

FOOD CHAIN SYSTEM AND NUTRITIONAL STATUS OF INMATES IN UGANDA: A CASE STUDY OF OLIA GOVERNMENT PRISON, ADJUMANI DISTRICT. A CROSS-SECTIONAL STUDY.

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ABSTRACT.

Background:

This study analyzed the effectiveness and efficiency of the prison food chain system, determined the nutritional adequacy of the prison food, and the nutritional status of the inmates in Olia government, Adjumani district, Uganda.

Method:

A cross-sectional study design was used in an average 200-bed capacity of Olia government prison. Multiple methods were used to assess food available at the group and individual levels, including verification of food portion size through food plate measurements, and quality. Food portion size measurement was done for all the 199 eligible prisoners, 179 measurements were conducted for weight and height, 2 key informant interviews were conducted, and 1 FGD with the prisoners was conducted.

Result:

Planned prison food ration to be nutritionally adequate in terms of energy (Kcal), but low in quality. The micronutrient content of the ration was low in minerals and vitamins, especially minerals like calcium and iron, and vitamin A, vitamin B5, vitamin C, vitamin D, vitamin E, and deficient in vitamin B12. The ICRC dietary targets for inmates were not achieved. The prevalence of malnutrition (overweight and underweight) among the inmates was at a serious level, 10.6%. No cases of severe wasting and obesity were identified.

Conclusion:

The inmate population is at a greater risk of developing a triple burden of malnutrition due to the presence of overweight, underweight, and micronutrient deficiencies cases in the prison. Food intake to be nutritionally adequate in terms of caloric requirement but of inadequate quality. The food chain system works well, with energy change from one from preparation to distribution phase along the food chain being below the acceptable limit of 5% from the day's ration.

Recommendations:

More efforts are needed to improve the food storage and preparation facility, local production of fruits, vegetables, small ruminants, and documentation of food stocks.

Keywords: Effectiveness, Prison Food Chain System, Nutritional Adequacy, Nutritional Status, Inmates, Adjumani District

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BACKGROUND TO THE STUDY.

Globally, over 10.77 million people are held in penal institutions, either as pre-trial detainees/remand prisoners or having been convicted and sentenced. Of this, about 1.2 million detainees are found in the African continent with Uganda having approximately 65,000 detainees across the country (Fair & Walmsley, 2021).

However, the increase in these prison populations has not been matched by additional built capacity or greater investment in staff and other resources most especially in developing countries like Uganda (ICPR & Heard, 2019).

And, it should be noted that the people detained in prisons still retain their fundamental human rights, so the power to detain anyone comes with a corresponding

responsibility to provide for their basic human rights (UNOHCHR, 2020).

Given the above responsibility, it is recommended that prison diets be supportive of health and well-being, as well as meet the financial obligations of the state (Edwards et al., 2007). The (OSCE Office for Democratic Institutions and Human Rights & Penal Reform International, 2018) and (ICRC, 2016a) further spelled out the international standards and recommendations for the management of prisons, including that prison food has to be of adequate nutritional value for health and strength.

To achieve this, various measures have been instituted, including the provision of funds/budgets to the UPS by the GoU Ministry of Finance and economic planning through internally mobilized revenue, and other support development partners and donors like the EU, GTZ, and philanthropic organizations like ICRC to ensure efficient prison management and provision of necessities to the inmates.

The UPS management has developed a Standing Order that authorizes the provision of standard dietary scales to prisoners in full and may not be varied without the authority of the Commissioner General except in the interests of the health of a prisoner and on the written authority of a medical officer. The prisoners are supposed to be served three meals a day, namely: breakfast, lunch, and supper (Auditor-General, 2010) and (The Prisons Act, 2006).

The (ICRC, 2016a) further developed and set the dietary recommendation for prison foods at a minimum of two meals to be served each day with an energy content of detainees' ration being 2,400Kcal.

But despite all the above measures and recommendations in place, the issues of dietary/nutritional inadequacy of prison foods and malnutrition among inmates remain prevalent in prison facilities. For example, comprehensive studies conducted in 25 Australian (Williams et al., 2009) and 16 UK prison food services (Edwards et al., 2007), revealed gaps in the food chain operation and dietary inadequacy of the prison foods. Therefore, specific recommendations were made to improve the nutritional value of the catering menus such as: adding fresh and seasonal fruits, adjusting the timing and presentation of meals, and a suggestion for future research in prison food service operations.

Elsewhere in Sub-Saharan Africa, a study conducted in an Ethiopian prison reported a comparable magnitude of undernutrition in the prison population to that of the general population (Wondimu et al., 2021) and severe acute malnutrition in Zimbabwean prison (Alexander, 2008). Incidences of inadequate dietary diversity resulting in nutrition-related deficient diseases were also reported.

For example, xerophthalmia and optic neuropathy cases were registered in the Papua New Guinea prison population (Gould et al., 2013), vitamin A deficiency in Kenyan prisons (Mathenge et al., 2007); and the outbreak of beriberi in Cote d'Ivoire prisons (Aké-Tano et al., 2011); (Ahoua et al., 2007).

Similarly, a study conducted in Fort Portal prison in western Uganda revealed a high prevalence of underweight among the inmates, with 14.6% of inmates having consumed less than the minimum recommended number of food groups (Wanyama, 2021).

And, according to the audit report conducted in 15 prison facilities across the various regions of Uganda, including the Western Nile region where the Olia government lies, it was found that inadequate quantity and quality of foods were served to the inmates compared to the UPS's recommended dietary scale. While only posho and beans were served, some prisons were not served all three meals in a day. There is also laxity in supervision and accountability for the food grown on prison farms to supplement government resources. The quality of the food served does not meet all the basic food nutrients necessary for requisite the health and strength of the inmates (Auditor-General, 2010).

This study, therefore, intends to analyze the effectiveness and efficiency of the food chain operation, determine the nutritional adequacy of the prison food and the nutritional status of the inmates in Olia government, Adjumani district to inform food and nutrition policies in the prison setting by collecting and triangulating data from FGD, KII, anthropometric measurements, and actual food plate measurement, unlike the previous studies approaches rather employed FGD, KII, and 24-hour recall methods without actual food plate measurements to determine the calorific values of the prison foods served in each inmate's plate.

Purpose and Objectives of the Study.

This study aimed to analyze the effectiveness and efficiency of operation of the prison food chain operation, determine the nutritional adequacy of the plated food of the prison food, and determine the nutritional status of the inmates in Olia government, Adjumani district to inform food and nutrition policies in the prison setting.

Objectives of the Study.

- To understand the association between the prison food chain system (supply, storage, preparation, and distribution) and undernutrition among inmates.
- To determine the nutritional status of the inmates.

- To determine the nutritional adequacy of the plate food served to the inmates.

METHODOLOGY.

Study design.

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The qualitative research method employed a case study approach as it can be used to examine a person, group, and community or institution. It helps in the evaluation and in-depth analysis of a program, event, activity, or process, of one or more individuals. It is time, space, and activity bound, and researchers collect detailed information using a variety of data collection procedures over a fixed period (Creswell, 2014). Data collection was done through key informant interviews with OC and storekeeper, FGD with the inmates, and review/analysis of food records and observations in the store.

A cross-sectional descriptive study design was applied for quantitative data because of its potential to gather data from different respondents at a single point in time to be able to make statistical inferences on the entire study population.

Area of study/location.

The study was conducted in Olia government prison, Pakelle Sub-County, Adjumani district. This is one of the oldest government prisons in the country with approximately 200 inmates, constructed in 1966, it is in the East of Adjumani district just after Pakelle town council, 7 kilometers out of Adjumani town. This area was the ideal setting for this study as the study intended to analyze the food chain operation in penitentiary institutions.

Study population.

The study population for this study was inmates in the Olia government in Adjumani district, Uganda. The total population of inmates in the prison facility during this assessment was 199 inmates.

Sample size determination.

The sample size for this study was determined using Krejcie and Morgan's table (1970) or calculated by the using Yamane, and Taro (1967:886) method.

This is given by; $n = N/(1+Ne^2)$.

Whereby,

n = Required sample size; N = study or accessible population; e = margin of error ($e = 0.05$ at 95% CI or level of significance).

$n = N/(1+Ne^2)$, = $[200/ (1+ 200(0.05)^2)] = [200/ (1+200(0.0025))] = [200/ (1+0.5)] = [200/1.5] = 133$ inmates.

Therefore, n (required sample size) = **133 inmates**.

Meanwhile, the ICRC's Excel spreadsheet sample size calculator meant for food chain analysis in places of detention was used to determine the sample size for the food plate measurement. However, an exhaustive measurement of plate food and anthropometric measurements were done. For the qualitative method, data collection was stopped when a data saturation point was reached. A data saturation point, also referred to as, "information redundancy", is a point at which no new information, themes, or codes are yielded from any further data collection (Lincoln and Guba, 1985). A purposive sample selection approach was employed to collect qualitative data based on the objectives of the study.

Sample techniques and procedures.

In this study, a two-stage cluster random sampling technique for selecting the samples in evaluating the nutritional status of the inmates and plate food measurements was used. For the key informant interviews, a purposive sampling method was used.

Two types of cross-sectional study data were collected (qualitative and quantitative) using the pre-defined questionnaires, key informant interviews, and focus group discussions that were administered to the target population by the researcher and his other three enumerators who were trained for eight contact hours and tested before the actual data collection exercise.

Data Collection Methods/Procedure.

Data was collected over 1 week (5 full days) on the different parameters. The food supply and storage data was collected in 2 full days through key informant interviews by administering semi-structured interviews to food service staff (OC prison, storekeeper, and kitchen staff), as well as on-site inspections of the kitchen, food storage areas, and work areas to verify the usual practice. Data was compared with records from the review of the standard menu and food purchase records to determine effectiveness and efficiency in the food supply, storage, preparation, and distribution (Williams et al., 2009); (Veiros et al., 2006); and (ICRC, 2016b).

The anthropometric data for the inmates will be collected in 1 day. This will involve the measurement of their MUAC, weight, and height to evaluate their nutritional status and determine the prevalence of malnutrition among the inmates (Gibson, 2005);(Cashin & Oot, 2018); and (ICRC, 2016b).

Individual dietary data by weighing the plate during food distribution to inmates. Meanwhile, raw weights of food ingredients are weighed before food preparation to ensure internal consistency between food available and standard portions provided in the prison (ICRC, 2016a). An hour dietary interview without witness (ICRC, 2016b) was

conducted face-to-face with the inmates to evaluate the prisoners' attitudes towards the prison food.

Data Collection Instruments/tools.

Multiple data collection tools/instruments were used to assess the food available to prisoners to enhance accuracy and confidence in the data collected. These included the use of questionnaires, interview guides, observation checklists, or focus group discussions with the inmates, as well as the use of field equipment/tools like weight scales, height boards, and tape measures to measure food portion sizes and raw weights of food ingredients, weight of inmates, height of the inmates to determine the food quality, prisoners' nutritional status, and attitudes towards the prison food respectively.

Data Quality Control.

The data collection tools were pilot-tested to ensure that the instruments used were reliable and valid for the research questions for the study. A 1-day training was done with the assistants to ensure on-spot data verification, calibration of weighing scales, and performing the data.

Reliability of the instruments.

To ensure that the instruments are reliable, a pilot run was conducted on a non-participating sample in the sub-counties under study to test the suitability of the instruments for the study. Any questions that brought out irrelevant responses were discarded from the research instruments. Meanwhile, the reliability of qualitative data was ensured by carrying out a content analysis and triangulation of qualitative data (Carter et al., 2014); (Creswell, 2014).

Validity of the instruments.

To ensure validity, a pilot test was conducted to help make the content of the study instruments valid. This involved prior administration of the instruments to a similar group of subjects, editing the questions, aligning them to the research questions, and using only those questions to seek relevant data.

Data Analysis.

Statistical analysis of quantitative data was conducted using IBM SPSS Statistics for Windows version 16.0 (Hannan-Jones & Capra, 2016), NutVal version 4.1 software, and the ICRC's FCA data analysis tool for food chain assessment in places of detention, version 2.33. The results of the analysis are presented in tables and figures such as charts and graphs.

For qualitative data, a transcription, sorting, and arrangement of data into the different groups was done; verified for errors, coded, or grouped into different themes for analysis; and a content analysis was done for their meaning/interpretation using an Excel spreadsheet and results presented using figures or tables.

Ethical Consideration.

Informed consent – Participants were informed on the purpose, nature, data collection methods, and extent of the research before the commencement of the data collection exercise. Approval was obtained from the Commissioner General of the Prisons, as well as the OC for Olia Government prison.

Privacy, confidentiality, and anonymity - The confidentiality and anonymity of the participants were maintained by the removal of any identifying characteristics before the widespread dissemination of information.

Voluntary participation – Participants were informed that the research is only for academic purposes and that their participation in it is voluntary. No one was forced to participate. Permission was sought from the respondents and relevant prison authorities before data collection. Respondents were first explained the purpose of the study and assured that all the data collected was to be used for academic purposes only. The respondent's names or identities stayed anonymous.

RESULTS.

Response rate.

179 inmates were assessed for anthropometric measurements and 199 inmates for food plate measurement out of the 199 inmates available in the prison. The response rate is 100% for food plate measurement and 89.9% for anthropometry.

Demographic Characteristics.

The demographic composition of the respondents was characterized by age, gender, and nationality as discussed.

Gender of respondents.

Olia government prison is composed of 100% male inmates. The researcher was able to evaluate 89.9% (179 out of 199 inmates) for their nutritional status through the anthropometric method. This is due to the varying work schedules.

Table 1: Summary of response rate.

	Frequency	Percent	Valid Percent
Male	179	100.0	100.0

Age of respondents.

Of the 179 inmates accessed, none of them were under-age (below 18 years old). The majority of the inmates are

in their youthful age, 18 years to 45 years old, 97.2% (174 inmates out of 179), 2.8% (5 out 179) were young old, none were in the age bracket greater than 65 years old as presented in table 2.

Table 2: Age Segregation of respondents.

	Frequency	Percent	Valid Percent
18 years old - 45 years old	174	97.2	97.2
46 years old - 65 years old	5	2.8	2.8
Total	179	100.0	100.0

Nationality of respondents.

Of the total number of inmates surveyed (179 out of 199), 85.5% (153 inmates) were Ugandan nationals who came

from across the country. While 26 inmates (14.5%) of the 179 inmates were foreign nationals from the countries neighboring Uganda (South Sudan, Kenya, Rwanda, Congo).

Table 3: Nationality of the respondents.

	Frequency	Percent	Valid Percent
Ugandan	153	85.5	85.5
Non-Ugandan	26	14.5	14.5
Total	179	100.0	100.0

Descriptive results.

For the qualitative objective, two (2) key informant interviews were with the OC station and storekeeper for Olia prison respectively. A focus group discussion was conducted with the inmates of Olia prison on 07.07.2023 to understand their feelings and perceptions about the prison food ration being provided to them. The demographic characteristics of the FGD respondents included the age, occupation/title, and address, where they sleep (wards) in the prison as discussed.

Age of FGD respondents.

The majority of the FGD respondents, 75% (6 out of 8 inmates) of the inmates were in the age range of 18-45 years old (youthful age group), and 25% (2 out of 8 inmates) were in the age range of 46-65 years old (young-old). There were no inmates below 18 years old and above 65 years old in the FGD with the inmates as presented in Table 4

Table 4: Age segregation for FGD respondents.

	Frequency	Percent	Valid percent
< 18 years old	0	0	0
18-45 years old	6	75	75
46-65 years old	2	25	25
>65 years old	0	0	0
Total	8	100	100

Occupation/title of FGD respondents.

Of the 8 inmates in the FGD, 75% (6 out of 8 inmates) held leadership positions as cooks, 37.5% (3 out of 8 inmates), and ward leaders, 37.5% (3 out of 8 inmates),

meanwhile, 25% (2 out of 8 inmates) were ordinary inmates without leadership positions. Table 5, represents the occupations or titles of the respondents for FGD conducted with the inmates on 07.07.2023 to understand their feelings and perceptions about the prison food ration.

Table 4: Occupation/title of FGD respondents.

	Frequency	Percent	Valid percent
Cook	3	38	38
Ward leader	3	38	38
Ordinary inmate	2	25	25
Total	8	100	100

Address/wards of FGD respondents.

Olia prison facility has 10 rooms, also known as "Wards," for inmates' accommodation. They are labeled from 1-10 as ward 01, ward 02, ward 03, ward 04, ward 05, ward 06, ward 07, ward 08, ward 09, ward 10. One (1) respondent

was purposively selected from each ward of accommodation. However, the selection process was compromised due to the varied working hours of the inmates, and thus, there were more participants from some wards than others as presented in Table 6.

Table 5: Address of FGD respondents in Olia prison.

	Frequency	Percent	Valid percent
Ward 01	0	0	0
Ward 02	1	13	13
Ward 03	2	25	25
Ward 04	0	0	0
Ward 05	0	0	0
Ward 06	1	13	13
Ward 07	1	13	13
Ward 08	0	0	0
Ward 09	3	38	38
Ward 10	0	0	0
Total	8	100	100

Effectiveness and efficiency of the prison food chain system.

To evaluate this objective, qualitative data collection was done through two separate key informant interviews with the OC station and storekeeper for Olia government prison

respectively, 1 FGD with the inmates of Olia government prison, review/analysis of food records and observations in the store.

Food supply & budget.

Following the key informant interviews with the OC Station and the food storekeeper of Olia government prison, they both reported that: *“all prison food budget and other related expenses are handled at the national level at the Prison Headquarters/Quartermaster general in Kampala, except, for cooking fuel/firewood”*. The quantity, duration, and supply frequency are dependent on the number of inmates at a specific point in time, this can be bi-weekly, monthly, or bi-monthly as determined by the number and need of inmates which kept fluctuating every week or following the daily parade (daily counting of the inmates and staff).

There were no logistical constraints reported concerning food delivery as the prison truck routinely moves around the region and across the country. When asked about food shortage in the prison in the past 2 months, the OC station, and the storekeeper both replied: *“There are no logistical constraints with the prison delivery system, there were no cases of food shortage in the last 2 months. Neither was there a single day prisoner had gone without food.”* This was reported by key informants during this assessment, this was also confirmed by the inmates during the FGD (see annex: vii).

Fresh foods such as vegetables (onions, and other green leafy vegetables) are planned to be produced locally from the prison farms. However, due to the unpredictable nature of the climate and its seasonality, some months go without vegetable production as the prison does not have an irrigation system for the dry season.

The key issues and challenges identified noted with the supply chain, budgeting, and local food production include lack of adequate information and transparency on the prison food budget (so, this made fiscal analysis and evaluation option of this assessment impossible), inadequate vegetable in the daily prison diet, no daily menu displayed in the kitchen or storeroom, and no standard recommended minimal energy (Kcal) requirement per person per day from the prison headquarters.

Budget.

According to the key interview conducted on 04.07.2023 and 05.07.2023 with OC Station and storekeeper respectively, it was reported that; there is no food budget at the local/station level. All food budget and related expenses are handled at the national level, except, for cooking fuel/firewood for cooking food. There was no adequate information on the prison food budget during this study. So, fiscal analysis and evaluation could not be done for this assessment.

Food storage.

Through the key interview with the storekeeper, observation checklist, and review of food stock records, it was found that the food storage and management system are good and regulated. Food inventory records are updated and matched with the physical count of item stocks during this assessment. Foods received from the UPS headquarters are delivered with vouchers, verified at the station level, and then entered in the food ration ledger book by the storekeeper.

The food storeroom has a functional manual weight scale (100kg capacity). The wall storeroom has some cracks, the floor is untidy, and the roof has some small holes which leak during the rainy season. Food stocks are stacked/piled on the timbers and not far away from the walls. This storage condition exposes the food stocks to moisture absorption and insect infestations which can cause food contamination, especially, aflatoxin.

There are no bin cards for the food items in the store, instead, the storekeeper uses a food ration ledger book to keep inventory, this book does not have provisions for batch numbers and expiration dates of these food items. This will food recall process and tracing of food intoxication incidence difficult in the future.

Foods for the kitchen are issued daily in the morning depending on the number of inmates. This is managed by the storekeeper and 4 inmate cooks.

The major issues and challenges noted include lack of proper ventilation and illumination from natural light, untidiness, no bin cards, inefficient weight scale, poor storage conditions for example food items being stacked on the timber and close to the wall, all increasing the risks of food contamination and spoilage.

Kitchen structure or building.

The new kitchen structure is a concrete structure under construction, with the floor still uncemented. The building has good ventilation, and adequate surface area (7mx5m) for cooking, with 2 fuel efficient stoves (FES).

Issues identified, the kitchen structure is incomplete, and the uncemented floor and open window could spread dust into the food as it is kept open for a long period. Also, there is no worktop, sink, and water tap in the kitchen, this reduces work efficiency and effectiveness in the kitchen in terms of hygiene and time spent on cooking.

Human resource.

There 4 inmate cooks working in the kitchen, with no other external cook. These cooks are exempted from routine manual labour. There is no clear way to reward or

pay them for their service. However, the OC station or prison administration occasionally pays them money on Saturdays to buy themselves other food ingredients that are not available in the stock or on the prison menu.

The cooks can read, write, and know their daily menu. They weigh the daily food required by the total number of inmates and as per measurement is being done by the supervisor and prepared the day before.

Hygiene.

The general prison environment is clean and well maintained even around the kitchen. Every prisoner has his food dish, and food is always served while hot, but questions remain over the hygiene of the cooks. The kitchen equipment is in good working condition but is inadequate for efficient work execution.

There is no running water tap in the kitchen, although, there is an adjacent handpump to the kitchen, but the water yield is low. There was no soap or cleaning detergent in the kitchen for hand washing and utensil cleaning on the day of this assessment although the storekeeper reported that there is the periodical release of hygiene materials from the store to the kitchen. Cooking pots and utensils were not cleaned, and the cooks did not wash their hands before handling the food, as well as multiple people came over to help with serving the food.

Issues and challenges identified include poor hand hygiene by the cooks, and not washing their hands before touching food and during the food preparation. There is no handwashing tap around the kitchen for cooks, no protective wear for cooks, such as safety boot/gumboot, or industrial gloves, some cooks have long and dirty nails, as well as uncovered hairs and beards, there is no rack for drying cooking pots and other utensils after cleaning them. ; and the kitchen structure is incomplete, the uncemented floor and open window could spread dust into the food as it kept open for a long period.

Cooking.

According to both the OC station and the storekeeper, two (2) meals are normally cooked per day according to the daily meal plan and menu designed by prison headquarters. i.e., breakfast, (lunch and dinner) are cooked together but served at separate times depending on the activity demands. Breakfast cooking starts at 4:00 am and is served at 6:30 am every day, lunch and dinner

preparation starts at 7:00 am and is served at 1 pm or 2 pm daily.

The daily meal plan and menu consist of maize flour/posho, beans, salt, and cooking oil (maize flour, 680g/person/day; beans, 142g/person/day; salt, 15g/person/day; and 15.16ml/person/day of cooking oil). No menu was displayed either in the storeroom or kitchen. It was not clear how much kilocalories of energy are recommended for inmates per person per day and none of the prisoner officers could explain it. The sauce is cooked without cooking oil as it has been out of stock for a longer period, inmates end up buying it for themselves for those who can afford it.

Issues and challenges noted include an inadequate number of cooking pots and stoves, incomplete recommended food ingredients, e.g., lack of cooking oil, and food cooking for too long hours which destroys the heat-labile nutrients in the foods.

Food distribution.

Food was distributed by the cooks in 2 servings of breakfast, with lunch and dinner served together as lumpsum. The cooked foods were served from the cooking pots while still in the oven in the kitchen.

Pre-defined scoops were used to measure the food amounts for each inmate.

Overall, the ideal prison daily meal plan and daily menus should have been designed to provide a minimum of 2,400 Kcal of energy per day per person as the official recommendation (ICRC, 2016a) and (ICRC, 2016b). However, there was no information on the UPS energy (Kcal) recommendation for inmates at the station level.

At deliveries and warehouse, the food stocks were worth 993 Kcal and 1,288 Kcal energy, respectively indicating inadequate stock available to cook for 199 inmates for 52 days remaining before the next supply arrives at the station as per the available records, physical counts, and confirmation from the key informant interview with the storekeeper.

At the kitchen/preparation level, 2,943 Kcal of energy in the ration per person per day was prepared which was sufficient as per the recommendations (ICRC, 2016a) and (ICRC, 2016b). Meanwhile, at the inmate's plate level, 2,838 Kcal of energy of the ration was served or distributed. So, inmates got a sufficient amount of energy, way above the minimal recommended energy requirement of 2,400 Kcal per person per day (ICRC, 2016a) and (ICRC, 2016b), see figure 4.1 below for summaries.

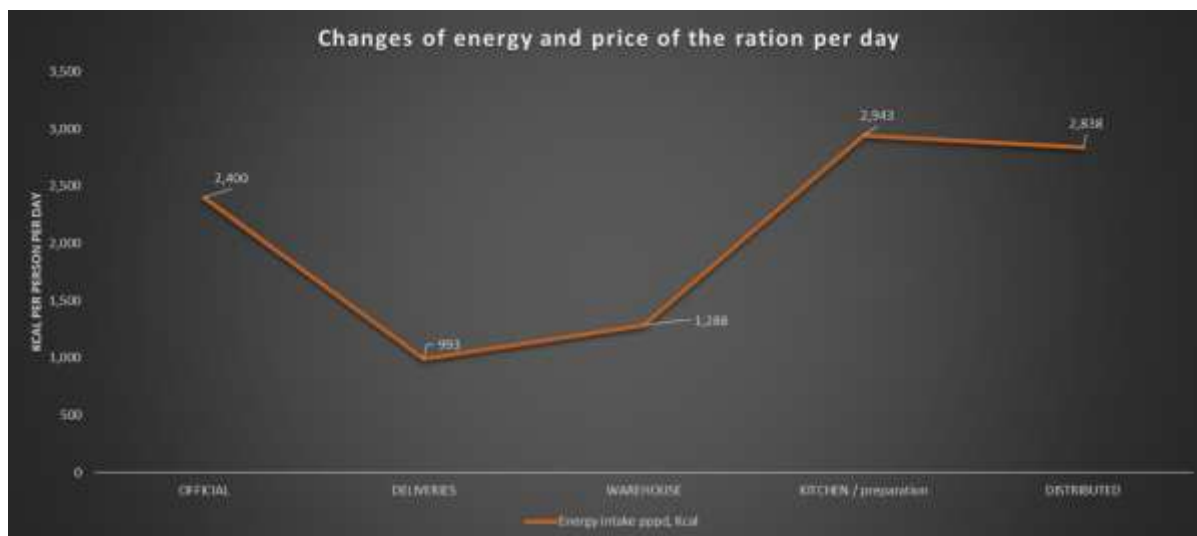


Figure 1: Changes in the energy of the ration at different steps of the FCA on 06.08.2023.

Challenges identified: the last amount delivered and available in stock in the store was inadequate to feed the 199 inmates for 2 months in terms of energy requirements. This means food will be compromised to sustain until the next stock arrives, which is very detrimental to the prisoners' health.

Nutrition content of the prison ration.

The ideal prison daily meal plan and daily menus should be designed to provide a minimum of 2,400 Kcal of energy per inmate per day as the official recommendation (ICRC, 2016a) and (ICRC, 2016b). However, according to the OC station and storekeeper, 3 meals (breakfast, lunch, and dinner) are saved in the prison every day. The daily menu is beans with posho, plus vegetables on an occasional basis. The UPS recommends: 680g of cereal, 142g of beans, 15g of salt, and 15.16ml of cooking oil per

inmate per day. This recommendation translates into 3424.4 Kcal of energy per inmate per day.

To evaluate the nutritional adequacy of the prisoners' food plates provided by the prison food ration, an exhaustive plate food measurement for breakfast and lunch – combined with dinner, was done for all the 199 inmates in Olia prison during the 2 mealtimes.

The result of the inmates' food plate measurements has revealed that 2,838 Kcal of energy per inmate per day was served by the ration on 06.07.2023 upon distribution. the 2,838 Kcal of the energy provided by the ration intended for 3 meals (but distributed in 2 servings on the assessment day) on each prisoner's plate has 80% of energy from cereals, 11% from protein, and 9% from fat as presented in figure 2.

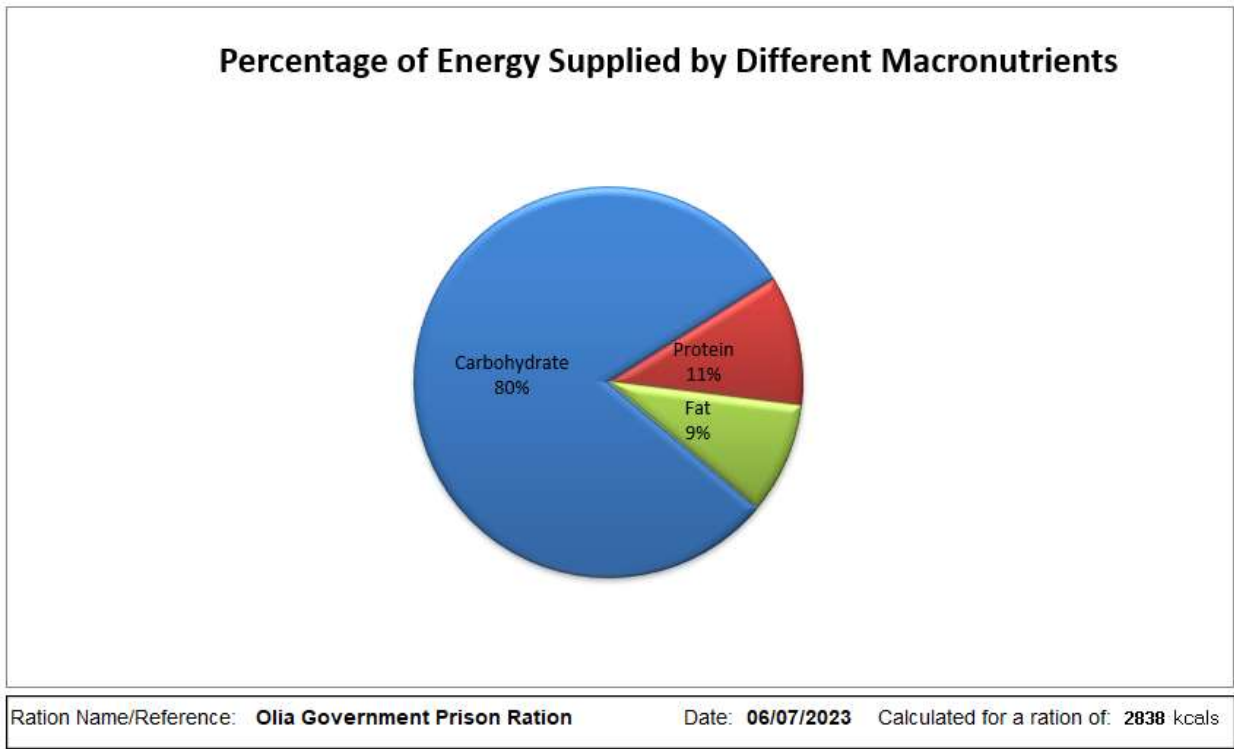


Figure 2: Energy covered by macronutrients from the ration on 06.07.2023.

Although the day's ration met the ICRC's minimal recommendation of 2,400 Kcal of energy per inmate per day, it does not meet the national recommendation of about 3,400 Kcal translated from the ingredient quantities recommended by UPS as per the explanations from the prison interlocutors during my key informant interviews with them.

The micronutrient content of the distributed food ration was low in vitamin A, vitamin B5, vitamin C, vitamin D, and vitamin E, and deficient in vitamin B12, as illustrated by figure 3. The mineral content of the ration revealed low calcium and iron in the diet as presented by the chart in figure 4.

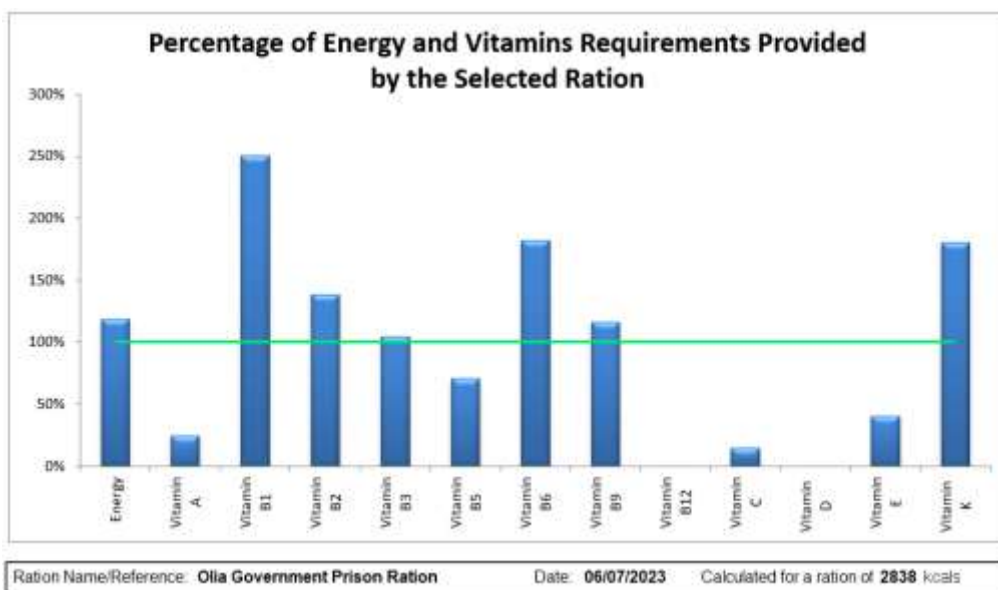


Figure 3: Percentage of energy and vitamin requirements provided by the prison ration on 06.07.2023.

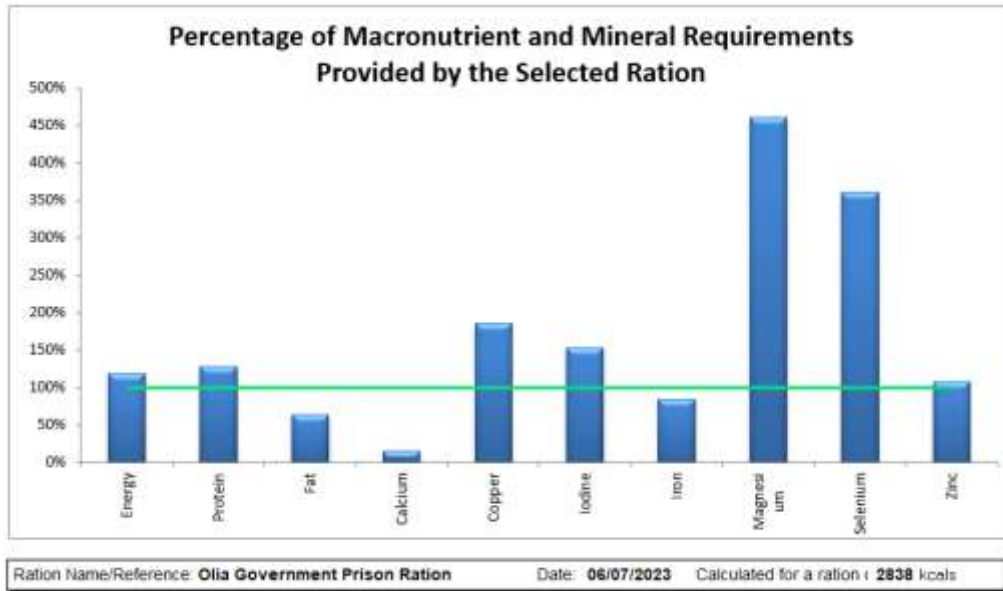


Figure 4: Percentage of macronutrients and minerals requirements provided by the prison ration on 06.07.2023.

The low concentrations of vitamins A, B5, and C could potentially predispose the inmates to the risks of nutrition-related micronutrient deficiency diseases of the above-mentioned vitamins such as ocular morbidities, beriberi, and gingival infections. While low concentration of calcium could potentially compromise the health and strength of their bones and iron deficiency in the diet is a risk factor for iron-deficiency anemia.

Nutritional status of the inmates.

The anthropometric data was with assistance from the non-uniformed prison staff (enrolled nurse) whom the researcher trained and tested on the procedures before the data collection exercise. Data collection was done over 4 days, from 2:00 pm to 4:00 pm, Monday to Friday, excluding Thursday – 06th July 2023 which was used for food plate measurements. During the anthropometric data collection, the weight and height of the inmates were measured to determine their nutritional status based on the BMI (Body mass index). These anthropometric indicators were analyzed using the SPSS version 16.0 and the

prevalence of malnutrition among the inmates in Olia government prison was determined.

A total of 179 (90%) inmates were assessed for BMI out of the total 199 inmates. Based on the WHO BMI cut-off for adults (Gibson, 2005);(Cashin & Oot, 2018); and (ICRC, 2016b), of the 179 inmates assessed, 89.4% of the inmates were normal (BMI, $\geq 18.5\text{kg/m}^2$ to 24.9kg/m^2); 9.5% were underweight (BMI, $< 18.5\text{kg/m}^2$); and 1.1% were overweight (BMI, $\geq 25.0\text{kg/m}^2$). However, there were no cases of obesity (BMI, $\geq 30.0\text{kg/m}^2$) and severe thinness (BMI, $< 16.0\text{kg/m}^2$) detected during this assessment. The prevalence of malnutrition (both undernutrition and overnutrition) among the inmates of Olia government prison is 10.6% as presented in Figure 5. This prevalence of malnutrition among the inmates is at a serious level and requires an urgent preventive intervention, complimented by curative treatment of the already malnourished inmates, and closing monitoring of the nutrition situation before it deteriorates to an alarming level.

A Pie Chart Showing the Nutritional Status of Inmates in Olia Government Prison

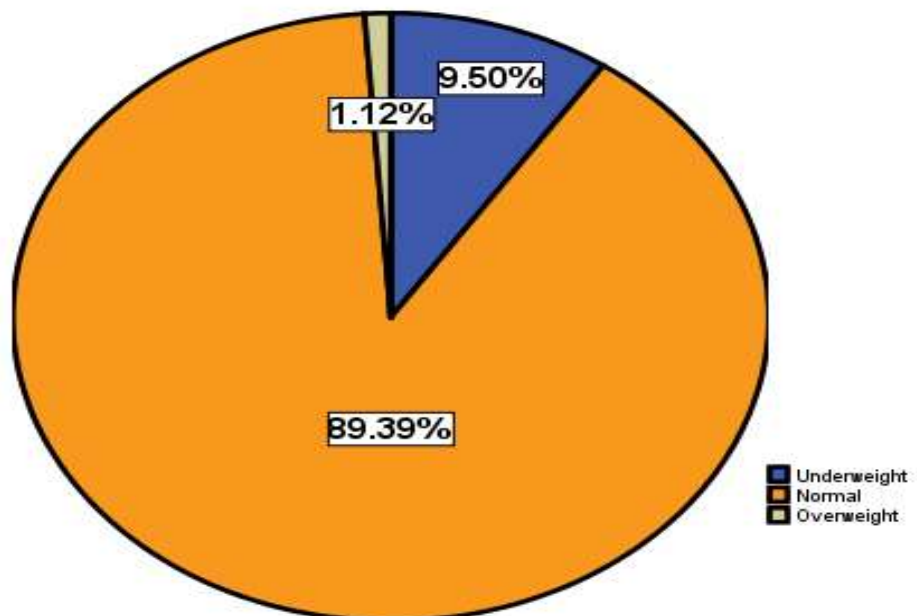


Figure 5: Nutritional status of the inmates in Olia prison.

SUMMARY OF THE FINDINGS.

Olia government prison has a 200-bed capacity. However, there were 199 inmates at the time of this assessment, and the study was able to reach 179 inmates for anthropometric measurements and 199 inmates for food plate measurement out of the 199 inmates. The response rate is 100% for food plate measurement and 89.9% for anthropometry. The prison is composed of 100% male inmates. None of them was underage (below 18 years old). The majority of the inmates are in their youthful age, 18 years to 45 years old, 97.2% (174 inmates out of 179), 2.8% (5 out of 179) were young, and none were in the age bracket greater than 65 years old. 85.5% (153 inmates) of the 179 inmates surveyed were Ugandans, while 14.5% (26 inmates) were foreigners from neighboring countries.

The prevalence of malnutrition (both undernutrition and overnutrition) among the inmates is at 10.6%. However, there were no cases of obesity (BMI, $\geq 30.0 \text{ kg/m}^2$) and wasting (BMI, $< 16.0 \text{ kg/m}^2$) detected among the inmates during this assessment.

For the nutrition adequacy of the prison food ration, food plate measurements were done for all the 199 inmates present, these were done for both breakfast and combined (lunch and dinner). The result of the nutrient content analysis of the ration has revealed an adequate amount of energy intake (2,838 kcal), meeting the minimal energy requirement of 2,400 kcal per inmate per day. However,

the fat content of the diet, 9% did not meet the threshold requirement of 15-30% of energy from fat. The micronutrient content of the ration was low in vitamins A, B5, and C, and minerals, like calcium and iron.

The qualitative food chain system analysis result has shown an acceptable/moderate efficiency and effectiveness of the prison food chain operation. There was no report of food shortage in the last 2 months before the assessment. There is a food/welfare committee that manages all food-related issues, this is constituted of both the inmates and prison officers. The supply system is reliable with no logistical constraints reported and communication back and forth between the lower and higher authority at the headquarters is smooth. Food deliveries are done with vouchers and on-spot stock verification is done by the food committee, and any issues are documented and reported immediately to the headquarters. Although there is no food budget at the station level, there is a budget for cooking fuel and petty cash which can be used for soaps and detergents. However, the quantity of the last food supply was not sufficient to feed the current 199 inmates for the 2 months planned (there remained 52 days to go on the assessment day) as reported by the storekeeper, there is no adequate vegetable in the diet, no cooking oil, and local production of vegetable is only restricted to rain season causing meaning there is lack of vegetables in the diet during dry season.

The food storage facility is a permanent structure, and food stuffs are stacked off the floor and away from the wall, daily inventory is documented in the ration ledger book. Documentation needs to be improved by initiating the use of stock cards and the purchase of a good digital weight scale for the store. The prison management should also consider using pallets, especially plastic pallets for stacking foodstuffs. Arrangement of foodstuff in the store should apply the FIFO approach, far away from the wall (6 inches) and off the floor (6 inches).

Via observations and practical measurements of food plates with a kitchen weight scale (500g capacity, 1g precision), the distribution was fair and just, with all the inmates receiving averagely the same food. Also, the low energy change from the preparation to distribution phase is recommendable, and it reflects lower risks of food loss/theft or food diversion or being served to the wrong people (unplanned), e.g., the warders/wardress other than the inmates themselves.

Overall, the prison food chain operation is moderately effective and efficient, the nutrition content of the prison food is adequate in terms of quantity but insufficient in quality, and the prevalence of malnutrition among the inmates is at a serious threshold with the risk of deteriorating to triple burden malnutrition if timely interventions are not carried out.

CONCLUSION.

Conclusively, the FCA result showed an adequate food intake (2,838 Kcal) by the inmates compared to the ICRC's 2,400 Kcal per inmate per day recommendations, but insufficient in quality.

The prevalence of malnutrition (underweight and overweight) is significant and requires urgently both preventive and curative actions to prevent the situation from deteriorating further and prevent nutrition-related morbidities.

The food chain operation is moderately effective and efficient with acceptable energy changes in the day's ration. However, adequate stocks should be calculated based on the right recommendations, the number of inmates, and the duration to avoid compromises on the quality and quantity of food being served to the inmates. Food storage conditions need to be improved, by purchasing a digital weight scale of 200kg capacity, plastic pallets, and introducing the use of bin cards in the food store.

LIMITATIONS.

There were some security restrictions by the prison authority on entry with mobile phones and time limitations for the data collection despite the researcher's

dialogue and negotiation with the prison authority and obtaining of the letter of authorization from the commissioner general in the prison headquarters, ministry of internal affairs, Kampala.

The inability of cross-sectional descriptive study design to assess the incidence and to make a causal inference.

RECOMMENDATIONS.

Based on the findings of this study, and from the saying of Hippocrates: "May thy food be thy medicine, may thy medicine be thy food", the study recommends the following actions to the various stakeholders along the prison chain system:

For the policy makers (Members of Parliaments, Ministry of Internal Affairs, the Judiciary, Uganda Prison Services),

Uganda should prioritize nutrition in detention or prisons on the national development agenda to achieve its vision of 2040.

Increase the annual prison food budget to ensure prisoners are served nutritionally adequate foods in terms of quality and quantity.

Establish or lobby for partners for malnutrition treatment facilities in the prisons and capacity-building treatment of the existing nutritionists & dieticians on nutrition in detentions.

The Office of the Auditor General should consider conducting value-for-money audits in the prison food chain for accountability and improvement in service delivery in this setting,

For Commissioner General Uganda Prisons Services:

Consider creating a nutrition unit in the Uganda Prison Services (UPS) Headquarters which should then be cascaded down to the station level,

Recruit more non-uniformed nutrition technocrats (nutritionists and dieticians) into this unit to improve nutrition security for this vulnerable population across the country,

The prison food budget should be publicly accessible and decentralized to station level for easy management and transparency in the procurement process, while also considering context-specific challenges and cultural food preferences,

In collaboration with stakeholders, develop new detention-specific national nutrition guidelines and recommendations for nutrition in detention/prisons, i.e., energy requirements (Kcal), meal plans, daily menus, and quantification of each ingredient. This should be made

accessible to interested persons, students, and academicians.

Add multiple micronutrient paste (QBmix™) to the list of dry foods to supplement the prison diet already in micronutrients. This will prevent micronutrient deficiency—related diseases.

Allocate money from the overall budget to establish small ruminant and poultry farms in the prisons to increase the prisoners' intake of animal-source proteins which is lacking in the current diet.

For Olia government prison, OC station:

Print out and display on the walls of the kitchen and food store the nutrition guidelines and recommendations for prisoners to ensure clarity and transparency,

Renovate the food storeroom, ensure ventilation in the room, and purchase plastic plates,

Buy an appropriate (logistic) digital weight scale with adequate surface and 200kg capacity.

Provide the cooks with kitchen protective wear like safety boots or gumboot, heavy-duty gloves, and hair cover to prevent work-related hazards and promote food safety.

Buy food coolers (food flasks) of 45-liter capacity for easy transportation during distributions and to keep food hot for a longer time,

In collaboration with the district health team and with support from non-governmental organizations (NGOs) or UN Agencies, consider organizing hygiene and food safety training sessions for the cooks and the prison officers to disseminate on basic nutrition and improve their personal and food hygiene, and avoid outbreak of food-borne illness or infections in the prison,

Speed up the construction process of the new kitchen building, while factoring in provisions for a worktop, kitchen sink, water tap, and drying rack in and/or around the new kitchen building,

Together with the cooks and storekeepers, the OC needs to determine the conversion factors for the different foods on the prison menu and buy standard scooping tools for distributing the cooked foods.

For Olia government prison, storekeeper.

Store foodstuffs 6 inches away from the wall, 6 inches above the floor.

Follow the first-in, first-out (FIFO) approach in foodstuff arrangements in the store.

Use of stock/bin cards to ensure monitoring of expiry date, accurate daily documentation, and easy tracing of food origin from the batch/lot number in case of issues.

Carry out daily cleaning of the food storeroom,

Weigh the vegetables harvested from the prison gardens, document them daily, and ensure that each prisoner can get at least 200g per prisoner per day as the standard nutrition recommendation.

Avoid too long cooking, it destroys the nutrients in the food, especially vitamins.

SUGGESTION FOR FURTHER STUDY.

Due to limited resources including financial, human, and time, the study was conducted in the Olia government prison facility. Therefore, the researcher recommends that a more comprehensive, multi-layered (from top to bottom approach) prison food chain assessment/analysis (FCA) needs to be conducted in the various government prison facilities across the country to estimate the nutritional adequacy of the prison ration and the monetary value associated with prison food loss/waste. This will serve as a benchmark for value-for-money monitoring, official and academic reference literature on the prison chain system in Uganda, and promote food and nutrition security amongst these vulnerable populations in the prisons.

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ACRONYMS.

BMI: Body Mass Index
EU: European Union
FGD: Focus Group Discussion
GoU: Government of Uganda
GTZ: German Technical Cooperation
ICRC: International Committee of Red Cross
KII: Key Informant Interview
MoFP: Ministry of Finance and Economic Planning
MUAC: Mid-Upper Arm Circumference
OAG: Office of the Auditor General
OC: Officer-in-Charge
PoD: Places of Detention
UPS: Uganda Prison Services

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