pork, tilapia, Nile perch, beef, chicken, goat	Pork, tilapia, beef, chicken	Silverfish, enkejje	Silver fish
Eggs	Eggs	-	N/A	-
Dark green leafy veg	Nakati, amaranth, sukuma wiki	-	Nakati, amaranth, sukuma wiki	-
Vit-A-rich fruit and veg	Mangoes, pawpaw, passion fruits, pumpkin	Passion fruit	N/A	-
Other veg	Tomatoes, mushrooms	-	Aubergine, cabbage, garden egg, tomatoes	-
Other fruit	Pineapples, avocado, apple, watermelon, sweet bananas	-	N/A	-
Sweet snacks	Cake, ice cream	Sweets, cake daddies	N/A	-
Fried/savoury snacks	Chips	-	N/A	-
Beverages	Soda, beer, processed juice	Soda, processed juice	N/A	Soda, beer

Table 10. Food sourcing, as reported in the focus groups

Food group	Produced on farm		Commonly purchased	
	Women	Men	Women	Men
Grains, roots, and tubers	Matooke, sweet potatoes, cassava, yams, maize	Matooke, sweet potatoes, cassava, rice, maize	Irish potatoes, cassava flour, maize flour, millet flour, rice, bread, maize, macaroni	Matooke, maize flour, Irish potatoes, millet flour, rice
Pulses	Beans	Beans, soybean	Beans, cowpeas, soybean	-
Nuts and seeds	Ground nuts	Groundnuts	Groundnuts	-
Dairy	Milk	-	Milk, ghee, yoghurt, bongo	Milk
Meat, poultry, fish	Pork, chicken, rabbit	Pork, chicken	Pork, silverfish, tilapia, Nile perch, beef, goat	Silver fish, tilapia, chicken
Eggs	Eggs	-	Eggs	-
Dark green leafy veg	Nakati amaranth, sukuma wiki, spider plant, yam leaves, pumpkin leaves	Amaranth, sukuma wiki, spider plant leaves	Nakati	-
Vit-A-rich fruit and veg	Mangoes, pawpaw, passion fruits, pumpkin	Passion fruit, pumpkin	Passion fruits	Mangoes, passion fruit
Other veg	Cabbage, garden egg, tomatoes	Aubergine, cabbage, tomatoes, green pepper	Cabbage, tomatoes, onions	-
Other fruit	Sweet bananas, avocado, orange, watermelon, jackfruit, guava, jambula	-	Pineapples, apple, watermelon	Avocado, orange, jackfruit
Sweet snacks	N/A	-	Biscuits, Cake	Biscuit
Fried/savoury snacks	N/A	-	Chapati, mandazi, samosas, kabalagala, fried cassava, gorillos	Chips
Beverages	N/A	-	Soda, beer, waragi, processed juice	Soda, waragi, processed juice

4.2 Infant feeding: focus groups

Key informants reported that infants were fed low nutrient-density foods too early, such as porridge. During the focus group discussions, participants explained that exclusive breastfeeding usually lasted between 3 to 6 months, although it was acknowledged that some women were not able to produce enough milk for that duration. Partial breastfeeding was continued up until the age of around 2 and occasionally up to 3 years. Weaning foods were mainly porridge or mashed vegetables fortified with milk, margarine, or powdered silver fish. Breast milk substitutes comprised the following: milk from cows or goats – sometimes diluted with water – soya milk, and dilute porridge made from cassava, potato, pumpkin or other carbohydrate foods. These were of low nutritional density and therefore an issue of concern (Table 11).

Table 11. Infant feeding practices in the district of Mukono

Practice	Time period/composition
Duration of exclusive breastfeeding:	3-6 months
Duration of partial breastfeeding	1.5 – 2 years
Weaning foods used	Irish potato, sweet potato, matooke, or pumpkin mashed and maybe fortified with groundnut, beans, soya, or powdered silver fish. Porridge made from soya, millet, cassava, or rice, maybe fortified with cow's milk, margarine, or groundnut. Fresh fish, fresh fish soup, boiled silver fish soup, mashed boiled eggs, milk, sweet banana.
Breast milk substitutes used	Cow's milk, goat milk, soya milk, tin milk (Lato). Milk sometimes diluted with water. Porridge made from cassava, pumpkin, mushroom, soya, diluted with water and sometimes fortified with milk. Traditionally eggs were used to treat cough amongst children.

4.2.1. Stakeholder evaluation

The food security pillars of stability and utilization (to a lesser extent) were generally considered to be of concern for all food groups. There was concern across all the pillars over junk foods and sugar-sweetened beverages and alcohol; their increasing availability, access and utilization are all reasons for concern since they are considered detrimental to nutritional outcomes. Grains, roots and tubers were widely available because they are grown within the district. They were also accessible in the markets, from farmers, hawkers, large stores or markets. Beans were widely grown, but other pulses such as nuts and seeds were grown by only a small percentage of households, and though available and accessible, presented with issues around utilization and stability. People mainly reported consuming starchy staples and it is probable that price was a limiting factor to consumption of these, just as the other foods and even more so, since fewer households cultivate pulses, nuts and seeds locally.

In all the food groups, there were issues with stability. This is most probably due to price fluctuations arising from shocks to availability across seasons. Animal source foods were available but were reported to be highly priced, with beef prices cited as much higher than pork. Notably too, productivity is likely a limiting factor to animal source foods as it was reported that few households collected milk and eggs in the district.

4.3 Synthesis of food consumption patterns

The assessment of food groups consumed in flush and lean seasons from household survey results indicated that less than half of the population ate fruits, fruit and vegetables rich in vitamin A, and animal source foods (except dairy milk) more than once a month, suggesting a significant gap in the consumption of these foods (Figure 7). The survey data indicated fairly stable consumption patterns between the lean and flush seasons, which contrasts with FGD reports where the seasonal fluctuations in food prices were highlighted as a major concern. This may indicate that while poorer households are hit hard by price fluctuations, other households are able to maintain a similar diet throughout the year (Figure 8). The most commonly consumed foods in Mukono included

matooke, Irish potatoes, sweet potatoes, maize, cassava, beans, cowpeas, soybean, groundnuts, bread and rice. Apart from bread, rice and Irish potatoes, the rest were produced on farm. The diets of infants were generally reported to be inadequate, with infants consuming low nutrient-density foods too early.

Based on the information presented and integrating input from the stakeholders' workshop, Table 12 presents a summary score card assessing the main bottlenecks to food and nutrition security by food security pillar and food group in Mukono. The score card is a qualitative assessment of the level of severity each issue has in preventing the population of Mukono from achieving greater food security. To simplify this assessment, a colour coding system has been developed, with red indicating the highest level of hindrance, yellow, middle hindrance, and green low or no hindrance.

Table 12. Summary score card assessing gaps in the consumption of food groups in Mukono by food and nutrition security pillar

Food group	Availability	Access	Utilization	Stability
Grains, roots, and tubers				
Pulses, nuts, and seeds				
Animal source foods				
Vegetables and Fruits				
Junk Foods				
Sugar-sweetened beverages and alcohol				

Colours indicate the level of concern to food and nutrition security, with red most concerning and green the least. Note that for undesirable foods, the colour coding represents the inverse situation compared to the desirable foodstuff – e.g. red availability of junk food could imply too much availability, whereas red for animal source foods could imply too little availability.

5. Nutritional outcomes

In this section, an overview of the main food and nutrition security indicators are presented using a combination of data from the RHoMIS survey (Caulfield et al. 2021) and the Uganda DHS (Uganda Bureau of Statistics 2018). These data are used to better understand the level and severity of food and nutrition insecurity in the district. While the data from the surveys are not statistically representative of the whole of Mukono, they do provide important indicative statistics for the district. The results were presented to a workshop of stakeholders for verification.

5.1. Food and nutrition security outcomes

Levels of stunting in children under 5 years in Mukono were concerning, with a high prevalence of around 24%. Wasting affected only 1.4% of the child population, which is considered very low (de Onis et al. 2018). The proportion of underweight children was at about 7% of the population. The adult BMI scores showed a fairly low prevalence of underweight adults (less than 4%), while overweight adults were more common. Women were nearly twice as likely (28.7%) as men (14.8%) to be overweight or obese (Table 13).

Table 13. Food and nutrition outcome indicators

Indicator	% worse than threshold
Child stunting (height-for-age)	24.3
Child underweight (weight for age)	7.1
Child wasting (weight for height)	1.4
BMI % men too low	3.7
BMI % women too low	3.7
BMI % men too high	14.8
BMI % women too high	28.7

Uganda Bureau of Statistics (2018)

5.2. Food and nutrition security indicators

This section covers key food and nutrition security indicators drawn from the RHoMIS survey (Caulfield 2021) and DHS (Uganda Bureau of Statistics 2018). District-specific aspects of the food and nutrition security indicators are descriptively presented in the following discussion characterizing existing situation and areas that require attention.

The availability component of food security shows a minor need for improvement. The average household can afford more than five times their basic calorie requirement. However, the proportion of households not meeting their basic calorie requirement was still 20% (Table 14). Access also shows minor need for improvement. The majority of households (90%) reported experiencing little to no impacts of food shortages within their homes. Acceptable average dietary diversity scores were observed in both the flush season (mean score 6.4) and the lean season (mean score 5.6), although it was notable that 36% of households reported consuming less than the acceptable threshold levels of dietary diversity in the lean season. Access to animal source foods was reasonable, with 53% reporting consumption within the last 24 hours. However, as noted above, this is probably due to higher levels of consumption of milk, as consumption of meat and fish remains rare, with less than half of the population consuming it more than once a month.

Regarding utilization, we considered individuals' consumption of foods, water quality and digestive disorders, as well as the consumption of packaged snack foods. Intra-household food utilization shows moderate need for improvement. Men and women scored similarly on a 24-hour recall of food groups consumed (4.5 and 4.3); and with around 60% of the sample below the threshold of five food groups in 24 hours for both sexes. This does not suggest that food allocation is a problem between males and females; however, the dietary diversity scores for individuals are notably lower than the household dietary diversity scores. This could be an indication of how the data for the indicators are collected with the diets of children included in the household dietary diversity indicator, and the timeframe for recall for the household indicator being much longer and therefore more likely to capture foods that are less frequently consumed (e.g. only once a week). Notwithstanding these differences, the results appear to imply that women do not consume the necessary nutrients to promote proper nutrition, potentially compromising their nutrition outcomes and that of their (future) babies. We do not have information regarding allocation of food to children during times when food was not enough. Prevalence of diarrhoea among children was 22% within the last two weeks. The majority of households drink water from an improved source (borehole, well, pipe, or rainwater collection), although an important proportion (22%) drank from a river or natural body of water (or other unimproved source). Packaged food was consumed by 10% of respondents within the last 24 hours, which indicates that processed/junk food is available and is used, although it is not the dominant food type.

Stability of food security throughout the year shows minor need for improvement. On average, households experienced 0.9 months of reduced food access, and 14% of respondents experienced two or more months of reduced food access. The difference between household dietary diversity scores in the flush and lean seasons was relatively low (0.8 food groups) and closely related to the fact that there is an over-dependence on staples, which might help explain why the difference between seasons is low.

Table 14. Food and nutrition security indicators

Indicator	Mean	SD	Acceptable score (threshold)	% worse than threshold	FNS component
PFA (kcal/pers/day)	14014	9573	>=2500	20%	Availability
FIES	0.6	1.7	<=2	10%	Access
HDDS (lean)	5.6	2.5	>=5	36%	Access
HDDS (flush)	6.4	2.2	>=5	21%	Access
% Consumed animal source foods in past 24 hours	53%	-	-	-	Access
% Consumed packaged snack food in past 24 hours	10%	-	-	-	Access
% drinking from unimproved water source	21%	-	-	-	Utilization
% Children with diarrhoea in last 2 weeks	22%	-	-	-	Utilization
Male IDDS 24hr	4.5	1.8	>=5	59%	Utilization
Female IDDS 24hr	4.3	1.8	>=5	63%	Utilization
Months food shortage (count)	0.9	1.4	<=2	14%	Stability
Diff b/n HDDS flush and HDDS lean	0.8	1.7	<=2	13%	Stability

Source: RHoMIS survey 2020, except for unimproved water and diarrhoea which are from DHS 2016.

5.3. Stakeholder evaluation of the food and nutrition security situation

Participants raised concerns about the status of the DHS data used, cautioning that more recent data was needed as the dataset used was outdated. It was recommended that the figures be reviewed in light of the most recent DHS from 2021, although it was noted that the data was not yet publicly available but could be looked at upon release, and that further consideration made on the sites selected to reflect what would be a typical Mukono situation other than the selected sites that may not quite reflect what much of Mukono is truly like.

The selected sites from which the qualitative data was drawn were also deemed not typically representative of Mukono, with one being closer to Lake Victoria while the other bordered Kayunga District. It was advised that if other sites typically representative of Mukono were to be included, the stunting figures would be much lower. It is therefore important to consider similarities or differences across the sites within Mukono.

It was also noted that there is need to further understand why there were more overweight women than men. Suggested explanations are reproductive aspects and lower mobility of women, which have been explored at the national level in Uganda (Baalwa et al. 2010).

5.4. Synthesis of the food and nutrition situation

The food and nutrition security situation in Mukono shows moderate need for improvement. Based on the indicators reported above, around 20% of households may be considered to have inadequate diets. This is based on dietary diversity, total income (calorie availability), and child undernutrition resulting in sub-optimal growth. This appears to corroborate the findings from Section 4 where it was reported that infant diets were generally inadequate; they were consuming low nutrient-density foods too early.

While the RHoMIS rural household survey reporting diets in the flush and lean seasons seemed to suggest little seasonal effects on dietary intakes, FGDs and the expert stakeholder workshop argued that such seasonality effects were important, with households unable to consume as much diversity during the lean seasons. The analyses also provided indications of poor nutrition choices, with 15% of men and 29% of women overweight.

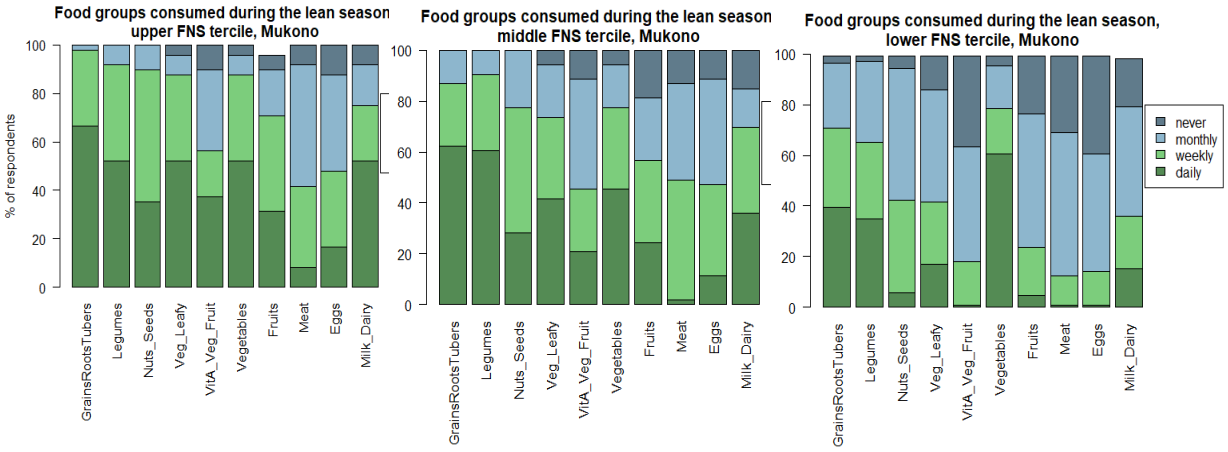
6. Identification of vulnerable groups

In this section, groups of people particularly vulnerable to food insecurity and inadequate nutrition are identified and described. Two assessments are presented: one based on a quantitative household survey, and one based on qualitative description from FGDs. Finally, an assessment of intra-household inequities is undertaken based on the findings outlined in sections 3, 4, and 5 to assess inequalities in food and nutrition security within households.

6.1. Quantitative characterization of households by food and nutrition security strata

Food security was defined based on the combined scores of various food security indicators (see Section 2.1.5 for further details). There were large differences in the food consumption patterns between the food and nutrition security (FNS) terciles. Those in the upper tercile consumed almost all food groups in both lean and flush seasons, but those in the lower and middle terciles presented major dietary gaps in both seasons. The food groups under-consumed were vitamin A-rich fruits and vegetables, other fruits, and meat (including fish) and eggs. The most commonly consumed foods were starchy staples, legumes, and other vegetables (e.g. onion, tomato). The lower tercile – i.e. the most food-insecure third of the Mukono population – showed major gaps in food group consumption in the lean season, with many consuming only starches, legumes, and vegetables (excluding leafy greens and vitamin A-rich vegetables) (Figure 8).

Figure 8. Frequency of consumption of different food groups by food and nutrition security tercile.



The food security terciles are described below in terms of household characteristics, assets owned, and livelihood variables. Single-headed households were most frequent in the lowest tercile. In total, 60% of single male-headed households and 54% of single-female-headed households were in the lower FNS tercile compared to 50% of couple-headed households. There was a slight trend for households with more members to be in the lower FNS tercile; but average age of household members remained fairly constant (i.e. it was neither young families nor old couples/singles who were systematically scoring lower on the FNS indicators). Those household heads with no education (6% of the sample) were notably more likely to be in the lower FNS tercile and less likely to be in the upper tercile compared to those with post-secondary education, who were most likely to be found in the upper FNS tercile.

The differences in assets owned and livelihood activities between the three FNS terciles were prominent (see Table 15). The FNS terciles related largely to asset-base and income, with the greatest opportunity for income generation in Mukono from crops and livestock, although off-farm income sources also generated significant amounts of money. Households in the lower FNS tercile had the same amount of land under cultivation as those in the middle FNS tercile (1.10 ha), but less than households in the upper tercile (1.28 ha). The greatest difference in terms of cash incomes related to crops where the upper tercile generated over 250% more than households in the lower FNS tercile. Incomes from livestock displayed fewer differences among the tercile groups, but the lower FNS tercile group still generated less than the other two tercile groups. Households in the lower tercile owned about 2.1 TLUs of livestock, compared to households from the middle and upper FNS terciles (2.9 and 2.6 TLUs, respectively). The lower tercile also reported lower average non-farm incomes.

Table 15. Characterization of household assets and livelihood activities by their food and nutrition security tercile

Variable	FNS tercile	Mean value
Land cultivated (ha)	lower	1.10
	middle	1.10
	upper	1.28
Livestock holdings (TLU*)	lower	2.09
	middle	2.86
	upper	2.61
Market orientation (% produce sold)	lower	58
	middle	66
	upper	68
Value crop sales (USD/yr)	lower	902
	middle	1369
	upper	2545
Value livestock sales (USD/yr)	lower	1244
	middle	1508
	upper	1627
Value non-farm income (USD/yr)	lower	538
	middle	679
	upper	839

*TLU = Tropical livestock unit based on a live weight of 250kg

6.2. Qualitative characterization of households by food and nutrition security strata

Focus groups were asked to imagine three strata of food security amongst the general population of their communities, and then describe the households within those strata. The strata were defined by the number of meals they could eat per day: 1 meal, 2, or 3.

The focus group participants agreed that these strata existed, and rich descriptions were given (Table 16). Approximately 35% of the population were thought to be in the lower strata (1 meal per

day), 55% in the middle strata (two meals per day), and 15% in the upper strata (3 meals per day). There was little meaningful difference between the peri-urban and rural sites.

Similar to the quantitative results, descriptions of households in the lower strata (1 meal per day) often involved large family sizes (or sometimes very small families) with access to small pieces of land. They were also perceived to lack employment opportunities and be in poor health. They had inadequate access to basic assets such as bedding, clothing, and poor or no toilet facilities, poor housing, and possibly an old bicycle. Food was scarce, mainly consisting of "hard" carbohydrates with "no sauce" (i.e. stew or accompanying food for the carbohydrate), or no sugar ("they eat one type of food"). Food may be gifted from neighbours or stolen. There were a number of references to physical weakness, lethargy, and displays of anger or frustration.

Descriptions of people in the middle strata (2 meals per day) involved access to land with reasonable agricultural production (sometimes rented), and either small livestock (pigs/goats) or reasonable non-farm employment. Education of children was considered a priority and a challenge. Acquisition of adequate basic possessions was not certain but was considerably better than the lower strata. Many have bicycles, some motorcycles, chairs, tables, and a TV. They could commonly access foods rich in carbohydrate, cooking oil and sugar, with limited supply of vegetables and a shortage of meat or fish. One respondent described that "they usually have a poor sauce, although they can access enough of the other foods". Support measures for such people were very limited, with only a few respondents suggesting mechanisms which were NAADS and Savings and Credit Cooperatives (SACCO).

The description of people in the upper strata (3 meals per day) was that they were "financially stable", they could eat whatever they wanted, their children could attend any school to any level, and that they could afford the best health care. Housing would be large and well-constructed, behind walls and gates, and with plenty of possessions, including a car and probably home help. They would have larger plots of land, perhaps 6 or 7 acres, with cattle and other livestock. At least one family member had a white-collar job. Regarding food consumption, some over-consumption problems were noted, and there was enmity expressed regarding their perceived wastefulness and reports of theft, hatred, and even attempted poisoning by other community members.

Table 16. Qualitative characterization of the three food security strata

	Characteristics of the group	Challenges faced	Safety nets or support services	Proportion of the population
1 meal per day	Poor housing, inadequate basic possessions, and little or no land, inadequate employment. Many children, hungry and sickly, often eating in the neighbourhood. Parents have no cash and may beg or steal food.	Lack of food, hunger, sickness, weakness, family conflict.	Neighbours may gift food, and occasional support from churches or food-for-work schemes.	Between 20 and 50%
2 meals per day	Family stability, part of the community. Access to farmland (perhaps one acre), and likely livestock or employment. Reasonable housing, many with adequate basic possessions, including bicycle or even a motorbike. Education for children	Adequate supply of staple carbohydrate foods, beans, cooking oil, and sugar; limited supply of vegetables,	Little support, occasional micro-finance or non-official measures.	Between 40 and 70%

	and access to health care although these can both be challenging.	inadequate supply of meats and fish.		
3 meals per day	Large homes often walled and gated. Large farms with livestock and well-paid jobs. Plentiful possessions and a car. Children reach high levels of education and health care is assured.	May suffer from obesity and diabetes. Envied and disliked, targeted by thieves.	Do not receive support.	Between 10 and 30%

6.3. *Intra-household differences in food and nutrition security*

In addition to differences in food and nutrition security at the household level, differences among different age/gender groups was also evident in Mukono. Among the groups considered were infants and children, male and female youth, male and female adults, and male and female elderly. From the information presented in this report, it appeared that children and infants were often vulnerable to under-nutrition, and that women – both as primary caregivers and subject to some inequities of power and access to foods – were also vulnerable to undernutrition.

6.4. *Stakeholder evaluation of vulnerable groups*

While reviewing the vulnerable groups listed, some participants recommended examining further stratification of such groups and paying particular attention to the number of meals per day consumed by a specified percentage of the population. Children under 5 were also noted to be particularly vulnerable.

6.5. *Synthesis of the main vulnerable groups*

Table 17 presents a summary score card assessing the vulnerability of different population segments in Mukono, assembled from all the information presented, including stakeholder input. From both the quantitative and qualitative analyses, it was clear that households with less income, fewer opportunities for sustainable livelihoods and fewer assets were most at risk of food and nutrition insecurity. Indeed, while the more affluent households often did not display major signs of food or nutrition insecurity, the least affluent clearly suffered from mal- and under-nutrition. As such, when trying to address the challenges posed by food and nutrition insecurity it would be important to target these specific households who are most at risk. Moreover, women and children were also perceived to be more vulnerable groups within Mukono. In particular, inequalities within the household meant that men had greater access to more nutrient-dense meals than either women or children, as men would often eat out while women and children would only consume food available within the household, largely consisting of starchy staples.

Table 17. Summary score card assessing the vulnerability of different population segments in Mukono

Population segmentation	Overall nutritional outcomes
Population average	
More affluent households	
Middle income households	
Least resource-endowed households	
Men	
Women	
Children	

Colours indicate the level of vulnerability to food and nutrition insecurity, with red indicating the highest level of vulnerability, yellow, middle vulnerability, and green, less vulnerability.

7. Linking priority challenges to solutions

Based on the information and assessments above, priority challenges were identified. These comprise:

- Reducing seasonal fluctuation in terms of access to all fresh foodstuff through strengthening of marketing, value chain systems, and storage systems.
- Increasing accessibility to animal source foods and vegetables and fruits, especially for the poorest tercile of households.
- Reducing consumption of sugar-sweetened beverages and alcohol.
- Improving socio-cultural knowledge and attitudes around nutrition and nutritious diets.
- Improving sanitation and hygiene practices.
- Ensuring dedicated support for the improved nutrition of women and children.

The Excel-based Intervention Recommendation Tool (see Sections 2.1.3.5 and 6) was used to identify a long list of potential activities to address these priority challenges. The long-list of innovations was used as a starting point for discussions among stakeholders, and after sense-checking and feasibility assessment, a short-list was derived (Table 18). Participants were also free to suggest new and alternative innovations. Finally, stakeholders discussed and agreed on several next steps that could complement the proposed prioritized activities.

7.1 Linking challenges to solutions

Participants from the workshop short-listed five solutions and bottlenecks that they believed would have the most impact in addressing food and nutrition security in Mukono (Table 18). The solutions identified were largely seeking to build synergies in addressing multiple challenges rather than focusing on individual challenges. As part of the discussions, it was recognized that some policy mechanisms such as price regulation, could support the food system in achieving better outcomes aimed at addressing nutrition and food security challenges. Improved technologies were recommended as mechanisms to address both agro-potential and farm production challenges, and markets and value chains, while institutional innovations, such as collective action groups, were recommended mechanisms to target several challenges. Out of the severe hindrances to food and nutrition security outlined in section 7.3, workshop participants prioritized addressing "shortage of cash" (viable livelihoods), "prices and price fluctuations", "climate change and weather-related risks", and "value-chain development". It was proposed that these challenges be addressed by a combination of support in the development of viable income generation ventures, support for production infrastructure enhancement to facilitate year-round production, enhancement of collective production and marketing (e.g. cooperatives), price regulation of agro-inputs and outputs, and by improving access to financial services (Table 18).

Table 18. Priority activities to address the food and nutrition security challenges identified in the FoodSENSE framework process in Mukono

Activity	Challenges addressed	Comments – why this particular activity?
Support farmers in developing viable income-generation ventures coupled with behavioural change communication interventions	Market and value chain topics particularly addressing shortage of cash or poverty	• Having viable income generating ventures will help address the common practice of selling livestock and crops instead of consuming them for improved nutrition outcomes. • Increasing household income will enhance its ability to afford nutritious diets.
Agricultural infrastructure enhancement to include support for all year production systems (e.g. through access to irrigation)	Prices and price fluctuations arising from seasonal effects Climate and weather-related risks, particularly drought.	• Through production infrastructure enhancements people can produce sufficiently for the market as well as for own consumption.
Collective production and marketing of agro outputs	Prices and price fluctuations Value chains (marketing)	• Through collective production and marketing, further price stability can be established by enhancing storage and shelf-life of outputs. • In Mukono, there were limited value addition activities, and this gap can be addressed through aggregating of production and marketing activities for more opportunities of value chain upgrades.
Price regulation of agro-inputs as well as outputs	Shortage of cash to address high prices of agro-inputs; prices and price fluctuations of food (outputs)	• Regulation of agro-input prices to facilitate a boost in output production. Regulation of output prices so that food is affordable for local consumption to boost nutrition status.
Access to loans at low interest rates	Shortage of cash	• By accessing cheaper finances (e.g. through the existing Parish Development Model) producers can address the challenge of cost of inputs for production and enhance their production systems. This is particularly important in Mukono given the increasing population pressure on land. Enhancing agricultural inputs will be invaluable in ensuring that nutritional needs are met.

7.2 Next steps (complementary activities)

After identifying the five priority activities that participants at the workshop believed would have the largest impact in enhancing food and nutrition security outcomes in Mukono, the group discussed ideas for next steps. These are outlined in Table 19. Among the suggested next steps include a mapping exercise of stakeholders and existing development programs in Mukono, as well as a SWOT analysis of farmer cooperatives. This could be complemented by first presenting the results of this report to the District Food Security and Nutrition technical working group.

Table 19. Outline of potential next steps for developing a strategic plan to address food and nutrition security challenges in Mukono

Activity	Comments
Map existing programs in Mukono	There are existing programs in Mukono that should be taken into consideration and targeting these programs should be considered prior to implementation of new ones. Examples of such programs include the wealth creation model in Mukono targeting crop and livestock (pigs, poultry, fish) production; extension services; and marketing advisory services
Undertake a SWOT analysis of farmer cooperatives	Where these exist, these organizations can be supported and strengthened to meet the challenges outlined. This will require a good understanding of the current challenges and opportunities for cooperatives.
Stakeholder mapping – explore partners and programs with whom to co-operate on activities	Rather than building programs from scratch, there is need to explore the spectrum of partners and see how to work with them or with their frameworks.
Present the results to the food security and nutrition technical working groups	The results of the analysis of the FoodSENSE framework should be fed back into the food security and nutrition technical working groups.

8. Conclusion

A number of bottlenecks to improved food and nutrition security exist in Mukono. With regard to markets and value chains, while access to markets was generally good, value chain development was considered particularly problematic. Not only did it prevent farming households from generating higher value production for their agricultural commodities, but it also meant important fluctuations in market prices due to seasonality and the lack of storage and processing facilities. These challenges were compounded by climate change and important yield gaps resulting from structural issues (e.g. land fragmentation) and high input prices. Social and cultural norms also posed important bottlenecks for improved food and nutrition security. In particular, intra-household differences in access to diversified foods were broadly reported in the district, with men being able to access animal source foods much more readily than either women or children. Our data also suggests that personal hygiene (handwashing) and hygienic food preparation and water treatment are intractable issues within the district. A generalized lack of nutritional knowledge within the population is also problematic for improving food and nutrition security. Food handling throughout the value chain was also reported to be particularly problematic. While the policies and regulations were in place for improved food safety and hygiene, a lack of funds to ensure enforcement of these standards was the reason for the gaps.

These bottlenecks to food and nutrition security resulted in important gaps in the consumption of certain food groups in Mukono. Specifically, fruits, fruit and vegetables rich in vitamin A, and animal source foods (except dairy milk) were observed to be the main gaps in food consumption. It was also reported that the diets of infants were inadequate, with infants consuming low nutrient-density foods too early. Overall, the food and nutrition security context of Mukono showed moderate need for improvement with around 20% of households considered to have inadequate diets. Indeed, out of the whole population of Mukono, middle-income and least resource-endowed households were classified as vulnerable to food and nutrition insecurity. Moreover, women and children were identified as especially vulnerable.

To address these challenges, five priority activities were proposed by participants in a workshop comprising key stakeholders from Mukono. These activities included supporting farmers to develop viable income-generation ventures coupled with behavioural change communications; the enhancement of agricultural infrastructure to support year-round production; support for the development and strengthening of collective production and marketing; the introduction of price regulations for agro-inputs and outputs; and improving access to low-interest loans. It is expected that by undertaking these activities, multiple inter-connected bottlenecks to food and nutrition security will be addressed. To facilitate this process, it was recommended that stakeholders undertake a SWOT analysis of farmer cooperatives and map existing rural development programs, projects, and actors.

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Appendices

Appendix 1: Synthesis materials presented in the participatory evaluation workshop

The main findings of the report were summarized in posters and a brief info-note, which were made available to workshop participants. In addition, one of the report authors was available to explain and discuss the findings with the stakeholders. Stakeholder input was collected and integrated into the final draft of the report. Within this appendix the summary poster, the evaluation poster, and the info note are included.

Mukono: Traffic Light Evaluation

Nutritional Outcomes

Population segmentation	Overall Nutritional Outcomes
Population Average	
More Food Secure Households	
Middling Food Secure Households	
Least Food Secure Households	
Men	
Women	
Children	

Green = Nutritional outcomes are fine
Yellow = Nutritional outcomes are concerning
Red = Nutritional outcomes are bad

Food Security Challenges

Green = Good for FNS Yellow = Concerning Red = Bad for FNS	Availability (does the food exist in sufficient quantity?)	Access (can it be easily acquired by all households?)	Utilization (do all individuals eat it and derive benefit?)	Stability (do prices and access fluctuate?)
Grains, roots, and tubers				
Pulses, nuts, and seeds				
Animal sourced foods				
Vegetables and Fruits				
Junk Foods				
Sugar-sweetened beverages and alcohol				

Food System and Food Environment

Category	Are the below issues helping or hindering food and nutrition security? Green = Helping – Yellow = Mild Hindrance – Red = Severe Hindrance				
Markets & value chains	Market access	Prices and price fluctuations	Value chain (storage, processing, pasteurization)	Assurance of food quality	Shortages of cash
Socio-cultural context	Nutritional knowledge	Socio-cultural food norms	Equitable policies	Media and advertising influences	
Governance	State or NGO subsidized support / aid	Access to financial services (credit, savings etc.)	Healthcare, social care, health communication	Public infrastructure	Water, sanitation, hygiene
Agro potential & farm production	Agricultural and livestock productivity	Climate and weather-related risks	Natural disasters & conflicts		

Mukono: Food and Nutrition Info note

Introduction

Mukono neighbours peri-urban Kampala and is characterized by better markets and more mixed ethnicities. Most of the district is fairly urbanized, a feature considerably attributed to the fact that it neighbours Kampala, the national capital. Nonetheless, parts of the district are still more rural.

The exploration of Mukono covered Nakisunga (Nakisunga village, a peri-urban environment) and Kasawo (Namaliri village, a more rural environment) with focus group interviews conducted with men and women. Key informants such as the focal person for mother-child HIV transmission; the clinical officer; the nutritionist; the senior clinical officer; the senior health inspector; the senior agricultural officer; and the district health officer also gave their insights and the results below highlight key findings.

Food and nutrition security situation

Levels of child stunting in Mukono were 24.3%, which is lower than the other two districts, but still a cause for high concern. Levels of underweight children were also slightly lower, at about 7% of the population. Child wasting affects 1.4% of the child population, which is considered very low. The adult BMI scores fairly low with prevalence of underweight adults (less than 4%), and overweight adults more common. More women (28.7%) either overweight or obese compared to men (14.8%). This could probably be explained by over-dependence on starchy staples; less access to exercise due to mobility limitations and lack of time for exercise due to domestic care work, plus body changes resulting from cycles of childbirth coupled with child nutritional requirements that are mediated by the mother.

Table A1. Food and nutrition security outcomes

Indicator	*% worse than threshold*
Child stunting (height-for-age)	24.3
Child underweight (weight for age)	7.1
Child wasting (weight for height)	1.4
BMI % men too low	3.7
BMI % women too low	3.7
BMI % men too high	14.8
BMI % women too high	28.7

The availability component of food security shows some need for improvement. The average household can afford more than five times their basic calorie requirement. However, the proportion of households not meeting their basic calorie requirement was the highest compared to all districts at 20% as highlighted in Table 2.

Acceptable average dietary diversity scores were observed in both the flush season (mean score 6.4) and the lean season (mean score 5.6), although 36% of households reported consuming less than the acceptable threshold levels of dietary diversity in the lean season. Access to animal source foods was reasonable, with 53% reporting consumption within the last 24 hours.

Intra-household food utilization shows moderate need for improvement. Men and women scored similarly on a 24-hour recall of food groups consumed (4.5 and 4.3); and with around 60% of the

sample below the threshold of five food groups in 24 hours for both sexes. Nonetheless, this could mask normal trends in consumption patterns according to norms, e.g. men consume larger portions and certain portions as a sign of respect, and may not buy ASF for the family.

Packaged food was consumed by 10% of respondents within the last 24 hours, which indicates that processed/junk food is available and is used, although it is not the dominant food type.

Table A2. Summary of food and nutrition security indicators

Indicator	*Mean*	*SD*	*Acceptable score (threshold)*	*% worse than threshold*	*FNS component*
PFA (kcal/pers/day)	14014	9573	>=2500	20%	Availability
FIES	0.6	1.7	<=2	10%	Access
HDDS (lean)	5.6	2.5	>=5	36%	Access
HDDS (flush)	6.4	2.2	>=5	21%	Access
% Consumed ASF in past 24 hours	53%	-	-	-	Access
% Consumed packaged snack food in past 24 hours	10%	-	-	-	Utilization
% drinking from unimproved water source	21%	-	-	-	Utilization
% Children with diarrhoea in last 2 weeks	22%	-	-	-	Utilization
Male IDDS 24hr	4.5	1.8	>=5	59%	Utilization
Female IDDS 24hr	4.3	1.8	>=5	63%	Utilization
Children fed first	? %		?		Utilization
Months food shortage (count)	0.9	1.4	<=2	14%	Stability
Diff b/n HDDS flush and HDDS lean	0.8	1.7	<=2	13%	Stability

Food and nutrition insecurity among vulnerable groups

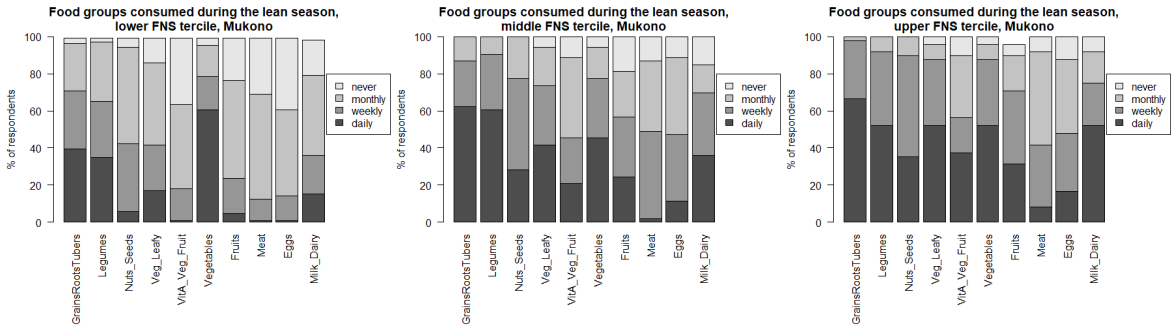
Single male-headed households were more likely to be in the lower food and nutrition security tercile; but interestingly, single female-headed households were not when compared to households with a couple. Sixty per cent of single male-headed households were in the lower FNS tercile compared to 54% of single-female-headed households and 50% of couple-headed households. There was a slight trend for households with more household members to be in the lower FNS tercile. Age was not a factor: it was neither young families nor old couples/singles who were systematically scoring lower on the FNS indicators. Household heads with no education (6%

of the sample) were notably also more likely to be in the lower FNS tercile and less likely to be in the upper tercile compared to those with post-secondary education.

Food consumption and sourcing

Figure A1 presents food groups consumed by the more food-secure, the less food-secure, and the very food insecure (FNS terciles). The lower tercile – i.e. the most food-insecure third of the Mukono population – showed major gaps in food group consumption in the lean season mostly consuming only starches, legumes, and other vegetables.

Figure A1. Food groups consumed during the lean season by food and nutrition security (FNS) tercile.



Left = upper FNS tercile; Middle = middle FNS tercile; Right = lower FNS tercile

Major crops produced locally comprise cooking banana (matooke), maize, beans, sweet potato, cassava, and coffee. Groundnuts and cowpea production is limited. Vegetable production is low, with about 10% of households engaged and home gardens are uncommon. Pig and chicken were the major livestock kept, although the survey data from which this is drawn focused specifically on pig farmers, and so may overestimate the prevalence of pig keeping.

Foods consumed include matooke, Irish potatoes, sweet potatoes, maize, cassava, beans, cowpeas, soybean, groundnuts, bread and rice. Apart from bread, rice and Irish potatoes, the rest of the foods consumed are produced on farms in the district. However, most foods are also purchased due to seasonality. Cowpeas though commonly consumed, is also purchased because its production is limited. There is more variety of dairy products consumed (ghee, yoghurt, bongo) compared to other districts, and although animal source foods are preferred, they are rarely consumed as they are expensive. These include tilapia, Nile perch, pork, beef, chicken and goat meat. Silverfish ("mukune") and sprat ("enkejje") are available and affordable, and widely eaten, but not preferred. Existing options of dark green leafy vegetables and vitamin A rich fruits and vegetables are carrots, and other vegetables and fruits such as cabbages, avocado, oranges, and apples – a number of these are produced locally.

The urban site in Nakisunga has more variety within the vitamin A-rich fruits and vegetables and fruits and vegetable category in terms of what is consumed and produced on farm compared to the rural location in Kasawo.

Bottlenecks in the food environment

Markets and value chains

Market access

Overall, majority of households could easily access food from small markets and retails shops for small purchases of dried and fresh foods such as fruits, vegetables, and bread. These were the main source of everyday purchases. Large markets and large shops were occasionally visited, but were not easily accessible due to transport constraints and less convenience, especially for the elderly. Direct purchases from farmers (mainly milk and fresh produce) and cereals from millers was also reported, while meat was available in the butcheries with pork butcheries cheaper than beef ones. Hawkers were the cheapest source of purchased foods, and a convenient source travelling from house to house, either on foot or by vehicle selling fresh vegetables, fruits, milk and silverfish. The key complaints were about the hygiene at the markets, higher prices of beef and higher prices of items at the smaller retail shops and markets compared to the larger markets.

Product prices

Moderate to high fluctuations in prices for cereals, meat, fish and milk citing issues around drought for milk and matooke; unavailability of fish, cropping cycle-related fluctuations for cereals such as rice; drought and festive season induced fluctuations for meat.

Value chains

Shorter value chains reported for milk and fresh produce with purchases from hawkers or directly from farmers. Some moderate transportation of goods reported heavily integrated with marketing such as for the hawkers. Food processing and storage is generally weak; a few organizations supporting horticulture aggregation (MACDO), grain processing (millers), and yoghurt production (with cold storage). Notably though, most of the food sold locally is produced locally. Longer value chains may be involved with the dried and packaged foods available from larger wholesale shops and large markets. Pork value chain may be better developed than the beef value chain, judging by the penetration of pork butcheries and pork eating establishments in the district. Key concerns around hygiene in the value chains, especially for food from markets.

Agro-potential and farm production

Low total agricultural production levels attributed to population pressure and land fragmentation, urbanization, drought, and high input prices. Nonetheless, agricultural production of matooke, maize, beans, sweet potatoes, cassava, and coffee was reported. Vegetables also produced but very low with about 10% of households engaged in production. There were schemes to increase backyard production of vegetables, but home gardens remain uncommon. Pigs and chicken were the most common livestock kept within Mukono; support for livestock suitable for small areas (chicken & pig) were desired, but collection of eggs was still very low.

About a third of the households kept cattle, and a third kept goats, although collection of milk was also still very low. Other sources of food reported such as reciprocity between family and neighbours mainly during seasonal gluts, but more common in rural locations; gifts during marriage ceremonies and festivities; school meals for children, usually a staple carbohydrate and beans, and NGO food provisioning for the elderly.

Socio-cultural norms

Food culture

Older taboos related to restricting the diets of women outdated and only practiced by some of the elderly. Taboos prohibiting consumption of clan totem animals still observed (e.g. lungfish, cow, sheep); along with taboos relating to religious restrictions on food items (Seventh Day Adventists, Muslims, etc.); religious beliefs around handling of livestock and, if one married a spouse who did not consume certain foods, they consumed such foods only outside the home. Other norms such as

women being responsible for domestic care activities were indirect constraints to them accessing some foods; e.g. mobility restrictions on women due to household responsibilities. Men were generally responsible for slaughtering, and perceptions that men should go to the butchery stall were reported with extremely conservative women afraid to queue for pork at pork joints.

Seemingly non-related norms such as the man being the head of the household also had implications on how ASF was shared in the home; some men perceived being given parts such as the gizzard and large portions as an expression of respect, and if not given would feel discouraged and avoid buying for the family. Gendered division of labour – women undertaking domestic tasks and growing food for household consumption while men grew cash crops and provided cash for purchasing food for the family. Nonetheless, mothers and grandmothers in practice made food preparation decisions and held considerable power over what was to be cooked.

Governance

WASH

While water, sanitation, and hygiene (WASH) were considered important issues by most key informants, handwashing was poor, and soap rarely used. Ninety percent of households could access water within a 15-minute walk from their homes (and usually less). However, the treatment (boiling) of drinking water was inadequately practised. Awareness of the importance of hygiene was reasonable, but execution of high standards of hygiene lagged behind. The COVID pandemic increased awareness of handwashing but the practice is already fading. Food safety at home and in value chains was still poor. Keeping toilets, kitchens, food, and water sanitary was generally considered to be the duty of women. Diseases caused by poor hygiene such as diarrhoea were very common, and is a clear area of improvement; gastro-intestinal diseases like diarrhoea, dysentery, and typhoid were reported and very prevalent amongst children.

Societal awareness

Lack of nutritional knowledge amongst all levels of the population was noted in most of the key informant interviews. The major source of knowledge was family relations. Occasionally, community groups, TV, and radio were mentioned. Hospitals and medical care of mothers and children were identified as a key contact point between nutritionists/medical professionals and the population.

The key informants widely perceived that the general population ate mainly only "one kind of food" which was usually a starchy staple foodstuff. The informants attributed this to a lack of nutritional knowledge. Although this could be true, lack of resources to acquire more varied foodstuff may also be a binding constraint.

Governance

Governance and official support were generally considered to be weak and lacking, primarily due to lack of funds. Where regulations existed (mostly in relation to food safety), there is no enforcement. The only driver for food safety standards by vendors is reputational risk.

Appendix 2: Long-list of solutions from FoodSENSE tool

From the prioritized food system challenges and demographic groups, a long list of potential solutions were identified using the intervention recommendation tool. Stakeholders in the evaluation meeting discussed these and selected the most feasible for implementation.

Prices and price fluctuations

Intervention	Time scale	Cost implications	Synergies trade-offs
Management training and capacity development of cooperatives (bookkeeping, marketing, gender empowerment, good governance, development of business plans, contracting etc.)	Medium-long term	Medium	Jobs & economy
Establishment of collection service points for livestock and livestock products	Medium term	High	Jobs & economy
Stimulate the development of home & school gardens (promote production of food groups lacking in diet)	Medium-long term	Medium	0
Community demonstration plots and gardens (promote production of food groups lacking in diet)	Medium-long term	0	0
Provision of inputs and training (sustainable intensification and production of food groups lacking in diet)	Medium-long term	Medium	Jobs & economy

Value chain (storage, processing, pasteurization)

Intervention	Time scale	Cost implications	Synergies trade-offs
Development of value-addition context-adapted processing facilities in communities or primary cooperatives (e.g. dairy pasteurization/sterilization, preparation of yoghurt, curd, ghee, butter, fish drying, preparation of meat-products)	Medium-long term	High	Jobs & economy
Support to cooperatives for legal establishment (registration)	Medium-long term	Medium	Jobs & economy
Management training and capacity development of cooperatives (bookkeeping, marketing, gender empowerment, good governance, development of business plans, contracting etc.)	Medium-long term	Medium	Jobs & economy
Support initiation of farmer groups and cooperatives	Medium-long term	Medium	Jobs & economy
Support development of value-chain aggregation groups (business to business groups)	Medium-long term	Medium	Jobs & economy
Market planning and information systems	Medium-long term	High	Jobs & economy
Investment in the improvement of infrastructure of slaughterhouses as well as quality control procedures	Medium term	High-very high	Jobs & economy
Stimulate investment in micro and SMEs (goods or services)	Medium-long term	High	Jobs & economy
Support development of delivery services (transporting farm produce)	Medium-long term	High	Jobs & economy
Hands-on training for youth throughout the value chain	Medium-long term	High	Jobs & economy

Public infrastructure

Intervention	Time scale	Cost implications	Synergies trade-offs
Improve quality of feeder roads	Medium-long term	High-very high	Jobs & economy
Increase frequency of bus services	Medium-long term	High-very high	Jobs & economy
Subsidize market transportation	Medium-long term	High-very high	Jobs & economy

Appendix 3: Definition of potential bottlenecks in the food system and food environment.

Explanation of bottleneck issues that were considered as part of the assessment of the food environment

Bottleneck category	Bottleneck issue	Explanation of challenges
Markets and value chains	Market access	Not being able to get to a market or food selling point easily for different reasons (e.g. poor road infrastructure, poor transport options, distance from homestead etc.) can have adverse consequences for food and nutrition security as certain food groups may not be easily procured. Furthermore, experiencing challenges marketing or selling farm production (due to lack of market, poor road infrastructure and transport services, distance, closed markets etc.), reduces opportunities for livelihood development thereby threatening food and nutrition security.
	Prices and price fluctuations	Prices being prohibitively expensive for the consumption of certain food groups (e.g. animal source foods) can have adverse consequences for food and nutrition security as certain food groups may not be easily procured. Prices fluctuating throughout the year for certain food groups from affordable to expensive due to cyclical or non-cyclical patterns (seasonality, market shocks, religious and non-religious festive periods etc.) can have a similar affect during the expensive periods.
	Value chain (storage, processing, pasteurization)	Poor development of a value chain that inhibits the marketing, sale or value addition processing of a farm product. Problems could include poor storage infrastructure, lack of cold-chain infrastructure, poor access to value addition processing, lack of value chain aggregators, unequal power relations within the value chain etc.). These challenges restrict the opportunities for households to develop sustainable profitable livelihoods.
	Assurance of food quality	Lack of, or poorly enforced, rules and regulations relating to food safety and hygiene for food products along the full value chain, from collection, to processing, marketing, and sale points increases the chances of consumers contracting foodborne diseases.
	Shortage of cash	Lack of financial resources to be able to purchase the food for a health and diverse diet for the household. This could be due to inability to generate sufficient income through livelihood activities, ill health, or other structural problems. The lack of financial resources also makes it difficult

Bottleneck category	Bottleneck issue	Explanation of challenges
		for households to invest in activities or infrastructure that will enhance future incomes.
Socio-cultural context	Nutritional knowledge	Poor knowledge about food, food preparation, diets, and nutritional requirements. This lack of knowledge leads to poor consumption decisions for individuals or the broader household.
	Socio-cultural food norms	Socio-cultural norms and beliefs influence what and how food is consumed. These socio-cultural norms may adversely affect certain sections of society more than others. For example, certain beliefs may prohibit the consumption of certain foods, other beliefs may mean that certain diets are fed to children or infants that may be detrimental to their health; societal norms may make unhealthy body shapes aspirational etc.
	Gender inequalities	Inequalities between sexes in terms of food consumption may stem from socio-cultural norms and beliefs, resulting from the framing of discriminatory laws, regulations or policies, or be a result of intra-household relationships. These inequalities can lead to important food and nutrition security outcomes. These inequalities often mean men have better access to foods that are more nutrient-dense than women.
	Media and advertising influences	Media and advertising of foods that are high in energy but low in other nutrients can often influence societal consumption patterns. If people are exposed to these messages constantly, it can have an adverse impact on food and nutrition security.
Governance	State or NGO subsidized support/aid	Access to state- or NGO-funded projects or schemes can often stimulate the development of more sustainable profitable livelihoods. A lack of access to these projects and programs restricts the opportunities enjoyed by others. Moreover, social safety nets in case of illness, family crises, loss of livelihoods, etc. can be critical to enhancing the resilience of livelihoods. Lack of access to these social safety nets is therefore likely to affect food and nutrition security.
	Access to financial services (credit, savings, etc.)	A lack of, or poor access to, affordable financial services such as micro-credits and savings schemes discourages investment and the development of more profitable livelihoods. It also decreases resilience and encourages short-term perspectives. These issues can adversely affect food and nutrition security by preventing households from developing more profitable livelihoods and thereby decreasing their ability to purchase food for a healthy and nutritious diet. It may also make it difficult for households to access financial resources during challenging times.

Bottleneck category	Bottleneck issue	Explanation of challenges
	Health care, social care, health communication	Good physical and mental health are critical components of food and nutrition security. Lack of access to or poor functioning of health care or social care services can therefore be problematic, both for individuals and other household members. Health centres are often a key independent source of information about health and nutrition. Lack of information about nutrition can lead to poor dietary habits.
	Public infrastructure	Public infrastructure such as transport is key to procuring food as well as the functioning of agricultural value chains. Other public infrastructure items such as water, sewage, and electricity are also important for the hygienic storage, preparation, and consumption of food and drink. Food-borne diseases are likely to result more frequently without access to these key infrastructure.
	Water, sanitation, hygiene	Knowledge about and access to clean water and sanitation is critical to avoid waterborne diseases and the safe management of sewage. Hygiene practices are also critical in this. A lack of knowledge about all areas of water, sanitation, and hygiene therefore threatens food and nutrition security.
Agro potential & farm production	Agricultural and livestock productivity	Agricultural and livestock productivity can help contribute to diverse and healthy diets. Households can produce their own foods. Moreover, improved yields can contribute to enhanced sustainable profitable livelihoods.
	Climate and weather risks	Climate and weather risks can lead to important crop and livestock losses. Not only does this make rural households less willing to invest in enhanced agricultural production, but it also directly threatens the livelihoods of these households, causing instances of acute poverty.
	Natural disasters & conflict	On climate and weather risks, natural disasters and conflict can lead to important crop and livestock losses. Not only does this make rural households less willing to invest in enhanced agricultural production, but it also directly threatens the livelihoods of these households, causing instances of acute poverty.

Appendix 4: FGD and KII templates

FoodSENSE – Focus Group Discussion Guide

Design

In each study site, a minimum of two focus group discussions should be carried out; one for males and one for females. If there are interesting differences in context within the study site (e.g. urban vs rural; highland vs lowland) then FGDs should be carried out in each location. For example, in a study site with an urban/rural divide, there would be four FGDs; one male rural, one female rural, one male urban, one female urban.

Each FGD should consist of 8 to 12 respondents, selected to represent a variety of wealth and food security strata, and who are talkative. A facilitator speaking the local language should set respondents at ease and ensure equal representation from each of the respondents. Respondents' comments will not be attributed to them personally. The findings of this and other focus groups will all be merged, and no names will be used when reporting the findings. The meeting may be recorded, and the note-taker should record the key points of all dialogue. Depending on the level of literacy, respondents may wish to write some of their responses on paper.

Make it clear that you want to know about the common practices within the community, as well as their own experience from their own families. Do not ask anybody to attribute any observation to any specific individuals or families – there should be no naming and shaming.

Topics covered

Q1: Food consumption

Q2: Foods favoured or discouraged for specific people

Q3: Infant and child feeding

Q4: Food acquisition

Q5: Food knowledge, information, and choices

Q6: Cleanliness, hygiene, and food safety

Q7: Food security and vulnerable groups

Q1: Food consumption

- What foods are eaten?

  - First ask for all the commonly consumed foods in the community. List them across all food categories. You may refer to the list of example foods within each food group.
  - Then do some probing about any missing foods and foods which might be eaten rarely/only occasionally.
  - Finally, talk about favourite foods, foods eaten out of necessity, and sourcing of foods. If there is no time to talk about all foods, choose a few from the food groups of grains, pulses, dairy, meat, leafy green vegetables, and vitamin A-rich fruits and vegetables.

Food group	Commonly consumed	Rarely consumed	Preferred foods (even if not consumed)	Consume but don't like it much	Produce on farm	Commonly purchase
Grains, roots, and tubers						
Pulses						
Nuts and seeds						
Dairy						
Meat, poultry, fish						
Eggs						
Dark green leafy veg						
Vit A-rich fruit and veg						
Other veg						
Other fruit						
Sweet snacks						
Savoury/fried snacks						
Beverages						

Q2: Favoured foods and taboo foods for specific people

- Are there any foods associated particularly with prestige? Any which are shameful or embarrassing to eat?
- How does this differ across groups of people (e.g. men, women, youth, the elderly, children)?
- Are some foods favoured or taboo for certain age groups or males/females?

- May add rows to the table if there are strong differences between ethnicities, religions, or other demographic groupings.
- Where do people eat? Does this differ between men, women, youth etc.?

	Foods especially consumed by each group	Favoured or prestige foods	Why favoured?	Taboo or shameful foods	Why taboo/shameful?
Children (3-12 years)					
Male youth (13-21 years)					
Female youth (13-21 years)					
Pregnant woman					
Breastfeeding women					
Adult male					
Adult female					
Elderly male (above 60 yrs)					
Elderly female (above 60 yrs)					

Q3: Infant and child feeding

- Regarding Infant feeding:

Duration of exclusive breastfeeding: (around what age are children first given food?)	
Duration of partial/mixed breastfeeding:	
Mixed or complementary foods used:	
Breast milk substitutes used (what product, what age, how long, how common)	

- Regarding child feeding (i.e. 2-12 yrs):

When food is in short supply, do the children receive any foods which others do not? Is their diet different compared to that of adults? In what way?	
Do children eat food at places which adults do not? **E.g. eat at homes of friends or other family members, eat wild fruits, eat at school? Especially consider when foods are in short supply.**	

Q4: Food acquisition

- Think about foods which are commonly purchased or acquired through other means. When purchasing foods, where do you purchase them from?

  - Select key foodstuffs – between 5 and 10 items. Must include staples, legumes, animal foods such as meat, milk, or eggs, and vegetables.

  - Prices of foodstuffs, and perceptions of affordability.
  - Seasonality of produce available in markets.

Commodity	**Source**	**Average price**	**Seasonal fluctuation in availability or price?**
Provide examples based on above conversation?			

- Presence of markets and other locations/sources to purchase foods

  - Consider physical markets, large and small, but also alternatives to markets, e.g. travelling vendors, kiosks, informal sales, etc.
  - Consider issues such as size, average travel time and means of transport (highlight if these vary for men, women, and youth), frequency, items stocked.
  - Infrastructure at markets – cold store, water, electricity, etc.
  - Which markets are more commonly used, and by who (men, women, and youth)?

Food purchasing point	Description of purchase point	Main commodities bought there	Frequently used?	Travel time (one way), means of transport	Differences compared to others (e.g. cheaper, more expensive, more convenient, wider choice, cleaner, etc.)	Equally accessible to all? (e.g. mainly used by men, women, youth, elderly etc.)

- **Any other important sources of foods, in addition to purchases and production? e.g. school meals, food aid, donations, wild, food exchanges with family/friends?**

Other sources of foods (wild foods, aid, gifts, arrangements with friends, etc.)	Types of foods obtained	Who benefits from this?

Q5: Food knowledge, information, and choices

- How do you find out about where to purchase food, what to produce, food preparation, nutrition, and so on? Where do you get information from? Which are the best sources of information?

	Best/preferred/trusted sources of Information	**Other sources of Information**
Where to acquire foods (and at a good price)		
Food production (on farm), and how to store/process		
Nutritional information (what is healthy food)		
Food safety information (to reduce contamination or food-borne disease)		
Cooking/food preparation techniques		

- What roles do different family members play in food acquisition, preparation, and decision-making?

  - Who does the work for different tasks – e.g. growing maize, growing vegetables, caring for animals, slaughtering, preparing meals?
  - Who makes the decisions on what should be done, when, and by whom?

	Role in food acquisition (e.g. purchase, production on farm, collecting wild foods etc.)	**Role in food preparation and decisions on food serving**	**Role in food consumption decisions – when to buy, slaughter, harvest etc.**
Children (<12)			
Young Men (13-21)			
Young Women (13-21)			
Adult Men (22-59)			
Adult Women (22-59)			
Elderly Men (>60)			
Elderly Women (>60)			

Q6: Cleanliness, hygiene, and food safety

- How much do people consider issues of food hygiene in the community? How widely are they practised?

  - Talk about issues of sanitation, hygiene, and prevalence of water-borne or food-borne diseases.

  - Handwashing, washing/cleaning of food, eating in areas which are not clean or where there is livestock.

	Choosing where to buy foods and which foods to buy on basis of cleanliness	**Washing/cleaning foods before preparation or consumption**	**Washing hands before food preparation and eating (use of soap?)**	**Eating in a clean location**
Are people concerned about this? Why?				
How commonly practised? Why/ Why not?				

- What are the main sources of water? How do people treat water to ensure it is clean for household use?

Main sources of water	**Travel time (there and back)**	**Who usually goes there**	**How do you ensure it is safe for household use?**	**Whose responsibility is it to ensure water is safe?**
River			Boiling, cooking, filter	
well			Do not treat it	

- What are the main types of toilet facilities? How common are they?

Types of toilet facilities	**How common**	**Cleanliness?**

- Do people get sick from water- or food-borne diseases? If possible, name the disease or the symptoms. Who is affected, how often?

Sickness/disease (e.g. food poisoning, diarrhoea, parasites)	Symptoms	Frequency/how common/when	Who most commonly affected? (e.g. kids, elderly men etc.)
Diarrhoea		Once every month	
		Rainy season	
		Dry season…	

Q7: Food security and vulnerable groups

- Imagine 3 categories of households – those who have lots of challenges getting enough food, those who have some challenges, and those who have no challenges getting enough food.

  - Consider assets, such as land, housing, livestock; incomes, such as from farming, trading, or jobs; also consider social issues such as education, position in the community.
  - This exercise of defining the groups could be done with drawing of pictures, perhaps in small groups, and then reporting back.

  - What are the main challenges each group faces?
  - Safety nets & financial services: are there any social security, food aid, cash aid, reciprocity, or other forms of safety nets when people are short on foods?

	Characteristics of those people/that group (e.g. own no land, no livestock, poor education, lost a key family member etc.)	Challenges faced (e.g. lack of meat/milk in diet, lack basic staples etc.)	Safety nets or support services available? If so, what are they?	Approximate proportion of the population in that group
Lots of challenges getting enough food (1 meal p day)				
Some challenges getting enough food (2 meal p day)				
No challenges getting enough food (3 meal p day)				

FoodSENSE - Guide for Key Informant Interviews at study-site level (community level)

Informant selection and interview guide

Key informants should be knowledgeable about the specific study sites, including the practicalities of food production and acquisition, and/or the food security and nutrition situation. Informants should be well informed and willing to share their insights. In addition to obtaining information for the decision support process, the interviews may be used as a means to establish interest and buy-in to the framework of activities. The key informants could also participate in the expert assessment phases of the framework.

There is no hard limit on the number of key informant interviews to carry out, but as a guide, 3 or 4 might be reasonable per study site. Informants should represent a variety of professional perspectives and a variety of demographic perspectives.

The interviews may be recorded with the express consent of the key informant, and should be informal in tone. It is much better to do the interviews in person if at all possible. Statements will not be attributed to individuals, but rather all the interviewed will be synthesized into a report, along with other complementary quantitative data and the outcomes of focus group discussions within the communities. Key informants should therefore feel free to speak frankly about their experiences and opinions, without the concern of being identified and held to account later on.

The topics of the interview are the food environment, production, and markets; food and nutrition policy and social support measures; food and nutrition outcomes within the study sites; and the specifics of foods promoted, marketed and consumed. Whilst it is desirable to raise every topic with each interviewee, it is sensible to focus on the topics about which each interviewee is most knowledgeable. As a guide, an interview may last around 30 minutes, and should not last more than 60 minutes.

Content of interview

Note: The questionnaire below is a guide. The interview must be tailored to the expertise of the respondent. Each respondent may not be able to comment on each point. It may not be necessary to probe on each question asked.

You should always ask the first and the last questions. The ones in between may be more suitable for certain interviewees; try to ask as much as possible, and tailor it to the respondent's expertise.

Q1: Please give a general overview of the food and nutrition situation within [the study site]

Q2: Food consumption

Q3: Food production

Q4: Food acquisition and markets

Q5: Governance, policy, infrastructure, and social support

Q6: Water, sanitation, and hygiene

Q7: Social and cultural norms

Q8: Interventions to address food and nutrition security

Q1: Please give a general overview of the food and nutrition situation within the study site

- In general, what are the nutritional concerns of this population?
- Are there data on the prevalence of inadequate nutritional outcomes? Can you share sources or references for these?

- Have there been any notable intervention measures put in place within the communities to address food and nutrition security?
- How do the food security and nutrition issues differ within the population?

  - Who has a worse food and nutrition situation? How would you categorize those with a worse (or better) food and nutrition situation?
  - E.g. by wealth, demographic groups (e.g. tribes, religious or cultural groupings), gender, or age?

- What do you think are the main causes of these food and nutrition problems identified?

- Have there been changes in recent years (improvements or declines)?

  - What led to these changes?

Q2: Food consumption

- What foods are over-consumed?

  - By who? Why do you think that is?

- What foods are under-consumed?

  - By who? Why do you think that is?

- What local foods do you think are the most important contributors to good nutrition in this population (that combine good availability, accessibility, and acceptability)?
- What foods are particularly important for the nutrition of the most vulnerable groups (e.g. poor households, women of childbearing age, children)?

- What are popular processed/junk foods? E.g., sugary beverages/soda, sweets, packaged salty snacks (e.g. potato chips), fried foods, fast food, etc. How prevalent are they? How available are they? How affordable are they?

Q3: Food production

- What are the main foodstuffs produced within the site?

  - Including: crops; horticulture; animal source foods such as meat, milk, and eggs; wild foods which may be collected or hunted.

- Is small-scale horticulture/livestock keeping common for supplying home needs (i.e. kitchen garden, backyard chickens)?

  - If so, what do people produce
  - If not, why?

- Are there any food processing facilities or co-operatives to which farmers can sell their produce?
- In your opinion, should the production of any particular foods be increased to boost local food security and nutrition?

  - Which foods? Why?
  - Would there be any challenges to increase the production of these foods?
  - How do you think this could be promoted?

Q4: Food acquisition and markets

- What are the main ways through which people obtain foods?

  - E.g. production, purchase, collection of wild foods, food aid, institutional meals (e.g. school meals).
  - How important are these different sources?
  - How does it differ for richer or poorer households?

- What are the main types of markets/shops/options for purchasing foods?

  - What types of food are well stocked, what types are food are not well stocked?
  - Which purchasing points are better, why, which are worse, and why?

    - How do they differ in terms of … e.g. prices, seasonality, freshness, cleanliness, facilities, etc.?

  - Which are more popular/used more? By whom?

- Where do people typically buy animal source foods, such as milk, red meat, poultry and eggs?

  - Are these foods typically stored hygienically?
  - What are the main barriers to increasing consumption of animal source foods?
  - What are the main barriers to increasing production of animal source foods?

- The foods sold at these venues, are they usually produced locally or imported?

  - What is the scope for local products to enter the local markets?

- Where are the imported foods from?

Q5: Policy, infrastructure, and social support

- How are the transport links, for movement of food and produce, in this area?
- How is the access to health care services of this population?

- Are there social security or safety net programs to support households with food shortages, or for feeding children?

    - For government or NGO programs: how do these operate? Who is eligible for support?
    - For traditional support systems: how and when do these operate (community groups that support during funerals, celebrations, times of scarcity etc.)?
    - Highlight gender roles and responsibilities within these traditional or official support mechanisms.

    - What facilities exist to support children who may be under-nourished?

- Are there any notable national or regional policies to support improved nutrition and food security operating within the site?

    - In your opinion, what are the successful policy measures?
    - In your opinion, what have been unsuccessful policy measures? Why is that? Could that be improved?
    - In your opinion, what other policy measures should be implemented (or developed)?

Q6: Water, sanitation, and hygiene

- Are food- or water-borne diseases common within the study sites?

    - What are key diseases? Who is most affected? What is their prevalence?
    - What could be done to reduce these?

- Are there food safety and quality controls, and do they function effectively?

    - Is there a need for more effective food safety regulation? At which points in the supply chain? E.g. food production, transport, slaughter, processing, packaging, sale, preparation, consumption.
    - In markets and restaurants, what are the main challenges?

- Are there food safety issues at household level? How are the food hygiene practices?

    - What would be required to improve food safety in households?

- What are the main sources of water for household use?

    - Is improving water access and quality a priority?

- What are the typical levels of handwashing?

- Is it adequate?
- How available/used is soap?

- What are the typical toilet facilities? How sanitary are they?

Q7: Social and cultural norms

- From where do people obtain information about nutrition and food preparation?

  - Are there public information programs regarding nutritious diets and food preparation? How do these operate? E.g. could be operated by the state, NGOs, or popular media.
  - What are the sources of traditional knowledge and practices?
  - What are specific information channels for infant feeding?
  - Explore the roles of different genders and ages in this knowledge and information sharing.

- Are there any traditions or cultural practices regarding what food certain people should eat, which are relevant to improving food security and nutrition?

  - General rules about what can and can't be eaten, perhaps by different tribes, religions etc.
  - Or food conventions for men, women, youth, children of different ages.
  - Or food conventions during pregnancy, postpartum (following childbirth), infant feeding.

Q8: Interventions to address food and nutrition security

- Finally, in your opinion, what are the most promising interventions or policy measures that could address food and nutrition insecurity within the study sites

  - For whom would these interventions work best (rich, poor, men, women, youth, children, etc.)?
  - In your opinion, why have they not yet been attempted? Or not been successful yet?

Closing the interview

Thank the respondent. Explain to them how and when they can get access to the full report.

Appendix 5: Glossary of local foodstuffs

Local name	English name	Description
Amatungulu	*Carissa macrocarpa* (Natal plum)	
Bongo	Yoghurt	Fermented milk
Bukopa yam	Bukopa yam	Amayuni in Luganda
Chapati	Unleavened flatbread	Unleavened flatbread that is usually fried in oil rather than baked
Enderema	Green leafy vegetable- Basella alba	
Enkejje	Sprat	Fished near the shore and several of the fish are lined up in a row on a stick, dried and sold in markets
Gonja	Plantain	Ripe bananas from a type of green bananas
Gorillos	Savory snack	Snack mix made primarily from Irish potatoes and other ingredients
Jambula	Java plum	Java plum fruit
Kabalagala	Banana pancake	Deep-fried banana pancake made mainly of cassava flour mixed with ripe bananas
Kasulu	*Mormyrus kannume*	Type of fish that lives mostly near stones on the riverbanks
Kasulubana	Same as Kasulu described above	
Kikomando	Chapati and beans	A common fast food or stall dish consisting of chopped chapati and beans refried together in oil
Kobe	Kobe yam (an air yam scientifically referred to as *Dioscorea bulbifera*)	Kobe yam is an indigenous plant, and is also a totem of one clan of the Baganda people from central Uganda
Mamba	African lungfish (of the *Protopterus* genus)	The fish is one of the oldest totems belonging to the original clans of the Baganda people
Matooke	Plantain	Green matooke, generally steamed and mashed
Mukene	Silver fish	Small fish (5-10cm) caught in Lake Victoria. Often dried and sold by weight.
Nakati	*Solanum aethiopicum* (Scientific name)	Green leafy vegetable
Nsenene	Grasshoppers	Grasshoppers, a local delicacy seasonally available
Posho	Maize meal	Maize meal is a staple food enjoyed in almost all African countries

Local name	English name	Description
Rolex	Omelette and chapati	Egg omelette and vegetables wrapped in a chapati
Sukuma wiki	Kale (*Brassica oleraceae var acephala*)	Cool-season vegetable of the Brassicas family
Waragi	A locally distilled gin	Available in most parts of Uganda
Tonto	A traditional alcoholic beverage	Locally fermented from sorghum, sweet banana (mabidde), and grass

The CGIAR Research Initiative on Sustainable Animal Productivity for Livelihoods, Nutrition and Gender inclusion (SAPLING) is working in seven countries focusing on livestock value chains to package and scale out tried-and-tested, as well as new, innovations in livestock health, genetics, feed and market systems. SAPLING aims to demonstrate that improvements in livestock productivity can offer a triple win: generating improved livelihoods and nutritional outcomes; contributing to women's empowerment; and, reducing impacts on climate and the environment. Its seven focus countries are Ethiopia, Kenya, Mali, Nepal, Tanzania, Uganda and Vietnam.

It forms part of CGIAR's new Research Portfolio, delivering science and innovation to transform food, land, and water systems in a climate crisis.

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