

**DIETARY HABITS AND NUTRIENT INTAKE AMONG ELDERLY PERSONS IN
ADJUMANI DISTRICT**

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DECLARATION

DECLARATION

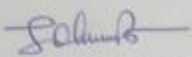
I, **Adibaku Francis (19/U/2554/MFN/PS)**, hereby declare that the content of this dissertation is my original work and that it has never been submitted for the award of a degree in any University or institution of higher learning.

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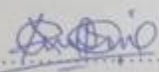
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DEDICATION

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ACRONYMS

UNDESA:	United Nations Department of Economic and Social Affairs
UBOS:	Uganda Bureau of Statistics
SNAP:	Supplementary Nutritional Assistant Program
DHO:	District Health Officer
GIT:	Gastro Intestinal Tract
HIV:	Human Immunodeficiency Virus
AIDS:	Acquired Immunodeficiency Syndrome
SPSS:	Statistical Package for Social Sciences
FAO:	Food and Agriculture Organization
FFQ:	Food Frequency Questionnaire
UNDP:	United Nations Development Programme
UN:	United Nations
UNHS:	Uganda National Household Survey
RDA:	Recommended Daily Allowance
TB:	Tuberculosis
P:	P-value
Vit:	Vitamin
SAGE:	Social Assistance Grants for Empowerment
SDGS	Sustainable Development Goals
UDHS:	Uganda Demographic Health Survey

ABSTRACT

Globally prevalence of malnutrition among elderly persons is alarming and it's even worst in developing countries due to poor dietary habits and low nutrient intake.

The overall objective of this study was to assess the dietary habits, energy and nutrient intake among elderly persons in Adjumani district. Specifically, the study determined the dietary habits, energy and nutrient intake adequacy among elderly persons and associated social and health factors. This study employed a cross-sectional survey design involving 246 elderly persons. Data was collected using individual household semi- structured questionnaires. Results showed that elderly persons had moderate dietary habits with majority consuming cereals, roots and tubers and pulses with less or no consumption of meat, milk and eggs. Majority of the respondents had two meals per day with medium dietary diversity score (DDS of 4.54 ± 1.11). Results for dietary intake adequacy indicated that RDA for most of the micronutrients were met although intake of iron was above RDA but within upper tolerance limit while intake of Vitamin A and B₁₂ were below the RDA. The intake of energy was below RDA and lipids intake was below RDA for male elderly persons although intake of carbohydrate was above the RDA. Intake of protein was adequate among male and low for female elderly persons. Calcium intake was below the RDA among the genders. The results also indicated that gender, living status, level of education, marital status and income level were among the social predictors of dietary habits, energy and nutrient intake ($p < 0.05$). The results also revealed that hypertension, dental illness and eye disease were the health predictors of dietary habits, energy and nutrient intake of elderly persons ($p < 0.05$).

There is need for more sensitization on good nutrition, prioritization of geriatric health management and deliberate nutritional intervention to target elderly persons.

Key words: *dietary habits, nutrient, elderly person*

CHAPTER ONE

INTRODUCTION

1.1 Background

The population of elderly persons is increasing at a very rapid rate all over the world. It is projected to reach 2.1 billion in 2050 (Cheng *et al.*, 2020). The proportion of elderly persons in Uganda is estimated to be 4.2 % while that of Adjumani District is 3.1% (UBOS, 2014). The rapid increase in the population of elderly globally comes with nutritional challenges and consequently poor health outcomes (Chang *et al.*, 2019). Globally, there is increasing prevalence of malnutrition among elderly persons with about 13–78% of the elderly persons suffering from malnutrition due to poor dietary habits and nutrient intake (Abate *et al.*, 2020). In developed countries the prevalence of under malnutrition among elderly persons is also on the rise with countries such as Italy, Iran, Netherlands and Germany recording 26%, 10.3%, 18.3% and 20.1% prevalence respectively (Agbozo, Amardi-Mfoafo, Dwase & Ellahi, 2018). On the other hand, prevalence in developing countries nearly doubles that of developed countries. The prevalence of under nutrition among elderly persons varies across several countries for instance it ranging from 62.2 and 44.6% in Ghana for men and women respectively, 75% in Sierra Leone to 50% in Burkina among others (Audain *et al.*, 2017). In the Lake Victoria Basin in East Africa, 26.4% of the elderly persons are underweight while 15.3% are overweight or obese (Agbozo *et al.*, 2018). Recent studies conducted in most of the African countries reported that elderly persons' diets mainly consist of carbohydrates and green leafy vegetables with very low intake and frequency (Maila, Audain & Marinda, 2021; Legesse, Abebe & Woldie, 2019). The prevalence of malnutrition of adult population of West Nile region where Adjumani district has been grouped is

also high where, 26.8% and 1.6% of men are undernourished and obese while 16.5% and 1.6% of their women counterpart are undernourished and obese respectively (UDHS, 2016).

Elderly persons in Adjumani district achieve their food security through own production and access from the market both within and outside the district. The main available food stuffs consumed in the district are; vegetable (onion, tomatoes, sukumawiki, okra, egg plants and cabbages), maize, sorghum, rice, cassava, sweet potatoes, yams, millet, beans, groundnuts, simsim, fish, meat and meat products (Longley *et al.*, 2023).

Elderly dietary pattern and nutrient intake is largely influenced by physiological, psychosocial, poor health condition and economic factors (Byker *et al.*, 2017). This indicates that underlying factors aforementioned significantly dictates nutritional outcomes of the elderly however, it is important to note that these factors vary geographically. They undergo physiological changes such as decline in body functions and tissue mass, loss of organ mass that results in reduced organ-related functions and metabolic processes, loss of bone mass, profound effects on the immune system and associated higher risk and prevalence of many chronic diseases (Elmadfa & Meyer, 2020). These risk factors may contribute to poorer nutritional health given the fact that avoidance of certain foods due to physiological changes and chronic illnesses including associated dietary restrictions can result in poorer food choice that undermines the quality and quantity of nutrient intake among elderly persons (Suke, 2020). While calorie needs decrease with age, vitamins and minerals need remain the same or some increase to compensate for impaired absorption and maintenance of physiological function (Clegg & Williams, 2018). In most cases the need for some nutrients like vitamin D and calcium increases among elderly persons (Wimalawansa, Razzaque & Al-Daghri, 2018).

Thus, older persons face the challenge of meeting their nutritional needs and are vulnerable to malnutrition and health complications, given the physiological changes that they experience. The physiological changes also affect the choices of foods consumed by the elderly as certain foods tend to be avoided while others are prioritized (Kyomuhendo & Adeola, 2021). Furthermore, some of these foods that are preferred by the elderly may not be easily affordable and accessible by most of them especially those from resource constrained settings due to low purchasing power (Mills, 2021). However, most of the nutrient intake and dietary habits related studies of older persons have been conducted in hospital and institutional home settings while the dynamics of elderly food choice and dietary habits vary from location to location due to different foods available (Chalerm Sri *et al.*, 2020). This implies that explicability and adoption of recommendations from such studies becomes difficult in household and community settings. Therefore, it is important to conduct studies of dietary habits among elderly in household settings since it will provide effective strategies relating to diet nutrient intake among older persons.

1.2 Problem statement

There are streamlined programs such as Supplementary Nutritional Assistance Program (SNAP) that specifically cater for the needs (physiological and nutritional needs) of elderly persons in developed countries unlike in developing countries (Guttermann, 2022). Most elderly persons in developing countries are unlikely to meet their nutritional needs due to factors such as responsibility of taking care of their grandchildren, low or lack of income, impaired senses of taste and smell, reduced physical activity, numerous chronic diseases, loneliness and loss of a partner despite the fact that their productiveness has significantly reduced (Ellis, 2019). Consequently, elderly persons are predisposed to high risk of disease infection and low food intake which affects their nutritional status and lead to poor health and nutrition outcomes.

Majority of elderly persons in Adjumani district live in poor conditions with uncertainty of meeting their nutrition needs which is worsened by poor health and limited attention from caretakers.

Most nutritional interventions in Adjumani district are intended for infants & young children, pregnant and lactating mothers and rarely targeting the elderly persons.

There have been very limited nutritional studies on elderly persons and yet they are more vulnerable due to physiological and numerous health complications thus exposing them to malnutrition and worsening health condition.

Therefore, this is the basis for undertaking studies on dietary habits and nutrient intake of elderly persons in Adjumani district.

1.3 Objectives of the study

1.3.1 General Objective

To investigate the dietary habits and nutrient intake among elderly persons aged 60 years and above in Adjumani District

1.3.2 Specific Objectives

- i. To assess the dietary habits of elderly persons aged 60 years and above in Adjumani District
- ii. To determine the energy and nutrient intake adequacy of elderly persons (60 years and above) in Adjumani district
- iii. To assess the health and social factors influencing dietary habits and nutrient intake adequacy of elderly persons (60 years and above) in Adjumani District

1.4 Research Questions

- i. What are the dietary habits of elderly persons 60 years and above in Adjumani District?
- ii. What are the levels of energy and nutrient intakes of elderly persons in Adjumani District?
- iii. How do health and social factors influence dietary habits and nutrient intake of elderly persons in Adjumani District?

1.5 Conceptual framework

This study is premised on the fact that dietary habit influences dietary frequency, food fussiness and dietary diversity while energy and nutrient intake is determined by dietary quantity and quality. Dietary habits, energy and nutrient are all influenced by social and health drivers like age, gender, marital status, income level, occupation, living arrangement, chronic diseases, health services and oral health. (Senya, 2017).

Dietary intake and habit results in poor health outcome through manifestation of under malnutrition. Further it also result into over nutrition which consequently may lead to non-communicable diseases (hypertension, type II diabetes). It also exacerbates the already poor health condition of elderly persons as low intake of nutrient compromises body immunity.

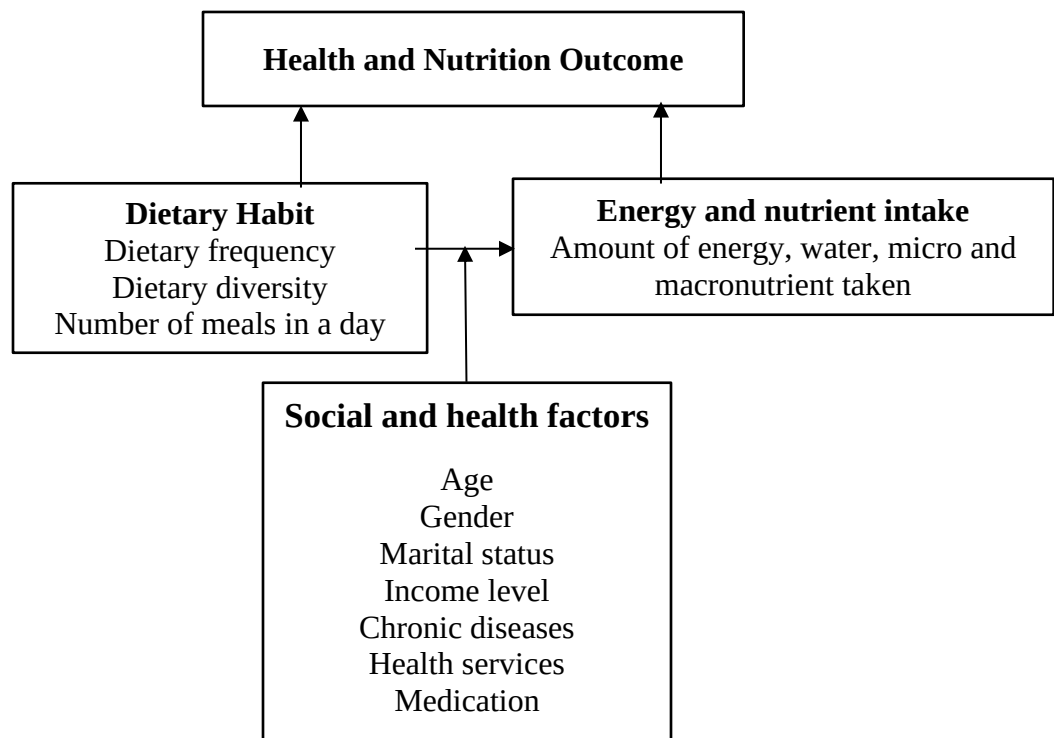


Figure 1: Conceptual framework for dietary habits and nutrient intake of elderly persons

1.6 Justification of the study

Elderly persons have different dietary pattern and nutrient requirement due to physiological changes contrary to people of other age categories which makes them vulnerable to malnutrition and poor health outcome. Information on the dietary habits and nutrient intake is required for effective identification of nutritional needs and design of appropriate intervention to meet the nutritional needs of elderly persons in Adjumani district.

1.7 Significance of the study

The result of the study will be useful for government of Uganda and some non-state actors in designing interventions that will address nutritional challenges of elderly persons thus leading to achievement of SDG two (End hunger, achieve food security and improved nutrition and promote sustainable agriculture) and implementation of food and nutrition policy of Uganda 2003.

The finding of this study will help the health sector in paying special attention in management and improvement of health complications of elderly persons resulting in attainment of SDG three (Ensure healthy lives and promote wellbeing for all at all ages) and implementation of national health policy of Uganda 2010. Additionally, the findings of the study will contribute to knowledge advancement on the nutrition of elderly persons in developing countries.

1.8. Operational definitions

Dietary habits: These are the food choices preferred by persons in their daily life

Nutrients: These are chemical compounds in food that are used by the body to function properly and maintain health.

Elderly persons: These are persons 60 years and above (United Nations, 2017).

Nutritional status: Nutritional status has been defined as an individual's health condition as it is influenced by the intake and utilization of nutrients.

Nutrient adequacy: This is the level of intake of an essential nutrient in relation to the nutrient requirement for adequate health, which is expressed as the percentage of recommended dietary allowance.

Social factors: These are things that affect someone's lifestyle

1.9 Dissemination plan

The result of this study will be disseminated to District health Department specifically to the office of District Health Officer (DHO) for their use in health service delivery to elderly persons.

The findings of the study will also be shared with development partners who are involved in implementation of nutrition and health programs especially for elderly persons.

Additional dissemination will occur through presentations such as locally, nationally, regionally and through articles published in peer review journals.

Finally, the result of this study will be shared with the community in the study area and the District at large through community sensitization meetings.

CHAPTER TWO

LITERATURE REVIEW

2.0 Health and nutritional status of elderly persons in developing countries

Health status of elderly persons is based on better nutrition. Unfortunately in most Sub-Saharan countries, health services delivery are not well suited for elderly persons which should have taken care of the nature of their vulnerability (Kelly, Mrengqwa & Geffen, 2019). It's worth noting that older persons with compromised nutritional outcomes seek medical attentions frequently and in fact they over stays in the hospital once admitted (Makwana, Ram & Khambhati, 2020). Poor nutritional status is closely linked to worsening body functions, poor immunity, diminishing muscle activities, chronic illness related to weak bones and poor memory. This enormous underlining conditions predispose the seniors frequent hospital admission and unexpected death (Abdelwahed, Algameel & Tayel, 2018).

Elderly persons in most developing countries are faced with high rate of malnutrition especially under nutrition. According several studies done in some of these countries, it was discovered that cases of under nutrition still remains high. Taking countries such as Democratic Republic of Congo and Central African Republic 38% and 26% of the older persons were undernourished and whereas in Central African Republic, 8.8% were under nourished and 14.6% were obese (Jésus *et al.*, 2017). This situation is even worse among HIV/AIDS patients as malnutrition is exacerbated by other additional disease burden like diabetes, anemia and hypertension (Ciccacci *et al.*, 2019). According to Maila, Audain and Marinda (2021), cases of malnutrition is triggered by several factors among which chronic diseases are the most prominent ones. They are faced with complex health complications such as non-communicable diseases (hypertension and diabetes) including arthritis which causes rampant frailty among them.

Furthermore, several studies indicated alarming prevalence of malnutrition. El-Desouky and Abed (2017) in their studies also revealed that having numerous health conditions coupled with frequent use of medication put 35% of elderly persons at risk of malnutrition. Among several health conditions, elderly persons are also known to suffer from multi-morbidity like hypertension, visual impairments and diabetes which are responsible for altering their health and nutritional status (Sourtzi *et al.*, 2019). It's likely that an increased Non-Communicable Disease cases among elderly persons may equally pose a significant pressure on the health services in developing countries especially Sub-Saharan Africa due to long hospital admissions among older patients (Audain *et al.*, 2017). Interesting studies done in Baghdad indicate that 46% of elderly persons who were at risk of malnutrition were actual on multiple drugs. In the study same study, depression and impaired cognition were critical in determining the nutritional outcome elderly persons as their dietary intake is directly influenced by those conditions (Jamil, Salih, Sadiq & Shaker, 2021).

According to Uganda Demographic Health Survey of West Nile region, 26.8% and 1.6% of men are undernourished and obese while 16.5% and 1.6% of their women counterpart are undernourished and obese respectively (UDHS, 2016).

2.1 Dietary habits of elderly persons

The concept of dietary habits involves aspects of food choice and preferences. It involves having interest for some food as a result of the taste. This makes elderly persons to have specific choices of food due to social and health aspect (Arthur, Tawiah & Turkson, 2020). The desire to have specific preference for certain food is highly related to the feelings and physiological factors of the elderly persons. It's a common phenomenon among elderly persons to have worsening health

conditions due to poor dietary pattern which has great contribution to low nutrient intake among elderly (Chalermisri *et al.*, 2020).

Dietary habits and nutrient intake are key determinants of wellbeing of elderly persons. Healthy aging coupled with maintenance of body function, enhancement of immunity and healing are reinforced by a high-quality diet that meets micronutrient and macronutrient requirements (Lorenzo *et al.*, 2017). Different scholars indicated that food preferences of elderly persons could be explained by biological processes taking place in their body, emotional and societal variations which are associated with aging of individuals (Yannakoulia *et al.*, 2018).

In many countries, nutritional interventions targeting adults is closely associated with that of older persons. It should be noted that interest of such interventions is to have healthier diet for elderly persons where most of the carbohydrate sources are derived from whole grains while promoting the consumption of vegetables and fruits (Chea & Mobley, 2020). Previous studies indicated that a dietary habit has serious implication on the mortality of older persons. Consumption of healthy foods comprising mainly of vegetables, fruits and meat contributes to better health of elderly persons (Zhou *et al.*, 2020).

In related studies, there was improvement in cognitive ability including immerse decline in the mortality rate of elderly persons due to consumption of fruits and (Stamatakis *et al.*, 2019; Low *et al.*, 2019). Xu *et al.*, (2020) in their study reported frequent consumption of fish is important in improving the memory status of older persons. This implies that elderly persons should be encouraged to consume fish as part of sustaining healthy dietary habits. In many circumstances women have good dietary habits as opposed to their male counter parts. It's a common practice

especially in many African countries women are involved in making food choices for the households as such they end up consuming healthier diet (de Almeida Roediger *et al.*, 2019).

Frequency of food consumption and food fussiness are some of the most common issues regarding elderly persons' diet. Previous studies indicated that most of the older persons had less number of meals in a day apart and they avoided some foods in presence to others (Agbozo *et al.*, 2018). It should be noted that consumption of different food sources by elderly persons varies across different locations with some consuming more vegetable and carbohydrate sources with limited consumption of protein sources (Maila, Audain & Marinda, 2019).

The nutritional problems of elderly persons are mainly attributed to changes in dietary habits as a result of vulnerability nature and biological changes which is associated with elderly persons (Yannakoulia *et al.*, 2018). The elderly persons usually skip some of the meals for the day which eventually result into negative impact on their nutritional and health status (Almoraie *et al.*, 2021). Elderly persons usually prefer eating small portion of food although frequent and in most cases they like shifting their main meal from evening to noon as they feel more active in the afternoon than during the evening (Arthur *et al.*, 2020). The time and frequency of dietary intake changes among the elderly. Many studies conducted in West Africa indicate that most of the elder persons consume foods twice a day with varied proportion sizes depending on availability of the food (Muhammad *et al.*, 2020).

Several studies revealed different dietary habits of elderly persons which had effect on their nutrient intake. According to studies done in Kenya, elderly persons skipped some of their meals, others have their diets restricted due to medical condition or allergies, most of them had poor appetite and consumed two meals per day (Kamwana, Mapesa & Oirere, 2021).

2.2 The energy and nutrient intake adequacy of elderly persons

Intake of adequate levels of energy and nutrient intake is a corner stone in promoting healthy living among the elderly population (Johnson, 2021). Acceptable levels of nutrients are achieved by eating right amount of food. The adequate nutrient in the body is known to be involved in improving the much needed immunity, maintenance of bone health and better memory of older persons (Baugreet *et al.*, 2017). However, elderly persons often times fail to ingest an adequate amount and quality of food to meet their energy and nutrient needs as they are faced with low nutrient absorption capacity, functional impairments including poor oral health (Landi *et al.*, 2016).

Elderly persons have different nutritional needs as compared with others. In most cases the requirement for some nutrients tends to decrease while some especially micronutrients increases or remains the same to cater for the challenge of absorption which would have dire consequences on their health (Meiselman, 2020; Clegg & Williams, 2018). Despite of this known scenario, nutrients and energy intake among this age category changes from one location to another with some indicating adequate intake while others showing declining intake. Other studies showed that elderly persons who had adequate consumption of cereals, sweet potatoes, pulses, fruits and vegetables, fish and meat, eggs and dairy were able to derive the required amounts of fibre, iron, zinc, vitamins, potassium, protein, and calcium (Yokoyama, Sasaki & Sato, 2019). Contrary, consumption of smaller portion size, reduction in consumption of dairy products, meat and fish with increased preference for sweet items by elderly persons contributes significantly to deficiency of micronutrients such as folate, riboflavin, and vitamin B6 which are needed for various functions in advanced age (Gillies *et al.*, 2020).

Furthermore, several studies reported low dietary diversity and frequency as contributing factors to inadequate nutrient and energy intake. Cano *et al.*,(2019) in their study showed that low diversity and frequency of consumption of food sources like vegetables, fruits, cereals, dairy products legumes, meat, fish, eggs and nut was responsible for inadequate intake of most of the micronutrients contrary to the recommended daily allowance of elderly.

According to studies done in Spain most of the micro and macro nutrients taken by elderly person were inadequate as compared to the recommended daily allowance. This intake greatly varies among female and elderly persons and the different age categories (Senec, Ishnoo & Jeewon, 2022). In several studies increased frequency consumption of food is closely linked to adequate levels of nutrients. In terms of frequency of consumption, having all the required number of meals is of great importance especially ingestion of breakfast and snacks in between meals results in to adequate levels of both micro and macro nutrients (Johannesson, Rothenberg, Gustafsson & Slinde, 2019). Notwithstanding other several reasons for low nutrient intake, selective food choices due to dietary restrictions, medication and cultural beliefs is also known to result in lower macro and micronutrient intake among elderly persons (Castaneda, Redwood & Thompson, 2018).

2.3 Factors influencing dietary habits and nutrient intake adequacy of elderly persons

2.3.1 Social factors influencing dietary habits and nutrient intake adequacy of elderly persons

Dietary habits and nutrient intake are influenced by several factors among which include socioeconomic status (Chae *et al.*, 2018). Better socio economic status of elderly persons has

great influence on the consumption of healthy food more especially that containing low fats and whole grains (Chukwujekwu, 2023).

Reduction in portion sizes by elderly persons is attributed to anorexia of age, while eating with family members increase dietary intake as revealed in previous studies (Asamane, Greig, Aunger & Thompson, 2019). Evidence suggests that elderly persons with a lower education level and income including living alone is a risk factors for a lower level of protein intake due to illiteracy and low purchasing power (Hung, Wijnhoven, Visser & Verbeke, 2019).

Other than maintenance of life, meals are viewed as an aspect that keeps household members together as meal time brings them together. Several studies indicate similar factors such as loneliness, isolation, marital status, low educational level, poor socioeconomic status, residence and loss of spouse as risk factors of low dietary diversity and frequency of food consumption among the elderly population (Besora, Llauradó, Tarro & Solà, 2020). Relatedly, household composition has a bearing on dietary habits and nutrient intake. Family separation and widowhood have also been found to be responsible for poor dietary habits and low dietary intakes. Most of elderly persons living under these arrangements cannot prepare food for themselves (Avgerinou *et al.*, 2019).

In most developing countries especially Sub-Saharan Africa, elderly persons mostly women are involved in taking care of their grandchildren more especially orphans who lost their parents to HIV/AIDS (Ntuli & Madiba, 2021). This burden makes it very difficult for the elderly persons to have adequate intake of nutrients because they are experiencing an array of financial and psychological strain that makes food access very difficult (Avgerinou *et al.*, 2019). Additionally, the elderly persons are also engaged in taking care of the sick. They perform intensive tasks like turning the sick, supporting them to toilets and outside the house. Such heavy

tasks has bearing on their health as they do not get enough time to rest and sleep which ultimately affect their appetite leading to compromised nutrient intake (Neema, 2020).

Elderly persons are said to be more vulnerable due as a result of increased dysfunction, both physiological and psychological impairment ultimately making them vulnerable to frailty and unfavorable environmental condition (Bozzaro, Boldt & Schweda, 2018). In most Sub-Saharan African Countries, elderly persons mainly depend on their children and relatives for care. Despite of this, they are neglected as most of their children move to urban areas leaving their elderly parents to take care of themselves where they cannot adequately provide food for themselves hence having as negative consequence on nutrient intake (Kaushik, 2020).

2.3.2 Health factors influencing dietary habits and nutrient intake adequacy of elderly persons

Aging is commonly connected with an acceleration of a number of chronic illnesses such as arthritis, depression, diabetes, respiratory infection, dementia and stroke among others (Maresova *et al.*, 2019). These conditions tend to lower appetite leading to lower dietary intake and eventual impairment of nutritional status (Tek & Karaçil, 2018). Better prognosis of elderly conditions requires timely treatment of ailment among the elderly population as such most of them given their poor health status undergo medication. Evidence has shown that elderly persons who are on medication for various medical conditions have reduced appetite which limits nutrient intake (Senec, Ishnoo & Jeewon, 2022).

Several health related factors are believed to be responsible for altering dietary habits and nutrient intake. Difficulty in walking or movement and poor oral health are some of the most prominent conditions in elderly persons which makes it difficult for them to access and ingest food due to challenge of chewing properly (Hung *et al.*, 2019; Cichero, 2018). Aging comes with

several conditions which could alter the body shape from both clinical and functional aspects. Moreover poor oral health complication as a result of losing teeth and poor dentures can aggravate loss of appetite. Elderly persons with fewer teeth have challenges in meeting their dietary requirement as they cannot take adequate portion sizes (Kossioni, 2018).

It should be noted that other than several health conditions, serious health complications including irritable bowel syndrome, psychological torture including prolong hospital admission are known to affect food choices and intake among elderly persons (Avgerinou *et al.*, 2019).

Several meta-analyses revealed the consumption of highly processed foods is detrimental to the health of elderly persons (Muñoz-Garach, García-Fontana & Muñoz-Torres, 2020). In the context of African diet therefore, when right quantity of food is consumed at good frequency, elderly persons are likely to maintain and sustain healthy living.

Additionally, certain medical conditions influence food choices of elderly persons. Dietary restriction due to health complication such as diabetes and coeliac diseases pose additional threat to nutrient intake (Shakoor *et al.*, 2021). Health complications like poor eyesight, hearing impairment, poor dentition, hip fracture, cognitive impairments and coexistence of chronic diseases was found to be determinants of food selection which has a bearing on the nutritional status of elderly persons (Bakhtiari & Omidvar, 2020; Malafarina *et al.*, 2018). It yet remains unknown whether health conditions found in previous studies are responsible for altering nutrients intake and adequacy in Adjumani district.

CHAPTER THREE

METHODOLOGY

3.1 Study design and study area

A cross-sectional study design was used to undertake this study by conducting household survey. This study design was chosen because it allows data collection at single point at a time and relatively inexpensive. The participants who took part in this study were selected based on inclusive and exclusive criteria. This study involved visiting of households and interviewing elderly persons of the targeted age category.

3.2 Study variables

In this study, dietary habit was the dependent variable while energy and nutrient intake were the independent variables and social and health factors are the moderating variables.

3.3 Study area

The study was conducted in Adjumani district (Figure 2). In the District, the study was conducted in the three Sub-counties of Adropi (Lajopi, Openzinzi and Esia parish), Dzaipi (Ajugopi, Mgbere and Miniki parish) and Pakele (Fuda, Pereci and Meliaderi parish). The District was chosen because there was no previous study on dietary and nutrient intake among elderly persons conducted in the area.

Adjumani district became a fully-fledged district in 1997 after being created out of Myo. The District is situated in the north-western part of Uganda lying between latitudes 31° 24" and 32° 4" east of Greenwich line and longitudes 2° 53" and 3° 37" north of the Equator.

It borders the districts of Amuru in the south and east, Yumbe and Arua, obongi in the west and Moyo in the north and it shares international border with the Republic of South Sudan in the

northeast direction. The total land area of the district is estimated to be 3128 Sq. Kms where 46.8 Sq. Kms of the area is covered by water. Land under forest cover is approximated at 37.44 Sq. Kms and total arable land under cultivation is sq. Kms.

The main water body in Adjumani is the river Nile which is the boundary of the district with Obongi and Moyo districts in the west and north respectively. Some prominent water bodies are streams like Tete, Ayugi, Adidi and Esia. The district has moderate rainfall and temperature. The annual rainfall is considered to be bimodal ranging from 750 mm to 1500 mm.

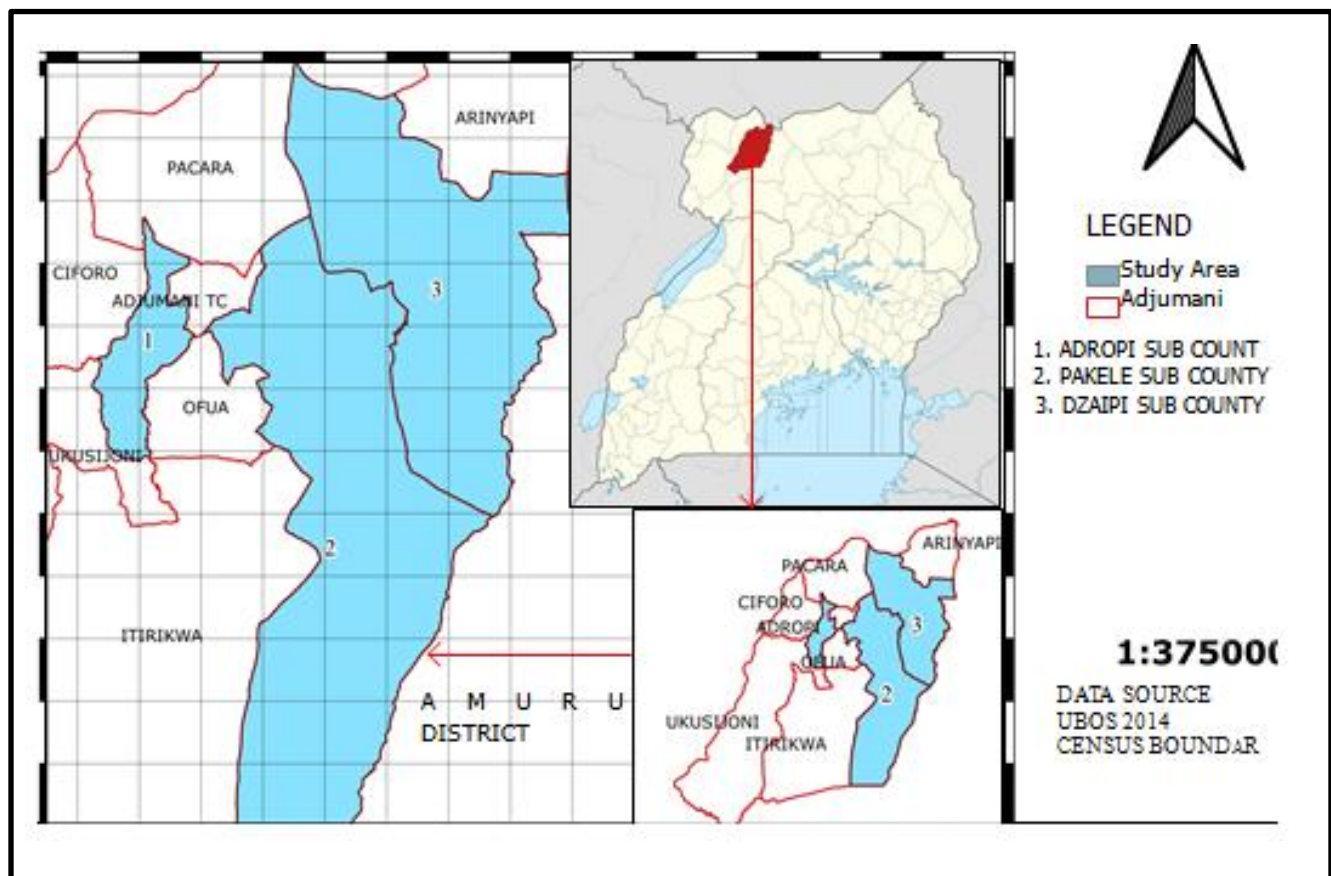


Figure 2 Map of Adjumani District showing study areas

3.4 Study population

The study targeted elderly persons aged 60 years and above living in Adjumani District. Nutrition studies in elderly persons is critical as good nutrition is considered to be fundamental in sustaining their lives given the nature of vulnerability brought about by decline in appetite and presence of numerous chronic diseases (Guigoz & Vellas, 2021).

The respondent's age was determined by the respondent or by use of their national identification cards or their caretakers. In cases where the respondents lost or misplaced their identification cards, dates of important historical and social events were applied to estimate their age.

3.4.1 Inclusion Criteria

Elderly persons 60 years and above who reside in the study location and were willing to take part in the study were included.

3.4.2 Exclusion Criteria

Elderly persons who were not willing to take part in the study were not interviewed. Also those who were weak and severely ill were not interviewed.

3.5 Sample size determination

A sample size of 246 was chosen for the study using formula of Yamane (1967). The choice of sample size was guided by National population and housing census (UBOS, 2014).

$$n = \frac{N}{1+N(e)^2}$$

Where;

n = Sample size

N = Population of target group

e = The margin error (0.05)

3.6 Sampling methods

The study used multi-stage random sampling method in order to get elderly persons who participated in the study as guided by previous studies (Biswas, *et al.*, 2018). At the District, three sub-counties with the highest population of elderly persons were selected purposively (UBOS, 2014). From each of the three selected sub-counties, three parishes were selected randomly where their names were written on pieces of paper, folded and tossed from which selection was done. The above procedure for selection was repeated to select two (02) villages per parish to form a total of eighteen (18) Villages for the study. At Village level, the local leaders were used to map the households where elderly persons 60 years and above resided. Simple random sampling procedure was used to select both male and female elderly persons from the households mapped and where elderly persons in the selected households were not present, they were skipped as guided by previous studies (Woldekidan, Haile, Shikur & Gebreyesus, 2021). Both female and male elderly persons were selected for the study. In households where the selected elderly persons were too weak or unable to answer, their caretakers were interviewed instead and in cases where they did not have caretakers, they were replaced by those who were able to answer the interview questions.

3.7 Data collection

The tool for data collection was structured questionnaire that comprised of the following sections; dietary habits, the energy and nutrient intake adequacy and health and social factors influencing dietary habits and nutrient intake adequacy of elderly persons.

Dietary habits among elderly persons were measured using Food Frequency Questionnaire as used in previous studies (Arthur, Tawiah & Turkson, 2020; Zhou *et al.*, 2020). Food Frequency Questionnaire (FFQ) is a method which is used to ask respondents about the average intake of

food over a given time. The time period for recall usually ranges from days to months and for this particular study, a period of seven (07) days was used as the elderly persons could not remember food intake over long period of time. Food frequency questionnaire helps in lowering respondent's burden of answering. In addition, it captures foods eaten rarely and tracks the frequency of consumption of foods which makes it possible to understand dietary habits over time. The questionnaire included a food list commonly eaten within the locality and elderly persons were asked to identify the food, ingredient and beverages they consumed alongside the frequency of consumption. A questionnaire consisting of twelve main food groups such as cereals, Fish and sea food, root and tubers, pulses/legumes/nuts, vegetables, milk and milk products, fruits, oil/fats, meat, poultry, offal, sugar/honey , eggs and miscellaneous were developed for the study (Rodríguez *et al.*, 2019; FAO, 2010).

Furthermore, dietary habits was assessed using 24hour recall where the dietary diversity score and number of meals consumed per day by elderly persons was determined as used in other studies (Motadi *et al.*, 2022).

To assess the energy and nutrient intake adequacy of elderly persons, an estimated 24-hour dietary recall was used with modifications as applied in previous studies (Batal *et al.*, 2021; Angeles-Agdeppa *et al.*, 2019). A 24-hour recall was chosen for this study because it assesses the actual intake of individuals, captures information on eating patterns, preparation methods of food with estimated weights consumed and the mode of administration does not affect food choice and eating pattern (Bailey, 2021; Brouwer-Brolsma *et al.*, 2020). The respondents were asked to recall and report all foods and beverages consumed including method of preparation and weight estimates over the preceding 24 hours. The recall involves the first meal in the morning till the last meal taken before waking up the following day. The estimate of the quantity of food

eaten was done through using of common household measurement materials like calibrated cups, tablespoons and digital weighing scale. To calculate energy and nutrient intakes, the estimated portion size or the amount of food taken were multiplied by the values of nutrient content in foods using food composition tables developed by Harvest plus for East and Central Uganda (Hotz *et al.*, 2012).

To assess the health and social factors that influenced the dietary habit and nutrient intake among elderly persons, critical factors known to affect dietary habits and nutrient intake among elders were drawn from previous literature and included in the questionnaire with modification. For example, health factors such as use of health services, use of medication, chronic diseases status, mental health, self-perception of health, swallowing difficulty, vision problem and chewing difficulty were added as stated in earlier studies (de Mello *et al.*, 2020; Azzolino *et al.*, 2019). Among the social factors, gender, age, employment status, income, level of education, living arrangement, marital status, feeling of loneliness, smoking, drinking alcohol and occupation were included as applied in previous studies (Besora-Moreno, Llauradó, Tarro, & Solà, 2020; Shahar *et al.*, 2019).

Data quality was enhanced through pretesting of the questionnaires in Pakele Sub-county with focus in Fuda Parish and specifically at Fuda Central Village with similar characteristics as the study area. Twenty respondents were interviewed prior to actual data collection and modifications were subsequently made on some questions that seemed to be difficult for respondents to answer. At this stage several modifications were made including but not limited to rephrasing in order to ensure they ably understand the questions. All the data collected were checked and verified on daily basis both from the field and after returning from the field for

completeness. The questionnaires were translated into local language so that the respondents could grasp the meaning of the questions.

3.8 Data analysis

Prior to entry of the data in to SPSS analytical software, it was cleaned and coded. Upon entry of the data it was analyzed using the Statistical Package for Social Sciences (SPSS) software version 22. The different sections of the questionnaire were analyzed as below; the first part contained socio-demographic and health and characteristics of the respondents which was expressed as percentages and frequencies (descriptive statistics). The second part contained information on frequency of consumption of the different categories of food over the past 7 days, number of meals consumed per day and dietary diversity score which was analyzed using descriptive statistics expressed as percentages.

The third section was about energy and nutrient intake adequacy of each respondent quantified from different food sources eaten by respective individuals over the past 24 hours based on Harvest plus food composition table for East and Central Uganda and it was analyzed using an independent T test and one sample T-test to compare actual mean intake of energy and nutrient intake among female and male respondents with RDA for different nutrients. P- Value of 0.05 was used to show statistical significance.

The last part of the questionnaire was on social and health influencing the intake of energy and nutrients of the elderly persons which was analyzed using multiple linear and Poisson regression. P- Value of 0.05 was used to show statistical significance.

3.9 Limitation of the study

1. The amount of food eaten in the last 24 hours was based on remembering the estimated quantities which is prone to memory error.

This was minimized by in depth probing and finding more information from caretakers of the elderly persons in the household.

2. The reading of the digital weighing scale was sensitive to blowing wind which could have affected the accurate reading of the final result of the measurement.

This was addressed by taking measurement at a location with minimum wind speed

3. Some respondents could not correctly remember what they consumed over 7days period.

This was addressed by cross-checking information from caretakers or one responsible for food preparation in the household.

3.10 Ethical consideration

Ethical approval of this study was attained from Gulu University Research Ethics Committee (GUREC-2021-177) (Appendix). Authorization to conduct the study in the District was obtained from the Chief Administrative Officer of Adjumani district.

The consent of the respondents was sought and the rationale for the study was explained to them before proceeding with data collection. The respondents were guaranteed of confidentiality of their information. Furthermore, during data analysis, codes were used for personal information for anonymity.

CHAPTER FOUR

RESULTS

4.1 Characteristics of the respondents

4.1.1 Socio demographic characteristics of the respondents

Table 1 presents the socio-demographic characteristics of the respondents. Majority (62.6%) of the respondents were women while their male counterpart comprised of 37.4% of the respondents. Among the respondents, most of them (56.5%) were in the age category of 60-70 years old and 43.5% of them were above 70 years old. Household sizes of the respondents (49.6%) mainly were in the range of 5-10 while a few (0.8%) were above 16. Half of the respondents (50.8%) were widowed, 41.1% were married, 6.5% of them were separated and 0.4% were single .Most (96.3%) of the elderly persons stay with other family members in their households although 3.7% of them stay alone. In terms of economic status, 93.3% of the respondents had combined Monthly household income below 57 US \$ which is equivalent of 210,900 Uganda shillings and only 6.5% earn above 210,900 Uganda shillings.

Most of the respondents attained primary education (52.4%), 34.6% did not go to school, 9.3% attended secondary education and 3.7% of them attained post-secondary education. Majorities (68.3) of the respondents were peasants, 28.9% were unemployed, 2% were pensioners, 0.4% were formally employed and 0.4 % were business persons. More than half (57.7%) of the respondents did not consume alcohol although 42.3% of them did. Most of the respondents (77.2%) of them were non -smokers although 22.8% were smokers.

Table 1: Socio-demographic characteristics of the respondents

Variables	%	Variables	%
Sex		Income level (UGX)	
Female	62.6	Above 210,900	6.5
Male	37.4	Below 210,900	93.5
Age group		Education level	
Above 70	43.5	No formal education	34.6
60-70	56.5	Post primary	3.7
Household size		Primary	52.4
1-5	42.7	Secondary	9.3
6-10	49.6	Occupation	
11-15	6.9	Business person	0.4
>16	0.8	Fully employed	0.4
Marital status		Peasant	68.3
Married	41.1	Pensioner	2.0
Separated	6.5	Unemployed	28.9
Divorced	0.4	Alcohol Consumption	
Widowed	50.8	Yes	42.3
Living status		No	57.7
Staying alone	3.7	Smoking	
Staying with others	96.3	Non smokers	77.2
		Smokers	22.8

4.1.2 Morbidity and health seeking behaviour of the respondents

Table 2 presents the morbidity and health seeking behaviour of the respondents. The finding of the study showed that all the respondents had access to health services whenever they fell sick (100%). The sources of access to health services by the respondents were, health facilities (39%), over the counter (34.6%), herbal medicine (20.3%) and faith based healing (6.2%). The distance to the nearest health facility for most of the respondents (71.1%) was less than 3km while 28.9% of them accessed health services very far up to more than 3km.

The challenges experienced by respondents in accessing health services were financial constraint (48.2%), lack of transport (23%), getting too tired and too old to walk (22.1%) and long distance to health service point (6.7%). In the last past 30days, majority of the respondents (45.1%) experienced arthritis/osteoporosis and the least experienced illness was constipation (1.2%). Most of the elderly persons indicated that they had fair health status (42.7%) and 1.2% had

excellent health status. The study further revealed that 34% of the respondents had poor memory and 8.5% of them had very good memory status.

Table 2 Morbidity and health seeking behaviour of the respondents

Variables	Levels	%
Do you access health services when sick?	Yes	100
	No	0
Sources of health services	Health facility	39
	Herbal medicine	20.3
	Over the counter medication	34.6
	Faith healing	6.2
Distance to the nearest health facility	Less than 3km	71.1
	More than 3km	28.9
Challenges faced in accessing health services	Lack of transport	23
	Long distance	6.7
	Too tired and too old to walk	22.1
	Financial constraint	48.2
Common illness suffered	Arthritis/Osteoporosis	45.1
	Hypertension	11.0
	Eye	13.4
	Ulcer	24.4
	Dental	4.9
	Constipation	1.2
Perception of health status	Poor	18.7
	Fair	42.7
	Good	29.5
	Very good	7.9
	Excellent	1.2
Perception of memory	Poor	34
	Fair	25.9
	Good	10.1
	Very good	8.5
	Excellent	21.1

4.2 Dietary habits of elderly persons in Adjumani District

4.2.1 Frequency of consumption of different food groups over a period of 7days by elderly persons sampled from Adjumani District

Table 3 presents 12 food groups commonly consumed by the respondents in the last 7 days. Using a 7-day food frequency questionnaire, the study findings showed that roots and tubers (40%, 19.5%, and 14.2%), pulses (7.3%, 42.3%, and 23.6%) and cereals (28%, 28.5%, and 13.8%) were the most frequently consumed foods. However the consumption of eggs, milk and meat were very low as the three food groups were not consumed by 93.5%, 91.5%, and 50% of the respondents respectively.

Table 3 Proportion of respondents who consumed different food groups in 7 days (N=246)

Food groups	Percentages				
	Daily	One -Two	Three-Four	Five to Six	Not eaten
Cereals	28	24	28.5	13.8	5.7
Roots and Tubers	40	15.9	19.5	14.2	9.8
Pulses	7.3	21.1	42.3	23.6	5.7
Vegetable	1.6	35.8	45.9	13	3.7
Milk	0.8	6.5	0.8	0.4	91.5
Fruits	4.5	32.9	10.2	4.9	47.6
Oil/Fats	1.6	24.8	37.8	11.8	24
Meat	0	41.9	7.3	0.8	50
Fish	1.2	41.1	39.4	12.2	6.1
Eggs	0	6.1	0.4	0	93.5
Sweets	34.1	21.1	14.2	8.9	21.5
Condiments	97.2	0.4	0.8	0.8	0.8

4.2.2 Number of meals consumed by elderly persons in Adjumani district in the period of 24 hours

A 24 hour recall was used to establish the number of meals the respondents consumed per day.

The majority (45.9%) had two meals per day while 40.2 of them had the recommended 3 meals per day (Figure 3).

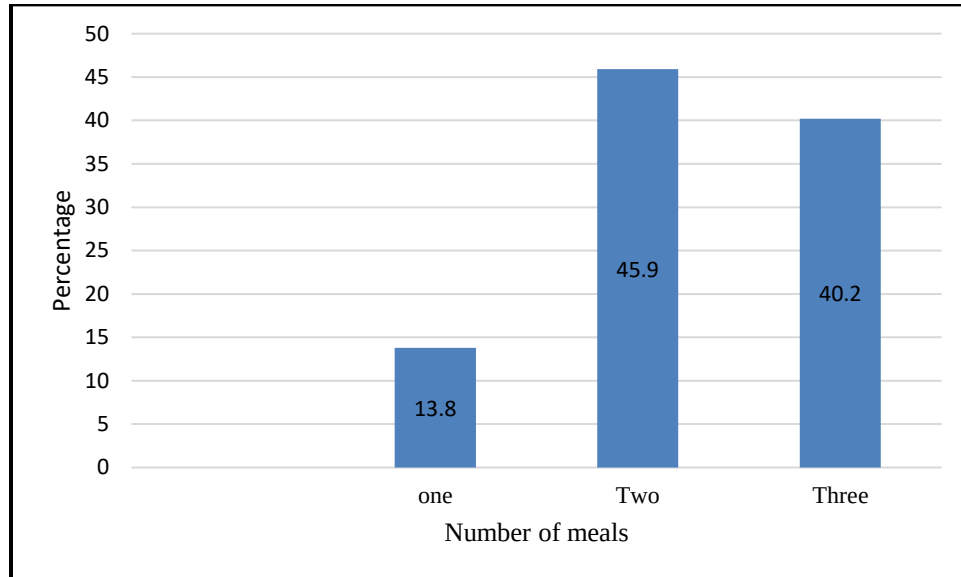


Figure 3: Proportion of elderly persons consuming different number of meals per day

4.2.3 Individual Dietary Diversity Score of elderly persons in Adjumani district

Figure 4 presents the dietary diversity score of twelve food groups consumed by elderly persons in 24 hour period. The mean DDS was 4.54 ± 1.11 which is an indicative of medium dietary diversity score. Consumption of three or less food groups was considered low DDS, four to five food groups was considered medium DDS and six or more food groups was considered having high DDS (FAO, 2010).

The result in this study showed that majority (66.7%) of the respondents had medium DDS, 17.9% had high DDS and 15.4% had low DDS.

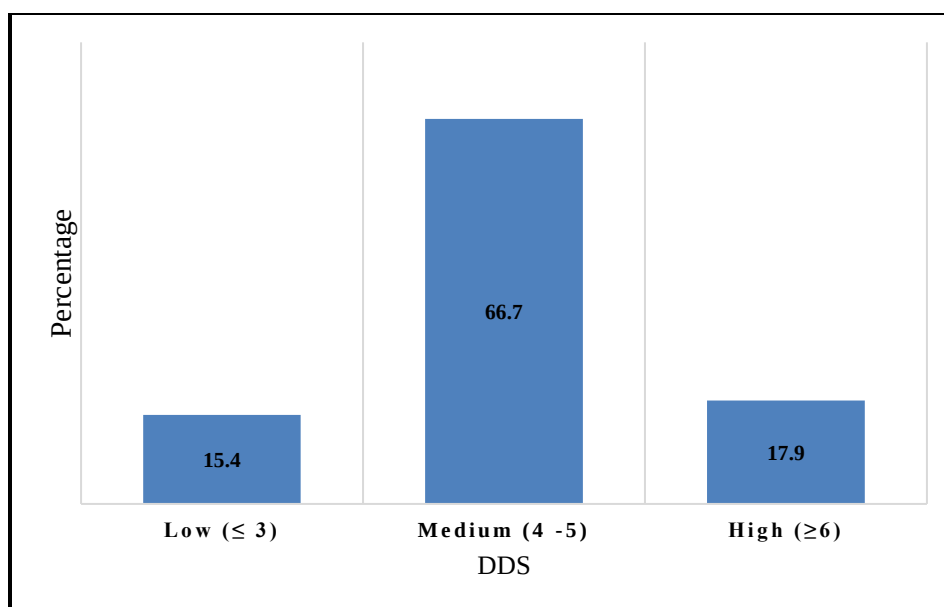


Figure 4: Proportion of elderly persons with different dietary diversity score

4.3 The energy and nutrient intake adequacy of elderly persons in Adjumani district

4.3.1 Energy and nutrient intake levels of elderly persons in Adjumani district

The findings of energy and nutrient intake by the respondents are shown in table 4.

The mean energy intake by female respondents was $1,278.90 \pm 761.11$ kcal and their male counterpart was $1,489.35 \pm 997.66$ kcal although their intake was not significantly different. Their carbohydrate intake was 199.09 ± 135.31 g and 239.53 ± 144.74 g for female and male respondents respectively and no significant difference existed among them. Female respondents took significantly more lipid (71.21 ± 7.938 g) than their male (37.87 ± 32.02 g) counterparts ($p < 0.001$). There was no significant difference in the intake of fibre by both female (25.59 ± 16.9 g) and male (30.32 ± 21.16 g) respondents (25.59 ± 16.9 g). Protein intake among male and female respondents were 53.71 ± 44.64 g and 40.96 ± 25.08 g respectively which was significantly different ($p = 0.001$). The female respondents significantly took more (803.37 ± 801.09 mg) than their male counterpart (790.29 ± 729.77 mg) ($p < 0.001$). Female respondents had intake of iron as 17.31 ± 13.41 mg and

male 21.20±19.41mg respectively although their intake was not significantly different. Significant difference existed between female (8.71±5.85mg) and male (10.65±9.36mg) respondents in intake of zinc (p= 0.047). There was significant difference in the intake of Vitamin B12 by female (1.06±0.18 mcg) and male (0.93±0.246mcg) respondents (P<0.001). Furthermore, among the two genders, the intake of Vitamin A by females and males were 50.54±4.78 mcg and 46.15±6.05 mcg respectively which were significantly different (P<0.001).

Table 4 Amount of energy and nutrient taken by elderly persons sampled from Adjumani district

Nutrient	Gender		P-value
	Female means	Male means	
Energy (kcal)	1,278.90±761.11	1,489.35±997.66	0.064
Carbohydrate (g)	199.09±135.31	239.53 ±144.74	0.094
Lipids(g)	71.21±7.938	37.87±32.02	<0.001
Fiber (g)	25.59±16.9	30.32±21.16	0.055
Protein (g)	40.96± 25.08	53.71±44.64	0.001
Calcium (mg)	803.37±801.09	790.29±729.77	<0.001
Iron (mg)	17.31±13.41	21.20±19.41	0.065
Zinc (mg)	8.71±5.85	10.65±9.36	0.047
Vitamin B12 (mcg)	1.06±0.18	0.93±0.246	<0.001
Vitamin A RAE (mcg)	50.54±4.78	46.15±6.05	<0.001

4.3.2 Comparison of actual and recommended intake of energy and nutrient among elderly persons sampled from Adjumani district

Table 5 Energy and nutrient intake adequacy levels of male elderly persons sampled from Adjumani district

Nutrient	Mean $\pm$SD	RDA	Mean difference	% Met RDA	P-value
Energy(kcal)	1,489.35 $\pm$ 997.66	2300	810.65	64.8	<0.001
Carbohydrate (g)	239.53 $\pm$ 144.74	130	-109.53	184.3	<0.001
Lipids (g)	37.87 $\pm$ 32.02	77	39.13	49.18	<0.001
Fiber(g)	30.32 $\pm$ 21.16	30	-0.32	101.1	0.880
Protein(g)	53.71 $\pm$ 44.64	56	2.29	95.91	0.428
Calcium (mg)	790.29 $\pm$ 729.77	1200	-409.713	65.86	<0.001
Iron (mg)	21.2 $\pm$ 19.41	8	-13.20	265.0	<0.001
Zinc (mg)	10.65 $\pm$ 9.36	11	0.35	96.8	0.720
Vitamin B12 (mcg)	0.93 $\pm$ 0.246	2.4	-1.47	38.75	<0.010
Vitamin A RAE (mcg)	46.15 $\pm$ 6.05	900	-853.85	5.12	<0.001

Table 5 presents the energy and nutrient intake adequacy of male elderly persons. The caloric intake by male respondents was significantly low compared to the recommended intake with 64.8% of the RDA met ($p < 0.001$). The respondents met the RDA for carbohydrate by 184.3% and it was significantly more than the RDA ($p < 0.001$). Intake of lipids was significantly below the recommended intake with 49.18% of RDA met ($p < 0.001$). The intake of fibre by male respondents was not significantly different from the RDA where 101.1% RDA for fibre was met. The respondents' intake of protein was not significantly different from the RDA although 95.91% of the RDA was met. The intake of calcium was significantly different compared with

the RDA where 65.86% RDA met. The actual intake of iron was significantly higher than the RDA where 265% of RDA was met ($p<0.001$). The actual intake of zinc by the respondents was not significantly differently from the RDA even when 96.8% of the RDA was achieved. The respondents significantly took low levels of Vitamin B12 against the RDA with about 38.75 % RDA met ($p= 0.010$). The respondents had too low intake of Vitamin A with only 5.12 % of RDA met ($p<0.001$).

Table 6 presents the energy and nutrient intake adequacy of female elderly persons.

The intake of energy by female respondents was significantly low where 67.31% of the RDA was met ($p<0.001$). The intake of carbohydrate was significantly more than the recommended intake for elderly persons where 153.1% of the RDA was met ($P<0.001$). Their actual intake of lipids was significantly high compared to the RDA where 127.16% of RDA was met ($P<0.001$). The intake of fibre was significantly more compared with the recommended daily intake where 121.9% of RDA was met ($p=0.001$). There was a significant difference in the actual intake and RDA for protein where 89.04% of the RDA was attained the respondents. Although calcium is one of the very important nutrients needed by elderly persons, the intake by the female respondents was significantly low compared with the RDA where 66.95% of RDA was met ($p<0.001$). The intake of iron among the female respondents was higher than the RDA with 216.38% of the RDA was met ($p<0.001$). There was no significant difference in the actual intake of zinc even if 108.88% of RDA was met. Much as vitamin B12 is essential in strengthening immune system of elderly persons the intake was significantly low as 44.2% of the RDA was met ($p=0.004$). The intake of vitamin A was also significantly very low where only 7.22 % of the RDA was met by the female respondents ($p<0.001$).

Table 6 Energy and nutrient intake adequacy levels of female elderly persons sampled from Adjumani district

Nutrient	Mean $\pm$SD	RDA	Mean difference	% Met RDA	P-value
Energy(kcal)	1,278.90 $\pm$ 761.11	1900	621.1	67.31	<0.001
Carbohydrate(g)	199.09 $\pm$ 135.31	130	-69.9	153.1	<0.001
Lipids (g)	71.21 $\pm$ 7.938	56	-15.21	127.16	<0.001
Fiber (g)	25.59 $\pm$ 16.9	21	4.59	121.9	0.001
Protein (g)	40.96 $\pm$ 25.08	46	5.04	89.04	0.028
Calcium (mg)	803.37 $\pm$ 801.09	1200	396.63	66.95	<0.001
Iron (mg)	17.31 $\pm$ 13.41	8	-9.31	216.38	<0.001
Zinc (mg)	8.71 $\pm$ 5.85	8	0.71	108.88	0.132
Vitamin B12 (mcg)	1.06 $\pm$ 0.18	2.4	-1.34	44.2	<0.00
Vitamin A RAE (mcg)	50.54 $\pm$ 4.78	700	649.46	7.22	<0.001

4.4 The social and health factors influencing dietary habits and nutrient intake adequacy of elderly persons in Adjumani district

4.4.1 Factors influencing energy and nutrient intake of elderly persons in Adjumani district

Table 7 and 8 show the results of multiple linear regression of social predictors of energy and nutrient intake of the respondents. The results show that female elderly persons have 17.2%,16.7%,16.6%,17.7,19.7% and 17.6% more intake of energy, lipids, fibre, calcium, iron and zinc respectively than their male counter parts ($p<0.05$). The results further showed that elderly persons who stay alone have 23%, 21.2%, 16%, 18.1% 22.1%,13.8%, 17.9 and 17.6% more intake of energy, carbohydrate, lipids, fibre, proteins, calcium, iron and zinc respectively than those who stay with other household members ($p<0.05$). With regards to occupations,

unemployed elderly persons have 15.5% and 15.6% less intake of Iron and Zinc respectively than those who are employed in different occupations. Results also showed that elderly persons with higher income have 18.9% higher intake of vitamin B12 than those with lesser incomes ($P < 0.05$).

Table 7 Social predictors of macronutrients intake of elderly persons sampled from Adjumani District

Independent Variables	Energy		Carbohydrate		Lipids		Fibre		Protein	
	B	P	B	P	B	P	B	P	B	P
Sex	0.172	0.032	0.139	0.086	0.167	0.039	0.166	0.040	0.144	0.072
Level of education	-0.041	0.600	-0.037	0.637	-0.068	0.384	-0.112	0.152	0.043	0.585
HH size	0.055	0.414	0.054	0.428	0.025	0.718	-0.022	0.749	0.069	0.311
Marital status	0.023	0.758	0.009	0.905	0.042	0.567	-0.089	0.226	0.012	0.867
Occupation	-0.112	0.121	-0.055	0.447	-0.170	0.020	-0.104	0.150	-0.078	0.277
Caretakers	0.080	0.251	0.063	0.375	0.073	0.301	0.082	0.245	0.083	0.235
Living Status	0.230	0.001	0.212	0.002	0.160	0.018	0.181	0.008	0.221	0.001
Alcohol Consumption	-0.046	0.478	-0.062	0.348	-0.003	0.969	-0.004	0.948	-0.039	0.547
Income	-0.025	0.713	-0.054	0.422	0.006	0.931	-0.036	0.585	0.049	0.460
Constant		0.006		0.006		0.045		0.000		0.129

Table 8 Social predictors of micronutrients intake of elderly persons sampled from Adjumani District

Independent Variables	Calcium		Iron		Zinc		Vitamin B12		Vitamin A	
	B	P	B	P	B	P	B	P	B	P
Sex	0.179	0.027	0.197	0.014	0.176	0.029	-0.517	0.605	0.015	0.855
Level of education	-0.135	0.088	-0.118	0.133	-0.059	0.450	0.368	0.714	0.052	0.516
HH size	-0.004	0.956	0.026	0.706	0.021	0.760	0.666	0.506	-0.025	0.717
Marital status	-0.048	0.518	0.007	0.923	-0.014	0.850	0.299	0.765	0.030	0.692
Occupation	-0.132	0.070	-0.154	0.034	-0.156	0.032	-0.528	0.598	-0.130	0.080
Caretakers	0.044	0.529	0.077	0.273	0.078	0.265	1.954	0.052	-0.026	0.720
Living Status	0.138	0.044	0.179	0.008	0.176	0.010	0.793	0.429	0.008	0.903
Alcohol Consumption	-0.018	0.785	0.008	0.902	-0.017	0.789	-1.115	0.266	0.033	0.624
Income	-0.022	0.739	-0.007	0.918	-0.023	0.730	2.811	0.005	-0.060	0.380
Constant		0.009		0.015		0.007		0.925		0.034

B= Standardized value of beta Co-efficient, P = p-value

Gender (1= Female, Male=2), Marital status (1= Single, 2= married, 3= separated, 4= divorce 5= widowed), Living arrangement (1=Staying alone, 0 = Staying with others), Alcohol consumption (1= Yes, 0=No), Education (1= None , 2= Primary, 3= Secondary, 4 = Post-secondary), Occupation (1= unemployed, 2= Fully employed , 3= Peasant,, 4= Pensioner, 5= Business person), Caretaking status (1= Spouse, 2= Children, 3= Relative, 4= None), Income (Continuous variable), Household size, (Continuous variable)

Table 9 and 10 presents the results of analysis of health factors which predicted the intake of energy and nutrient of elderly persons. Among the health factors, hypertension, eye disease and dental illness were good predictors of intake of energy and nutrient of elderly persons ($p < 0.05$). Elderly persons with hypertension have 14% and 16.2% higher intake of energy and carbohydrate respectively than those without hypertension ($p < 0.05$). Elderly persons suffering from eye diseases have 15.7% more intake of calcium than those without eye diseases while elderly persons with dental related illness have 14.1% higher intake of calcium than elderly persons without dental diseases ($p < 0.05$).

Table 9 Health predictors of macronutrient intake of elderly persons sampled from Adjumani District

Independent Variables	Energy		Carbohydrate		Lipids		Fibre		Protein	
	B	P	B	P	B	P	B	P	B	P
Number of diseases	0.013	0.860	-0.001	0.990	0.020	0.785	0.011	0.884	0.030	0.680
Suffered illness in the last 30 days	-0.060	0.553	-0.014	0.890	-0.069	0.495	-0.071	0.480	-0.154	0.127
Arthritis/Osteoporosis	0.088	0.176	0.062	0.339	0.109	0.097	0.115	0.080	0.044	0.498
Constipation	-0.030	0.648	-0.039	0.547	0.000	0.997	-0.035	0.594	-0.034	0.595
Hypertension	0.140	0.040	0.162	0.017	0.077	0.260	0.101	0.137	0.060	0.372
Eye disease	0.035	0.596	-0.009	0.889	0.074	0.271	0.056	0.403	0.087	0.191
Ulcer	0.014	0.844	0.031	0.660	-0.001	0.993	0.020	0.785	-0.020	0.780
Dental illness	-0.014	0.833	-0.040	0.558	0.043	0.534	0.011	0.867	-0.028	0.684
Weather on medication in the last 30 days	-0.024	0.808	-0.042	0.676	-0.008	0.940	0.022	0.825	0.026	0.796
Weather diet is restricted	-0.039	0.616	-0.027	0.726	-0.027	0.732	-0.041	0.600	-0.067	0.389
Health status	-0.042	0.573	-0.009	0.902	-0.069	0.362	.019	0.797	-0.060	0.427
Memory status	0.121	0.088	0.129	0.069	0.049	0.490	0.076	0.285	0.123	.0083
Constant		0.000		0.000		0.002		0.000		0.000

B= Standardized value of beta Co-efficiency, P = p-value

Diet restriction (1=Yes, 0=No), Whether on medication (1=Yes, 0=No), Perception of memory (1=Poor, 2 =Fair, 3= Good, 4= Very good), Health status(1=Poor, 2 =Fair, 3= Good, 4= Very good), Arthritis/Osteoporosis (1= Yes, 0=No), Constipation (1=Yes, 0=No), Hypertension (1=Yes, 0=No), Eye disease (1=Yes , 0=No), Ulcer (1=Yes , 0=No), Dental illness (1=Yes , 0=No)

Table 10 Health predictors of micronutrient intake of elderly persons sampled from Adjumani district

Independent Variables	Calcium		Iron		Zinc		Vitamin B12		Vitamin A	
	B	P	B	P	B	P	B	P	B	P
Number of diseases	0.016	0.827	0.0206	0.724	0.016	0.829	0.036	0.623	0.059	0.953
Suffered illness in the last 30 days	-0.092	0.356	-0.076	0.450	-0.102	0.314	0.033	0.741	0.083	0.934
Arthritis/Osteoporosis	0.080	0.217	0.104	0.112	0.100	0.125	-0.028	0.668	0.449	0.654
Constipation	-0.006	0.922	-0.011	0.862	-0.015	0.815	-0.027	0.681	0.290	0.772
Hypertension	0.057	0.401	0.105	0.125	0.076	0.262	0.023	0.739	-0.353	0.725
Eye disease	0.157	0.019	0.080	0.233	0.086	0.200	0.070	0.301	1.485	0.139
Ulcer	-0.011	0.872	-0.018	0.806	-0.011	0.881	-0.107	0.137	-0.695	0.488
Dental illness	0.141	0.038	0.046	0.501	0.056	0.417	-0.083	0.226	1.895	0.059
Weather on medication in the last 30 days	0.107	0.287	0.013	0.895	0.026	0.798	-0.070	0.489	0.635	0.526
Weather diet is restricted	-0.037	0.634	-0.022	0.780	-0.051	0.517	-0.028	0.724	-0.516	0.607
Health status	-0.005	0.950	-0.036	0.633	-0.048	0.524	-0.087	0.253	-0.003	0.998
Memory status	0.002	0.983	0.037	0.598	0.087	0.220	0.103	0.149	1.154	0.250
Constant		0.028		0.002		0.001		0.203		0.243

B= Standardized value of beta Co-efficiency, P = p-value

Diet restriction (1=Yes, 0=No), Whether on medication (1=Yes, 0=No), Perception of memory (1=Poor, 2 =Fair, 3= Good, 4= Very good), Health status(1=Poor, 2 =Fair, 3= Good, 4= Very good), Arthritis/Osteoporosis (1= Yes, 0=No), Constipation (1=Yes, 0=No), Hypertension (1=Yes, 0=No), Eye disease (1=Yes , 0=No), Ulcer (1=Yes , 0=No), Dental illness (1=Yes , 0=No)

Table 11 and 12 presents the result of Poisson regression for the social and health predictors of dietary diversity score.

The result of the Poisson regression showed that education level has an effect on the dietary diversity score of elderly persons. Findings showed that a unit change in education level results in a 1.205 times higher dietary diversity score (B= 0.186, se = 0.0934, p= 0.046). The dietary diversity score of elderly persons with Arthritis/Osteoporosis is 5.133 times higher than those without Arthritis /osteoporosis (B= 1.636, se= 0.7769, P= 0.035).

Table 11 Social predictors of dietary diversity scores of elderly persons sampled from Adjumani district

Independent variables	Dietary Diversity Score			
	B	Std. Error	P-value	Exp (B)
Level of education	0.186	0.0934	0.046	1.205
Alcohol Consumption	-0.025	0.1432	0.863	0.976
Household size	0.009	0.0234	0.702	1.009
Occupation	-0.008	0.0412	0.838	0.992
Caretakers	0.048	0.0672	0.479	1.049
Intercept	4.833	0.704	0.000	125.631

B= Estimated Poisson regression coefficients for the model

Exp (B) = Exponential value of Beta

Education (1= Yes, 0= No), Alcohol consumption (1= Yes, 0=No), Household size (continuous variable), Occupation (1= Yes, 0= No), Caretaking status (1= Yes, 0= No).

Table 12 Health predictors of dietary diversity scores of elderly persons sampled from Adjumani district

Independent variables	Dietary Diversity Score			
	B	Std. Error	P-value	Exp (B)
Arthritis/Osteoporosis	1.636	0.7769	0.035	5.133
Dental illness	-0.834	0.5587	0.136	0.434
Hypertension	0.000	0.3732	0.999	1.000
Whether on medication in the last 30days	0.076	0.1493	0.611	1.079
Intercept	4.833	0.704	0.000	125.631

B= Estimated Poisson regression coefficients for the model

Exp (B) = Exponential value of Beta

Arthritis/Osteoporosis (1= Yes, 0 =No), Dental illness (1=Yes, 0=No), Hypertension (1=Yes, 0=No), Eye disease (1=Yes, 0=No), whether on medication in the last 30days (1=Yes, 0=No)

CHAPTER FIVE

DISCUSSION

5.1 The dietary habits of elderly persons 60 years and above.

Under normal circumstances, elderly persons are expected to consume all the different classes of food (Kumari, 2022). However, in this study dietary habit of elderly persons was poor as most of them consumed starchy and energy dense food as they frequently ate cereals, roots and tubers (Table 3). This implies that they are likely to suffer from non-communicable diseases like hypertension and diabetes as this kind of food would contribute to weight gain (Seid & Rosenbaum, 2019). This finding is in agreement with the findings of other studies conducted on similar subject (Khorommbi & Maluleke, 2021). The findings also revealed that they consumed more plant based proteins especially pulses (Table 3). Pulses eaten as main source of proteins is not desirable as they have low digestibility and are not readily absorbed by the body in comparison to animal based proteins hence their intake is limited (Thakur, Sharma & Thakur, 2019). This is contrary to the findings of Bahuleyan & Balan (2018) where they found out that elderly persons consumed less pulses over seven days period. After consumption of meals, there is less synthesis of protein in the muscles of elderly persons due to resistances which is brought about by low levels of insulin in the blood stream. The likely consequence of this scenario is that the body of elderly persons could not adequately compensate for protein loss after absorption hence posing risk of sarcopenia (Trommelen, Betz & van Loon, 2019). However this could be rectified by consuming good quality animal proteins which have a greater ability to boost muscle protein synthesis rate and support muscle mass (Berrazaga, Micard, Gueugneau & Walrand, 2019). Interestingly in this study, the intake of animal based protein was low as evidenced by less frequency of consumption of eggs, milk and meat over the last 7days (Table3). The low

intake of animal based protein could be associated with low purchasing power which makes it hard for them to afford those food sources (Singh & Sit, 2022). This finding is similar to previous studies where the frequency of intake of eggs, milk and its products and meat was low over a period of seven days for elderly persons (Das, 2022).

This study revealed that majority of the respondents consumed two meals per day contrary to the recommended of least three meals per day (figure 3). Eating less than three meals per day compromises nutritional status of elderly persons as their nutrient intake tends to be low (Jamil, Salih, Sadiq & Shaker, 2021). This finding is similar to previous studies where majority of the elderly persons consumed two meals per day (Omia *et al.*, 2019).

Higher dietary diversity among elderly persons enhances better health and reduced risk of various chronic diseases (Ray & Dutta, 2022). However, the finding of this study revealed that majority of the respondents had medium dietary diversity score. This implies that they are at risk of compromised health status (Suke, 2020). This finding is not any different from other related studies conducted in Kenya (Ezenwosu *et al.*, 2022).

5.2 Energy and nutrient intake adequacy by elderly persons.

In this study, energy was contributed by carbohydrates, lipids and protein. However, the mean energy intake for both female and male elderly persons was low and did not meet the RDA despite the fact that most of them consumed starchy and energy rich foods (Table 5 & 6). Adequate intake of energy is known to be the biggest contributor to muscle mass of elderly persons. This implies that intake below the recommended daily allowance could lead to decline in synthesis of the much needed protein and distribution of amino acid in the body (Okamura *et al.*, 2019). These findings are in agreement with other studies where the intake of calories was below the RDA for both female and male elderly persons (Angeles-Agdeppa *et al.*, 2019).

The intake of carbohydrate by both male and female elderly persons was above the RDA. The high intake of carbohydrate could have resulted from more consumption of cereals in form of whole grains. Deriving carbohydrates mainly from whole grain is beneficial to elderly persons as the calories from this contribute to minimizing weight loss which is a common phenomenon in old age (Nestel & Mori, 2022). This finding is the same with other studies conducted on dietary intake among elderly persons in Ireland (Kehoe *et al.*, 2021).

In this study, male elderly persons had low intake of lipids than the recommended although the females achieved the RDA. Dietary lipids are considered to be essential source of energy reserves in the body and it also plays vital function of being component for cell membrane (Denisenko *et al.*, 2020). This implies that elderly persons may have limited energy reserves to meet increased energy demand. This finding is similar to studies done in Iran on intake of energy and other macro nutrient intake among elderly persons where both male and female elderly persons had low intake levels of lipids (Heidari *et al.*, 2019).

Fibre intake by male elderly persons was significantly higher than their female counterpart although the intake in both categories was slightly above the RDA. Due to physiological changes, elderly persons are faced with challenge of digestion leading to constipation (Al-Fatlawi & Mohammad, 2022). Adequate intake of fibre helps in improving bowel function and avoids constipation. It's therefore important to maintain this adequate intake levels to sustain better quality of life among the older persons.

This finding is different from studies conducted by (Kehoe *et al.*, 2021) where they found the intake of fibre was low with intake of 18.9g and 17.8g among male and female elderly persons respectively.

Protein intake by female elderly persons in this study was below the RDA. The low intake could be due to low frequency of intake of animal protein and relying mainly on plant based protein which is not readily absorbed by the body (Alcorta *et al.*, 2021). Inadequate intake of protein poses a risk of loss of muscle mass and frailty among elderly persons (Domić, Grootswagers, van Loon & de Groot, 2022). This result is similar to other studies where the intake of protein was low (Park, 2018).

The mean intake of by both female and male elderly persons was low. Inadequate intake of calcium is of great concern as it plays pivotal role in muscle contractility, heart and digestive system health, builds bone and supports synthesis and function of blood cells (Uwitonze *et al.*, 2020). This implies that female elderly persons are at risk of developing arthritis and osteoporosis including debilitating bone disease associated with aging. This finding is similar to studies done in Malaysia where the mean intake for calcium was 414.2mg for males and 426.0mg for female elderly persons (Zamzuri *et al.*, 2019).

The intake of iron was above the RDA in both female and male elderly persons. However, the intake was within the upper tolerable limit of 45mg. Iron plays essential roles in the body among which include, metabolic functions of transportation of oxygen to the vital body organs and production of oxidative energy including inactivation of free radicals in the body. This finding is in agreement with studies done in Kenya by Suke (2020) where the mean intake of iron was above the RDA.

According to the finding of this study, both the male and female elderly persons took adequate levels of zinc and met the RDA. Adequate intake of zinc is particularly important as it is involved in the maintenance of immune system, regulatory catalyst ion for the biological activity of many enzymes among others. This finding is in contradiction with that conducted by

Alqabbani and AlBadr (2020) which indicated that the intake among elderly persons was below the RDA.

Vitamin B12 intake by both male and female elderly persons was below the RDA. This implies that the seniors are at risk of developing health complications related to making of red blood cells and functioning of the nerves (Watson & Garcia-Casal, 2018). This finding is in agreement with others studies done to evaluate the vitamin B12 intake among elderly persons (Lavriša et al., 2022).

This study revealed that the intake of vitamin A by elderly persons was too low where only 5.1% and 7.2 % of the RDA was met by male and females respectively. Intake of vitamin A was below the RDA especially by elderly persons could result in vision impairment and compromises their immunity. Other studies pointed out low intake vitamin A among elderly persons which is similar to the finding in this particular study (Liu *et al.*, 2019).

5.3 Social and health factors influencing dietary habits and nutrient intake adequacy of elderly persons.

Different social factors were regressed to find out those which could predict the energy and nutrient intake among elderly persons (Table 9 and 10). The results show that female elderly persons had high chance of taking more energy, lipids, fibre, calcium, iron and zinc than males. This could be attributed to females having better tendency of endorsing healthy eating habits and their involvement in making food choices for the households (Kyomuhendo & Adeola, 2021). This finding is consistent with previous studies where gender of elderly persons positively predicted energy and nutrient intake (O'Connell *et al.*, 2021).

The results further showed that elderly persons who stay alone had increased of chance of taking more energy, carbohydrate, lipids, fibre, proteins, calcium, iron and zinc than elderly persons

staying with other household members. The finding from this study could possibly be explained by the fact that persons living alone have greater control over what to eat and they have low total food demand in the household compared to those living with other household members. Interestingly this finding is in disagreement with other studies which revealed that social isolation and loneliness are associated with diminished appetite, skipping meals, lower food intake, decreased physical activities and less enjoyment of meal time (Senee, Ishnoo & Jeewon, 2022).

With regards to occupations, unemployed elderly persons have less intake of Iron and Zinc than those who are employed in different occupations. Being employed enhances the income levels of the elderly persons which could be used to buy food rich in Iron and Zinc (Ziliak & Gundersen, 2020). This finding is related to previous studies where positive relationship existed between nutrient intake and occupation of seniors (Nichols, Dalrymple, Prout & Ramcharitar-Bourne, 2022).

Results also showed that elderly persons with higher income have 18.9% higher intake of vitamin B12 than those with lesser incomes ($P < 0.05$). Increase in income level enhances affordability of vitamin B12 rich food sources like meat, fish, eggs, milk which are quite expensive for a low income earner (Ryckman *et al*, 2021). Previous studies revealed that intake of Vitamin B 12 were associated with financial status of elderly persons. Those who had better financial status had adequate intake of Vitamin B12 than those with poor status as they could not afford meat (Lavriša *et al.*, 2022).

Among the health factors, hypertension, eye disease and dental illness were good predictors of intake of energy and nutrient of elderly persons. Elderly persons with hypertension have higher intake of energy and carbohydrate than those without hypertension. This could be because

elderly persons who suffer from hypertension are normally advised to eat healthy food such as whole grains which have contribution in lowering blood pressure (Rasmawati *et al.*, 2022). However several studies instead revealed the influence of carbohydrate on progression of hypertension among elderly persons contrary to the findings of this study (Xia *et al.*, 2021). Elderly persons suffering from eye diseases have more intake of calcium than those without eye diseases while elderly persons with dental related illness have higher intake of calcium than elderly persons without dental diseases. This finding could be arising from medical advice given to elderly persons with eye and dental health complications to eat food rich in calcium which is needed in limiting age-related macular degeneration and to manage the progression of dental disease (Lekwuwa, Choudhary, Lad & Malek, 2022; Antoniadou & Varzakas, 2021). This finding is in contradiction to those done by García *et al.*, (2020) where they found out that eye disease reduced the intake of calcium among elderly persons. With regards to dental illness, other studies conducted on oral health of elderly persons revealed that dental disease contributed to low nutrient intake including calcium (Azzolino *et al.*, 2019).

Findings from Poisson regression showed that increase in education level resulted in higher dietary diversity score (Table 11). Elderly persons who are educated at least from primary school level or above had significantly higher levels of dietary diversity score than those with no formal education. This finding is similar with that conducted in Thai community among community dwelling elderly persons. (Chalermisri *et al.*, 2022). This could be explained by several reasons such as; education level can increase the nutritional knowledge among elderly persons who could use it to make food choices and ultimately resulting in higher Dietary diversity (Hamulka *et al.*,

2021). Relatedly educated elderly persons might have higher income and thus better purchasing power than people who have a lower educational level (Piekut, 2020).

The dietary diversity score of elderly persons who have arthritis/osteoporosis is likely to increase higher than those without (Table 12). This could be due to several advice given to elderly persons by health professionals on eating certain types of foods and varieties to manage the disease condition (Parvez & Akanda, 2019). This finding is in contradiction with that of other studies in Iran (Tajary *et al.*, 2022).

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The purpose of this study was to determine the dietary habits and nutrient intake of elderly persons in Adjumani district.

Based on the findings of this study, Elderly persons in Adjumani district had moderate dietary habits mainly because; they consumed starchy and energy dense foods, plant based protein sources with low consumption of meat, milk and eggs which are rich sources of protein and other micronutrients. They have poor dietary diversity since most of them had medium dietary diversity score and they consume on average two meals per day contrary to the recommended of at least three meals per day.

Intake for vitamins and calcium in both female and male elderly persons was poor as they all did not meet the RDA for the selected vitamins and calcium and on the other hand, RDA for micronutrients of iron and zinc were met by the elderly persons. The intake of energy among the female and male elderly persons was below the RDA.

With regards to protein intake, male elderly persons achieved the RDA however the females failed to achieve.

In regards to social factors, sex, occupation, living status and level of income were among the know factors which influenced nutrient intake of elderly persons while level of education influenced the dietary habits of elderly persons. Among the health factors, hypertension, arthritis, dental illness and eye disease were known health conditions which predicted dietary habits and energy and nutrient intake of elderly persons.

6.2 Recommendations

6.2.1 Recommendation for policy

Ministry of health should put emphasis on management of geriatric health complications so as to handle health conditions of elderly persons holistically.

The government and non-governmental organizations should equally prioritize geriatric nutrition interventions as they do for children and pregnant women since elderly persons are also vulnerable.

6.2.2 Recommendation for the community

Community nutrition workers like development partners and government extension workers should sensitize elderly persons and the entire community on the importance of having at least three meals per day, eating variety of foods and conducting routine health checks for elderly persons.

6.2.3 Recommendations for further research

This study looked at dietary habits and nutrient intake in the context of rural setting, however to generate more conclusive finding there is need to study dietary habits and nutrient intake of elderly persons in both rural and peri-urban setting.

This particular study used proxy methods in determining the intake of nutrients. There is need to use biochemical assessment method to find out the level of nutrients in elderly persons.

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APPENDICES

I. Data collection tool

DIETARY HABITS AND NUTRIENT INTAKE AMONG ELDERLY PERSONS IN ADJUMANI DISTRICT

My name is **Adibaku Francis**, a student of Gulu University pursuing Master of Science Degree in Food Security and Community Nutrition. I am conducting a study on dietary habit and nutrient intake among elderly persons 60 years and above in Adjumani District. I am requesting you to take part in the study by answering some questions.

The information you will provide helps the target population in improving their food choice and nutrient intake and help the policy makers in designing nutrition sensitive policies that guides nutritional interventions which takes care of the issues of elderly persons. The information you will provide will be confidential and used for study purposes only.

Please circle or tick the responses where necessary.

Household no.....Village Parish.....

Sub-county.....

Date of interview.....Interviewer.....

A. Socio demographic factors

S/No	Questions	Responses
1	Name of the elderly person/household member (optional)	
2	Gender	1. Male 2. Female
3	Age of respondent	
4	Level of education attainment	1. None 2. Primary 3. Secondary 4. Post-secondary
5	Household size	
6	Marital status	1. Single 2. Married 3. Separated 4. Divorced 5. Widowed
7	What is your current main occupation?	1. Unemployed 2. Formal employment 3. Peasant 4. Commercial farmer 5. Business person 6. Pension earner 7. Others specify
8	Who are your caretakers?	1. Spouse 2. Children 3. Relatives 4. None
9	Do you stay alone?	1. Yes 2. No
10	Do you smoke?	1. Yes 2. No

11	Do you take alcohol?	1. Yes 2. No
13	What is the estimate average combined household income (Monthly)?	
14	Who is responsible for buying food in your home?	1. My self 2. Spouse 3. Children 4. Relatives 5. All the above
15	If you buy your own food do face any challenge in purchasing food?	1. Yes 2. No
16	If yes, what are those challenges	1. Financial constraint 2. Physical disability 3. Long distances 4. Transport constraint 5. Others specify.....
17	Who prepares food for you?	1. I prepare my own food 2. Someone prepares
18	If you prepare your own food, do you face any challenge in food preparation?	1. Yes 2. No
19	If yes, what are those challenges you face?	1. I don't know how to prepare food properly. 2. I lack cooking facilities 3. Physical disability 4. Poor access to food 5. Others specify

B. Health factors

S/No	Questions	Responses
1	Do you have access to health services when you feel sick?	1. Yes 2. No
2	What is the distance of the nearest health center from your residence (km)?	
3	In case you are not feeling well, where do you normally seek assistance? (circle where appropriate)	1. Health facility 2. Herbal medicine 3. Over the counter medication 4. Faith healing 5. None
4	Do you have challenges in accessing health services?	1. Yes 2. No
5	If yes what problems do you have in accessing a health facility for medical care?	1. Lack of transport 2. Long distance 3. Too tired and too old to walk 4. Lack of money to pay for medical services 6. Other (specify).....
6	In the last one month, have you even felt unwell?	1. Yes 2. No

7	If yes what are those health conditions you suffered from among the following?	1. Back pains 2. Stomach disorder 3. Arthritis/ Osteoporosis 4. Constipation 5. Diabetes 6. Hypertension 7. Asthma 9. Cancer 10. Eye problems 11. Ulcers 12. Malaria 13. Dental problems 14. Mental health 15. Difficulty in swallowing 16. Tuberculosis (TB) 16. Any other (specify)
8	Have you been on medication in the last 30days?	1.Yes 2.No
9	Have your diet been restricted due to any medical condition?	1.Yes 2. No
10	How do you compare your health status with your peers?	1.Poor 2. Fair 3. Good 4. Very good 5. Excellent
11	How do you perceive your memory status? .	1.Poor 2. Fair 3. Good 4. Very good 5. Excellent

C. 24 Hour Dietary Recall

Can you explain the foods and drinks you took yesterday (day and night) starting from morning hours up to the time you slept?

Category	Time	Place	Food/ beverage item	Details/Ingredients/Preparation	Quantity
Breakfast					
Snacks					

Lunch					
Snacks					
Super					

D. Frequency of Dietary Intake

How many times in a **week** do you consume foods in the following food groups? (Tick where appropriate in the table below).

Q No	Food group	Examples	Yes =1 No =2	Daily	1-2 times a week	3-4 times a week	5-6 times a week	How many times have you consumed these food groups in the last one Month
1	Cereals	Bread, biscuits, cookies, food made from millet, maize, sorghum, rice, wheat						
2	Roots and tubers	Cassava, sweet potato, yams, Irish potato						
3	Pulses/legumes/nuts	Beans, pigeon peas, green grams, cowpeas, field peas, groundnut						
4	Vegetables	Tomatoes, cabbage, kale, amarantus, egg plants, sweet pepper, cow pea leaves, indigenous green leafy vegetable, cassava leaves, pumpkin leaves, Nakati, hibiscus						
5	Dairy products	Whole milk, processed milk products.						
6	Fruits	Mangoes,						

Q No	Food group	Examples	Yes =1 No =2	Daily	1-2 times a week	3-4 times a week	5-6 times a week	How many times have you consumed these food groups in the last one Month
		avocado, pawpaw, oranges, lemon, sour soup, banana, guava, apple, wild fruits, passion fruit, pineapple, jack fruit						
7	Oil/fats	Oil, fats added to food						
8	Meat, poultry, offal	Chicken, beef, lamb, pork, organ meat, goats, rabbits, duck, wild game, other birds						
9	Fish and sea food	Tilapia, silverfish, Nile perch, fresh or smoked fish						
10	Sugar/honey	Sugar, honey, sweetened soda, sweets						
11	Eggs	Eggs						

II: Photo gallery for the research



Photo A: Showing samples of different food recipes prepared for measurement of food intake



Photo B: Showing the principal researcher conducting an interview



Photo C: Showing estimation of actual food intake

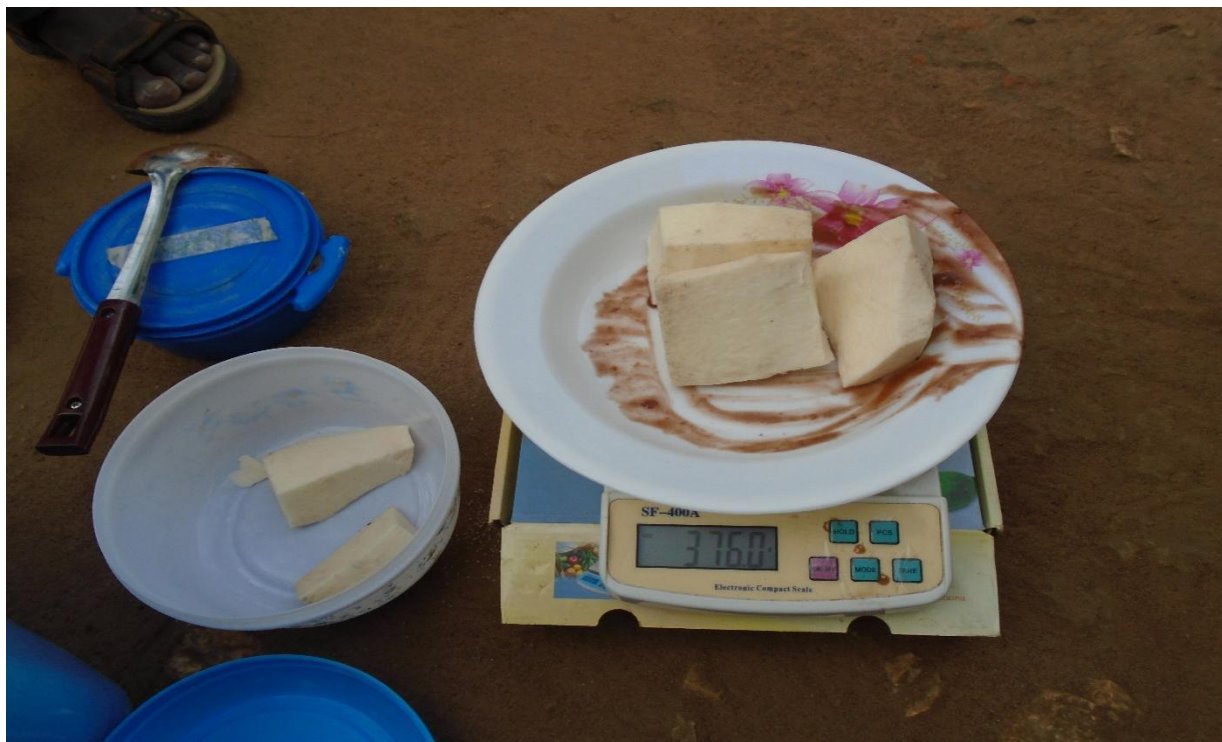
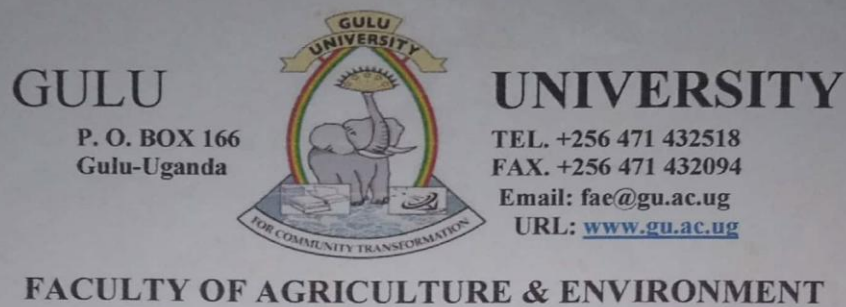


Photo D: Showing weight measurement of food sample

III: Introduction Letter



2nd December, 2021

The Chief Administrative Officer,
Adjumani District Local Government (ADLG),
P.O. Box, 2, Adjumani

Dear Sir/Madam,

RE: INTRODUCTION OF MR. ADIBAKU FRANCIS

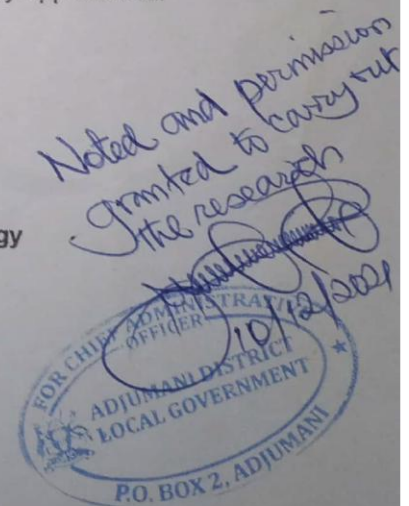
I would like to introduce to you the bearer of this letter (**Adibaku Francis**) who is a student of Gulu University with registration number **19/U/2554/MFN/PS**. He is also a staff at ADLG. He is pursuing a graduate program leading to the award of the degree of Master of Science in Food Security and Community Nutrition.

Francis is researching on the topic "**Dietary Habits and Nutrient Intake among Elderly Persons in Adjumani District**" and will be conducting a survey among elderly persons aged 60 years and above in Adjumani District. Results from his study may help the target population in improving their food choices and nutrient intake.

Any assistance offered to him during the study in your area is highly appreciated.

Yours sincerely,

Dr. Solomon Olum (PhD)
Head, Department of Food Science and Postharvest Technology
s.olum@gu.ac.ug



IV: Plagiarism Certificate

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Declaration for Originality Form

This form must be completed and signed for all scholarly work produced.

Name: FRANCIS ADIBAKU

Personal File No.(staff) Reg. (student). REG 19/U/2554/MFN/PS

Faculty/Institute: AGRICULTURE AND ENVIRONMENT

Department: FOOD SCIENCE AND POST HARVEST TECHNOLOGY

Title and bibliographic description of the work
**DIETARY HABITS AND NUTRIENT INTAKE AMONG ELDERLY PERSONS IN
ADJUMANI DISTRICT**

Declaration.

1. I understand what plagiarism is and I am aware of the University policy on this regard,
2. I declare that this ...**Thesis**... (thesis, dissertation, essay, assignment, paper, report etc.) is my original work and has not been submitted elsewhere for examination, award of a degree or publication. Where other people's work or my work has been used, this has been properly acknowledged and referenced in accordance with Gulu University requirements,
3. I have not sought or used the services of any professional agency to produce this work,
4. I have not allowed, and shall not allow anyone to copy my work with the intention of passing it off as his/her own,
5. I understand that any false claim of this work shall result in disciplinary action in accordance with University Policy on Plagiarism.

Signature

Date

27/11/2023

Originality Report

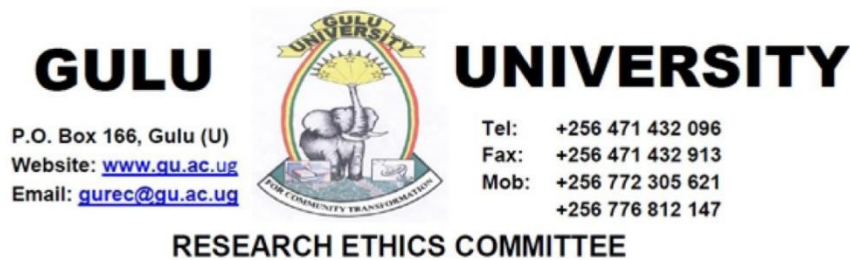
The article/thesis/document titled above have been subjected to plagiarism check and the level was found to be.....**15%** (percent) this is classified as:

- ☒ **Minor**
☐ Moderate
☐ Serious

Yours sincerely,

Dr. Ongaya Kizito (PhD)
Senior Librarian

V: GUREC Approval Letter



23/11/2022

To: FRANCIS ADIBAKU

+256775796898

Type: Initial Review

Re: GUREC-2021-177: DIETARY HABITS AND NUTRIENT INTAKE AMONG ELDERLY PERSONS IN ADJUMANI DISTRICT, 3.0, 2022-11-22

I am pleased to inform you that at the 81st convened meeting on 17/02/2022, the Gulu University REC, committee meeting, etc voted to approve the above referenced application.

Approval of the research is for the period of 23/11/2022 to 23/11/2023.

As Principal Investigator of the research, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the REC for re-review and approval prior to the activation of the changes.
3. Reports of unanticipated problems involving risks to participants or any new information which could change the risk benefit: ratio must be submitted to the REC.
4. Only approved consent forms are to be used in the enrollment of participants. All consent forms signed by participants and/or witnesses should be retained on file. The REC may conduct audits of all study records, and consent documentation may be part of such audits.
5. Continuing review application must be submitted to the REC eight weeks prior to the expiration date of 23/11/2023 in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely fashion may result in suspension or termination of the study.
6. The REC application number assigned to the research should be cited in any correspondence with the REC of record.
7. You are required to register the research protocol with the Uganda National Council for Science and Technology (UNCST) for final clearance to undertake the study in Uganda.

The following is the list of all documents approved in this application by Gulu University REC:

No.	Document Title	Language	Version Number	Version Date
1	Protocol	English	3.0	2022-11-22
2	Data collection tools	English	2.0	2022-03-30
3	Data collection tools	Madi ti	2.0	2022-03-30
4	Informed Consent forms	Madi ti	2.0	2022-03-30
5	Informed Consent forms	English	2.0	2022-03-30
6	Measures for prevention and Control of COVID-19	English	1.0	2021-11-11

Yours Sincerely



Julaina A. Obika (PhD)
For: Gulu University REC