FACTORS ASSOCIATED WITH NUTRITIONAL STATUS OF WOMEN 18-59 YEARS IN MUKONO MUNICIPALITY, UGANDA

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Declaration

This thesis is my original work and has never been presented for a degree in any other university or higher institution of learning.

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Approval

I/We as university supervisors confirm the work in this thesis was done by the candidate under my/our supervision.

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Dedication

This thesis is dedicated to God almighty who created me, blessed me with the gift of life and gave me wisdom and strength to pursue my career. I specially dedicate this thesis to my late Father Mr. Okecho Basil Xytus. Dad, I will always be indebted to you for the love for your children and the desire for them to go to school despite your little earnings then. My Mother Mrs. Okecho Florence, you are a strong woman, you did all you could to make sure all of us remained at and completed school after Dad's demise, I can't thank you enough.

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Definition of terms

Anthropometry: Is the science of measuring the human body such as height, weight, and size of component parts, including skin fold thickness, to study and compare the relative proportions under normal and abnormal conditions (FAO, 2007).

Nutritional status: Is a condition of the body as influenced by the diet; levels of nutrients in the body and the ability of these levels to maintain normal metabolic integrity (FAO, 2007).

Socio demographics: Is the study of people in society and includes factors such as gender, age, household income and education level among other factors (Yadin, 2002).

Diet: The food and drink usually eaten or drunk by one person or group of people (Cambridge, 2019).

Physical activity: Physical activity is any bodily movement produced by skeletal muscle that requires energy expenditure; the popular ways to be active is through, walking, cycling, sports and recreation which can be done at any level of skill for enjoyment (WHO, 2011).

Transport related physical activities: These are active ways of travel to and from places they include mainly walking and cycling (WHO, 2018b).

Work related physical activities: Things that an individual does such as paid or unpaid work for example: study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment etc. (WHO, 2018b).

Recreation activities: Are planned, structured, and repetitive movements with the intention of promoting or maintaining one or more components of physical fitness they include swimming, aerobics, jogging, skipping etc. (WHO, 2018b).

Vigorous intensity activities: Are activities that require hard physical effort and cause large increases in breathing or heart rate like carrying or lifting heavy Jerricans, digging or construction work for at least 10 minutes continuously, assigned a MET value of 8+ (WHO, 2018b).

Moderate intensity activities: Are those that require moderate physical effort and cause small increases in breathing or heart rate such as brisk walking, simple house hold chores, carrying light loads for at least 10 minutes continuously, assigned a MET value of 4+ (WHO, 2018b).

Metabolic equivalent (MET): Is a unit used to express physical activity (PA) intensity and defined as "the ratio of a person's working metabolic rate relative to the resting relative rate. One MET corresponds to the basal metabolic rate, or oxygen consumption that approximates to 3.5 ml/kg per minute, equivalent to about 1 kilocalorie (kcal)/kg body weight per hour (WHO, 2018b).

Women: Are female human beings as distinguished from girls or men (Collins et al., 2012).

List of Acronyms

BMI	Body Mass Index
CDs	Communicable Diseases
CI	Confidence Interval
CVDs	Cardiovascular Diseases
DALYS	Disability Adjusted Life Years
DDS	Dietary Diversity Score
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agricultural Organization
GHO	Global Health Observatory Data
GPAQ	Global Physical Activity Questionnaire
HRQoL	Health Related Quality of Life
IUGR	Intrauterine Growth Retardation
LBW	Low Birth Weight
MDD-W	Minimum Dietary Diversity for Women
METS	Metabolic Equivalents of Tasks
NCDs	Non-Communicable Diseases
AOR	Adjusted Odds Ratio
PA	Physical Activity
REC	Research and Ethics Committee
SES	Socioeconomic Status

SPSS	Statistical Package for Social Scientists
SQFFQ	Semi Quantitative Food Frequency Questionnaire
TBF%	Total Body Fat Percentage
UBOS	Uganda Bureau of Statistics
UNCST	Uganda National Council for Science &Technology
UNICEF	United Nations International Children's Fund
WC	Waist Circumference
WEF	World Economic Forum
WHO	Word Heath Organization
WHR	Waist Hip Ratio

Abstract

Recent findings indicate an increase in obesity and persistent underweight among women in Uganda. Obesity, overweight and underweight have been associated with diet and physical activity. It is however not clear which socio demographic, physical activity and dietary factors are most important influencers of nutritional status among urban women in Uganda. Identifying these will go a long way in determining appropriate intervention strategies for the control of obesity and the associated complications in Uganda.

The aim of the study was to assess the prevalence of underweight, overweight and obesity and how they are associated with socio demographic, dietary and physical activity factors among women 18-59 years in Mukono Municipality. Participants were randomly selected. A semi structured socio demographic questionnaire, semi quantitative food frequency questionnaire and the Global Physical Activity Questionnaire were used to collect data. Data was analyzed using SPSS version 20, frequencies and percentages used to ascertain the prevalence and multinomial logistic regression models used to predict factors at 95% confidence interval.

The study revealed that prevalence of BMI-defined overweight was 29.7%, obesity 20.7% and underweight 2.9%. Older women were less likely to have healthy WHR (AOR 0.2; 95% CI: 0.04-0.90; *P<0.05*), those with moderate monthly expenditure were less likely to be obese (AOR 0.3; 95% CI: 0.1-0.9; *P<0.05*). Frequent consumption of foods from: meat and eggs group increased the likelihood of having excessive abdominal fat (AOR 1.7; 95% CI: 1.02-2.8; *P<0.05*), (AOR 1.2; 95% CI: 1.0-1.5; *P<0.05*) respectively, nuts and seeds increased the likelihood of being overweight (AOR 1.2; 95% CI: 1.0-1.5; *P<0.03*), plantains decreased the likelihood of healthy waist circumference (WC) (AOR 0.8; 95% CI: 0.7-0.9; *P<0.01*), poultry decreased the likelihood of moderately unhealthy WC (AOR 0.7; 95% CI: 95% CI:1.0-1.4; *P<0.05*). There was low (31%) attainment of minimum dietary diversity for women. Non-participation in active transport related physical activity (PA) increased the likelihood of being over fat (AOR=1.8 95% CI: 1.5–3.0; *P<0.05*) while more time spent in work related PA decreased the likelihood of having severely unhealthy WHR (AOR=0.9 95% CI: 0.9–2.0; *P=0.01*). Attainment of WHO standard of PA was at 47.1%.

In conclusion, obesity and abdominal obesity were prevalent among the respondents. They are associated with age, high parity, expenditure per month, time spent in work activity and reliance on walking for transport. They are also associated with a high frequency of consumption of meat, eggs, nuts and seeds and with a low consumption of poultry and vegetables.

Key words: Socio demographic, diet, physical activity, nutritional status and women.

CHAPTER ONE: INTRODUCTION

1.0 Background

Globally, women have nutritional challenges which include; underweight, overweight and obesity (WHO, 2012a). The prevalence of underweight in women has slightly reduced from 11.6% in 2000 to 9.7% in 2016 (WHO, 2018 a). Underweight among women is known to be caused by household food insecurity, high disease burden, intense physical activity in form of workload and inadequate self-care among others (Saikia and Hazarika, 2012). Underweight is associated with a variety of communicable diseases (CDs) as well as low birth weight, preterm birth, mental health impairment, increased risk of infant mortality and higher risk of early mortality (Kalk, 2009; Mond, 2011; Tennant, 2011).

Despite the persistence of underweight, there is a global increase in overweight and obesity observed among women, rising from 31.7% in 2000 to 39.2% in 2016 according to WHO(2018a). Epidemiological studies in Africa have demonstrated an increasing burden of overweight and obesity, particularly in urban areas (Shrimpton and Rokx, 2012; Ngaruiya et al., 2017). Overweight and obesity are associated with an increased risk for many non-communicable diseases (NCDs), such as type 2 diabetes, cardiovascular disease, and respiratory problems, among others (Mendez et al., 2005; Yoon et al., 2006), that are the largest contributors to the years of life lost due to illness, disability and premature mortality (WHO, 2015b). At least 2.8 million adults including women die each year as a result of complications of obesity or overweight (WHO, 2012a).

This increasing prevalence of overweight/obesity and related morbidity and mortality in developing countries have been attributed to the rising economic development, rapid urbanization, changes in food production, dietary patterns and physical activity (Bygbjerg, 2012; Oyeyemi et al., 2012, Yoon et al., 2006). The rates are alarming in Sub-Saharan Africa; where as much as 20-50% of urban populations were estimated to be overweight or obese (Sodjinou et al., 2008).

Uganda is also experiencing a triple burden of malnutrition of obesity, overweight and related non communicable diseases (NCDs) alongside the underweight that has long plagued the country (WHO, 2010). Global Health Observatory Data (WHO), 2017b indicated that in Uganda, overweight or obesity was 30.9% among women with the urban residents more overweight or obese than their rural counterparts.

Although the Uganda demographic and Health Survey of 2016 showed a slight reduction in the prevalence of underweight among women of reproductive age, from 12% in 2011 to 9% in 2016, it showed on the other hand an increase in overweight and obesity from 17% in 2006 to 19% in 2011 and 24% in 2016 (UBOS, 2016). The increasing trend in over weight and obesity presents a challenge to the health care system, which has been traditionally overstretched by under nutrition problems arising from famine, food insecurity and infectious diseases, but now has to deal also with obesity-related NCDs that are projected to account for 46% of all deaths by 2030 (World Bank, 2011). This calls for an in-depth understanding of how different factors lead to the overlap and coexistence of these forms of malnutrition in order to facilitate the development of effective policies and the appropriate allocation of resources to tackle them.

1.1 Problem statement

According to the Global nutrition report, malnutrition remains a big problem among women globally (WHO, 2018a). Studies reveal that Africa is going through a rapid socio demographic transition, with an alarming increase in incidences of overweight and obesity despite the persistence of underweight (Agyemang et al., 2015; Osungbade et al., 2015). The increase in overweight and obesity especially among women in the urban settings has been linked to the changing lifestyles that are affecting diet and physical activity. Physical inactivity is the 4th leading risk factor of death globally; causing 6% of deaths worldwide (WHO, 2005b). It's estimated by WHO (2011) that 1 in every 4 adults including women globally are not physically active enough. Results from MoH (2014) similarly showed that Ugandan women especially in urban settings are becoming increasingly physically inactive.

Despite the rapid transition in diet and physical activity, a study by Ngaruiya et al. (2017) reported limited data which affects comprehensive understanding of the problem. Raschke et al. (2008) noted that nutrition studies that have been carried out to provide information and guide policies in most developing countries are primarily focused on under nutrition particularly among vulnerable children whereas available studies among women are limited in detail on the major factors leading to coexistence of overweight, obesity and underweight among women.

The Uganda demographic and health survey of 2016 indicated that the combined national prevalence of overweight and obesity among women aged 15–49 was 24% with Greater Kampala in which the study area is situated having a higher prevalence of 41.4%,

while underweight was at 9% (UBOS, 2016). The survey didn't avail data on the nutritional status of women in specific urban centers like Mukono that are also experiencing rapid urbanization according to Mukono District local government (2010).

Obesity, overweight and underweight have been associated with diet and physical activity. It is however not clear which socio demographic, physical activity and dietary factors are most important influencers of nutritional status among urban women in Uganda. Identifying these will go long way in determining appropriate intervention strategies for the control of obesity and the associated complications in Uganda.

The purpose of this study therefore was to assess the socio demographic, dietary and physical activity factors associated with underweight, overweight and obesity among women 18-59 years in Mukono Municipality. Findings of this study will be useful in informing policies that can be used in the prevention, reduction and management of the burden of malnutrition among women in Mukono and the country at large.

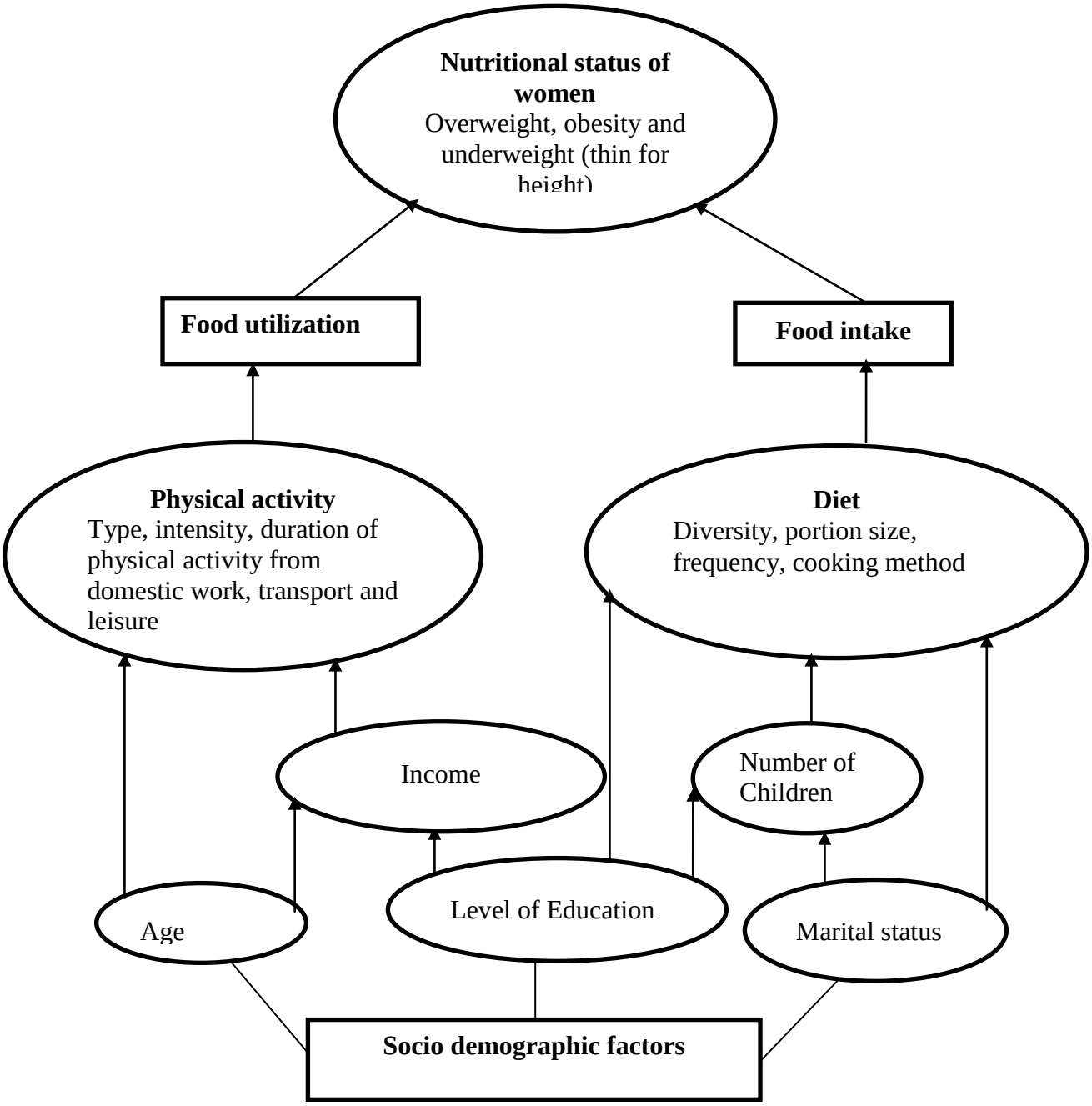

Fig1. Conceptual framework of socio demographic, dietary and physical activity factors associated with nutritional status of women.

Adopted from the conceptual framework of UNICEF (1990)

This conceptual framework classifies the causes of malnutrition among women in the context of the study into two levels; with one level influencing another level. It shows that socio-demographic factors affect both diet and physical activity that in turn affect food intake and utilization. The factors associated with nutritional status are many and diverse but diet and physical activity remain prominent factors determined by the socio demographic characteristics (Agyemang et al., 2015).

Socio demographic factors affect nutritional status indirectly by affecting physical activity and dietary patterns. They include: Age, marital status, level of income, level of education and number of children (Yadin, 2002). Some of these factors also affect each other like; Age and level of education affect income which has an effect on dietary patterns.

Dietary patterns are quantities, proportions, variety or combination of different foods, drinks, nutrients in diets, and the frequency with which are habitually consumed; these are usually linked directly to nutritional status (Kreb, 2014).

Physical activity patterns affect how the food taken is utilized by the body and they include; type, frequency, intensity and duration of physical activity from domestic work, active transport and recreation. Imbalance in food intake and food utilization causes malnutrition in form of overweight obesity and underweight (Popkin et al., 2012) and (Wansink & Chandon, 2006).

1.2 Research objectives

1.2.1 General objective

To assess the prevalence of underweight, overweight and obesity and how they are associated with socio demographic, dietary and physical activity factors among women 18-59 years in Mukono Municipality.

1.2.2 Specific objectives

i. To assess the prevalence of underweight, overweight and obesity among women 18-59 years in Mukono Municipality.

ii. To establish socio demographic factors associated with underweight, overweight and obesity

iii. To establish dietary factors associated with underweight, overweight and obesity

iv. To assess the physical activity patterns associated with underweight, overweight and obesity

Table 1.1: Objectives, research questions and indicators

S/No.	Objectives	Research questions	Indicators
i.	To assess the prevalence of underweight, overweight and obesity among women 18-59 years in Mukono Municipality.	What is what is the prevalence of underweight, overweight and obesity?	Numbers and percentages of respondents with nutritional status below or above the reference to the standard cut offs.
ii.	To establish socio demographic factors associated with underweight, overweight and obesity.	What are the socio demographic factors associated with underweight, overweight and obesity?	Adjusted odds ratio (AOR) at 95% CI to predict socio demographic factors. Significance (P value of <0.05).
iii.	To establish the dietary factors of overweight, obesity and underweight.	What are the dietary factors associated with underweight, overweight and obesity?	Adjusted odds ratio (AOR) at 95% CI to predict dietary factors. Significance (P value of <0.05).
iv.	To assess the physical activity patterns associated with underweight, overweight and obesity.	What are the physical activity factors associated with underweight, overweight and obesity?	Adjusted odds ratio (AOR) at 95% CI to predict physical activity factors. Significance (P value of <0.05).

CHAPTER TWO: LITERATURE REVIEW

2.1 Nutritional status of women

Nutritional status is defined by the food and nutrition dictionary as; a condition of the body as influenced by the diet; levels of nutrients in the body and the ability of these levels to maintain normal metabolic integrity (David, 2005). The status of an individual's nutrition can be classified as normal, overweight, obese, underweight, wasted, stunted or being deficient of vitamins and minerals by carrying out nutrition assessment (FANTA, 2016). Anthropometry is an important way of carrying out nutrition assessment (WHO, 2018a). For non-pregnant and non-postpartum women, general adequacy is assessed by measuring weight and height; the result is commonly expressed as the body mass index (BMI), the ratio of weight (kg) to height $(m)^2$. Body fat can also be estimated by measuring skin fold thickness, waist and hip circumference (FAO, 2007) and in pregnant and postpartum women, the most appropriate anthropometric measurement is mid upper arm circumference (MoH, 2016). Total body fat percentage and abdominal fat can also be used to assess nutritional status of women (TANITA, 2018).

2.1.1 Prevalence of overweight and obesity among women

World Health Organization (WHO) defines overweight and obesity as "the abnormal or excessive fat accumulation that presents a risk to health" (WHO, 2019). The simplest and commonest measure of excessive fat is the BMI which is based on a ratio of a person's weight in kg to their height in square meters. Based on this measure, individuals

with a BMI greater than or equal to 25kg/m^2 are classified as overweight while those over 30 kg/m^2 are classified as obese (WHO, 2012a). BMI provides a useful population level measure of overweight and obesity as it is the same for both sexes and for all ages of adults. However, it should be considered a rough guide because it may not correspond to the same degree of fatness in different individuals (WHO, 2018a).

The Global Health observatory data, WHO (2017b) indicated an increase in overweight and obesity among women, from 13% in 2010 to 15% in 2014 globally and 14% in 2010 to 16% in 2014 in Africa, respectively. Similarly, the Global nutrition report indicated, an alarming prevalence of overweight and obesity of 39.2% among women (WHO, 2018a). According to the UBOS (2016), the overall national prevalence overweight and obesity among women of reproductive age in Uganda has been increasing from 17% in 2006 to 19% in 2011; and 24% in 2016. Greater Kampala had much higher levels of 41.4%, (24.3% overweight and 17.1 % obese) (UBOS, 2016). The same survey also indicated that the overweight and obesity were substantially higher among urban than rural women (34.3% and 19.9%, respectively).

2.1.2 Prevalence of underweight among women

Underweight is considered to be one of the world's most serious, but least addressed, health problems (Sun movement, 2011). An underweight woman is one whose BMI is $\leq$ 18.5kg/m^2 or has a weight 15% to 20% below that is normal for her age and height group (Mahan, 2003). There is evidence this increases the mortality rate, risk of illness and also contributes directly to low birth weight (LBW) incidence among term

births (WHO, 2017a). Underweight in women of childbearing age is a risk factor for adverse pregnancy outcomes, such as intrauterine growth retardation or low-birth weight infants (Mukuria et al., 2005). Data from 32 African countries on the proportion of women who had a low body mass index (BMI) between 2000 and 2015 showed a median of 10.9% (Neupane et al., 2016). Findings from another related study carried out in Tanzania among women showed that the prevalence of underweight was 11% (Mtumwa et al., 2015). According to UBOS (2016), the proportion of underweight among women aged 15-49 in Uganda had declined over the past 10 years, from 12% in 2006 and 2011 to 9% in 2016 although there remains a challenge of limited research on this problem in the country.

2.2 Causes of malnutrition among women

There are various causes of malnutrition among women as shown in the conceptual framework of UNICEF (1990). This study explored the socio demographic factors that affect women's nutritional status and its major determinants: dietary and physical activity patterns (Agyemang et al., 2015).

2.2.1 Socio demographic factors associated with nutritional status

Socio demographics; is the study of people in society and includes factors such as gender, age, household income and education level among other factors (Yadin, 2002) which according to Agyemang et al, (2015); Mawa (2018) and (Mtumwa et al., 2015) greatly affect nutritional status.

Globally socio demographic factors are powerful predictors of nutritional status however; the effects vary depending on a particular factor and region as shown in studies by (Mclaren, 2007; Kim & Knesesbeck, 2018; Mtumwa et al., 2015 & Yibeltal et al. (2014). A number of studies in Africa have reported a positive association between age and obesity among women; (Muhihi et al., 2012; Atek et al., 2013; Pereko et al., 2013 and UBOS, 2016). Agyemang et al. (2015) reported that while obesity increases with age, it increases up to a certain age and declines afterwards especially in women. Where as in a study by Yibeltal et al. (2014), in Ethiopia showed that the highest prevalence rates of underweight were observed among women of younger age (15-19) compared to the older ones; women in the age ranges of 30-49 were less likely to be underweight. Relatedly, women aged 20-29 and 30-39 years were less likely to suffer from underweight than women aged 15-19 or 40-49 years (Mtumwa et al., 2015). Another study by Mawa (2018) also indicated that being in the age group of 45-49 years was associated with increased risk of overweight (OR 2.45;95% CI, 1.39-4.33) and obesity (OR 10.59; 95% CI, 4.08 -27.52). This is not very different from a report from a national survey in Uganda which also showed that the proportion of women who were overweight or obese increased with age, from 11% among those aged 15-19 to 34% among those aged 40-49 (UBOS, 2016). This positive association between age and overweight/obesity might be explained by the underlying socio-cultural and physiological factors. In a socio-cultural perspective, middle aged African women and especially those living in urban areas tend to lead sedentary lifestyle than their younger counterparts who are often more involved in physical activities such as sports, and leisure activities (Micklesfield., et al 2017; Joseph.,

et al 2018). It's also noted that younger women in developing countries have no or little power in decision making about food distribution in the household, and can be marginalized, leading to poor nutritional status according to (Mtumwa et al., 2015). Physiologically there is often increase in adiposity and progressive loss of muscle mass from the age ≥ 30 years in both women and men (Keller & Engelhardt, 2013). Another existing evidence also attributed brown adipose tissue that regulates fat mass and energy homeostasis in mammals to obesity; brown adipose tissue mass tends to decline slowly with age in women than in men (Pfannenberg, et al., 2010).

Marital status is an important determinant of nutritional status of women in Africa and according to Agyemang et al (2015) being married increases the likelihood of being overweight or obese. In South Africa, Menendez (2009) reported that never married participants had a lower risk of being overweight or obese than the married. According to a study in Kenya, married and cohabiting respondents showed significant increased risk for obesity at 1.9 times more likely compared to unmarried respondents (Masibo et al., 2013). Similarly, women who had never married were more likely to be underweight (OR of 1.73) than married women or those living with their partners (Mtumwa et al., 2015). A study by Tania et al. (2019) also showed that, 'not being married' status for rural women were positively associated with underweight and negatively associated with overweight and obesity. In an African setting this can be explained by the fact that many married women are financially dependent on their partners while single women are economically disadvantaged, and less able to achieve food security and maintain optimum health on a sustainable basis (Mtumwa et al., 2015).

Number of children is another pertinent socio demographic factor that studies have linked to nutritional status. Women with more children are more likely to be overweight or obese compared to those with no children (Agbeko et al., 2013; Yibeltal et al., 2014). This is partly because more children may mean older age and more fat but also the increased body weight in women may be associated with the inevitable gestational weight gain according to Girard & Ferre (1982).

In developed countries, low wealth index is linked to increased body weight (Mclaren, 2007; Kim & Knesesbeck, 2018) while on the contrary findings in developing countries indicate that those classified as rich to have higher likelihood of overweight and obesity (Neupane et al., 2016; Bitew et al., 2010; Tania, et al., 2019). This is because economically disadvantaged people are more likely to consume junk and empty calorie foods (Anu et al., 2016) in developed countries where as in in transition societies over eating is primarily explained by economic access to food according to Mclaren (2007). A study in Uganda by Mawa (2018) also found the highest risk of obesity was among women living in the richest households, who had 13 times the risk of obesity in comparison with women living in poor households. These findings could have reflected the reality that most women living in affluent households in Uganda tend to lead: sedentary lifestyle, often driven or use public transport systems most of the time, eat more fatty and refined foods, in current shift of dietary patterns to meet western or so called civilized lifestyle and social class difference in Ugandan context (Mawa, 2018).

Other studies by Mtumwa et al. (2015) in Tanzania and Saikia and Hazarika (2012) in India both indicated that women with low economic status were significantly more

likely to be affected by underweight than those with the wealthiest economic status. This can be attributed to the fact that poverty is associated with poor housing and access to basic and social needs, including water and sanitation; poverty that leads to a scarcity of resources and low purchasing power with respect to adequate and nutritious food, resulting in macro- and micronutrient deficiencies (Mtumwa et al., 2015).

Differences in women's nutritional status by level of education in most countries across Africa are not any different from those found in other previous studies in other countries (Dinsa et al., 2012). Studies by Ziraba et al. (2009); Agbeko et al. (2013); Anu et al. (2016) reported that women with higher education were more likely to be overweight or obese compared to those with no formal education and also rural women without an education (OR of 1.77), or with a primary education (OR of 1.68) were significantly more likely to experience underweight than women with secondary or higher education (Mtumwa et al., 2015). Mawa (2018) in Uganda also reported an increased risk of overweight among women with primary, secondary and tertiary level educational attainment in comparison with those that had no formal education. These findings can be related to that of UBOS (2016) which revealed that number of years of education increased with wealth and wealthy people have economic access to food (Mclaren, 2007).

2.2.2 Dietary factors associated with nutritional status

Dietary patterns are quantities, proportions, variety or combination of different foods, drinks, nutrients in diets, and the frequency with which they are habitually consumed; these are usually linked to nutritional status (Krebs, 2014). Generally, there is a global shift in diet (Popkin et al., 2012), which manifests in the form of increased intake of

energy dense foods with high fat and sugar amounts but low in vitamins and minerals (WHO, 2008).

Urban Africans have also shifted to increased consumption of refined foods and those high in fats and sugars yet less in fiber (Agyemang et al., 2015) which are considered to be unhealthy (Wadolowska et al., 2016). Consumption of calorie-dense foods, low intake of fruits and vegetables, and frequent drinking of sweetened tea have been linked to and overweight obesity (Manyema et al., 2014).

Obesity involves increased fat cell size and number, the fundamental cause is imbalance between calories consumed and calories expended (Popkin et al., 2012). High caloric consumption among women has been attributed to unhealthy eating habits which include; frequent consumption of sweets, chocolates, soft drinks, energy drinks, sweetened drinks and fast foods (Wadolowska et al., 2016). This occurrence is common because most families are unable to afford or access enough nutritious foods like fresh fruits and vegetables, legumes, meat and milk, while foods and drinks high in fat, sugar and salt are cheaper and more readily available, leading to a rapid rise in overweight and obesity according to WHO (2012a). Findings of UBOS (2016), reported there was limited intake of food sourced from animals, fruits and vegetables. This lack of dietary diversity was associated with underweight, overweight and obesity among women (Mayega et al., 2012).

Calorie underestimation, coupled with increasing portion sizes, is another driver of the obesity pandemic (Wansink & Chandon, 2006). A study in Ghana indicated that consuming more servings of carbohydrate foods and less of fruit has been shown to be

associated with increased likelihood of being overweight and obese (Biritwum et al., 2005). Another related study by Ngaruiya et al. (2017) also indicated that high-carbohydrate meals, such as “posho”, bread made from starchy flours like cornmeal or cassava, common in Uganda and are usually served in large quantities with fatty meat, which contributes to satiety, resulting to increased caloric intake but deficiency in micro-nutrients. It’s further noted that Ugandan women tend to have preference for high calorie foods such as fried chicken and chips, pork, sweetened beverages e.g. coca cola products, etc. (Mawa, 2018).

Another dietary factor that has been strongly associated with being overweight or obese is the frequent consumption of snacks (Piernas & Popkin, 2010). Having snacks has increased around the world (Poulain, 2002). A study by Piernas & Popkin (2010) reported frequent consumption of snacks to be linked to the rising rates of obesity. Other researchers have found conflicting results on the timing of snack and consumption frequency with BMI while other related studies found no relationship between BMI and frequent eating regardless of when they consumed their snacks i.e. at any time of the day (morning, afternoon, evening) (Bellisle, 2004). According to (Piernas & Popkin, 2010), the number of snacks, and the consumption of drinks between meals such as milk drinks, regular soft drinks, sports drinks, and energy drinks differ from country to country and all these contributed to the total caloric intake.

2.2.3 Physical activity patterns associated with nutritional status

Physical activity (PA) is any bodily movement produced by skeletal muscle that requires energy expenditure; the popular ways to be active is through, walking, cycling, sports and recreation which can be done at any level of skill for enjoyment (WHO, 2018b). A systematic review by Webster (2015) showed that PA is becoming part and parcel of life in many developed countries owing to its positive impact on the Health-Related Quality of Life (HRQoL). Studies by Oyeyemi et al. (2012) and Agyemang et al. (2015), implicated physical inactivity as one of the major causes of overweight and obesity. The WHO (2008) recommends that throughout a week, including activity for work, during transport and leisure time, adults should do at least 150 minutes of moderate-intensity physical activity or; 75 minutes of vigorous-intensity physical activity or an equivalent combination of moderate and vigorous intensity physical activity achieving at least 600 MET-minutes.

Physical activities that women engage in range from low, moderate to vigorous activities of various types (Agyemang et al., 2015) like spending time on watching T.V, indoor games, using internet etc. Some women participate in different household activities like preparing food, going for shopping, cleaning the house, laundry or ironing etc. while some may engage in vigorous activities like floor exercises, jogging, tennis or badminton, football or hockey, cricket, martial arts etc. (Wadolowska et al., 2016).

Sedentary lifestyles are increasing in most societies around the world, mainly owing to increased access to effort-saving technologies, structural and social constraints (Neupane et al., 2016). Sedentary behaviors include, watching TV, reclining in office,

sitting and sleeping during the day among others (Agyemang et al., 2015). Sedentary people often eat large quantities of food that exceed their relatively lower energy requirements, go into a positive energy balance and are at risk of becoming overweight or obese (Dietz and Gortmaker, 2001). Studies have implicated television viewing which is very common in urban areas to be positively associated with cardiovascular disease risk factors, lower energy expenditure over-eating and high-calorie, high-fat foods according to Agyemang et al. (2015). Relatedly Wadolowska et al. (2016) also reported that less time spent watching television was associated with better dietary quality.

There is an overt increasing shift from high physical activity-based occupations such as construction and working in factories to sedentary and service-based occupation (Neupane et al., 2016) in Africa. Examples of these are increased use of automobiles for transportation, piped water, television, computers, elevators and escalators in buildings that have simplified work and reduced physical activity especially in urban areas (Goran & Treuth, 2001). While on the other hand findings reveal that woman who are low income earners especially the urban poor and those from rural settings engage in too much work and care less about themselves which causes high energy expenditure coupled with inadequate dietary intake leading to underweight (Saikia & Hazarika, 2012; UBOS, 2016). Similarly Ugandan women of low socio economic status might be more involved in rigorous physical activities such as 4-6 hours of cultivation using non-motorized agricultural tools, and also walking over an hour or more to fetch water for domestic use (Mawa, 2018). These activities might be equivalent to the WHO recommended 150 minutes of moderate to vigorous intensity physical activity per week for adults aged 18-64

years (WHO, 2010) and may partly lead to weight loss or prevent weight gain among women of low income status.

CHAPTER THREE: METHODOLOGY

3.1 Study area

The study was carried out in Mukono Municipality located in Mukono District, Central Uganda. Mukono Municipality is bordered by Kalagi to the North, Kira town to the West, Lake Victoria to the South, and Lugazi to the East. The town is about 27 kilometres (17 mi) by road, East of the central business district of Kampala, Uganda's capital and largest city. The Municipality occupies approximately 31.4 square kilometres (12.1 sq mi) of land area. The coordinates of the town of Mukono are 00 21 36N, 32 45 00E (Latitude: 0.3600; Longitude: 32.7500) (Globefeed.com, 2014).

Most of the residents in Mukono Municipality are average income earners and have attained some basic level of education. Mukono municipality is undergoing rapid urbanization (27%) (Mukono District local government, 2010); it is within Greater Kampala where 41.4% of women aged 15-49 were overweight/obese, and 13% obese (UBOS, 2016). This trend is likely to be in Mukono Municipality given its proximity to Kampala the major capital but there is no existing study underpinning it and that is why Mukono is the study area of choice.

3.2 Target Population

The study targeted women 18-59 years living with in Mukono Municipality. It focused on women in this age group because this caters for both women in the reproductive and menopausal age who according to many studies Agyemang et al. (2015);

Sarma et al. (2015) and UBOS (2016) are prone to malnutrition especially overweight and obesity.

3.2.1 Inclusion and Exclusion Criteria

Participants were eligible to participate if they were female, 18-59 years old and have been residents of the selected villages for at least 6 months and excluded if they had recent deliveries (less than 6 months to data collection day), pregnant and also if they declined to consent.

3.3 Research design

A cross sectional design was used to collect data on the socio demographic characteristics, dietary and physical activity patterns of women.

3.4 Sample Size determination

Sample size was calculated using the Araoye, 2003 formula as follows:

$$N = \frac{Z^2 P (1-P)}{X^2}$$

Where; N = sample size; Z = confidence level (which was taken as 95% with a degree of probability of 1.96%, P = total prevalence of women overweight, obesity and underweight of women taken as 50.4% (UBOS, 2016); (1 – P) = prevalence of women not malnourished; and, X^2= level of precision, taken to be 5%.

$N = \frac{(1.96)^2 \times 0.504 \times (1-0.504)}{0.05^2}$ = 384 respondents.

A sample size of 384 respondents was used.

3.5 Sampling

The study employed a simple random sampling. It employed two-stage sampling in which a sample of a primary unit was selected and then another sample of secondary units also selected within each primary unit (Creswell et al., 2018).

Mukono municipality is comprised of 4 wards/parishes. Each of the parishes is comprised of several villages totaling up to 35.

In the two stage sampling procedure, a sampling frame was formed from the 4 parishes/wards: Ntaawo, Ggulu, Namumira-Anthony and Nsuube-Kauga in Mukono Municipality (Mukono District local government, 2010). In the first stage, a raffle was drawn using excel to select four villages from each of the parishes and the following villages were randomly selected: Ssaza, Mulago, Kigombya and Nabuti.

In the second stage, households were randomly selected by the interviewer who then inquired if there was a woman in the household who met the inclusion criteria. Informed consent was sought and if willing to participate, the woman was interviewed.

3.6 Pretesting of the research instruments

When the instruments were designed, 10 people from the target group to pretest it were identified to answer questions in the instrument. The questionnaires were completed the same way that it would be in the actual study. While being taken through the questions, the participants were required to understand the question and answer. The interviewer took notes of everything they said and later identified places where they misunderstood, hesitated or made mistakes. When all the questionnaires had been

completed, a review of notes from each session was done. The research team then improved the instruments to address the identified problems.

3.7 Validity and reliability

The research instruments were checked by research team to see if they covered all the objectives and if all areas of concern had been reflected. Paired sample test was done and in non-normally distributed data; the Wilcoxon Signed Rank test was used. Basing on the results adjustments were made and the tools refined to give consistent values.

Reliability was checked by collecting data from10 respondents and calculating the Intra-Class Correlation Coefficient (ICC) (two-way random, absolute agreement, single measures with a 95 % confidence interval). The cut-off points for reliability assessment of; >0.90 (excellent), 0.75-.90 (good), 0.60-0.75 (moderate), and < 0.60 (low) was used and the results indicated that instrument was good.

3.8 Data collection

Semi structured interview: This included closed and open-ended questions on the socio demographic data, dietary and physical activity patterns of the respondents. It was administered by an interviewer and conducted in person. Responses were analyzed using quantitative methods (Creswell et al., 2003).

3.8.1 Research instruments

An interviewer administered questionnaire which included socio demographic questions, a semi quantitative food frequency questionnaire, Global Physical Activity Questionnaire (GPAQ) and a template for body composition measurements were used to collect data. The questionnaire included a number of questions on the social and

demographic aspects such as age, gender, education, expenditure per month as a proxy of socio economic status and household size.

A semi quantitative food frequency questionnaire was used in this study to determine typical food consumption in a week using an embedded question approach. It was an instrument of choice in this study because it is most suitable in estimating dietary intake of large groups of people and is capable of giving information on the quality of diets (FAO, 2003).

For assessing physical activity, the Global Physical Activity questionnaire was used. It was a good choice in this case because it is designed to collect data on physical activity participation in three domains of work, travel to and from places and recreational activities. It also has the ability to measure physical activity patterns since the participant is asked about their usual weekly physical activity. It requires participants to state the number of days and time they usually spend doing a particular category of activity as in the WHO (2018 b).

3.8.2 Anthropometric and body composition tools

Height of the participants was measured to the nearest 0.1cm using a portable height scale: **T023000201 PRESTIGE India,** and the weight to the nearest 0.1kg using **TANITA BC-202-WH**, Japan weighing scale. This scale has the ability to automatically generate readings for body mass index, muscle mass, abdominal fat level, basal metabolic rate, bone mass, metabolic age, total fat percentage and total body water when the respondent steps on it after her age, sex and height have been entered in it.

A flexible **Oxford measuring tape** was used to measure waist and hip circumference of the respondents to the nearest 0.5cm. All the readings from the equipment were taken and recorded immediately by the interviewers.

BMI is an easy and reproducible indicator of nutritional status for adults but it hasn't been used alone in this study because according WHO (2016), it is not a perfect measure of obesity due to its inability to measure body fat directly. The other indicators used in this study include total body fat percentage, waist circumference, waist hip ratio and abdominal fat according to their standard cut off as shown Table 3.1 below.

Table 3.1 Cut offs of variables according to reference standards

Variable	Indicators	Standard cut offs				
Obesity/over weight, Underweight	BMI (kg/m^2)	< 18.5 Underweight 18.5-24.99 Normal 25-29.99 Overweight ≥30 Obese				
	Waist Hip Ratio	< 0.85 Low risk of developing NCDs (Healthy WHR) ≥0.85 Substantially increased risk of NCDs/ (Unhealthy WHR).				
	Waist circumference (cm)	<80 Low risk of developing NCDs (Healthy WC) 80-88 Increased risk of developing NCDs (moderately unhealthy WC) >88 Substantially increased risk of developing NCDs (Severely unhealthy WC).				
	Body fat Percentage (%)	Age	Body fat percentage cut off			
			Under fat	Healthy	Over fat	Obese
		18-19	0-<15.6	15.6-<30.9	30.9-<33.9	>or=33.9
		20-39	0-<19	19-<33	30-<39.5	>39.5
		40-59	0-<23	23-<34	34-<40	>40
	Abdominal fat	1-12 Healthy >12 Excessive				
Diet	MDD-W	<5 Inadequate = or > 5 Adequate				
Physical activity	Vigorous PA Moderate PA Low PA Physically active	MET value 8+ MET value 4+ MET value < 3 = or> 600MET-minutes				

Adopted from WHO (2008); TANITA (2018); WHO (2018b); FAO(2016); WHO(2011)
MDD-W Minimum dietary diversity score for women, PA= Physical Activity, NCDs= Non communicable diseases.

3.9 Data Analysis

Quantitative data was analyzed using SPSS version 20. Frequencies, percentage, were generated and used to ascertain the prevalence of women overweight, obesity and underweight. The minimum dietary diversity score for women (MDD-W) was determined using the 10 food groups of women (FAO, 2016) which included grains roots and tubers, nuts and seeds, dairy, meat and fish, eggs, green leafy vegetables, vitamin A rich fruits and

vegetables, other vegetables and other fruits. Respondents were given a score of 1 for a food group eaten the previous day and 0 for those that they didn't eat. The total score from each of the food groups then computed. Respondents who scored less than 5 were considered not to have attained the minimum dietary diversity score and those who scored ≥5 were considered to have attained the minimum dietary diversity score.

The expanded version of the food groups used was used to assess aspects of diet quality other than the micronutrient adequacy that is measured by the MDD-W in the context of the nutrition transition (FAO, 2016). This resulted in a total of 18 food groups including meat, sweets, poultry, roots and tubers, nuts and seeds, eggs, vitamin A rich fruits and vegetables, dark green vegetables, fish, other vegetables, other fruits, dairy, plantains, fried snacks, pulses, grains, sugars and sweetened beverages, fats and oils. For analysis, these were regrouped into 5 groups i.e. carbohydrates (grains, roots and tubers, plantains), plant protein sources (pulses, nuts and seeds), animal protein sources (meat, poultry, fish, dairy, eggs), fruits and vegetables (dark green leafy vegetables, Vitamin A rich fruits and vegetables, other vegetables, other fruits), and low nutrient density foods (oils and snacks, fried snacks, sweets, sugars and sweetened beverages). These sub food groups were derived from major food groups that include; Carbohydrates, plant proteins sources, animal protein sources, fruits and vegetables and low nutrient density foods. The average frequencies of consumption of these food items in each of the groups were entered into a logistic regression model to check which of the food items in each group were related to nutrition status and how using adjusted odds ratio (AOR) at 95% confidence interval.

A similar approach was employed in the analysis of the physical activity patterns in which the variables in the Global physical activity questionnaire (GPAQ) were categorized into four groups for analysis to find out which variables were associated with nutrition status and how. The groups were as follows: group 1 (Meeting WHO standards; Mean Time of Total PA per day; Percent of Vigorous PA; Sedentary time per day), group 2 (Mean time work related PA per day; Mean time in transport related PA; Mean time in recreation related PA), group 3 (Nonparticipation in work related PA; Nonparticipation in transport related PA; Nonparticipation in recreation related PA) and group 4 (Percent of total PA from work; Percent of Total PA from transport; Percent of Total PA from recreation), accordingly.

Multinomial logistic regression was used to determine the odds of being overweight, obese or underweight in regard to the factors hypothesized to be associated with the nutritional status indicators. Logistic regression model was used.

$$\textit{Logit}\,[P(Y=1] = \alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots\ldots\ldots\ldots\ldots \beta_k x_k$$

Where: Y is the i^{th} observation on the dependent variable (e.g in this case; body mass index), $x=$ is the i^{th} observation of the independent variable (e.g in this case age, sex, number of children) which are many in a multinomial regression. α is intercept of the dependent and independent variables. β is the slope coefficient; refers to the effect of x_1 on the log odds that $Y=1$, controlling other for instance, $exp(\beta_1)$ is the multiplicative effect on the odds of a one- unit increase in x_1 at fixed levels of other x_2. (Menard, 2002).

3.10 Ethical consideration

Clearance and introductory letter were obtained from Kyambogo University and permission was sought from the town clerk of Mukono central division. The researcher then got recommendation from Mbale Regional Referral Hospital Research and Ethics committee (**No. MRRH-REC OUT01042018).** The research protocol and instruments were then submitted to the Uganda National Council for Science and Technology (UNCST) for approval and registration **(No. SS4961).** The office of LC1 chairpersons of each of the selected villages were visited to obtain permission. Details of the study were explained to the respondents and written informed consent was sought from each respondent.

CHAPTER FOUR: RESULTS

4.1 Socio-demographic characteristics of respondents

Table 4.1 shows socio demographic characteristics of 384 respondents in the cross-sectional survey.

Table 4.1: Socio demographic characteristics of respondents

Characteristics	Number (n)	Percentage (%)
Age		
18-19	33	8.6
20-29	200	52.0
30-39	86	22.4
40-49	36	9.4
50-59	29	7.6
Marital status		
Single/never married	107	27.9
Married/cohabiting	212	55.2
Divorced/separated	54	14.0
Widowed	11	2.9
Education Level		
Didn't attend formal education	24	6.3
Primary education	13	3.4
Secondary education	306	79.7
Tertiary education	18	4.7
University education	23	6.0
Employment status		
Formal employment	20	5.3
Self-employment	139	36.1
Casual workers	58	15.1
Unemployed	159	41.4
Student	1	0.3
Subsistence Agriculture	6	1.6
Commercial Agriculture	1	0.3
Parent hood		
No child	83	21.4
1-3	209	54.4
>3	93	24.2
Household size		
<3	96	25
3-5	193	50.3
>5	95	24.7

Table 4.1 above shows that majority (52.0%) of respondents was young within the age group of 20-29 years, 55.2% were married or cohabiting and (79.7%) had attained secondary education. The unemployed were 41.4%, 54.4% had 1-3 children and 50.3% of the respondents lived in households that had 3-5 members.

4.2 Prevalence of malnutrition among women in Mukono

Table 4.2 shows the prevalence of malnutrition based on different anthropometric and body composition parameters: Body mass index, total body fat percentage, waist circumference, waist hip ratio and abdominal fat.

Table 4.2: Prevalence of malnutrition in Mukono Municipality

Variables	Number(n)	Percentage (%)
BMI (kg/m^2)		
Underweight (<18.5)	11	2.9
Normal (18.5-24.9)	185	48.0
Overweight (25-29.9)	114	29.7
Obese (≥ 30)	79	20.6
Waist Hip Ratio (WHR)		
Low risk (< 0.85)	225	66.4
Substantially increased risk (≥ 0.85)	129	33.6
Waist Circumference		
Low risk (<80 cm)	168	43.8
Increased risk (80-88 cm)	108	28.1
Substantially increased risk (>88cm)	108	28.1
Total body fat percentage (cut offs depend on age)		
Under fat	7.0	1.8
Healthy	130	33.8
Over fat	100	26.0
Obese	147	38.3
Abdominal fat level		
Healthy (1-12)	362	94.3
Excessive (>12)	22.0	5.70

N=384

Results in Table 4.2 indicate that the prevalence of obesity (BMI≥ 30) was 20.6%, overweight (BMI=25-29.9) was 29.7%, while underweight (BMI<18.5) was 2.9%. Waist hip ratio results indicate that 33.6% the respondents had waist hip ratio ≥ 0.85 (categorized as severely unhealthy), while 66.4% were in the healthy category (WHR< 0.85). Waist circumference (WC) results showed that 43.8% of the respondents had WC < 80cm categorized as healthy, 28.1% were in the 80-88 cm category considered as unhealthy and the same percentage were in the >88 cm category classified as severely unhealthy. Total body fat percentage (TBF %) results indicated that 2.1% were under fat, 27.6% over fat and 36.2% obese. Ninety-four-point three percent (94.3%) of respondents had abdominal fat in the range of 1-12 (healthy) and 5.7% had >12 classified as excessive abdominal fat level.

4.3 Socio demographic factors associated with nutritional status

The socio demographic factors assessed included; age, marital status, parenthood, education level, monthly expenditure as a proxy of socio-economic status, and household size against body mass index, total body fat percentage, waist hip ratio, waist circumference and abdominal fat.

4.3.1 Socio demographic factors associated with body mass index

Table 4.3 shows a multinomial logistic regression results (Adjusted odds ratio (95% confidence interval) predicting socio demographic factors associated with body mass index (BMI) of respondents.

Table 4.3: Socio demographic factors associated with body mass index

Socio demographic factors	Body Mass Index		
	Underweight	**Overweight**	**Obese**
	AOR (95% CI)	**AOR (95% CI)**	**AOR (95% CI)**
Age			
20-29	1.1(0.1-9.4)	1.1(0.4-2.3)	0.5(0.3-1.2)
30-39	0.2(0.09-4.1)	1.7(0.6-4.9)	0.9(0.3-2.9)
40-49	0.8(0.04-13.8)	2.7(0.8-9.2)	0.4(0.07-1.9)
50-59		3.2(0.8-13.0)	1.9(0.4-8.0)
18-19			
Marital status			
Single/ Never married	1.7(0.3-8.6)	5.9(0.6-56.9)	1.7(0.3-8.6)
Married/Cohabiting	0.8(0.2-3.9)	6.6(0.7-59.4)	0.8(0.2-3.9)
Divorced/Separated	0.8(0.04-13.8)	6.3(0.7-59.3)	1.2(0.2-6.2)
Widowed			
Parent hood			
No Child	0.2(0.01-3.1)	2.4(0.8-6.7)	1.2(0.4-3.6)
1-3	0.4(0.1-2.0)	1.9(0.9-3.9)	1.5(0.70-3.4)
>3			
Education Level			
No formal education		2.4(0.8-6.7)	1.2(0.4-3.6)
Primary education		1.2(0.3-4.1)	0.7(0.2-3.9)
Secondary education		0.5(0.2-1.7)	0.5(0.1-2.3)
University education		0.6(0.2-1.8)	0.6(0.2-2.2)
Tertiary education			
Expenditure per month (proxy of ES)			
High (>300,000)	0.6(0.2-2.3)	1.5(0.8-3.1)	0.5(0.2-0.9)
Moderate (150,000-300,000)		1.3(0.5-3.6)	***0.3(0.1-0.9)*** *
Low (<150,000)			
Household size			
<3	1.9(0.3-11.8)	1.0(0.5-1.9)	1.9(0.9-4.0)
3-5	1.8(0.3-9.5)	1.3(0.7-2.4)	1.6(0.8-3.2)
>5			

**P*<0.05, **P<0.01. AOR= Adjusted odds ratio at 95% CI AOR>1 =More likely, =1= Equal, <1=Less likely, ES= Economic status.

Respondents with moderate expenditure per month (150,000-300,000 UGX) were less likely to be obese compared those with high monthly expenditure (AOR 0.3; 95% CI: 0.1-0.9; *P< 0.05*). Although not significant, respondents with less than 3 house hold members were more likely to be obese than those with more members. (AOR 1.9; 95% CI: 0.9-4.0; P>0.05).

4.3.2 Socio demographic factors associated with total body fat percentage

Table 4.4 shows multinomial regression results with odds ratio (95% confidence interval) predicting socio demographic factors associated with total body fat percentage of women in Mukono Municipality.

Table 4.4: Socio demographic factors associated with total body fat percentage

Socio demographic factors	Total fat percentage		
	Under fat	Over fat	Obese
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Age			
20-29	0.7(0.1-8.2)	1.4(0.5-3.9)	1.2(0.5-2.9)
30-39	0.4(0.02-8.0)	1.8(0.5-5.9)	1.4(0.5-3.9)
40-49	0.3(0.01-1.0)	1.5(0.4-6.4)	1.2(0.3-4.1)
50-59		3.7(0.8-18.0)	2.8(0.7-11.8)
18-19			
Marital status			
Single/ Never married		1.6(0.3-9.5)	1.8(0.4-9.3)
Married/Cohabiting		1.4(0.3-7.3)	1.1(0.2-5.0)
Divorced/Separated		1.6(0.3-9.0)	1.6(0.3-8.0)
Widowed			
Parent hood			
No Child	0.6(0.002-1.4)	0.06(0.02-1.4)	1.4(0.5-4.1)
1-3	***0.1(0.1-1.0)*** *	1.0(0.45-2.1)	1.4(0.7-2.9)
>3			
Education Level			
No formal education		1.9(0.5-7.1)	2.9(0.9-9.1)
Primary education		1.0(0.2-4.0)	0.6(0.2-2.5)
Secondary education		0.9(0.3-2.7)	0.4(0.1-1.3)
University education		1.4(0.5-3.9)	0.6(0.2-1.8)
Tertiary education			
Expenditure as a proxy of SES			
High (>300,000)		0.9(0.3-1.5)	1.1(0.6-2.0)
Moderate (150,000-300,000)		0.7(0.3-1.5)	0.7(0.3-1.2)
Low (<150,000)			
Household size			
<3	0.5(0.05-5.5)	2.3(1.1-4.8)	2.2(1.1-4.3)
3-5	0.6(0.1-3.2)	1.2(0.6-2.4)	1.7(1.0-3.1)
>5			

**P<0.05, **P<0.01,* AOR= Adjusted odds ratio at 95% CI AOR>1 =More likely, =1= Equal, <1=Less likely

Table 4.4 above shows that respondents who had at least 1-3 children were less likely to be under fat (AOR 0.1; 95% CI: 0.1-1.0; *P<0.05*) although it wasn't very different from those who had no children (AOR 0.6; CI: 0.002-1.4; *P>0.05*). Although not significant, Respondents with no formal education were more likely to be over fat. (AOR 2.9; 95% CI: 0.9-9.1; *P>0.05*).

4.3.3 Socio demographic factors associated with abdominal obesity

Table 4.5 shows multinomial regression results with odds ratio (95% confidence interval) predicting socio demographic factors associated with waist hip ratio, waist circumference and abdominal fat.

Table 4.5: Socio demographic factors associated with abdominal obesity

Socio demographic factors	Waist Hip ratio	Waist circumference		Abdominal fat
	Unhealthy	Healthy	Moderately unhealthy	Excessive
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Age				
20-29	0.8(0.4-1.8)	0.7(0.2-2.6)	0.5(0.1-2.1)	0.8(0.2-4.1)
30-39	0.5(0.9-1.2)	0.4(0.1-1.5)	0.4(0.1-1.9)	0.7(0.1-4.2)
40-49	0.5(0.2-1.6)	***0.2(0.04-0.9)*** *	0.2(0.03-1.0)	0.6(0.07-6.0)
50-59	0.6(0.2-2.0)	***0.02(0.002-0.3)*** **	0.2(0.04-1.3)	
18-19				
Marital status				
Single/ Never married	5.8(0.7-50.3)		***0.1(0.02-0.6)*** *	
Married/Cohabiting	4.8(0.6-40.0)		0.2(0.04-1.0)	
Divorced/Separated	3.5(0.4-30.6)		0.3(0.1-1.5)	
Widowed				
Parent hood				
No Child	0.5(0.2-1.4)	3.7(1.0-13.3)	2.0(0.5-7.0	0.2(0.02-1.9)
1-3	0.8(0.4-1.5)	1.2(0.6-2.7)	0.8(0.4-1.7)	1.1(0.3-4.1)
>3				
Education Level				
No formal education	1.0(0.3-3.6)	1.5(0.4-4.9)	2.4(0.8-7.0)	3.7(0.9-15)
Primary education	1.0(0.3-3.6)	0.3(0.05-2.1)	2.5(0.5-13.1)	0.3(0.04-3.1)
Secondary education	0.9(0.3-2.6)	0.4(0.1-1.4)	0.2(0.04-1.0)	
University education	0.9(0.4-2.4)	0.3(0.1-1.0)	0.5(0.1-1.6)	
Tertiary education				
Expenditure (proxy of SES)				
High (>300,000)	0.9(0.5-1.4)	0.6(0.2-1.5)	0.6(0.2-1.5)	0.3(0.04-3.1)
Moderate (150,000-300,000)	0.5(0.2-1.4)	0.7(0.4-1.3)	0.7(0.4-1.3)	0.7(0.02-1.4)
Low (<150,000)				
Household size				
<3	1.5(0.8-2.9)	1.4(0.5-2.1)	1.0(0.5-2.1)	1.1(0.3-4.0)
3-5	1.6(0.9-2.9)	1.3(0.7-2.4)	1.3(0.7-2.5)	1.3(0.4-4.1)
>5				

*P<0.05, **P<0.01. AOR= Adjusted odds ratio at 95% confidence interval. Healthy WHR= Low risk NCDs, Unhealthy WHR=Substantially increased risk; Healthy WC= Low risk, Moderately unhealthy WC=Increased risk; Severely unhealthy WC =Substantially increased risk of developing NCDs.

Multinomial logistic regression results in Table 4.5 above shows that older women in their 40s and women in their 50s were less likely to have healthy WHR (AOR 0.2; 95% CI: 0.04-0.90; *P<0.05*) and (AOR 0.02; 95% CI: 0.002-0.30; *P<0.01*) respectively compared to younger women. The single/never married were less likely to have waist hip ratio classified as increased risk (AOR 0.1; 95% CI: 0.03-0.70; *P=0.01*) compared to the married, widowed or divorced.

4.4 Dietary patterns associated with nutritional status of respondents

Dietary patterns assessed in this study included; frequency of consumption of food groups in a week based on 18 food groups and diet quality (Micronutrient adequacy) assessed using minimum dietary diversity for women (MDD-W) based on the 10 major food groups of women (FAO, 2016).

4.4.1 Frequency of consumption of different food groups

The average frequency of consumption of different foods (computed as the summation of frequency of consumption of each food listed in a particular food group divided by the total number of foods consumed in that food group), was as given in figure 2 below.

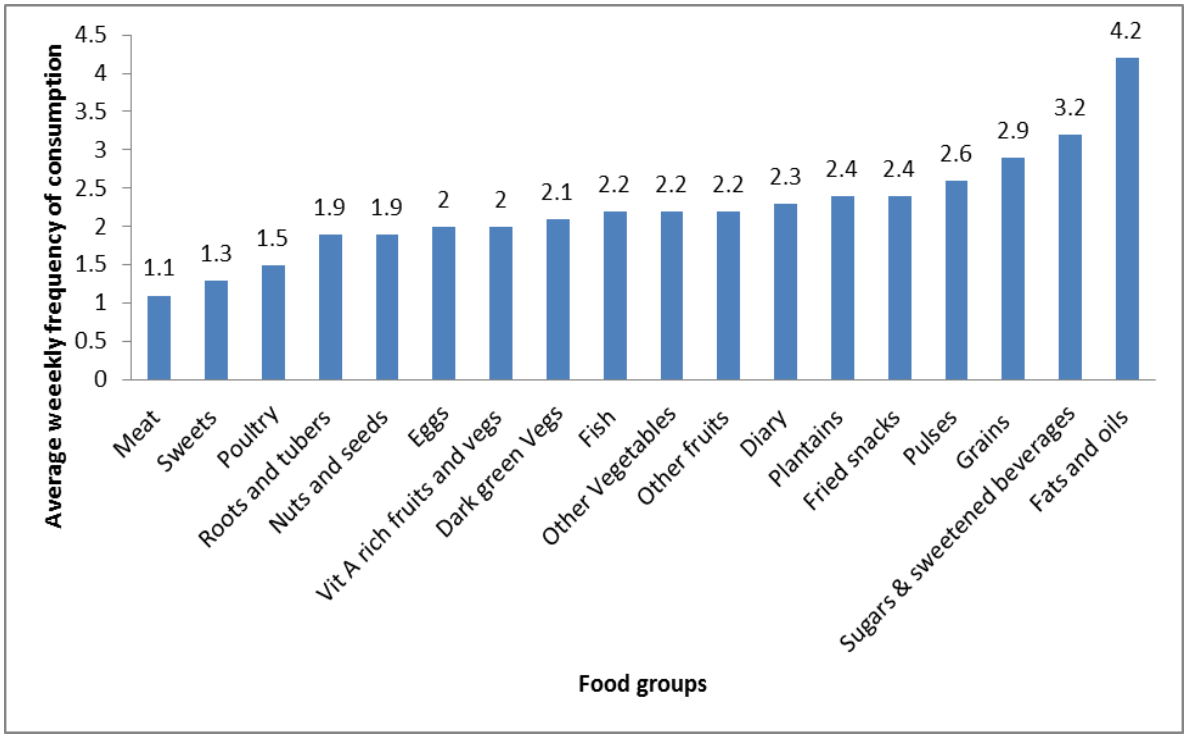

Figure 2: Average weekly frequency of consumption of different food groups

Figure 2 above shows that fats and oils sugars and sweetened beverages, grains and pulses, were the most frequently consumed food groups both at average frequency of 4.2 times a week followed by sugars at 3.2 times, grains at 2.9 times and pulses at 2.6 times. The least consumed food group was meat at an average frequency of 1.1 times.

4.4.2 Association between the frequency of consumption different foods and body mass index

Table 4.6 shows a multinomial regression results odds ratio (95% confidence) interval of weekly frequency of consumption of food groups associated with body mass index.

Table 4.6: Association between frequency of consumption of different food groups and body mass index

Average frequency of consumption of food groups	Body mass index (BMI)		
	Underweight	**Overweight**	**Obese**
Carbohydrates	**AOR (95% CI)**	**AOR (95% CI)**	**AOR (95% CI)**
Grains	1.3(0.8-2.2)	1.0(0.6-1.7)	1.1(0.8-1.6)
Roots and tubers	1.0(0.6-1.7)	0.9(0.7-1.1)	1.0(0.8-1.3)
Plantains	1.1(0.8-1.6)	1.0(0.8-1.1)	1.0(1.0-1.2)
Plant protein sources			
Pulses	1.0(0.7-1.4)	1.0(0.8-1.1)	1.1(1.0-1.3)
Nuts and seeds	1.2(0.8-1.9)	***1.2(1.0-1.5)*** *	1.0(0.8-1.3)
Animal protein sources			
Meat	1.3(0.7-2.6)	0.7(0.5-0.9)	0.8(0.5-1.1)
Poultry	0.9(0.5-1.5)	0.9(0.7-1.1)	0.8(0.6-1.0)
Fish	1.3(0.8-2.0)	1.2(1.0-1.4)	1.1(0.9-1.4)
Dairy	1.1(0.8-1.4)	0.9(0.8-1.0)	1.0(0.9-1.0)
Eggs	0.9(0.6-1.4)	1.1(0.9-1.2)	1.1(1.0-1.3)
Fruits and vegetables			
Dark green leafy vegetables	0.9(0.6-1.5)	0.9(0.7-1.2)	0.9(0.6-1.5)
Vitamin A rich fruits & vegetables	0.9(0.6-1.3)	1.0(0.8-1.1)	0.9(0.6-1.3)
Other Vegetables	0.8(0.4-1.7)	1.0(0.8-1.3)	1.2(0.9-1.7)
Other fruits	1.2(0.9-2.0)	0.9(0.8-1.2)	1.2(0.8-2.0)
Low nutrient density foods			
Oils and fats	1.0(0.8-1.3)	1.0(0.9-1.1)	1.0(0.9-1.1)
Fried snacks	1.2(0.8-1.8)	1.0(0.8-1.2)	0.9(0.7-1.2)
Sweets	0.8(0.4-1.3)	1.0(0.8-1.6)	1.0(0.8-1.2)
Sugars and sweetened beverages	1.1(0.8-1.6)	1.0(0.8-1.1)	1.1(0.9-1.3)

*$P<0.05$, **$P<0.01$. OR= Adjusted odds ratio at 95% CI AOR>1 =More likely, =1= Equal, <1=Less likely.

Findings in Table 4.6 above indicate that respondents with a high frequency of consumption of nuts and seeds were 1.2 times more likely to be overweight compared to those with a low frequency (AOR 1.2; 95% CI: 1.0-1.5; P<*0.05*).

4.4.3 Association between frequency of consumption of different food groups and total fat body fat percentage

Table 4.7 shows multinomial regression results odds ratio (95% confidence) interval of food groups with average weekly frequency of consumption associated with total body fat percentage.

Table 4.7: Association between frequency of consumption different foods and total body fat percentage of the respondents

	Total body fat percentage (TBF %)		
	Under fat	**Over fat**	**Obese**
Carbohydrates	**AOR (95% CI)**	**AOR (95% CI)**	**AOR (95% CI)**
Grains	1.3(0.7-2.3)	0.9(0.7-1.2)	0.9(0.8-1.2)
Roots and tubers	1.8(1.1-2.9)	1.0(0.8-1.3)	1.0(0.8-1.2)
Plantains	0.8(0.5-1.4)	1.1(0.9-1.2)	1.0(0.8-1.1)
Plant protein sources			
Pulses	1.2(0.7-1.8)	1.0(0.9-1.2)	1.1(1.0-1.3)
Nuts and seeds	0.8(0.4-1.8)	0.9(0.7-1.1)	1.0(0.8-1.2)
Animal protein sources			
Meat	0.8(0.5-1.3)	0.9(0.8-1.1)	1.0(0.9-1.1)
Poultry	1.6(0.9-2.8)	1.0(0.8-1.3)	0.8(0.7-1.1)
Fish	1.7(0.4-1.3)	0.8(0.6-1.0)	1.0(0.8-1.2)
Dairy	0.8(0.5-1.3)	0.9(0.8-1.1)	1.0(0.9-1.1)
Eggs	1.2(1.0-1.4)	1.1(0.7-1.7)	1.1(1.0-1.3)
Fruits and vegetables			
Dark green leafy vegetables	1.0(0.6-1.7)	1.0(0.8-1.2)	0.9(0.8-1.1)
Vitamin A rich fruits and vegetables	1.1(0.8-1.6)	1.0(0.9-1.2)	1.0(0.9-1.2)
Other Vegetables	1.0(0.6-1.6)	0.9(0.8-1.1)	1.0(0.9-1.2)
Other fruits	1.4(0.8-2.4)	1.0(0.8-1.3)	1.4(0.8-2.4)
Low nutrient density foods			
Oils and fats	1.1(0.8-1.7)	1.0(0.8-1.1)	1.0(0.9-1.1)
Fried snacks	1.4(0.9-2.2)	0.9(0.6-1.6)	1.0(0.8-1.2)
Sweets	0.1(0.02-1.0)	1.0(0.9-1.2)	1.0(0.8-1.1)
Sugars and sweetened beverages	1.1(0.7-1.7)	1.0(0.9-1.2)	1.0(0.8-1.1)

**P<0.05, **P<0.01*. AOR= Adjusted odds ratio at 95% CI AOR>1 =More likely, =1= Equal, <1=Less likely.

There was no significant relationship between average frequency of consumption of all food groups in a week and total body fat percentage of the respondents (Table 4.7).

4.4.4 Association between frequency of consumption of food groups and abdominal obesity

Table 4.8 shows results of multinomial regression analysis with odds ratio (95% confidence interval) showing association between average weekly frequency of consumption of food groups and abdominal obesity.

Table 4.8: Association between frequency of consumption of different food groups and abdominal obesity

	Abdominal fat	Waist Hip Ratio	Waist circumference	
Food groups	**Excessive**	**Unhealthy**	**Healthy**	**Moderately unhealthy**
Carbohydrates	**AOR (95% CI)**	**AOR (95% CI)**	**AOR (95% CI)**	**AOR (95%CI)**
Grains	0.8(0.5-1.2)	1.0(0.9-1.2)	1.0(0.8-1.3)	0.9(0.7-1.1)
Roots and tubers	1.1(0.8-1.6)	1.1(0.9-1.3)	1.1(0.9-1.4)	1.3(1.0-1.7)
Plantains	1.3(1.0-1.6)	1.0(0.9-1.2)	***0.8(0.7-0.9)*** **	0.9(0.8-1.0)
Plant protein sources				
Pulses	1.0(0.8-1.3)	1.0(0.9-1.1)	0.9(0.6-1.2)	1.0(0.7-1.5)
Nuts and seeds	1.0(0.7-1.5)	0.9(0.8-1.1)	0.9(0.7-1.1)	1.0(0.8-1.2)
Animal protein sources				
Meat	***1.7(1.0-2.8)*** *	1.0(0.9-1.1)	0.9(0.6-1.2)	1.0(0.7-1.5)
Poultry	1.0(0.7-1.4)	0.8(0.6-1.0)	0.9(0.7-1.1)	***0.7(0.6-1.0)*** *
Fish	1.0(0.7-1.1)	1.1(0.9-1.3)	1.0(0.9-1.1)	0.9(0.8-1.0)
Dairy	0.8(0.7-1.1)	1.1(0.9-1.3)	1.0(0.9-1.1)	0.9(0.8-1.0)
Eggs	***1.2(1.0-1.5)*** *	1.0(0.8-1.1)	1.0(0.8-1.1)	1.1(0.9-1.3)
Fruits and vegetables				
Dark green leafy vegetables	0.8(0.5-1.1)	1.0(0.8-1.2)	0.9(0.8-1.2)	0.9(0.7-1.1)
Vitamin A rich fruits & vegetables	1.2(1.0-1.5)	1.0(0.8-1.0)	1.0(0.8-1.0)	1.0(0.8-1.1)
Other Vegetables	0.9(0.7-1.3)	1.1(0.9-1.2)	***1.2(1.0-1.4)*** *	1.1(0.9-1.3)
Other fruits	1.1(0.7-1.5)	1.0(0.9-1.3)	0.9(0.7-1.1)	1.0(0.8-1.3)
Low nutrient density foods				
Oils and fats	1.0(0.7-1.1)	1.0(0.9-1.1)	1.0(0.9-1.1)	1.2(1.0-1.3)
Fried snacks	1.1(0.7-1.5)	1.0(0.8-1.2)	1.1(0.9-1.4)	1.1(0.8-1.4)
Sweets	1.2(1.0-1.6)	1.0(0.9-1.2)	0.9(0.8-1.1)	1.0(0.8-1.2)
Sugars and sweetened beverages	1.0(0.7-1.3)	1.0(0.9-1.2)	0.9(0.8-1.1)	0.9(0.8-1.1)

*P<0.05, **P<0.01. AOR= Adjusted odds ratio at 95% confidence interval. Healthy WHR= Low risk NCDs, Unhealthy WHR=Substantially increased risk; Healthy WC= Low risk, Moderately unhealthy WC=Increased risk; Severely unhealthy WC =Substantially increased risk of developing NCDs.

Respondents who had a high frequency of consumption of meat were 1.7 times more likely to have abdominal fat level classified as excessive than those with a lower frequency (AOR 1.7; 95% CI: 1.0-2.8; *P<0.05*). Those who had a high frequency of consumption of plantains were 1.3 times less likely to have healthy WHR compared to women with a low frequency (AOR 0.8; 95% CI: 0.7-0.9; *P<0.01*). Women with a high frequency of consumption of eggs were 1.2 times more likely to have excessive abdominal fat compared to those with a lower frequency (AOR 1.2; 95% CI: 1.0-1.5; *P<0.05*). Those who consumed poultry more frequently were 1.4 times less likely to have a waist circumference categorized as unhealthy (AOR 0.7; 95% CI: 0.6-0.9; *P<0.05*), those who consumed other vegetables frequently were 1.2 times more likely to have waist circumference categorized as healthy (AOR 1.2; 95% 1.0-1.4; *P<0.05*) and lastly although not significant, those who consumed fats and oils more frequently were more likely to have severely unhealthy WC (AOR 1.2; 95% CI: 1.0-1.3; *P>0.05*) as shown in Table 4.8 above.

4.4.5 Minimum dietary diversity-women (MDD-W) and nutritional status

Figure 2 below shows the percentage achievement (≥ 5 food groups) and non-achievement (<5 food groups) of minimum dietary diversity score using 10 food groups.

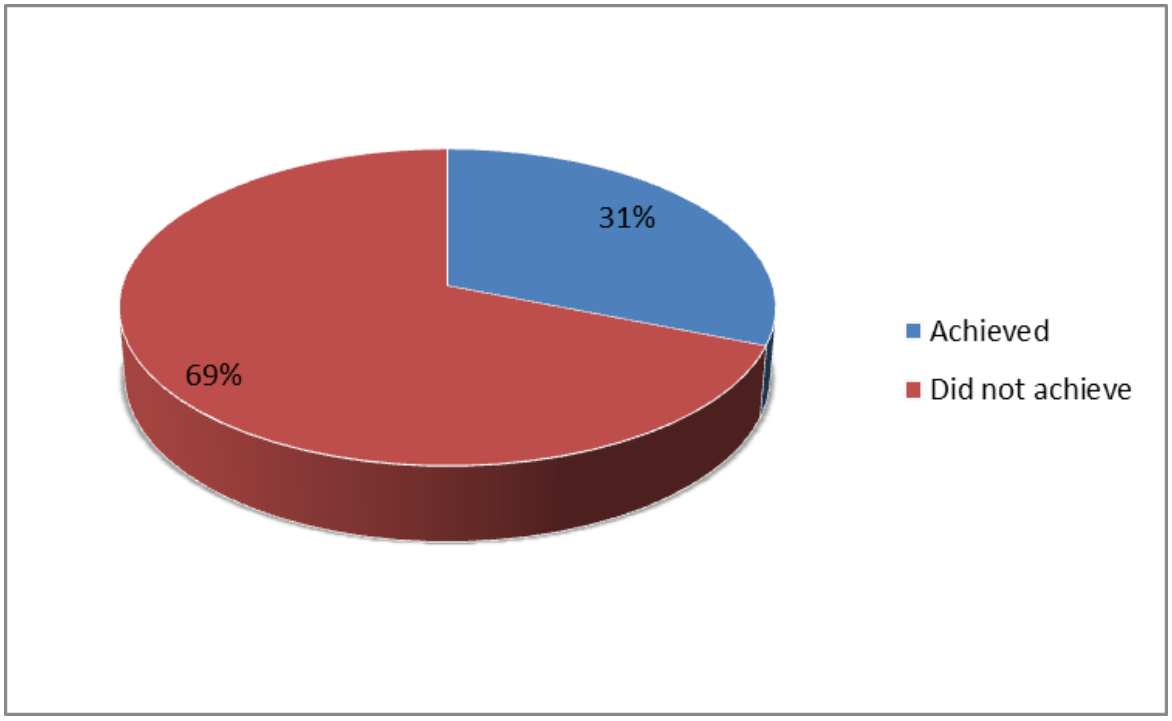

Figure 3: Percentage of respondent who achieved minimum dietary diversity score

Only 31% of respondents achieved the minimum dietary diversity score and 69% did not achieve as indicated in the above figure.

Table 4.9: Attainment of minimum dietary diversity score and nutrition status indicators

Anthropometric/ Body composition indicators	Achieved MDD-W		Didn't achieve MDD-W		
	Number (n)	Percentage (%)	Number (n)	Percentage (%)	Total
Body mass index (BMI)					
Underweight	3	27.3	8	72.7	11
Normal	57	31.7	123	68.3	180
Overweight	35	30.7	79	69.3	114
Obese	24	30.4	55	69.6	79
Total	119	31.0	265	69.0	384
Total body fat percentage					
Under fat	2	28.6	5	71.4	7
Healthy	42	32.3	88	67.7	130
Over fat	35	35.0	65	65.0	100
Obese	40	27.2	107	72.8	147
Total	119	31.0	265	69.0	384
Waist Hip Ratio (WHR)					
Low risk	80	31.4	175	68.6	255
Substantially increased risk	39	30.2	90	69.8	129
Total	119	31.0	265	69.0	384
Waist circumference					
Low risk	51	30.4	117	69.6	168
Increased risk	38	35.2	70	64.8	108
Substantially increased risk	30	27.8	78	72.2	108
Abdominal fat					
Total	119	31.0	265	69.0	384
Healthy	111	30.7	251	69.3	362
Excessive fat	8	36.4	14	63.6	22
Total	119	31.0	265	69.0	384

N=384

For comparisons

Percentage achievement of MDD-W was lowest in the underweight BMI women, followed by the obese and overweight women. The normal BMI women had the highest percentage achievement of the MDD-W. Percentage achievement of MDD-W was lowest

in the obese women, followed by the under fat and the healthy body fat percentage women. The over fat women had the highest percentage achievement of the MDD-W. Percentage achievement of MDD-W was lower in the women with unhealthy WHR than in those with healthy WHR. Percentage achievement of MDD-W was lowest in the group of women with severely unhealthy WC, followed by those with low risk and was highest in those with increased risk. Lastly, percentage achievement of MDD-W was lowest in the healthy abdominal fat group and highest in the excessive abdominal fat group as shown in Table 4.9. For most of the indicators of nutrition status in the study, under achievement of MDD-W was associated with both dimensions; underweight and obesity

4.5 Physical activity patterns associated with nutritional status of the respondents

Physical activity was assessed using the three domains work, recreation and travel to places (active transport). These domains are categorized basing on the intensity and Table 4.10 below shows the percentage of participation in the various categories of physical activity and the extent of meeting the WHO standards of physical activity.

Table 4.10: Distribution of respondents according to participation in different physical activities

Participation in categories of physical activity	Yes		No	
	Number (n)	Percentage (%)	Number (n)	Percentage (%)
Vigorous work	0.0	0.0	384	100
Moderate work	356	93.0	27	7.0
Light work	366	95.3	18	4.7
Vigorous recreation	14	3.6	370	96.4
Moderate recreation	32	8.3	352	91.7
Light recreation	9	2.3	375	97.7
Active transport PA	44	11.5	340	88.5

N= 384, PA= Physical activity, Vigorous PA MET Value= 8+, Moderate PA MET value=4+, Light PA MET value= < 3

Majority of the respondents participated in moderate work-related PA (93%) or light work-related PA (95.3%), none of them participated in work categorized as vigorous. Only 14 respondents (3.6%) participated in vigorous recreation, 8.3% in moderate recreation, and 2.3% in light recreation. Only 44 respondents (11.5%) regularly engaged in active transport related physical activity (Table 4.10).

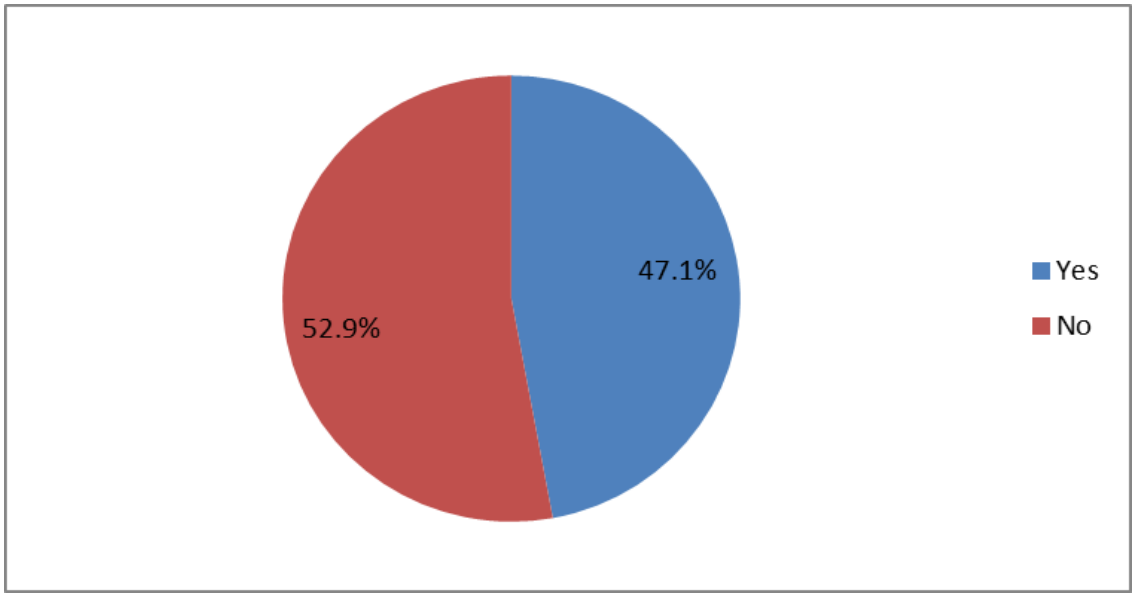

Figure 4: Percentage of respondents who met WHO standard of physical activity

The above figure 4 shows that 47.1% of respondents met the WHO standards of physical activity (at least 600 MET minutes per week) and 52.9% did not.

4.5.1 Physical activity patterns associated with body mass index

Table 4.11 shows results of multinomial regression analysis with odds ratio (95% confidence interval) of physical activity patterns associated with body mass index among of respondents.

Table 4.11: Physical activity factors associated with body mass index

	Body mass index		
	Underweight	**Overweight**	**Obese**
Physical activity patterns	**AOR (95% CI)**	**AOR (95% CI)**	**AOR (95% CI)**
Group 1			
Meeting WHO standards	1.0(0.9-1.1)	1.0(0.9-1.0)	1.0(0.9-1.1)
Mean Time of Total PA per day		1.0(1.0-1.1)	1.0(0.9-1.0)
Percent of Vigorous PA	1.0(1.0-1.1)	1.0(0.9-1.1)	1.0(0.9-1.1)
Sedentary time per day	2.0(0.5-8.4)	1.0(0.6-1.6)	0.9(0.5-1.7)
Group 2			
Mean time work related PA per day	1.0(1.0-1.1)	1.0(0.9-1.0)	1.0(0.9-1.0)
Mean time in transport related PA	1.0(1.0-1.1)	1.0(0.9-1.0)	1.0(0.9-1.0)
Mean time in recreation related PA	1.0(0.7-1.7)	1.0(0.9-1.2)	1.1(0.9-1.3)
Group 3			
Nonparticipation in work related PA	1.9(0.2-1.6)	1.9(0.8-4.6)	1.2(0.4-3.6)
Nonparticipation in transport related PA	0.5(0.1-2.2)	1.3(0.8-2.1)	1.0(0.6-1.7)
Nonparticipation in recreation related PA	1.0(0.1-8.3)	0.5(0.2-1.1)	0.7(0.3-1.5)
Group 4			
Percent of total PA from work		1.0(0.9-1.1)	1.0(0.9-1.0)
Percent of Total PA from transport		1.0(1.0-1.1)	0.9(0.9-1.1)
Percent of Total PA from recreation		1.0(0.9-1.0)	1.0(0.9-1.0)

**P<0.05, **P<0.01*. AOR= Adjusted odds ratio at 95% confidence interval. Meeting WHO standards=MET minutes >1500, PA= Physical activity.

The study revealed no significant association between physical activity patterns assessed and Body mass index (Table 4.11)

4.5.2 Physical activity patterns associated with total fat body fat percentage

Table 4.12 shows a multinomial regression results with odds ratio (95% confidence interval) of physical activity factors associated with total body fat percentage of women in Mukono Municipality.

Table 4.12: Physical activity factors associated with total body fat percentage

	Total body fat percentage (TBF %)		
	Underweight	**Over fat**	**Obese**
Physical activity patterns	**AOR (95% CI)**	**AOR (95% CI)**	**AOR (95% CI)**
Group 1			
Meeting WHO standards	1.6(0.3-9.6)	0.7(0.4-1.3)	0.9(0.6-1.5)
Mean Time of Total PA per day	1.0(0.9-1.0)	1.0(1.0-1.1)	1.0(1.0-1.1)
Percent of Vigorous PA		0.9(0.9-1.1)	1.0(1.0-1.1)
Sedentary time per day	1.0(0.9-1.0)	1.0(1.0-1.1)	1.0(1.9-1.0)
Group 2			
Mean time work related PA per day	1.0(1.0-1-1)	1.0(0.9-1.0)	1.0(0.9-1.0)
Mean time in transport related PA	1.0(0.9-1.1)	1.0(0.9-1.0)	1.0(0.9-1.0)
Mean time in recreation related PA	1.0(0.6-1.5)	0.9(0.7-1.1)	0.9(0.7-1.1)
Group 3			
Nonparticipation in work related PA		1.1(0.4-3.1)	1.0(0.4-2.4)
Nonparticipation in transport related PA	0.7(0.1-3.8)	***1.8(1.1-3.0)*** *	1.1(0.7-1.8)
Nonparticipation in recreation related PA	0.8(0.1-7.0)	0.8(0.3-1.7)	1.0(0.5-2.1)
Group 4			
Percent of total PA from work	1.0(0.9-1.0)	1.0(0.9-1.0)	1.0(0.9-1.0)
Percent of Total PA from transport	1.0(0.9-1.0)	1.0(0.9-1.0)	1.0(0.9-1.0)
Percent of Total PA from recreation	0.9(0.7-1.2)	1.0(0.9-1.0)	1.0(0.9-1.0)

**P<0.05, **P<0.01.* AOR= Adjusted odds ratio at 95% confidence interval. Meeting WHO standards=MET minutes >1500 PA= Physical activity.

Table 4.12 shows that respondents who did not participate in transport related physical activities were 1.8 times more likely to be over fat compared to those who participated regularly (AOR=1.8 95% CI: 1.5–3.0; *P<0.03*). Those who met the WHO standards of PA were less likely to be over fat (AOR 0.7; 95% CI: 0.4-1.3; *P>0.05*), however this was not significant.

4.5.3 Physical activity patterns associated with abdominal obesity

Table 4.13 shows a multinomial regression results with odds ratio (95% confidence interval) of physical activity factors associated with abdominal obesity among women in Mukono Municipality.

Table 4.13: Physical activity factors associated with abdominal obesity

	Abdominal fat	Waist hip ratio	Waist Circumference	
	Excessive	Unhealthy	Healthy	Moderately unhealthy
Physical activity patterns	**AOR (95% CI)**	**AOR (95% CI)**	**AOR (95%CI)**	**AOR (95%CI)**
Group 1				
Meeting WHO standards	5.3(1.5-18.8)	0.9(0.6-1.5)	1.2(0.7-2.0)	1.2(0.7-2.0)
Mean time of total PA per day	1.0(0.9-1.0)	1.0(0.9-1.0)	1.0(0.9-1.0)	1.0(0.9-1.1)
Percent of Vigorous PA		1.0(0.9-1.0)	1.0(0.9-1.1)	1.0(0.9-1.0)
Sedentary time per day	1.0(0.9-1.0)	1.0(0.9-1.0)	1.0(0.9-1.0)	1.0(0.9-1.0)
Group 2				
Mean time work related PA per day	1.0(0.9-1.0)	***0.9(0.9-2.0)*** *	1.0(0.9-1.0)	1.0(0.9-1.0)
Mean time in transport related PA	1.0(1.0-1.1)	1.0(0.9-1.0)	1.0(1.0-1.1)	1.0(0.9-1.0)
Mean time in recreation related PA	1.2(1.0-1.5)	1.0(0.9-1.2)	1.0(0.8-1.1)	0.9(0.7-1.1)
Group 3				
Nonparticipation in work related PA	0.8(0.9-6.0)	0.8(0.3-1.9)	1.1(0.4-2.6)	0.7(0.2-2.2)
Nonparticipation in transport related PA	0.2(0.1-0.7)	1.0(0.7-1.6)	0.8(0.5-1.4)	1.0(0.6-1.6)
Nonparticipation in recreation related PA	0.4(0.2-1.3)	1.2(0.6-2.5)	1.2(0.6-2.5)	1.3(0.6-3.1)
Group 4				
Percent of total PA from work	1.1(0.5-2.1)	1.0(0.9-1.0)	1.0(0.9-1.1)	1.0(0.9-1.0)
Percent of Total PA from transport	1.1(0.5-2.2)	1.0(0.9-1.0)	1.0(0.9-1.1)	1.0(0.9-1.0)
Percent of Total PA from recreation	1.1(0.5-2.1)	1.0(0.9-1.0)	1.0(0.9-1.0)	1.0(0.9-1.0)

**P<0.05, **P<0.01.* AOR= Adjusted odds ratio at 95% confidence interval. Meeting WHO standards=MET minutes >1500 PA= Physical activity, Healthy WHR= Low risk NCDs, Unhealthy WHR=Substantially increased risk; Healthy WC= Low risk, Moderately unhealthy WC=Increased risk; Severely unhealthy WC =Substantially increased risk of developing NCDs.

Results indicate that those who spent more time participating in work related physical activity were less likely to have severely unhealthy WHR than those who spent less time in work related physical activity (AOR=0.9 95% CI: 0.9–2.0; *P=0.01*).

CHAPTER FIVE: DISCUSSION

5.1 Nutrition status and associated socio demographic factors

The dominant forms of poor nutrition status in this study were overweight (29.7%), and obesity (20.7%), based on BMI, and over fat (26.0%) and obesity (38.3%) based on total body fat percentage. There was a relatively low prevalence of underweight (2.9%) or under fat (1.8%) respectively, among the respondents. There was also a high prevalence of abdominal obesity indicated by a high waist circumference (33.6%) and waist hip ratio (56.2%) indicative of increased risk of developing non communicable diseases.

The only other known study on nutrition status of adults in Central Uganda 9 years ago found a much lower prevalence of overweight 10.2% and obesity 4.4% respectively in Kampala (Baalwa et al., 2010). Maher et al. (2010) reported a high prevalence of abdominal obesity in women 71.3% by WHR and 31.2% by WC in South western Uganda. Not many studies assess for underweight prevalence in adult women but in Eastern Uganda, Kirunda et al. (2015) reported a higher prevalence of underweight (5.9%) than that in the present study, and a lower prevalence of overweight (23.1%) and obesity (12.7%). This was probably because the study area was more rural and far away from the capital city where the prevalence of overweight and obesity were found to be high according to UBOS (2017) compared to the current study area. In Western Uganda, Maher et al. (2010) reported a prevalence of 14.5% overweight and 4% obesity while Mondo et al. (2013) reported a prevalence of 16.8% for overweight and 9.0% for obesity in the same region.

The reason for these differences in nutrition status may be found in the examination of the socio demographic characteristics of respondents. Age, expenditure per month and number of children were the most important socio demographic predictors of nutritional status of respondents in this study. Findings revealed that older women in their 40s and 50s were less likely to have healthy WHR putting them more at risk of getting non communicable diseases (NCDs) compared to younger women. Indeed Villareal et al. (2005); Jafar et al. (2006); Pasquest et al. (2003); Hajian et al. (2006) & Dessalu et al. (2008) reported that BMI and mean body weight tended to go up with age. Overweight and obesity are the major risk factors for NCDs like type 2 diabetes, hypertension, heart disease and a variety of cancers currently responsible for 56% of all deaths and 46% of the disease burden measured in disability-adjusted life years (DALYs) in low and middle-income countries (Adeyi et al., 2007).

Many other authors (Muhihi et al., 2012; Atek et al., 2013; Pereko et al., 2013 & UBOS, 2017), observed a positive association between age and obesity among women. This may be attributed to natural changes in body composition and the decreasing rate of metabolism associated with aging (Villareal et al., 2005; Tania et al., 2016). It's also proven that there is an increase in adiposity and progressive loss of muscle mass from the age $\geq$ 30 years in both women and men (Keller & Engelhardt, 2013). Other existing evidence also attribute brown adipose tissue that regulates fat mass and energy homeostasis in mammals to obesity; brown adipose tissue mass tends to decline slowly with age in women than in men (Pfannenberg, et al., 2010). These partly explain the observed association between women's age and overweight and obesity.

This study further revealed that women with lower/moderate monthly expenditure (150,000 –300,000UGX per month) were less likely to be obese than those with a higher monthly expenditure (>300,000UGX per month) that normally characterizes long term urban residence. This is in line with findings in developing countries and sub-Saharan Africa which indicate that women of low economic status are less likely to be affected by overweight and obesity than those with high economic status; (Bitew et al., 2010; Neupane et al., 2016; Saikia and Hazarika, 2012) because, in transition societies over eating is primarily explained by economic access to food according to Mclaren (2007). However, this seems to differ from findings of studies from developed countries which suggest that low economic status is associated with higher risks for obesity because the economically disadvantaged people are more likely to consume junk and empty calorie foods (Mclaren, 2007; Kim & Knesesbeck, 2018). The prevalence in the current study is also likely because the study area was urban and findings of MoH (2014) found that obesity and overweight were more prevalent in urban areas at 22.6% and 9.6% respectively. In fact, many studies in Uganda have found that overweight and obesity are associated with urban residence (Baalwa et al., 2010; Kirunda et al., 2015 and Mayega et al., 2012).

House hold size is another important determinant of nutritional status of women (Agbeko et al., 2013; Yibeltal et al., 2014). Findings of this study although not significant indicated that respondents who had less than 3 house hold members were more likely to be obese than those with more. Small family sizes are common among women with high level of education and also high socio economic status (UNHS, 2017) who by virtue of their life style are at high risk of obesity as reported by Mawa, (2018); Kirunda et al.

(2016); Agbeko et al. (2013); Anu et al. (2016) while on the other hand large house hold sizes may compromise nutrition security of the house hold members in a developing country like Uganda where a woman gives birth to 5 children on average (UBOS, 2017) whom in addition to dependents increase house hold size (UBOS, 2011 and 2017). A large house hold size strains family resources including food (UBOS, 2016).

Higher education has been positively linked to overweight and obesity in many studies (Dinsa et al., 2012). Studies by Ziraba et al. (2009); Agbeko et al. (2013); Anu et al. (2016) in Africa who reported that women with higher education were more likely to be overweight or obese compared to those with no formal education. Although these findings agree with those of UBOS (2017), they contrast findings of the current study which despite being insignificant indicated that respondents with no formal education were more likely to be obese compared to those with secondary or tertiary education. This finding is also in line with findings by (Alaba and Chola 2014; Anyanwu et al. (2010). This can be explained by findings that attribute women with no or low education to have more children (UNHS, 2016), and number of children has been positively linked to obesity in the current study. It is also possible that women with no education are un ware of their health status as indicated in a study by Hazarika et al. 2012 in India and similarly a study in Uganda by Mawa (2018) who also reported that women with higher education have more health knowledge on the deleterious effects of overweight and obesity, therefore they may be more involved in changing lifestyles and diet than their uneducated counterparts.

5.2 Dietary risk factors associated with nutritional status

The top 5 most commonly consumed food groups were fats and oils, sugar and sweetened beverages, grains, pulses and fried snacks and the 5 least commonly consumed food groups were meat, sweets, poultry, roots and tubers and nuts and seeds. The food groups whose consumption frequency emerged as having a significant relationship with nutritional status in the study were the nuts and seeds group, meat, eggs, plantains, poultry and other vegetables. Frequent consumption of the nuts and seeds food group was positively associated with BMI (overweight), while the rest of the food groups were associated with the incidence of abdominal obesity. Meat, eggs and plantains had positive association with abdominal obesity risk while poultry and vegetables had negative association.

The lowest percent of achievement of MDD-W was observed in the underweight, under fat and obese women based on BMI and TBF%; and in those with abdominal obesity based on WC and WHR. For most of the indicators (BMI, TBF%, WC, WHR and abdominal fat, under achievement of MDD-W was associated with malnutrition in both dimensions. The only Ugandan study that has investigated the relationship between diet and nutritional status of adults so far is that by Mayega et al. (2012) and revealed that those with moderate or higher diet diversity were less likely to be overweight than those with low diet diversity. The current study shows that low MDD-W is also associated with underweight, under fat and obesity. Low dietary diversity in women has been attributed to the growing urbanization coupled with climate change and other socioeconomic transitions that have raised food prices in most developing countries making it a possible

reason why women find it difficult to diversify their diets according to Popkin (2004). This agrees with a study in Mukono and Buikwe by Namayengo et al. (2017) which indicated that respondents, who depended more on food purchase as a source of food, were not able to access adequate diets because of lack of funds for food purchase.

Respondents who consumed nuts and seeds frequently were more likely to be overweight than those who consumed less frequently. Nuts are high energy density foods containing high levels of fats and proteins (Natoli & McCoy, 2007). They have been associated with reduction of risk factors of obesity and chronic diseases (Ibarrola-Jurado et al., 2013) and there is evidence that people consuming five servings or more of nuts per week do not weigh more than people who consume less than one serving of nuts per week (Natoli & McCoy, 2007). It would imply that in the current study, nuts and seeds is a predictor of another factor that influences the occurrence of overweight or that nuts and seeds in the study area unlike in other countries where they are eaten alone are consumed in sufficient amounts (usually as groundnuts sauce) with other high carbohydrate accompaniments that may contribute significantly enough to the energy density of the diet, to spark increases in body weight.

It is now well understood that a high frequency of consumption of energy, fat and sugar are associated with an increased risk of overweight and obesity both globally and in Africa (Steyn and Mchiza 2014; Keding et al., 2011) whereas low consumption of vegetables is associated with an increased risk for obesity (Mawaw et al., 2017). In fact, Tucker et al. (2015) determined that a meat pattern was associated with high BMI and

body fat among women in Tanzania while a prudent pattern (vegetables and other healthy foods) was negatively associated with both.

A recent ecological study based on data obtained from 170 countries suggested, the consumption of meat contributes just as much as sugar to the growing burden of overweight and obesity (You & Hernneberg, 2016). This is also consistent with a study by Wan & Beyoun (2009) which showed a positive association between the consumption of 'all meat' and 'other meat products' and obesity and central obesity. Romaguera et al. (2015) also reported a positive association between meat consumption and WC as in the current study. In Ethiopia, a study by Derebo et al. (2019), found out that the odds of overweight including obesity increased with the rise in frequency of consumption of meat and eggs however, the contribution of frequent consumption of eggs to obesity is less studied and inconsistently observed (Woo et al., 2016; Miranda et al., 2016).

There is evidence that when consumed as part of a healthy diet low in fat, sugars and salt/sodium, fruits and vegetables may also help to prevent unhealthy weight gain (Boeing et al., 2012; Ledoux et al., 2011; Alinia et al., 2009) by promoting satiety and reducing hunger (Howarth et al., 2012; WHO, 2005a) thus limiting overall energy intake. Vegetables are important components of a healthy diet (WHO, 2014; Alinia et al., 2009) and reduced vegetable consumption is linked to poor health and increased risk of non-communicable diseases (NCDs) (WHO, 2014). It should further be noted that an estimated 6.7 million deaths worldwide were attributed to inadequate fruit and vegetable consumption in 2010 according to Lim et al. (2012).

Although there is limited literature on the dietary risk factors for abdominal obesity which in turn is a main risk factor for what has come to be known as the metabolic syndrome, Nour et al. (2018) and Rodriguez-Monforte et al. (2017) have demonstrated that a high consumption of vegetables is associated not only with a low risk of overweight and obesity, but also of abdominal obesity indicated by waist circumference, as well as of metabolic syndrome respectively.

A finding from this study that is not common is the reduced likelihood of those with a high frequency of consumption of plantains to have abdominal obesity. This finding necessitates further investigation to understand why this may be so for instance if people consume larger portion sizes when they eat plantains, the accompaniments or side dish that is usually eaten with plantains e.g. meat or nuts and seeds, and the characteristics of people with a high frequency of consumption of plantains.

The findings further revealed that those who consumed fats and oils more frequently were more likely to have severely unhealthy WC in the current study although it wasn't significant. A study in Uganda by Ellis et al, (2015) showed that there was high consumption of fats and oils especially among the urban women who preferred frying most of their foods. Another study in South Africa also revealed that women consumed fats and oils more than once a day (Reinnette, Francois & Corinna (2018). Eating too much fats and oils can add extra calories to one's diet and cause weight gain because fats contain 9 calories per gram of fat which is more than twice the amount found in carbohydrates and protein (Chowdhury et al., 2014).

5.3 Physical activity patterns associated with nutritional status

The influence of physical activity on nutritional status has been assessed in numerous studies in the literature. Studies by Oyeyemi et al. (2012) and Agyemang et al. (2015), implicated physical inactivity as one of the major causes of overweight and obesity. This study found a high prevalence of physical inactivity (52.9%) and noted that the predominant source of physical activity was light and moderate work-related physical activity. Less than 15% of the women regularly participated in transport and recreational activities, and regular engagement in vigorous work was inexistent. Physical activity factors that were associated with nutritional status in this study were participation/non-participation in transport related activities, and time spent in work related activities. Women who did not often walk or ride to their destinations were more likely to be over fat while those whose work (domestic or occupational) kept them active were less likely to have severely unhealthy WHR.

A high prevalence (51%) of physical inactivity in Uganda has previously been reported by Mondo et al. (2013) among women in South western Uganda and Kirunda et al. (2015) in Eastern Uganda (46.6%). The current study although not significant revealed that respondents who met WHO standards of Physical activity were less likely to be over fat, this contrasts findings of Petersen et al, (2004) who did not find a relationship between physical activity participation and development of obesity. Relatedly, studies by Baalwa et al. (2010) and Mayega et al. (2012) found that physical activity level was negatively associated with overweight and obesity in 18-30-year olds and in 35-60-year olds respectively. In particular, Baalwa et al., 2010 reported that people who were not engaged

in any physical activity or sports were more likely to be overweight and obese compared to those who regularly engaged in some kind of physical activity or sports. Unlike Sedentary people who often eat large quantities of food that exceed their relatively lower energy requirements, go into a positive energy balance and are at risk of becoming overweight or obese (Dietz and Gortmaker, 2001), there is evidence that more physically active people have high energy expenditure which decreases their chances of getting overweight or obese (Agyemang et al., 2015; Omuleke, 2013; Tavares & Plotnikoff, 2008). The increase sedentary lifestyles in most societies in Africa mainly owing to; increased access to effort-saving technologies (Neupane et al., 2016) are partly the reason for the physical inactivity in this study in addition to social norms that permit lower levels of work-related PA among women and limited time to participate in recreation activities as indicated by Tavares & Plotnikoff (2008); Para & Messias (2011) and Omuleke (2013).

Evidence on the relationship of active transport to physical activity and body weight is not common and research has so far been limited to developed countries particularly the UK (Wanner et al., 2012). However existing research shows that active commuting is a significant contributor to physical activity in women (Yang et al., 2012), and is inversely associated with both BMI and body fat (Brown et al., 2017; Tristan et al., 2016; Flint et al., 2014; Mytton et al., 2017; Gotchi et al., 2015). Two related studies in developing countries: India and Latin America both found an inverse relationship between active transport and overweight/obesity (Millett et al., 2013) and active transport and metabolic syndrome as well as abdominal obesity (Sadarangani et al., 2017). In India,

walking to work was commonest among rural dwellers and those walking or cycling to work were significantly less likely to be overweight or obese (Millett et al., 2013).

Unfortunately, findings by Neupane et al. (2016) showed that participation in active transport has reduced in Sub Saharan Africa due to transition to use of motorized means of transport which agrees with finding of MoH (2014) that showed an increase in the use of motorcycles commonly known as *boda-boda* as means of transport in Uganda which has affected the number of people walking long distances and reduced the role of walking as a physical activity. This study therefore highlights the relevance of work-related and transport related physical activity in controlling body weight and abdominal obesity of women in Uganda, both of which have not been previously reported.

CHAPTER SIX: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

Overweight and obesity particularly abdominal obesity were the prevalent forms of malnutrition among the respondents. Respondents who were older were unlikely to be free of abdominal and total obesity and those who could not afford a high monthly expenditure were less likely to be obese while those who could afford to spend more on meat, eggs and nuts, were more likely to be abdominally obese and overweight respectively. In contrast, those who ate chicken meat (poultry) frequently were less likely to be abdominally obese and those who ate vegetables frequently were more likely to be free of abdominal obesity. Less than a third of the respondents achieved the minimum dietary diversity that characterizes a high frequency of consumption of vegetables.

The main type of physical activity for the respondents was moderate (fetching water, farming, washing, jogging etc.) and light (walking, mopping, tailoring, cooking etc.) work-related activity from both domestic and occupational work, which reduced the likelihood for one to be abdominally obese. However, less than half of the respondents spent enough time in moderate activity to achieve the WHO recommendation of 150 minutes a week. Walking for transport also reduced one's likelihood for being overweight but it was nearly as uncommon as engagement in recreational physical activity.

6.2 Conclusion

Findings of this study point overweight and obesity particularly abdominal obesity as the most prevalent forms of malnutrition among the respondents. It implicates age, expenditure per month and parity as partly responsible for this occurrence in addition to frequent consumption of meat, eggs and nuts seeds while on the other hand it high lights the health benefits of frequent consumption of vegetables and poultry in the reduction of this pandemic. The relevance of work and walking for transport in controlling body weight and abdominal obesity has also been emphasized in this study. This therefore calls for targeted nutrition education and physical activity promotion interventions among women in Uganda.

6.3 Recommendations

Education on the healthy benefits of vegetable consumption is necessary. The message that needs to be out there is the age-old message of balance diet. As demonstrated by MDD-W, poor dietary diversity is characteristic of diets predisposing women to overweight/ obesity and underweight/ under fat.

Regular engagement in domestic work needs to be promoted as they can be protective against abdominal obesity since it is the commonest form of physical activity in the area. This if coupled with walking and biking as a choice of transportation can offset the rising prevalence of overweight, obesity and abdominal obesity among women.

And lastly there is need for interventions that promote alternatives to meat, among the middle income group. Consumption of products such as poultry that have a negative

relationship with abdominal obesity may be key to curbing obesity in the middle-income group that has the ability to access foods perceived as better.

6.4 Strengths and limitations of the study

The present study provided the advantage of using various anthropometric and body composition parameters which included; Body mass index (BMI), Waist hip ratio (WHR), waist circumference (WC), total body fat percentage (TBF%) and abdominal fat in order to provide complimentary results on the nutritional status of respondents.

The study included a fairly representative study sample size *(N=384).* It also had a wide age group (18-59 years) which included both reproductive and menopausal women. Anthropometric and body composition measurements in this study were repeated and averages got; this provided fair and consistent estimates of nutritional status of respondents.

However, being a cross-sectional study, it had recall bias since it used a semi quantitative food frequency questionnaire and Global physical activity questionnaire which required respondents to remember their dietary and physical activity patterns and finally other factors which the study had no control over other than socio demographic, dietary and physical activity factors might have influenced nutritional status of the women.

6.5 Suggestion for further research

It also important to make further inquiry how marriage and childbearing are related to rapid increases in the body weight of women in order to identify appropriate interventions. Women's knowledge and perception of weight, diet and physical activity as also needs to be explored

Further investigation to understand why there is reduced likelihood of those with a high frequency of consumption of plantains to have low abdominal obesity may be necessary. In addition, an investigation on why nuts and seeds consumption may be associated with increased likelihood of overweight.

More studies of this nature and related longitudinal studies in rapidly urbanizing communities in Uganda should be carried out to best understand the distribution and risk factors of malnutrition in these communities in order to establish strategies to handle such situations in the country.

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Appendix i: Work plan

ACTIVITY	MONTHS OF THE YEAR											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017												
Identify the Problem												
2018												
Topic Selection												
Proposal writing												
Defending Proposal												
Approval from REC and UNCST												
Data collection												
2019												
Data entry												
Data analysis												
Report writing												
Defending Thesis												
Handing in in Thesis												

Appendix ii: Budget

S/No.	**Item**	**Quantity**	**Unit price**	**Total amount**
1	Travel/Transport	1	605,000	605,000
2	Administrative costs	1	59,5000	59,5000
3	Internet services	10 GB	10,000	100,000
4	Ream of ruled papers	4	15,000	60,000
5	Ream of Duplicating paper	32	18,000	57,6000
6	Pens	5 dozens	12,000	60,000
7	Pencils	5dozens	2500	12500
8	Markers	1 dozen	6000	5,000
9	Note Books	2 dozens	12,000	6,000
10	Other Materials and supplies	1	320,000	320,000
11	Printing drafts	20	10,000	200,000
12	Final printing and binding	6	50,000	300,000
13	Miscellaneous	1	250,000	250,000
14	Result dissemination	1	556,000	556,000
	TOTAL			**3,645,500 UGX**

PARTICIPANT INFORMED CONSENT FORM

(To be completed in duplicate)

My name is …… I am one of the members on the team that is collecting data for a research study titled "Factors associated with nutritional status of women 18-59 in Mukono municipality Uganda".

This study is being undertaken as a Master Research study by Justine Athieno, a student at the department of Human Nutrition Kyambogo University. The researcher is being supervised by Dr. Joweria Nambooze Galabuzi and Dr. Faith. M. Namayengo both Lecturers of Kyambogo University.

Please be informed that you will not receive any form of material compensation for participating in this study however the data collection team will take your body measurements including blood pressure, explain to you the results and give advice depending on your results about healthy diets, physical activity and how to generally maintain good health.

In addition, your participation in this study is voluntary and you may choose to withdraw from the study at any point of the interview. No action will be taken against you however; it would be of great benefit for us and your community if you opt to continue to the end of the interview process.

In case of any concern, complaint or clarification, you can call the researcher on +256706600658; Email: athienoj@gmail.com.

With this in mind, I therefore request for 30-45 minutes of your time to complete this interview.

I……..of Mukono Municipality, agree to participate in a study titled "factors associated with nutritional status of women 15-59 years" in my area on the……day of November 2018.

Signature/Thumb print **(Respondent)** Signature **(Research assistant)**

Research Instruments

This questionnaire is designed to collect data about Socio demographic, dietary and physical activity factors associated with nutritional status of women 18 to 59 years in Mukono Municipality.

Parish……..Village……....

Interview date…… Serial Number……..

SECTION 1: SOCIO DEMOGRAPHIC FACTORS

S/No	Question	Options/ Response
Socio-demographic data. Now I am going to ask you about yourself and your family.		
1.1	How old are you?	1=18-30 2=31-40 3=41-50 4=51-59
1.2	Religious affiliation	1= Catholic 2=Anglican 3= Islam 4=Pentecostal 5= If others, specify
1.3	Ethnic background	1=Luo 2=Muganda 3=Musoga 4=Munyankole 5=Itesot 6=Ifothers specify…….....
1.4	What is your highest level of education attained?	1=Primary 2=Secondary 3=Tertiary 4=University 5=None 6= If others specify……..
1.5	What is your marital status?	1=Single 2=Married/Cohabiting 3=Divorced/Separated 4=Widowed 5=If others,

		specify……
1.6	How many Children do you have?	1=None 2=One 3=Two 4=Three 5=Four 6=Five and above
Socio-economic data		
1.7	What is your main source of income? (Occupation)	1=Formal employment 2=Informal employment 3=Farmer 4= Self-employed 5=Unemployed 6= If others; specify……
1.8	What is the gender of the breadwinner in your family?	1= Male 2=Female

SECTION 2: DIET

Semi Quantitative Food Frequency Questionnaire (Adopted from National Health and Nutrition Examination Survey).

Now I am going to ask you some questions about eating and health.

Interviewer, the Questions below should be answered on the table

2.1.1 Food Item

2.1.2 How often do you usually eat (name of food item) in seven days?

2.1.3 How do you usually prepare it?

2.1.4 From these photos please show the size of food you usually eat. (***Interviewer show one of the food photographs at a time starting from the smallest to the largest***)

2.1.5 Did you eat this food item yesterday?

S/No	2.1.1 Food Item	2.1.2 Frequency of consumption in the last seven days	2.1.3 Cooking Method	2.1.4 Amount consumed by respondent	2.1.4.1 Unit/ food model reference/ Food photograph reference	2.1.5 Eaten by yesterday (Yes or No)
1	Mashed Matooke					
2	Rice					
3	Cassava (Whole)					
4	Cassava Katogo					
5	Sweet potatoes					
6	Beans					
7	Irish Potatoes					
8	Milk					
9	Mukene					
10	Posho					
11	Yams					
12	Spaghetti					
13	Liver					
14	Chapati					
15	Eggs					
16	Yoghurt					
17	Millet bread					
18	Beef					
19	Cabbage					
20	Greens					
21	G. nuts stew					
22	Chicken					
23	Pumpkin					
24	Fish					
25	Tea/ Sugar					
26	Corn Porridge					
27	Peas					
28	Pork					
29	Eggplant					
30	Bread					
31	Pineapple					

32	Doughnut					
33	Mandazi					
34	Fried cassava					
35	Roasted G. nuts					
36	Millet porridge					
37	Ripe banana					
38	Byenda					
39	Fried Irish Potatoes					
40	Avocado					
41	Fried chicken					
42	Sausage					
43	Cake					
44	Ghee					
45	Cooking oil					
46	Fene					
47	Soda					
48	Passion fruit					
49	Mango					
50	Alcohol					
51	Others					

SECTION 3: PHYSICAL ACTIVITY

3.1 Global Physical Activity Questionnaire (GPAQ)

Physical Activity		
Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person. Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, office work (cooperate), household chores, harvesting food/crops, fishing or hunting for food, seeking employment. In answering the following questions 'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.		
Question	**Response**	**Code**
Work		
Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like [carrying or lifting heavy Jerrican, digging or construction work] for at least 10 minutes continuously? What kind of vigorous intensity activities do you usually do? 1. 2. 3. 4.	Yes 1 No 2 If No, go to P 4	P 1
In a typical week, on how many days do you do vigorous intensity activities as part of your work?	Number of days |___|	P 2
How much time do you spend doing each of the vigorous-intensity activities at work on a typical day?	1. 2. 3. 4. Hours; Minutes	P 3 (a-b)
Does your work involve moderate-intensity activity, that causes small increases in breathing or heart rate such as brisk walking, simple house hold chores, carrying light loads] for at least 10 minutes continuously?	Yes 1 No 2 If No, go to P 7	P 4

What kind of moderate intensity activities do you usually do on a typical day (list time for each activity) 1. 2. 3. 4.		
In a typical week, on how many days do you do moderate intensity as part of your work?	Number of days ⌊___⌋	P 5
How much time do you spend doing moderate-intensity activities at work on a typical day?	1. 2. 3. 4. Hours; Minutes	P 6 (a-b)
Question	**Response**	**Code**
Travel to and from places		
The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship. [e.g by Boda boda, bus, train, taxi, bicycle, foot]		
Do you walk for at least 10 minutes continuously to get to and from places? Do you use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?	Yes 1 No 2 If No, go to P 10	P 7
In a typical week, on how many days do you walk or for at least 10 minutes continuously to get to and from places? In a typical week, on how many days do you bicycle for at least 10 minutes continuously to get to and from places?	Number of days ⌊___⌋	P 8
How much time do you spend walking for travel on a typical day? How much time do you spend bicycling for travel on a typical day?	1. 2. 3. 4. Hours; Minutes	P 9(a-b)

Recreational activities		
The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure)		
Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [Skipping, running, swimming, netball, and volleyball] for at least 10 minutes continuously? What do you do? How often do you do it?	Yes 1 No 2 If No, go to P 13	P 10
In a typical week, on how many days do you do vigorous intensity sports, fitness or recreational (leisure) activities?	Number of days ⌊__⌋	P 11
How much time do you spend doing vigorous-intensity sports fitness or recreational activities on a typical day?	1. 2. 3. 4. Hours; Minutes	P 12 (a-b)
Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that cause a small increase in breathing or heart rate such as brisk walking, [cycling, swimming, and volleyball, Net ball] for at least 10 minutes continuously? What do you do? How often do you do it?	Yes 1 No 2 If No, go to P16 1. 2. 3. 4.	P 13
In a typical week, on how many days do you do moderate intensity sports, fitness or recreational (leisure) activities?	Number of days ⌊__⌋	P 14
Question	**Response**	**Code**
How much time do you spend doing moderate-intensity sports fitness or recreational (leisure) activities on a typical day?	1. 2. 3. 4. Hours; Minutes	P15 (a-b)

Sedentary behavior		
The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent sitting at a desk, sitting with friends, traveling in car, bus, train, reading, playing cards or watching television, but do not include time spent sleeping		
How much time do you usually spend sitting or reclining on a typical day? What do you usually do in this time?	1. 2. 3. 4. Hours; Minutes	P 16 (a-b)

SECTION 4: BODY COMPOSITION

Now I am going to take your body measurements, kindly be cooperative.				
S/No.	**Body Measurement**	**First Measure**	**Second Measure**	**Average**
4.1.	Height (cm)	……..	……	……
4.2	Weight (kg)	…….....	……	……
4.3	Body Mass Index (Kg/m^2)	……	……	……..
4.4	Total body fat percentage	……	……	……
4.5	Abdominal fat level	……	……	……..
4.6	Waist circumference in cm	……	……..	……..
4.7	Hip Circumference in cm	……	……...	……..