NUTRITION KNOWLEDGE, ATTITUDE, DIETARY PRACTICES AND NUTRITIONAL STATUS OF ADOLESCENT GIRLS (13–18 YEARS) ATTENDING PUBLIC MIXED DAY SECONDARY SCHOOLS IN GILGIL SUB-COUNTY, NAKURU, KENYA

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A Thesis Submitted to the Institution of Postgraduate Studies of Kabarak University in Partial Fulfillment of the Requirement for the Award of Master of Science in Human Nutrition and Dietetics Degree

KABARAK UNIVERSITY

NOVEMBER, 2025

DECLARATION

1. I do hereby declare that:

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The thesis titled "**Nutritional Knowledge, Attitude, Dietary Practices and Nutritional Status of Adolescent Girls (13–18 Years) Attending Public Mixed Day Secondary Schools in Gilgil Sub-County, Nakuru, Kenya"** and written by **George Ndichu Munjuga** is presented to the Institute of Postgraduate Studies of Kabarak University. We have reviewed the thesis and recommend it be accepted in partial fulfilment of the requirement for award of the degree of Master of Science in Human Nutrition and Dietetics.

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ACKNOWLEDGEMENTS

My sincere appreciation goes to everyone who offered their resources in form of money and time towards this thesis. I pass my gratitude to my supervisors, for immense inspiration and tirelessly reviewing my work, constructive criticism and the guidance they gave me throughout the research process. I owe a lot to my family members; my wife, my daughters and my siblings for their immense moral and spiritual support. Above all, to Almighty God, the Creator of the heavens and the earth, the Alfa and Omega, may all the glory and honour be given to Him for the successful completion of this thesis.

DEDICATION

I dedicate this work to my lovely wife, my daughters, my siblings, children's ministry and my colleagues.

ABSTRACT

Adolescent girls are nutritionally vulnerable because they have unique nutritional needs for optimal growth and development, have high risk-taking propensity and are predisposed to pressure from peers. Therefore, the objective of this study was to determine the association between nutrition knowledge, attitude, dietary practices and nutritional status of school-going adolescent girls. The school-based study was conducted in 34 public mixed day secondary schools in Gilgil Sub-County and included school girls aged 13-18 years attending the said secondary schools in Gilgil Sub County. The sample size was 420 girls obtained from six sampled schools obtained using the stratified random sampling method. The study employed an observational cross-sectional study design that involved collection of quantitative data using both questionnaires and anthropometric tools. The data was summarized using descriptive statistics including frequencies, percentages, means and standard deviations. The logistic regression was used to check the association between socio-economic variables, nutrition knowledge, attitude, dietary practices, and nutrition status at the 0.05 level of significance. The research sample was evenly distributed in terms of age while the majority (77.8%) resided in the rural areas. The majority of the girls (86.2%) were in healthy nutritional state based on the BMI while 13.8% were malnourished. Being younger 13-15 years (OR= 0.42, 95% CI: - 0.895- 1.197), mother being unemployed (OR= 0.086, 95% CI: 0.038- 0.196), and taking less than 2 litres of water a day (OR= 0.47, 95% CI: 0.258- 0.857) were significantly associated with lower likelihood of having a healthy nutritional status. On the other hand, living in rural areas (OR= 2.559, 95% CI: 1.374- 4.765),being from grandparent-headed household (OR=7.792, 95% CI: 5.983- 10.147), having a positive nutritional attitude (OR= 3.333, 95% CI= 1.519- 7.313) and having a higher individual dietary diversity score (OR= 2.526, 95% CI: 1.396- 4.571) were significant linked to greater chances of having a healthy nutritional status. Majority of the school-going adolescent girls in Gilgil Sub-County are in a healthy nutritional state. The majority of these girls have low nutritional knowledge but positive nutritional attitude and good dietary practices. Nutritional status of the girl is significantly determined by age with older girl being more likely to be in healthy nutritional state. Residing in rural areas, mother and father occupation, mother and father education, having a positive nutritional attitude and best dietary practices are positively associated with the girls' nutritional status. The study recommends that policies and programmes aimed at improving the nutritional status of school going adolescent girls should prioritize enhancing the nutritional knowledge of the girls and mothers through awareness campaigns. Nutritional interventions should prioritize girls residing in urban area, those in large households, and those from low-income households. The interventions should also focus on improving the girls' nutritional attitude and access to meals with diverse foods groups.

Keywords*:* *Dietary Practices, Nutritional Status, Adolescents, Girls*

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ABBREVIATIONS AND ACRONYMS

BMI	-	Body Mass Index
CDC	-	Centre of Disease Control Centre and Prevention
DD	-	Dietary Diversity
IDDS	-	Individual Dietary Diversity Score
IPGS	-	Institute of postgraduate studies
KDHS	-	Kenya Demographic Health Survey
KUSERC	-	Kabarak University Scientific and Ethics Review Committee
MDD-W	-	Minimum Dietary Diversity-Women
MOE	-	Ministry of Education
MOH	-	Ministry of Health
NACOSTI	-	National Commission for Science, Technology and Innovation
NCD	-	Non-Communicable Diseases
PII	-	Personally Identifiable Information
SDGS	-	Sustainable Development Goals
SPSS	-	Statistical Package for Social Science
TPB	-	Theory of Planned Behaviour
WFP	-	World Food Program
WHO	-	World Health Organization
WIFS	-	Weekly Iron Folic Supplements

OPERATIONAL DEFINITIONS OF TERMS

Dietary Practice: This study defined optimal dietary practices of adolescent girls as those who consume 5-6 meals and snacks daily, do not skip meals, know the importance of Weekly Iron Folic Supplements (WIFS) and engage at least four food groups in their choice of meals.

Nutrition Attitude: This refers to the adolescent girls' appraisal of nutrition particularly regarding healthy diet and its benefits.

Nutrition Knowledge: This refers to the adolescent girls' (13-18 years) knowledge on micronutrients, food groups, and food preparation.

Nutrition Status: It is the physiological condition of adolescent girls (13-18 years) as revealed by body mass index (BMI) for age.

Socioeconomic and Demographic Characteristics: The social, economic, and demographic traits of an individual often measured in terms of education, income, and family size among others. This study focused on students' parents' occupation, household income, parent education, and family size.

CHAPTER ONE

INTRODUCTION

1.1 Background

Even though adolescents make up one-sixth of the world's population, adolescent nutrition has not been given adequate attention in the majority of nations. According to the World Health Organization (2019), adolescence is the stage of life between the ages of 10 and 19 when a person transitions from a dependent childhood to an independent adulthood. Around 1.2 billion teenagers live on the planet, making up more than 18% of the entire population. Six hundred million of them are female, and about 90% of them reside in low- and middle-income nations (Igras et al., 2014).

The adolescence stage is typified by accelerated growth and development during which 15 to 25% of adult height is attained as well as up to 45% of skeletal growth (Das et al., 2019). The accelerated change in stature, muscle mass, and fat mass during this time make the risk of inadequate nutrition and other health problems a major concern. Teenagers' health as adults as well as this quick development spurt will suffer as a result of these major nutritional issues. Today's adolescent females have a high frequency of chronic energy and micronutrient shortages, and this is directly related to how well the following generation will fare. Without addressing these deficits, the cycle of poverty, chronic illness, and under nutrition across generations continues. Adolescent eating habits also predict eating practices and health during adult years (Blum et al., 2019).

Evidence suggested that adolescent females are frequently a marginalized and disempowered population, which results in fewer possibilities and options for them (Hadush et al., 2021). They are a nutritionally susceptible group due to their high growth requirements, risk-taking behaviours, and eating habits. Additionally, because they are more susceptible to environmental influences and the demanding physical and mental

labour typical of least developed countries, they may experience greater physiological distress and nutritional needs during adolescence. Girls are particularly vulnerable in certain cultures, from birth to adolescence, due to gender inequality (Heise et al., 2019). Furthermore, public health system accords little attention to adolescent because stakeholders often regard them as a low-risk category for poor health and nutrition. As a result, there is a shortage of knowledge about the nutritional status of adolescents, particularly those from developing countries.

In the USA, a study by the American Psychiatric Association (2020) observed that eating disorders affect approximately 14% of adolescents, with girls being more at risk than boys. The study also recorded a gender disparity in obesity rates, with girls being more susceptible. The incorporation of unhealthy dietary habits, lack of physical activity, and the influence of societal pressures on body image contribute to this issue. Teenage girls often face body image-related stress that can lead to disordered eating patterns, further exacerbating the problem (Pratt & Canavera, 2017). These alarming statistics underscores the urgent need to address nutritional challenges among teenage girls to mitigate the risk of developing eating disorders.

In addition, the World Health Organization (2019) opines that adolescent girls face unique nutritional challenges due to physiological changes during puberty. Adolescent girls experience significant bodily changes, including increased fat deposition and skeletal growth and higher iron requirements related to menstruation, which have implications for their nutritional needs. These changes make teenage girls more susceptible to developing certain nutritional deficiencies such as iron deficiency, particularly due to increased iron requirements related to menstruation (Golley et al., 2017). Girls who develop anaemia due to inadequate iron intake or other factors may experience fatigue, impaired cognitive function, and compromised immune function.

This gender-specific vulnerability underscores the importance of addressing the nutritional needs of teenage girls to promote their overall health and well-being (Virdi et al., 2017).

In Bangladesh, Blum et al. (2019) observed that gender norms combine with structural, social and economic factors to make adolescent girls more vulnerable to malnutrition than adolescent boys. Long breaks between meals caused by school schedules make adolescent girls in low-income households to skip meals. In India, Aurino (2017) observed that girls are disadvantaged at all ages when it comes to food allocation but gender difference in food allocation widens between the ages of 15 and 19 years. Girls at this age bracket consumed less vitamin-and-protein rich foods such as legumes, eggs, and fruits.

Kenya is one of the developing countries and middle low-income country undergoing rapid urbanization, industrialization and modernization which has resulted to change in lifestyles, nutrition habits and nutrition practices (Usman et al., 2017).Adolescents account for 22% of the entire population, suggesting the critical need for additional investment in their health, nutrition, education, livelihoods, and participation. There has been little research in Kenya on the level of teenage malnutrition in the country. According to research influencing Kenya Adolescent Programming, anaemia is prevalent (16.5% for 5-24-year-olds and 13.8% for 15-19-year-olds) and adolescents have 80% zinc deficiency (Harika et al., 2017). To combat the high prevalence of micronutrient deficiencies, the Ministry of Health through the County Government of Nakuru has initiated the weekly iron and folic supplementation (WIFS) programme and teachers provide health talks in class room prior to supplementation in Gilgil sub county ("Nakuru County," 2020). Therefore, apart from the study's objective to determine the association between the school-going adolescent girls' nutrition knowledge, attitude, dietary

practices and nutritional status, this study also sought to estimate the coverage for a number of factors to inform nutrition promoters to plan action.

1.2 Statement of the Problem

Poor nutritional status among adolescents is widespread in developing countries as characterized by over nutrition and under nutrition emanating from changes in nutrition habits (Sharma et al., 2019). Poor nutritional status is still a central public health challenge among adolescents in Kenya (Bentham et al., 2017). The Kenya Demographic and Health Survey of 2022 showed that16.6% of adolescents aged 13–18 years were thin, 12.2% were overweight or obese while 1.7% exhibited stunting (Kenya National Bureau of Statistics, 2022).Poor nutritional status puts adolescents at a risk of deprived health, below average school performance while over nutrition puts them at a risk of being exposed to lifestyle diseases and developing low self-esteem (Kamanu, 2016).Poor nutritional status at the adolescent stage also has long-term consequence including lifetime obesity, hyperlipidaemia, osteoporosis, loss of final adult height, retarded intellectual development and delayed sexual maturation (Berhe et al., 2019).

In Nakuru County, under nutrition costs the healthcare system approximately Kshs 175.6 million every year. The county also loses approximately Kshs 626.6 million as a result of mortality and low economic output caused by malnutrition. Gezaw et al. (2023) noted a lack of consistency in the information regarding factors that affect adolescent nutritional status. In their systematic literature review, Salam et al. (2020) observed that most of the studies examining factors contributing to the double burden of malnutrition among adolescence are concentrated in the European and North American regions. There is a gap in knowledge regarding factors that contribute to adolescent malnutrition in low- and middle-income countries despite the fact that 90% of adolescent live in these countries.

In addition, none of the studies reviewed by Salam et al. (2020) had adopted the gender lens in examining the malnutrition problem. Blum et al. (2019) contends that since gender norms have a major impact on nutritional habits and access in developing nations, embracing a gender lens in studying the malnutrition challenge will be of greater value. The study sought to fill these gaps by examining the association between dietary knowledge, nutrition attitude, dietary practices and nutritional status among school going adolescent girls (13 – 18 years) in Gilgil Sub County, in Nakuru County, Kenya. Establishing this association was important in supporting policy action aimed at addressing adolescent malnutrition.

1.3 Objective of the Study

1.3.1 General Objective of the Study

The objective of the study was to determine the association between nutrition knowledge, attitude, dietary practices and the nutritional status of adolescent girls (13-18 years) attending public mixed day secondary schools in Gilgil Sub-County.

1.3.2 Specific Objectives of the study

The study sought to achieve the following specific objectives: -

i. To determine the socioeconomic characteristics of adolescent girls (13-18 years) attending public mixed day secondary schools in Gilgil Sub- County.
ii. To assess the level of nutrition knowledge among adolescent girls (13-18 years) attending public mixed day secondary schools in Gilgil Sub- County.
iii. To determine the nutrition attitude of adolescent girls (13-18 years) attending public mixed day secondary schools in Gilgil Sub-County
iv. To describe the dietary practices of adolescent girls (13-18 years) attending public mixed day secondary schools in Gilgil Sub-County.

v. To determine the nutritional status of adolescent girls (13-18 years) attending public mixed day secondary schools in Gilgil Sub-County.

vi. To determine the association between socioeconomic characteristics, nutritional knowledge, attitude, dietary practices and nutritional status of adolescent girls (13-19 years)attending public mixed day secondary schools in Gilgil Sub-County.

1.4 Research Hypotheses

The following hypotheses were tested at the 0.05 level of significance:

H_{01}: There is no significant association between socioeconomic characteristics and nutritional status of adolescent girls (13-18 years)attending public mixed day secondary schools in Gilgil Sub-County.

H_{02}: There is no significant relationship between nutritional knowledge and nutritional status of adolescent girls (13-18 years)attending public mixed day secondary schools in Gilgil Sub-County.

H_{03}: There is no significant association between nutrition attitude and nutritional status of adolescent girls (13-18 years)attending public mixed day secondary schools in Gilgil Sub-County.

H_{04}: There is no significant relationship between dietary practices and nutritional status of adolescent girls (13- 18 years)attending public mixed day secondary schools in Gilgil Sub-County.

1.5 Justification of the Study

Among the SDGS there are health targets and gaps to achieve. These include and not limited to goals number three that aim at ensuring health and wellness of all people therefore adolescents should not be left behind hence the findings of this study may be of substantial help in achieving these targets (United Nations, 2023). Addressing adolescent nutrition challenges is important in lessening the threefold threat of malnourishment and

non-communicable diseases later in life. Adequate nutrition knowledge is one of the few controllable predictors of dietary behaviour and plays a role in the development of skills and capacities required to repel environmental pressures that lead to bad nutrition habits. Development of these capacities will result in a healthy generation, the end of intergenerational hunger, and the prevention/delay of lifestyle diseases in adulthood (Poskitt et al., 2014).

Nutrition interventions at the adolescent stage provide the last window of opportunity for intervention; thus, deficiency in nutrition knowledge, dietary habits, and nutritional position of adolescents will be evaluated through this study. Participants gain from the research by learning about their nutrition status; those who have nutrition issues were sent to a healthcare facility for further management. The research findings may be used by the school to promote nutrition programs and develop healthy menus for learners. The results of the study may aid the Ministries of Health and Education as well as non-governmental organizations in developing initiatives to address adolescent nutrition and health issues.

1.6 Significance of the Study

This research provides helpful data on adolescent girls' understanding of nutrition, their dietary habits, their attitude regarding nutrition, and how these variables relate to the nutrition status of the girls. The results are valuable to nutrition service providers when performing nutrition education activities, which include developing programs to encourage the intentional acceptance of proper eating habits that promote overall well-being. The outcomes of this study may aid schools in Gilgil Sub County in developing policies that address the nutritional needs of teenage girls in day secondary schools. The outcomes of the study inform stakeholders such as the ministries of education and health, the County government of Nakuru, and parents/guardians about the forms and extent of

teenage undernourishment. This information may aid in the development of policy and the implementation of interventions to enhance the nutrition of female adolescents. The results also help individuals become more conscious of their nutrition choices and improve nutrition education. The research also adds to our understanding of teenage nutrition.

1.7 Scope of the Study

This study was confined to Gilgil Sub County in Nakuru County. This Sub-County was selected because of the on-going two-year pilot study of integrated weekly iron and folic supplements (WIFS) and nutrition education program for teenage females to prevent anaemia. The study used nutrition knowledge, attitude, dietary practices, and nutritional status as variables of this study. This study was only conducted on day school-going adolescent girls aged 13 – 18 years. Boarding schools were excluded because meals in these schools are usually uniform and dictated by the school administration. This implies that the knowledge and attitude of students in boarding schools have a limited influence on the students' dietary habits and consequently, their nutritional status.

Private schools were also excluded because students in these schools are likely to have different socioeconomic characteristics from the general population of school going adolescent girls. This is because private secondary schools in Kenya often charge higher fees compared to public schools, which means that students attending these schools usually come from more affluent backgrounds (Kenya National Bureau of Statistics, 2019a). Most of these schools provide paid-for meals for most students in school and thus their dietary practices are determined by the schools.

Teenage girls who are 19 years old were also excluded from the study because their age falls outside the BMI for age chart. In addition, girls-only day schools were excluded because they may not provide a social environment where boys and girls interact and

socialize together as is the norm in many societal set-ups. The interaction between boys and girls influences dietary choices and eating behaviours of teenage girls and thus girls-only school may not capture this dynamic. In addition, mixed or coeducation schools are the most prevalent day secondary schools in Kenya, and thus selecting respondents from these schools gave results that are more generalizable and representative of the larger population of teenage girls.

1.8 Limitations of the Study

The data used in this study was gathered during a school term yet nutrition patterns may differ during school holidays. The big age difference among respondents could be a confounding factor to some of the indices. To control the confounding effect of age, this variable was included in the logistic regression model. This means that the age was held constant when the effects of the other variables were being tested.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter covers theories and empirical reviews, adolescent nutrition overview, teenage pregnancy by county in Kenya. The chapter also includes adolescents' nutrition knowledge, attitude, dietary practices and nutrition status; assessing nutrition status of adolescents, conceptual framework and summary of the literature review.

2.2 Theoretical Review

The study was guided by the theory of planned behaviour and Bloom's Taxonomy.

2.2.1 Theory of Planned Behaviour

The theory of planned behaviour(TPB) was developed by Icek Ajzen in 1980 for use to predict individuals' intention to engage in a particular behaviour at a given space and time (Taghipour et al., 2016). The theory contends that people's intention to adopt a particular behaviour is a function of their attitude regarding how this particular behaviour will lead to expected results, their belief on whether other people will approve of the behaviour and their belief regarding their capabilities to perform this behaviour. TPB thus recommends that to promote a given behaviours within a given population, there is need to change the population attitude regarding the benefit of this behaviour. There is also a need to support the population in developing the capacity to effectively implement the desired behaviour. For instance, if the desired behaviour needs some technical skills to implement, there should be an education intervention that seeks to impart the technical skills.

TPB has been used to understand and predict the adoption of health promoting behaviours such as exercise, seeking maternal care and maintaining healthy nutrition

habits. The study by Jeihooni et al. (2021) showed that nutritional behaviours of women in Fasa City of Iran were shaped by their attitude regarding the role of nutritional behaviour in preventing cardiovascular disease. Their nutritional behaviours were also determined by the women beliefs regarding how whether their families will approve new nutrition practices as well as their beliefs regarding their capability to afford and sustain new dietary practices. These findings validated the usefulness of TPB in predicting nutritional behaviour. The authors concluded that to promote healthy nutritional behaviour among the Fasa City women, there is need to educate them regarding the role that nutrition play in preventing lifestyle illnesses such as cardiovascular diseases. There is a need to empower these women to enable them to access healthy foods.

TPB was relevant to the study because it pinpoints factors that affect the dietary practices of adolescent girls. According to this theory, the dietary practices of adolescent girls is more likely to be shaped by their attitude regarding the benefits of healthy dietary habits and risks of unhealthy eating habits, societal norms and the girls' beliefs regarding their capability to maintain healthy eating habits. TPB also predicts the association between nutritional knowledge and dietary practices. According to theory, nutritional knowledge can have an impact on the girls' attitude regarding the benefits of healthy nutritional practices and risk of unhealthy eating practices. Gronhoj et al. (2012) also observed that adolescent girls with higher BMI had strong intention to adopt healthy eating practices. This implies that TPB can also explain the association between nutritional status (BMI) and nutritional practices.

2.2.2 Bloom's Taxonomy

Bloom's taxonomy is a framework that was developed by Benjamin Bloom in 1956 to describe how learning takes place (Newton et al., 2020). The framework contends that there are six levels of learning namely: remembering, understanding, applying,

analysing, evaluating, and creating. Remembering is the basic level or stage of learning that entails recalling facts or concepts. Understanding is the next level of learning, which entails gaining the ability to classify, explain, recognize, or translate concepts (Green & Chenarides, 2020). Applying is the third level of learning and entails developing the ability to use the concept being taught to solve problems or executing the concept. Analysing the fourth stage of learning and involves developing the ability to organize, differentiate, experiment, test, or compare concepts. Evaluation is the fifth stage and encompasses acquiring the ability to defend, judge, support, weigh, or critique concepts. Creating is the highest level of learning and involves developing the ability to use concepts to construct, formulate, design, or develop something new.

The Bloom taxonomy has become an important framework for designing education and awareness programmes and the learning goals of these programmes. According to Samruayruen and Kitreerawutiwong (2022), every education programme should begin with instructional strategies that seek to foster remembrance of concept. Remembering of concepts is the foundation of learning as it is this memory that enables individuals to comprehend and apply a concept as well as use the concept to evaluate, analyse and create. After all, you cannot apply what you cannot remember. However, education programmes should go beyond fostering memory to helping learners to advance to higher order thinking including the ability to apply concepts to solve problem and create (Green & Chenarides, 2020).

The Bloom taxonomy aided the analysis and interpretation of respondents' nutritional knowledge. Apart from assessing the respondent's ability to remember information about types, components and sources of food, the study assessed the respondents understanding of these aspects as well as the ability apply the nutritional knowledge to make reasonable

choices of food. The study also covered assessment of respondents' understanding of food preparation skills and how they affect the quality of nutrition.

2.3 Empirical Review

This section reviews empirical literature related to adolescent nutritional status, nutritional knowledge, attitude, and dietary practices.

2.3.1 Adolescent Nutrition Status

The WHO describes adolescent as individuals between the ages of 10 and 19 years as people. Adolescents now account for 18% of the global population, with 88% residing in developing nations. Adolescents account for 22% of the Kenyan population. Adolescence is a fragile period marked by accelerated growth and development as well as increasing dietary requirements. Adequate nourishment is vital for reaching full development, and deficient nourishment may lead to hampered and inhibited linear growth, as well as poor organ remodelling. Adolescence accounts for about half of the weight that a person attains in adulthood, 15% of the height attained in adulthood, and 45% of the skeletal mass attained in adulthood. Poor nutrition among adolescents can have lasting effects on health, and for girls, it may influence their offspring's survival and wellbeing (Leroy et al., 2018).

Nourishment challenges during adolescence must be addressed because their nutritional state has a significant impact on future generations, particularly girls. The dietary habits that the form at this stage shape their well-being during their adult years (Sahoo et al., 2015). Teenage health has not been a big issue, and as a result, there has been little research into teenage nutrition, particularly in underdeveloped countries such as Kenya (Deka et al., 2015). Adolescents are often overlooked by healthcare systems because they are less sensitive to diseases, have less severe problems than infants and grown-ups, and have lower death and morbidity rates. Programmes for addressing obesity around the

world focus their attention on the diets of adults and children despite the risk of overweight and obesity being high during adolescence because of adolescents' susceptibility to bad eating habits (Kansra et al., 2021). Studies suggest that one in every three adolescents worldwide is overweight or obese (Das et al., 2017).

Nutrition status assessment assesses an individual's health and aids in the identification of malnourishment and those at risk. Body Mass Index (BMI) for age is used as a proxy indicator for nutritional status. BMI is calculated by dividing an individual's weight in kilograms by their height in meters squared. BMI is a low-cost and simple approach of identifying weight levels that indicate a health problem. Adolescent BMI is given in percentiles in comparison to other adolescents of the same age and gender. According to WHO, BMI-for-age less than the 5th percentile is the best indication of adolescent nutrition status (Freedman & Berenson, 2017). Normal dietary status ranges from above the 5th percentile to below the 85th percentile. Individuals with BMI that is at or beyond the 95^{th} percentile of the same gender and age are classified as obese. Table 1 showcases the BMI for Age categories and corresponding percentiles

Table 1

BMI for Age Categories

Weight Status Category	Percentile Range
Underweight	BMI < 5^{th}
Normal	$5^{th} \leq$ BMI< 85^{th}
Overweight	$85^{th} \leq$ BMI >95^{th}
Obese	BMI $\geq 95^{th}$

Source: World Health Organization (2019)

2.3.2 Socioeconomic Characteristics and Nutritional Status

Socioeconomic characteristics affect the living conditions of adolescents and are projected to have an effect on their nutritional status. The link between socioeconomic characteristics and nutritional status is captured in the study by Galgamuwa et al. (2017), which was conducted among plantation communities in Sri Lanka. The study utilized a cross-sectional survey design that entailed collecting data from 547 children. Nutritional status of the participants was measured using BMI for age while data on socioeconomic characteristics was gathered using questionnaires. Results showed that under nutrition was associated with maternal employment, many siblings, high birth order, many family members in the households, living in a small house, and low household income. The study however focused on pre-school and primary school children, who might be more vulnerable to socioeconomic background than adolescents.

The study by Arage et al. (2019) focused specifically on adolescent girls. It was a school-based study that utilized the cross-sectional survey design and involved 362 adolescent girls aged between 10 and 19 years. Data was collected using anthropometric measurements and researcher-administered questionnaires. Results showed that adolescent residing in rural areas, whose mothers were not working, and who did not have access to snacks were more likely to exhibit stunting. On the other hand, the girl education levels were less likely to be thin. Although the study shows an association between socioeconomic status and adolescent nutrition status, it was conducted in Sri-Lanka where adolescents may have different socioeconomic backgrounds from the school going adolescents in Nakuru County.

In Kenya, Nguu-Gutu et al. (2017) found that there was an association between socioeconomic characteristic and snacking among adolescent in secondary schools in Nairobi County. The study utilized a cross-sectional survey design that entailed

collecting data from 352 adolescents from public national boarding schools in Nairobi County using semi-structured questionnaires. The student socioeconomic status was classified as high, middle, or low using data on parents' occupation, property ownership, and pocket money given to the students. Results showed that students with high socioeconomic status exhibited high snack intake than those from middle and low socioeconomic backgrounds. However, the concept of nutritional status is missing in this study. The study links socioeconomic background to snacking, which is more or less a dietary practice rather than a nutritional status. The study also focused on students in boarding schools who spend 9 out of 12 months in school and therefore have access to the same meals regardless of their socioeconomic backgrounds.

In Lang'ata Sub-County, Rapondo et al. (2017) found that 17.8% of school-going adolescents were either obese or overweight. This implies that there is a notable section of school going adolescents in the Sub-County who do not have a healthy nutritional status. Prevalence of overweight and obesity was higher among adolescent in private schools (23.5%), among female adolescents (20.59%), among those in boarding schools (21.56%), among those whose parents had higher education level (22.73%), and among those who were in form three (19.18%) and form four (19.67%). The study collected data from 296 school going adolescents from private and public secondary schools in the Sub-County. Although the study highlights the nutritional status of school-going adolescents and how it is related to socio-demographic characteristics of the adolescents, it does not link nutritional status to the adolescents' nutrition knowledge, attitude, and practices. The current study sought to fill this gap.

2.3.3 Adolescents Nutrition Knowledge and Nutritional Status

The theory of planned behaviour suggests that individuals' attitude and beliefs regarding cost and benefits of healthy dietary practices has an impact on their intention to adopt

health nutritional practices. Knowledge has a major bearing on individuals' attitudes and beliefs. The study by Cunningham et al. (2020) established that most school going adolescent girls have inadequate access to nutritional knowledge mainly because these girls have limited access to mass-media and the internet. The authors noted most nutritional education programmes utilize online or mass media to disseminate information, a practice that disadvantages most school going adolescent because they spend most of their time in school and thus, they do not access most of the programmes on television or radio. These adolescents also have little access to internet devices such as mobile phones, which limit their access to online nutritional programmes.

Ali et al. (2020) also found that 20% of students in Omani University in Canada did not have adequate knowledge regarding the daily energy requirement while 6% were not aware of their macronutrient need. The students had major deficiency in nutritional knowledge despite them being at the university level and in a developed country. This study highlights the lack of adequate knowledge about daily energy requirements and macronutrient needs among a significant portion of the study population.

The fact that 20% of the students did not have sufficient knowledge about their daily energy requirement suggests a lack of awareness about the amount of energy needed to meet their individual needs. This lack of knowledge can have implications for maintaining a balanced diet and proper energy intake, which are crucial for overall health and well-being. The study's conclusion that university-level students in a developed country like Canada had major deficiencies in nutritional knowledge raises concerns about the effectiveness of nutrition education and awareness programs. It suggests that there may be a gap in providing proper nutrition education to students, which is necessary to equip them with the knowledge and skills to make informed dietary choices.

The research by Wiafe et al. (2023) revealed that there is a robust link between nutritional knowledge and nutritional status of adolescent. The study utilized a randomized control trial design that involved a sample of 100 adolescents in the 10-14 years age brackets from one of the Municipalities in Ghana. The participants were randomly assigned into the intervention (n=50) and control group (n=50), with intervention group receiving nutritional education and counselling for a period of 6 months. Data on height, weight, vitamin C and dietary iron were collected from both groups before and after the six-month period. Results showed that adolescents in the intervention group had significantly higher Vitamin C and dietary iron intake as well as lower incidence of Anaemia than those in the control group.

However, use of experimental design may have exposed the study to the Hawthorne effects, which is the tendency of research participants to behaviour differently from how they would have behaved because they know that they are being studied. The study overcame this limitation by using a cross-sectional design that assessed the adolescent nutritional knowledge, practices, and status retrospectively consequently capturing these variables in the participants' natural set-up.

Similarly, the study by Humulka et al. (2018) established a notable link between nutritional knowledge and nutrition status of adolescents. Their study was carried out in Poland and targeted polish teenagers with the view of establishing the link between body mass, nutrition awareness and socio demographic variables. The study used cross sectional study research design that integrated the logistic regression method of analysing data. Results showed that 29% of the participants exhibited high nutrition awareness and active lifestyle, 56.9% exhibited lower nutrition awareness and sedentary lifestyle, 13.8% exhibited fast-food-Sedentary. Adolescent with high nutritional awareness and active lifestyle had 47% lower chances of being obese as compared to

those with low nutritional awareness. The study was done in developed country hence results can't be applied in developing countries and hence this study will bridge this knowledge gap.

Veronika et al. (2021) discovered no significant link between nutritional knowledge and nutritional status in a sample of 58 adolescents (15-18 years) from an Indonesian high school. The research utilized a cross-sectional design in which respondents were chosen using a stratified random selection method and data was collected from them using 30 item questionnaires to assess nutritional knowledge and anthropometrics to assess nutritional status. The Spearman rank correlation method was used to analyse the data. Results showed that 58.6% of the respondents exhibited severe nutritional status despite 81% having adequate nutritional knowledge. The Spearman correlation test revealed that there was an insignificant link between nutritional knowledge and nutritional status (p=.394). This study highlights a lack of consistency with the body of literature regarding the relationship between nutritional knowledge and nutritional status. The current study sought to clarify this relationship by studying adolescent girls in public day secondary schools in Gilgil Sub-County.

2.3.4 Adolescents Nutrition Attitude and Nutrition Status

Nutrition attitude refers to a person appraisal of nutrition particularly regarding healthy nutrition and its benefits. The theory of planned behaviour contends that individual's attitude towards nutrition has a major bearing on his or her intention to adopt a given nutritional behaviour (Jeihooni et al., 2021). A person who perceives that maintaining healthy nutrition habits will confer notable benefits to him or her is likely to adopt heavy nutritional habits leading better nutritional status. On the other hand, a person who believes that maintaining healthy nutrition habit has minimal benefits is less likely to

adopt healthy nutritional behaviours leading to adverse nutritional status (Najam et al., 2023).

The concept of nutrition attitude was examined in a study by Hammouh et al. (2023), which assessed nutritional attitudes among Jordanian elderly. The study utilized the survey design that entailed collecting data from 1200 using questionnaires. Nutrition attitude was measured using a Likert scale that comprised of 19 items that were rated on 5 points with attitude scores being classified into three categories: (1) negative comprising scores of less than 71.7%, (2) neutral comprising scores of 71.7% to 84.92%, and (3) positive comprising scores greater than 84.92%. The data was analysed using the independent sample t-test. Results showed that there was a significant association between nutrition attitude and dietary practices. Individuals who exhibited positive nutrition attitude were more likely to display health nutrition practices than those who attitudes were negative or neutral. However, the element of nutritional status was missing in this study. The study tested the association between nutrition attitude and dietary practices rather the association between nutrition attitude and nutrition status, which was the goal in the current study. In addition, Hammouh et al. (2023) focused on the elderly population that is likely to exhibit different nutrition attitude from school going adolescents, who are the target in the current study.

The study by Sharma et al. (2019) focused specifically on nutrition attitude among adolescent. This one also utilized the cross-sectional survey design that entailed collecting data from 2210 adolescents from the districts of Banda, Kaushambi, and Allahabad in India. Nutrition attitude was also measured using a Likert scale comprising of 9 items that were rated on a 5-point scale spanning from strongly disagree to strongly agree. The items measured the respondents' attitude towards eating habits that are requisite for good nutrition and healthy living. Results showed that there was a

significant association between nutrition attitude and the adolescent self-efficacy. Although the study focused on adolescent it also failed to capture the concept of nutritional status. The dependent variable was self-efficacy, which the authors defined as the adolescents' beliefs regarding their capability to plan and execute health eating practices. The study was also conducted in India where nutritional attitude of adolescents maybe different from that of Kenyan adolescents due to social and cultural differences.

The link between nutrition attitude and nutritional status of adolescents within the Kenya context is captured in the study by Wandia et al. (2020), who examined the effect of an education intervention on body weight status of adolescents in Uasin Gishu County. The study utilized the pre-test post-test experimental design with control on 222 adolescent students. The boys were divided into two arms; experimental (n=111) and control (n=111) and their baseline body weight were taken. The students in the experimental arm undertook an education programme that aimed to among other things change their attitude towards engaging in physical activities and maintaining healthy diet. The weights of the two groups of students were taken at 8 weeks and 6 months after the education programme. Results showed that the students in the intervention group had significantly smaller waist circumference and BMI than those in the control group.

These results meant that the education programme had a significant effect on the students' nutritional status. However, the education programme was broad-based and target to change a number of variables including the students' nutritional knowledge and knowledge on physical activities. It also sought to change the students' attitude towards healthy eating as well as physical activities. It is therefore difficult to isolate the effect of change in nutrition attitude on the students' nutritional status. It is difficult to tell whether the improvement in nutritional status of students in the intervention group was due to change in nutritional attitude or due to changes in the other factors.

2.3.5 Adolescents Dietary Practices and Nutrition Status

The study Ntwenya et al. (2015) queried the link between dietary practices and the food insecurity of rural households in Tanzania. Data was collected from 307 households in a rural district using the 24-hours dietary recall questionnaire and 30-day recall of experience to food insecurity. Results revealed that 80% of the households experienced food insecurity during the rainy season while 69% of the households experienced food insecurity during the harvest season. Households with diverse nutrition option were less likely to experience food insecurity. This implies that there is an inverse link between having diverse diet and food insecurity. This finding shed light regarding how dietary practices shape food insecurity. However, the study by Ntwenya et al. (2015) differs from the current study because it does link dietary practices and habit to nutritional status. In addition, the unit of analysis for the study by Ntwenya et al. was the household rather than adolescents, who are the focus of the current study.

In their study focusing on students of Omani University in Canada, Ali et al. (2020), found that more female students were consuming the recommended breakfast, 3 meals per day and vegetable when compared to male students. However, the difference in the dietary practices of male and female students was statistically insignificant. The study entailed collection of data from 132 students using questionnaires. Results showed that the majority of the male (68%) and female (78%) students were not taking vitamins and mineral supplements. In addition, 32% of the male students were taking coffee after meals as compared to 17% of female students. The study provides interesting insights regarding gender differences in dietary practices. It suggests that, overall, female students may have better adherence to these healthy dietary practices. However, the study does not assess the link between the dietary practices and the nutritional status of

the students, which is the aim of the current study. Ali et al. (2020) also conducted their study in the university status where most of the students are past the adolescent stage.

In their research conducted in Pakistan, Usman et al. (2017) found that the food choices of the students had evolved over time and that there was a decline in preference for traditional foods in favour of snacks and fast foods. Dining out had also become popular while the students exhibited a wide range of poor nutrition practices such as overeating, skipping meals, and eating of junk food. The dietary practices of students were shaped by trends in dining out, multinational food chains' popularity, exposure by the media, and influence by peers and family.

The study utilized a cross-sectional design and entailed collecting data using twelve focused group discussion that comprised of 5-8 students. Results revealed that during childhood, the food practices of individuals are largely shaped by family but the practices change as the children grow and begin to interact with peers. Proliferation of multinational food chains due to globalization and the media have contributed towards the abandonment of traditional foods in favour of fast foods and snacks. This study highlights the changes in the food patterns that most individuals in developing countries undergo as they grow up. However, the study did not link the food practices to the nutritional status of the respondents, which is the aim of the current study.

In South Africa, Okeyo et al. (2020) assess the dietary practices and weight status of male and female adolescents. The researchers randomly selected 16 secondary schools and surveyed 1360 learners in grade 8 to 12 from disadvantaged communities. The findings of the study revealed significant gender differences in the prevalence of combined overweight and obesity, with 9.9% in males and 36.1% in females. Females showed higher frequencies of eating sugary snacks and lower frequencies of eating breakfast compared to males. Additionally, females consumed more fried fish, pizza, fat

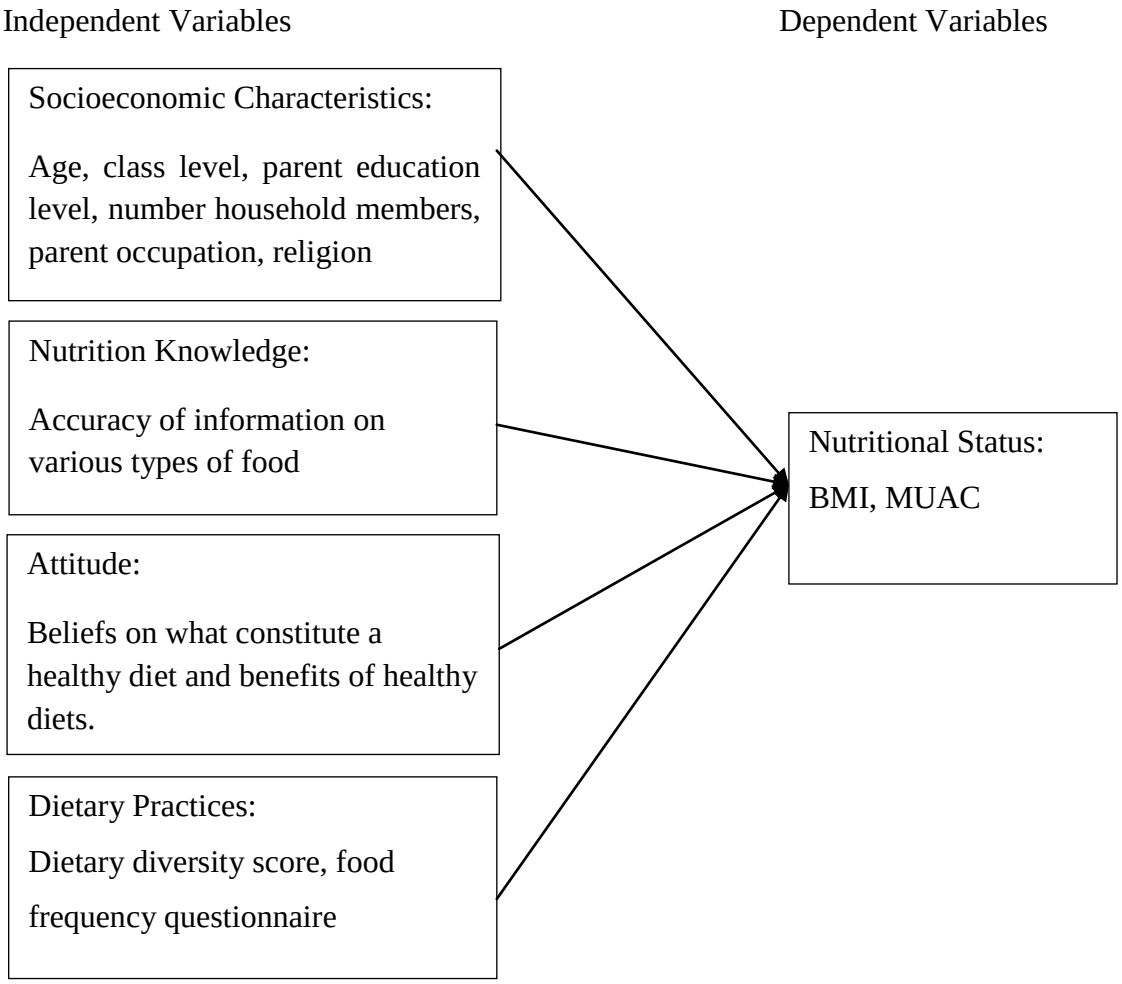
cakes (fried dough balls), hotdogs, candy, cake, and crisps. Overall, the study highlights the high prevalence of combined overweight and obesity among black female adolescents in South Africa, coupled with poor dietary practices. The significant gender differences observed emphasize the need for targeted interventions and strategies to address adolescent obesity and promote healthier eating habits, particularly in disadvantaged communities.

In Kenya, Kamanu et al. (2019) observed that 25.9% of adolescents were having three meals or less per day as compared to WHO's standards of 5-6 meals including snacks. Three out of 10 adolescents were skipping lunch while most were taking less than two litres of water per day. Four out of ten of the adolescents did not apply the concept of balanced diet. This implies that a notable section of the adolescents had less than optimal dietary practices. Deficient dietary practices had a negative effect on nutrition status with results indicating that adolescent who skipped meals were thinner than those who consumed all meals. Those who took milk less than 3times in a week were 11 folds more likely to be overweight than their counterparts. In addition, those who did not use fats and oils daily were more likely to be overweight while those who did not adhere to the concept of balanced diet were more likely to be overweight, underweight or obese. However, this study was conducted among adolescents in public secondary schools in Ruiru Sub-County, which differs from Nakuru Sub-County in terms of socio-demographic and economic characteristics.

2.4 Conceptual Framework

Figure 1

Conceptual Framework



Source: Author, (2025)

The framework above is based on the Socio-Ecological Model (SEM) and the Social Behavioural Change Communication (SBCC) approaches. The sustainability and effectiveness of the framework comes from the fact that it is designed to function at multiple influence levels. It seeks to involve the adolescents (girls and boys), their parents and their teachers (Maehara et al., 2019). At the individual level, the adolescent's current behaviour and knowledge influence actions around not consuming a healthy diet. On the other hand, the interpersonal level consists of the socioeconomic influences because the individual does not live in a vacuum.

2.5 Research Gaps

The literature reviewed suggests that there is existence of high level of malnutrition in developing countries Kenya being one of them. It has also shown that adolescents' nutritional status is affected by social demographic and economic characteristics, nutrition practices together with their health practices. The most affected groups of the adolescents are the pregnant girls and those from ASAL areas for they do not practice healthy dietary practices. The reviewed literature shows that poor nutrition practices in adolescents may lead to over nutrition and under nutrition that eventually affects their self-esteem especially for those who are obese. School going girls are most likely affected due to many food environments that influence their eating habits and eventually their nutritional status. The review revealed that developing countries health services give more focus on children and pregnant women and greatly neglecting the adolescents. There is still inadequate information about adolescents' nutritional status as affected by the dietary practices, socio demographic and economic characteristics and hence this research sought to bridge that gap.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter deliberates on data gathering strategies that were put in place to meet the objectives of study. It encompasses design of study, study location, target population, sample size, sampling processes, research instruments, validity and reliability of research instruments, study piloting, data collection procedures, data processing technique, and ethical issues.

3.2 Research Design

The research made use of the observational cross-sectional study design. This design was appropriate because the aim of the study is to establish patterns in nutritional knowledge, attitude, and practices of teenage school going girls and how they are related to the nutritional status of the girls(Schmidt & Brown, 2019). The cross-sectional design allowed the collection of data on both the independent variables (nutritional knowledge, attitude, and practices) and the dependent variable (nutritional status) at a single point in time (Bryman, 2016). This provided a snapshot of the relationship between these variables, allowing researchers to examine associations without the need for long-term follow-up.

3.3 Location of the Study

The research was carried out in the Gilgil Sub-County situated in Nakuru County, Kenya. The Sub-County lies 160 kilometres northwest of Nairobi and 40 kilometres from Nakuru town, at an elevation of 1,859 meters above sea level, with an area of 1348.40 kilometres and a population of 185,209 (Kenya National Bureau of Statistics, 2019). Karunga, Mbaruk/Eburu, and Elementaita are the three education zones of the Sub-

County. According to Nation Africa (2020), there were 18,000 students in secondary schools by 2020.Gilgil Sub County is cosmopolitan, with residents from all of Kenya's major tribes. Gilgil Sub-County was chosen for its on-going two-year pilot study of integrated weekly iron and folic supplements (WIFS) and nutrition education program for teenage females to prevent anaemia.

Figure 2

Map of Gilgil Sub-County

3.4 Study Population

According to the Gilgil Sub-County Director of Education office, there were 34 public mixed day secondary schools in Gilgil Sub County as at November 2023. The target population for this study were 7319students (girls) aged 13-18 years distributed in the34-public mixed day secondary schools in Gilgil-Sub County. The sampling frame is attached as Appendix III.

3.5 Sampling Procedure and Sample Size

3.5.1 Sample Size Determination

The sample size for the study was determined using the Slovin' formula (Statistics, 2023). The sample size formula is as follows:

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

Where

n = sample size

N= population size;

e= margin of error; taken to 5% or 0.05.

For this study, population size, N = 7319

So, sample size is given by

$$n = \frac{7319}{1 + (7319 \times 0.05^2)}$$

$$n = \frac{7319}{1 + (7319 \times 0.0025)}$$

$$n = \frac{7319}{1 + 18.2975}$$

$$n = \frac{7319}{19.2975}$$

= 379.27≈ 379 respondents

Thus, the sample size was rounded off to 379 since the study was dealing with human beings' respondents. A further 41respondents equivalent to about 10% of the desired sample size was added to cater for non response. Therefore, the total sample was 420 respondents.

3.5.2 Sampling Procedure

Respondents were selected using a multi-stage sampling process. Puerta et al. (2019) defines multi-stage sampling as a sampling process that is done in multiple iterative phases. The sampling process for the study comprised of two phases. The first phase focused on selection of schools in which the researcher conducted the study. The stratified random sampling method was used to select the schools. The stratified random sampling increased the representativeness of the study by ensuring that respondents are selected from all the sub-groups that make up the study population (Bryman, 2016).

Gilgil Sub-County was sub-divided into three strata in line with the three educational zones within the area: Karunga, Mbaruk/Eburu and Elementaita Zones. Random sampling technique was employed to select two schools from each zone making a total of 6 schools from where the sample was derived for this research study. The figure of two schools per educational zone was purposively set based on the assumption that 2 schools would provide a sample that adequately represents the population of adolescent girls in other schools within each Sub-County. The Microsoft Excel software was used to randomly select two schools in each zone.

The second phase of sampling focused on selecting girls within the six schools. The random sampling method was used at this stage to select 70 girls from each school. Table 3 present a summary of the sampling plan.

Table 2

Sampling Plan

Zone	Schools	Sample Size
Karunga	School 1	70
	School 2	70
Mbaruk/ Eburu	School 1	70
	School 2	70
Elementaita	School 1	70
	School 2	70
	Total	420

The MS Excel random selection method was then used to select the girls in each school. An Excel sheet containing the list of all the girls in a given school was prepared. The random selection formula was then entered on the second row of the next column to prompt the software to pick the name of one girl randomly from the list of all girls. After the name of the first girl appears, the cell was dragged downward until the desired number of girls was attained.

3.6 Study Subjects

3.6.1 Inclusion Criteria

Adolescent girls aged 13 to 18 years attending public-day secondary schools in Gilgil Sub-County who willingly consented to participate in the research. Girls were selected from all years of study.

3.6.2 Exclusion Criteria

Girls who met the inclusion criteria but had a chronic illness, were not willing to take part in the study or those who were absent from school were excluded from the study. Private secondary schools were excluded due to the differences in economic status of parents of students in public schools that greatly affects dietary practices. Boarding

schools were was excluded from the study because the dietary practices of girls in boarding schools are largely determined by the school meals' plans rather than the girls' nutritional knowledge, attitude or family background.

3.7 Instrumentation

3.7.1 Data Collection Instruments

This study used a questionnaire with both open – ended and closed – ended questions (Appendix II, page 72). The questionnaire was subdivided into five sections. Section A focused on demographic socioeconomic characteristics of respondents including age, household characteristics, parents' occupations, parents' education levels, and income levels. Section B assessed the nutrition knowledge of the respondents using multiple choice questions. Section C scrutinized the attitude of the respondents towards nutrition using a Likert scale comprising of 15 items developed by the researcher following a thorough review of literature. The items were measured on a five-points scale spanning from strongly disagree (1) to strongly agree (5).

Section D analysed the dietary practices of the respondents. This section comprised of the Individual Dietary Diversity Score (IDDS) items with supplemental questions (Hussien et al., 2021). The IDDS queried the foods and beverages consumed by the respondent the previous day. The supplemental question assessed the cooking method that the respondent preferred, the number of meals that the respondent consumers daily, the daily water intake, and whether the respondent skips meals. The questionnaire was paper-based.

In addition to the questionnaire data, a digital Seca ®813-bathroomscale was used to measure body weight. The SECA manufactured bathroom scale has a 150kg capacity and thus is eligible for weighing adults and children. Height was measured with a portable

Seca ® 213 height board with a sliding head bar to the nearest 0.1cm. The weight and height information was used to compute the respondents' BMI. The Centre for Disease Control (CDC) BMI chart was used to classify the respondents into one of four nutrition statuses using their BMI data. The four nutritional statuses include: underweight, healthy, overweight, or obese.

3.7.2 Pilot Study

Data collection instruments were pre-tested a tone of the schools in Gilgil Sub-County, which was selected randomly. The researcher used the Excel random selection function to select one school from the 28 schools that were left after picking the six schools for the main sample. A sample of 42 girls representing 10% of the sample for the main study was randomly selected also using the Excel method used to pick the schools. Pilot study participants were left out during the main study.

3.7.3 Reliability

The reliability of instruments was assessed during the piloting exercise using the test-retest method. The researcher first administered the questionnaire to the 42 girls after explaining the study to them as well as showing them how to complete the questionnaire. The girls were given 20 minutes to complete the questionnaire after which the researcher and the assistants began taking the anthropometric measurements of the girls. The weight and heights of the girls was measured in two rounds and the data for both rounds recorded. The exercise took approximately one hour.

The researcher then requested the girls to fill the same questionnaire after 2 weeks. Anthropometric data was also taken after the two-week interval. The data from the two rounds of measurement was compared using the Pearson correlation test. A Pearson correlation coefficient was computed for the weight measurement and height

measurements. A coefficient of 0.815 was obtained indicating that the instruments used to take the anthropometric measurements were reliable.

3.7.4 Validity

The accuracy of the instrument was tested through the content validation method. The researcher sent the questionnaires to four peers, who are also expert in nutrition, and request them to assess each of the four sections corresponding to the independent variable of the study. The advice and suggestions that they provided was utilized in revising the questionnaire.

3.8 Data Collection Procedure

Authorization to conduct the research was obtained from Kabarak University, the National Commission for Science, Technology and Innovation (NACOSTI) and the County Director of Education. The data collection exercise was conducted between 4pm and 5.30pm to avoid disrupted normal class schedule. The research required at most accuracy; therefore, data was collected from individual schools at a time to enable the principal investigator to be present to oversee the procedures.

Two (one male and one female) assistant researchers were recruited via an internal advertisement at Kabarak University, Department of Nutrition and Health Sciences. The study targeted individuals who were qualified nutritionists with previous experience with data entry and collection. The training was done in a day concerning the research contents, consent forms administration, guaranteeing confidentiality and safeguarding the collected data. Some of the topics included: the study objective, data collection materials and approaches, data collection code of conduct, work schedule and possible ethical issues in the field. They were also trained on how to accurately take anthropometric measurements (height and weight) and checking the questionnaire's

completeness. During the training there were role plays, where the questionnaire was administered and problematic issues addressed.

During the recruitment of the participants, the researcher visited the selected schools in person. He explained the study to the administration including its aim, benefits, and risk and request permission to conduct the study. Girls who met the inclusion criteria, in each school were assembled in one place. The researcher explained the contents of the questionnaire to the girls, assured them of privacy and confidentiality, and sought their consent to participate. Those who agree to participate were guided on how to fill the questionnaire and were assured of confidentiality.

A digital Seca ®813 scale was used to measure body weight barefooted and in light garments to the nearest 0.1kg. Height was measured barefooted in a standing position with a portable Seca ® 213 height board with a sliding head bar to the nearest 0.1cm. Participants stood upright, feet flat on the ground, back and buttocks straight and contacting the wall, for height measurement. All measurements were taken twice and averages computed. This information was used to compute BMI, which was used to determine nutritional status.

The date of birth provided by respondents was used to compute the age of the respondents. Using the CDC BMI for age chart, the researcher classified each respondent's nutritional status as underage, normal, overweight, or obese. The researcher then collected the completed questionnaires and thanked the participants. After the data collection exercise, the researcher held a talk with all students to sensitize and create awareness on nutritional issues. The talk also ensured that students who were selected to participate do not feel left out or discriminated.

3.9 Data Analysis

Following the data collection process, the data was sorted and cleaned. Demographic variables were coded and entered into the Statistical Package for Social Sciences (SPSS) software version 25. The coding process enabled the entry of the data provided by the respondents on these variables.

For nutritional knowledge, the researcher marked the respondents' answers to the six questions in this section and assigned each respondent a nutritional knowledge score. The scores ranged from 0 for respondents who did not get any other questions right to 6 for respondents who got all the questions right. These scores were entered into the SPSS software as continuous data. The scores were classified into two categories: scores of 3 or below were categorized as low nutritional knowledge and scores of 4 or above were categorized as high nutritional knowledge.

To analyse nutrition attitude, the 15 items in the scale were coded into the SPSS software and respondents' rating of each item entered appropriately. For each respondent, an aggregate nutrition attitude score was computed by summing up rating for the 15 items and then dividing the sum by 15. This implies that if a respondent gave all the 15 items a rating of 5, the aggregate nutrition attitude score was ([5*15]/15)= 5. Therefore, the aggregate attitude score ranged from 1 to 5 on an interval scale. A higher aggregate score signified a more positive attitude towards healthy nutrition. The scores were then classified into two categories: scores of 3 or below were categorized as negative nutrition attitude while scores of 4 or above were classified as positive nutrition attitude.

To assess dietary practices, the researcher entered the data on the IDDS items, water intake, number of meals per day, and skipping of meals into the SPSS software. The researcher computed the frequency and percentage of respondents' who take each of the

meals in the IDDS scale as well as the frequency and percentage of girls who meet the required water intake, who take the recommended number of meals per day, and who skip meals.

Table 3

Data Analysis Summary

Variables	Nature of the variable	Statistical Analysis
Socioeconomic characteristics	Categorical	Descriptive Statistics (Percentages and frequencies)
Nutrition Knowledge	Categorical	Descriptive Statistics (Percentages and frequencies)
Nutrition Attitude	Categorical	Descriptive Statistics (Percentages and frequencies)
Dietary Practices	Categorical	Descriptive Statistics (Percentages and frequencies)
Nutritional Status	Categorical	Descriptive Statistics (Percentages and frequencies)
Association	Categorical Independent Variable	Chi – Square test of independence
	Continuous Independent Variable	Logistic regression

To process respondents' nutritional status, the researcher began by calculating the participants' BMI using the formula BMI = weight (kg) / [height (m)]^2. On the CDC BMI for age chart, the researcher located the participant's age on the horizontal axis of the chart and their BMI on the vertical axis. The intersection of these two values indicated the participant's BMI category. The categories were: underweight, normal weight, overweight, and obese. The data on respondents' category was entered into the SPSS where underweight was coded as 1, normal weight as 2, overweight as 3, and obese as 4.

The data was summarized using descriptive statistics including percentages, frequencies, means and standard deviation. The association between socioeconomic variables nutrition status, dietary practices, nutrition attitude and nutritional knowledge was tested using the logistic regression at the 0.05 level of significance.

3.10 Data Quality Assurance and Control

The research assistants were trained on data collection approaches, use of equipment, accurate measurement and accurate reading and documentation to ensure minimal errors occur. There were daily calibration sessions where a 2kg weight was placed to observe the correct readings. The researcher closely supervised the data collection session and addressed any possible mishaps. The data collected during pretesting was useful in validating variables and fine-tuning the questionnaire. The questionnaire was cross checked each day to ensure they are properly completed. Data was check for any outliers through running means and frequencies.

3.11 Ethical Considerations

Ethical approval was obtained from Institute of postgraduate studies of Kabarak University, the Kabarak University Ethics and Research Committee (KUSERC) and from the NACOSTI. The researcher also sought permission from Ministry of Education Gilgil Sub county officer and respective school heads.

In addition, the researcher ensured the participants make informed decision by explaining the study's purpose and obtaining their consent. The respondents were informed regarding what information would be collected and how it would be used and were assured confidentiality, identity safeguarding and findings dissemination. Respondents were made aware that participation was voluntary and that they were free to refuse to participate without any fear of being victimized by school or any other party.

The participants were also informed of their right to withdraw from the study at any point during the data collection. Those who agree to participate were asked to sign a written consent form (Appendix I, page 68).

In line with the do no harm principle, it was important to ensure that the exercise does not interfere with the normal classes. Therefore, the data collection process was conducted after classes; between 4pm and 5pm. The questionnaires did not prompt the respondents to record their names or any other personal identifying information to safeguard their confidentiality. One of the foreseeable risks was that some of the sampled girls might refuse to fill in administered questionnaires in fear that they might be stigmatized especially those without privileged of getting the three meals from their homes. This was mitigated through assuring them of confidentiality and reminding them that they should not write their names on the questionnaires. The measurement was done one student at a time in a private room to protect each student's privacy.

All questionnaires were stored in a lockable cabinet in a private room only accessible to the researcher. Electronic data such as the SPSS file was password protected and stored for a period of 5 years and thereafter destroyed by shredding. To prevent feelings of exclusion or discrimination among students who were not be selected to participate in the study, the researcher held a talk with all students, including boys, after the data collection exercise. The researcher used the opportunity to educate the students about the basics of nutrition, its impact on health, and the importance of maintaining a balanced diet. The researcher also provided information on key nutrients, healthy eating habits, and the potential risks associated with poor nutrition.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND DISCUSSION

4.1 Introduction

This chapter presents the findings of the data collection and analysis exercise, it interprets the findings and discusses their implications in the context of previous studies. The chapter begins with the analysis, presentation and discussion of general and demographic information of respondents. It then presents findings related to the socioeconomic characteristic of school going adolescents in Gilgil Sub-County. It also presents and discusses findings on nutrition knowledge, nutrition attitude, dietary practices, and the nutritional status of school going adolescent girls in the study area. The chapter culminates with an analysis and discussion of the association between socioeconomic characteristics, nutritional knowledge, attitude, dietary practices and nutritional status of school-going adolescent girls (13-19 years) in Gilgil Sub-County.

4.2 General and Demographic Information

This section presents and discusses the general information including the response rate of the study and the demographic information of the respondents.

4.2.1 General Information

The researcher distributed 420 questionnaires to sampled girls in six schools across Gilgil Sub-County. Measurements of weight and height for all the 420 girls were also taken. After screening of the questionnaires, 42 were left out of the analysis because they had a lot of missing data. There questionnaire completion rate was thus 90.0% as illustrated in Table 4.

Table 4

Questionnaire Completion Rate

Zone	Schools	Questionnaires Issued	Questionnaires Duly Completed	Completion Rate
Karunga	School 1	70	62	88.6%
	School 2	70	63	90.0%
Mbaruk/	School 1	70	61	87.1%
Eburu	School 2	70	65	92.9%
Elementaita	School 1	70	62	88.6%
	School 2	70	65	92.9%

As illustrated in Table 4, the questionnaire completion rate was almost similar across the six schools suggesting that the cases of incomplete questionnaire occurred by chance rather than due to any systematic effect or bias. The response pattern suggest that it is less likely that the cases of incomplete questionnaires are a result of underlying factors affecting specific schools or zones in Gilgil Sub-County. The response rate for this study is close to the study by Nwosu et al. (2023), which also entailed collection of cross-sectional health-related data and had a response rate of 94.8%. The rate is also similar to another cross-sectional health study by Zhang et al. (2019) that focused residents of Dehui in China and obtained a response of 92.1%.

4.2.2 Demographic Information

The study sought to establish the demographic profile of respondents including their class/ grade, and age. Table 5 presents distribution of respondents according to the school class.

Table 5

Distribution of Respondents by School Classes

Class	Frequencies	Percent
Form 1	104	27.5
Form 2	104	27.5
Form 3	98	25.9
Form 4	72	19.0

Results in Table 5 shows that 27.5% of the respondents were Form 1 students and a similar proportion are Form 2 students. About 25.9% were Form 3 students while 19% were Form 4 students. These results show that sample was representative of students from all the classes, which enhances the validity of findings. Table 5 presents the distribution of respondents by age.

Table 6

Age of the Respondents

Age	Frequency	Percent
14 years	4	1.1
15 years	40	10.6
16 years	115	30.4
17 years	93	24.6
18 years	126	33.3

Table 6 shows that 4 respondents representing 1.1% of the sample were 14 year old, 40 (10.6%) were 15 years old, 115 (30.4%) were 16 years old, 93 (24.6%) were 17 years old and 126 (33.3%) were 18 years old. These results indicate that the sample was inclusive of girls of different ages. However, there was no girl aged 13 years in the sample despite this age falling within the inclusion criterion.

4.3 Socio-economic Characteristics of School-Going Adolescent Girls in Gilgil

The first objective of the study was to determine the socioeconomic characteristics of school-going adolescent girls in Gilgil Sub-County. Several socioeconomic variables were examined including the respondents place of residence, family structure, and parents' occupation. Table 7 presents the results:

Table 7

Respondents Socio-economic Traits

Socio-economic Trait	Categories	Frequency	Percent
Place of Residence	Urban	84	22.2
	Rural	294	77.8
Family structure	Father-headed	306	81.0
	Mother-headed	68	18.0
	Grandparents	4	1.0
Father Occupation	Unemployed	8	2.1
	Casual labour	12	3.2
	Long-term employment	48	12.7
	Self-employment	242	64.0
	N/A	68	18.0
Mother Occupation	Unemployed	28	7.4
	Casual labour	8	2.1
	Long-term employment	48	12.7
	Self-employment	292	77.2
	N/A	2	0.5
Father education	No education	12	3.2
	Primary	121	32.0
	Secondary	146	38.6
	Tertiary	31	8.2
	NA	68	18.0
Mother education	No education	28	7.4
	Primary	159	42.1
	Secondary	151	39.9
	Tertiary	38	10.1
	NA	2	0.5
Religion	Christian	362	95.8
	Muslim	16	4.2
Economic status	Low economic status	175	46.3
	Middle economic status	136	36.0
	High economic status	67	17.7
Household size	Small household	20	5.3
	Average household	42	11.1
	Large household	316	83.6

One of the socioeconomic variables that was assessed in this study was place of residence. Respondents were asked to indicate whether they resided in an urban or rural area. Results in Table 8 shows that the majority of the respondents (77.8%) lived in a rural setup. These results are congruent with statistic from the 2019 National Housing and Population Census, which indicated that 67.2% of the population in Gilgil Sub-County resided in rural areas (Kenya National Bureau of Statistics, 2019b). Residing in rural area may have a wide array of implications on the nutritional status of the school going adolescent girls. If the rural areas are agricultural rich areas, residing there would have a positive effect on nutritional status as the household would have access to food at affordable prices. However, if the rural areas are not agriculturally productive or produce a narrow variety of crop, the nutritional status of the girls would be adversely affected.

The study also assessed the structure of families in which the respondents were living. Respondents were asked to indicate the person who heads their family among the choices provided. Results in Table 7 illustrates that the majority (81%) were from household headed by the father. This proportion is slightly higher that 58.1% recorded in the 2019 National Housing and Population Census (Kenya National Bureau of Statistics, 2019). The father-headed households are more likely to be household that have dual parents that are actively present in the adolescents' lives. This is likely to have an implication on both the lifestyle and economic status of the home and consequently the nutritional status of the adolescent girls. About 18% of the respondents were from mother-headed households. These are more likely to be households with the mother as a single parent or where the father is absent. One the other hand, 1% of the responded were from household headed by grandparents. These are likely to be households where the adolescent has been left in the custody of grandparents due to various factors such as demise of the adolescent's parent or their unavailability due to work.

Regarding father's occupation, the majority of respondents (64%) reported that their fathers were self-employed mainly in the farming business. This result is congruent with the study by Waaswa et al. (2021), which showed that agriculture is the main economic activity in Gilgil Sub-County. About 18% of the respondents, indicated that this question was not applicable to them. These are more likely to be adolescents from households with an absent father. About 12.7% of the respondents reported that their fathers were in long-term employment, 3.2% were casual labourers and 2.1% said that their fathers were unemployed. Similarly, the majority of the respondents (77.2%) reported that their mothers were self-employed mainly through farming. The proportion of unemployed mother was higher at 7.4% while proportion of respondents whose mothers were in long-term employment was 12.7%. Those whose mothers were casual labourers were 2.1% while 0.5% indicated that this question was not relevant to them. The study also interrogated the highest education level of respondents' parents and the religion of respondents. Parents' occupation has an impact on economic status of the family and consequently the nutritional status of the adolescent. Parents' occupation also has an implication on parents' presence at home to supervise the lifestyle and habits of their adolescent girls.

On father's education level, the largest segment of the respondents (38.6%) reported that their fathers had the secondary level education. This result is congruent with the 2019 National Population and Housing Census, which found that about 34.4% of male residents of Gilgil Sub had attained the secondary level of education (Kenya National Bureau of Statistics, 2019). About 32% of the respondents said their father had the primary level of education, 8.2% had the tertiary education and 3.2% said that their fathers had no formal education. About 18% said that this question was not applicable to them. On the other hand, the largest segment of the respondents (42.1%) reported that

their mothers had the primary level of education. This result is also consistent with the 2019 National Population and Housing Census, which revealed that about 49% of female residents of Gilgil Sub-County had attained the primary level of education.

On religion, results in Table 4.5 illustrates that 95.8% of the respondents were Christians while the remaining 4.2% were Muslims. These results are congruent with the 2019 National Population and Housing Census, which indicated that 93.7% of residents of Nakuru County were Christians (Kenya National Bureau of Statistics, 2019). The study also sought to determine the size of the respondents' households.

The study also sought to determine the economic status of the respondents' household. Respondents were asked to indicate whether they own land, house, vehicle, livestock, and refrigerator at home. Ownership of each of these assets with accorded a score of 1 meaning that household that owned all the five assets received a score of 5. Based on these scores, the respondents were grouped into three categories; low economic status for those who score 2 or below, middle economic status for those get a score of 3 and high economic status for those with a score of 4 or above.

Results in Table 7 illustrates that 46.3% of the respondents were from household with low economic status, 36.0% were from middle economic status households while 17.7% were from the high economic status households. These results suggest that close to half of school-going adolescent girls in public day secondary schools are from households with low economic status. This proportion is higher than the 33.6% recorded by World Bank (2023) for household living below the poverty line in the entire country. The difference could be attributed to the fact that the current study focuses on household of adolescents attending public day schools leading to recruitment of large number of girls from low-income households. Public day secondary schools in Kenya are characterized

by a high population of learners from poor background because these schools are relatively cheaper than boarding schools or private day schools especially after the introduction of the Free Day Secondary School Education Programme (Newman, 2021).

Lastly, respondents were asked to indicate the total number of people that were living in their households at the time of the study include themselves, their parents, all adults, and children so as to establish their household size. Using this data, respondents were classified into three categories based on the national average household size of 4 members per household (Kenya National Bureau of Statistics, 2019). Households that had less than 4 members were categorized as small households, those that had 4 members were categorized as average households while those with more than 4 members were classified as large households. Results in Table 47 shows that 20 (5.3%) respondents were from small households, 42 (11.1%) were from average-sized household, and 316 (83.6%) were from large households. These results implies that household of school-going adolescent girls in Gilgil Sub-County are slightly larger than the average household in Kenya. This may have an implication of nutritional status of the girl as a larger household means more mouths to feed. However, the composition of the household also matters. If most of the household members are economic independent adult, then their large household size may have a positive impact on the nutritional status of the adolescent girls however if most of the household members are dependents, then the large household size may have a negative implication on the nutritional status of the girls.

4.4 Nutrition Knowledge of School-Going Adolescent Girls in Gilgil Sub-County

The second objective of the study was to assess the level of nutrition knowledge among school-going adolescent girls (13-18 years) in Gilgil Sub-County. The nutritional

knowledge of the respondents was measured using a set of six questions about various aspects of nutrition such as nutritional content of different foods and their functions in the body. Based on the questions, the study was able to assign each respondent a nutritional knowledge score that ranged from 0 to 6. Table 8 presents a summary of these scores.

Table 8

Nutrition Knowledge Score

Statistic	Value
Mean	2.99
Minimum	0
Maximum	6

Result in Table 8 shows that the mean nutrition knowledge score was 2.99. This suggests that the majority of the respondents had correct answers to half of the questions. The minimum score was 0 suggesting that there were respondents who gave wrong answers for all the six questions. A score of 0 thus indicate very low level of nutritional knowledge. The maximum score was 6 suggesting that there were respondents who gave correct answers to all the six questions. A score of 6 thus signifies high level of nutritional knowledge. To further interrogate the nutritional knowledge, respondents were classified into two categories based on their nutritional knowledge score. Those who scored 3 or below were categorized as having low nutritional knowledge and those who scored 4 or above were categorized as having high nutritional knowledge. Table 9 presents the respondents' distribution across the two categories of nutritional knowledge.

Table 9

Distribution of Respondents by Nutrition Knowledge

Nutrition knowledge	Frequency	Percent
Low nutrition knowledge	218	57.7
High nutrition knowledge	160	42.3

Results in Table 9 illustrates that 57.7% of the respondents had low nutrition knowledge. This implies that the majority of adolescent girls attending public day secondary schools in Gilgil Sub-County have low nutrition knowledge. These results are congruent with the study by Humulka et al. (2018), which also found that 56.9% of teenage girls in Poland had low nutritional knowledge. These results support the generalization of the position that most adolescent girls have little on nutritional issues. Low nutritional knowledge is evidence among adolescent girls in both developing countries as demonstrated in the current study as well as developed country as in the case of Poland. To further interrogate the nutritional knowledge of school going adolescent girls in Gilgil Sub-County, respondents were asked to indicate whether they had received any information or messages related to nutrition. Table 10 summarizes their responses.

Table 10

Distribution of Respondents based on Access to Nutrition Information

Access to Nutrition Information	Frequency	Percent
Had access to Nutrition Information	251	66.4
Had NO access to Nutrition Information	127	33.6

Results in Table 10 indicate that 66.4% of the respondents had access to nutrition information. These results imply that more than two-third of the adolescent girls in public day secondary schools in Gilgil Sub-County have access to nutrition information. This suggests that access to nutrition information is not to blame for the low level of nutrition knowledge among the majority of the girls. The problem could be linked to the

quality of messages, comprehensive of the information, and frequency at which this information is presented to the girls. Respondents who had access to nutrition information were asked to indicate the source from which they accessed this information. Table 11 presents their responses:

Table 11

Source of Nutrition Information

Source of Nutrition Information	Frequency	Percent
Health workers	67	17.7
Family or peers	24	6.3
School teachers	56	14.8
Internet	17	4.5
TV	71	18.8
Radio	16	4.2
NA	127	33.6

Results in Table 11 shows that television was the leading source of nutrition information among the adolescent girls with 18.8% of the respondents indicating that they accessed nutrition information through this channel. This result raises concerns regarding the accuracy, comprehensiveness, and quality of nutrition information that the girls are getting through television. Not all messages aired on television are for information purpose; in fact, the majority of the information is presented for marketing and promotion purposes and therefore the messages may be biased towards promoting products rather than educating consumers (Cunningham et al., 2020).

The results show that health workers are also importance source of nutrition information for the girls. Healthcare workers are more likely to provide accurate and comprehensive information. It is however not clear where the encounter between the adolescent girls and the healthcare works takes place. School teachers came third having been mentioned as

source of nutrition information by 14.8% of the respondents. This result raises questions regarding the existence and/ or effectiveness of traditional in-classroom nutrition education in the public day secondary schools. Family/ peers were the four leading sources of information having being cited by 6.3% of the respondents followed the internet (4.5%) and radio (4.2%). Table 4.9 presents a cross-tabulation of nutritional knowledge and socioeconomic variables and chi-square test of independence results.

Table 12

Relationship between Nutrition Knowledge and Socio-economic Variables

Factor	Category	Low knowledge n (%)	High knowledge n (%)	X^2	p-value
Residence	Urban	60 (71.4)	24 (28.6)	8.372	0.004
	Rural	158 (53.7)	136 (46.3)		
Mother occupation	Unemployed	16 (57.1)	12 (42.9)	10.566	0.032
	Casual labour	8 (100.0)	0 (0.0)		
	Long-term job	23 (47.9)	25 (52.1)		
	Self-employed	171 (58.6)	121 (41.4)		
Father occupation	Unemployed	9 (81.9)	2 (18.1)	24.117	.001
	Casual labour	8 (66.7)	4 (33.3)		
	Long-term job	24 (50.0)	24 (50.0)		
	Self-employed	146 (60.3)	96 (39.7)		
	NA	57 (83.8)	11 (16.2)		
Mother education	No education	16 (57.1)	12 (42.9)	10.449	.034
	Primary education	103 (64.8)	56 (35.2)		
	Secondary education	75 (49.7)	76 (50.3)		
	Tertiary education	24 (63.2)	14 (36.8)		
Father education	No education	8 (66.7)	4 (33.3)	24.184	.001
	Primary education	89 (73.6)	32 (26.4)		
	Secondary education	82 (56.2)	64 (43.8)		
	Tertiary education	12 (38.7)	19 (61.3)		
	NA	31 (45.6)	37 (54.4)		

Results in Table 12 shows that 46.3% of girls in rural areas had high nutritional knowledge as compared to 28.6% of girls living in urban areas. The chi-square test results (X^2= 8.372, *p*= .004) indicate that the difference in nutritional knowledge of girl

in rural areas versus urban area is statistically significant. These results imply that adolescent girls from rural areas have significantly higher nutritional knowledge than adolescent girls in urban areas.

Results also show that the proportion of girls with high nutritional knowledge was highest among girls whose mothers were in long-term employment (52.1%) followed by those whose mothers were unemployed (42.9%) and then those who mothers were self-employed (41.4%). The chi-square test results (X^2 = 10.566, p= .032) indicate that the statistically significant difference in the distribution of girls across the mother occupation categories. This implies that mother occupation has a significant impact on the nutrition knowledge of adolescent girls.

Similarly, the proportion of girls with high nutrition knowledge was highest among girls whose father were in long-term employment (50.3%) followed by girls whose father were self-employed (39.7%). The chi-square test results (X^2=24.117, p= .001) show that there is a significant difference in the distribution of girls with different nutritional knowledge across the father employment categories. This indicates that father occupation also has a significant effect on the nutritional knowledge of the adolescent girls.

In addition, result show that proportion of girls with high nutrition knowledge was highest among girls whose mother had the secondary education level (50.3%) followed by those whose mothers had no education (42.9%) and then those whose mothers had tertiary education (36.8%). On the other hand, the proportion of girls with high nutritional knowledge was highest among girls whose father had tertiary education (61.73%) followed by those who from families who fathers were absent (54.4%). The chi-square test showed that both father and mother education levels have a statistically significant influence on the nutritional knowledge of the adolescent girls.

4.5 Nutrition Attitude of School-Going Adolescent Girls in Gilgil Sub-County

The third objective of the study was to determine the nutrition attitude of school going adolescent girls in Gilgil Sub-County. To measure the nutrition attitude of the girls, a 15-item Likert scale was included the questionnaire. The respondents were prompted to rate each item on a five-point scale: 1 - Strongly disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly agree. Table 13 presents the findings.

Table 13

Respondents' Nutritional Attitude

SN	Item	N	Mean	S.D
1	I enjoy eating a variety of fruits.	378	3.88	1.288
2	I enjoy eating vegetables in every meal	378	3.69	1.281
3	I believe it is important to have a balanced diet for good health.	378	4.20	1.138
4	1 pay attention to the nutritional value of the foods I consume.	378	3.58	1.135
5	I often choose healthier options when given a choice.	378	3.41	1.370
6	I believe eating fast food regularly is detrimental to my health.	378	3.15	1.438
7	I am concerned about maintaining a healthy weight.	378	3.99	1.203
8	I believe that drinking enough water is essential for good health.	378	4.25	1.093
9	I am NOT influenced easily by advertisements when it comes to making food choices.	378	3.16	1.301
10	I feel confident in my ability to make nutritious food choices.	378	3.80	1.231
11	I believe that taking meals with whole grain is beneficial to my health	378	3.41	1.282
12	Eating diets high in salt is bad for health	378	3.55	1.395
13	I pay attention to the amount of sugar that I take in a day	378	3.32	1.436
14	I pay attention to the amount of food that I take in a meal	378	3.70	1.319
15	I avoid some foods in order to remain healthy	378	3.49	1.498
	Nutrition Attitude Aggregate Score	378	3.64	.764

Result in Table 13 shows that on average respondents exhibited a positive attitude towards eating fruits (item 1, mean= 3.88), eating vegetables (item 2, mean =3.69), and having a balanced diet (item 3, mean=4.20). They also exhibited a positive attitude towards the need to pay attention to nutritional value of the foods that they consume (item 4, mean-3.58). These results suggest that the majority of adolescent girls on public day secondary schools have a positive attitude towards incorporate fruits and vegetables in their diet and having a balanced diet. These findings are congruent with the study by Cebirbay and Bayrak (2022), which also found that school-going adolescents in Turkey had a positive attitude towards fruits and vegetables.

Conversely, the respondents were on average indifferent towards the need to choose healthier options when given a choice (item 5, mean= 3.41) and the need to minimize the consumption of fast foods (item 6, mean= 3.15). These results imply that most adolescent girls in public secondary schools in Gilgil Sub-County are not motivated to make healthier choices or reduce their consumption of fast foods. This can hinder efforts to promote healthy eating habits and enhance the nutrition status of these girls.

On average, the respondents exhibited a positive attitude towards maintaining a healthy body weight (item 7, mean=3.99). This result implies that most adolescent girls in public day secondary schools in Nakuru County are keen to maintain a healthy body weight. This attitude may motivate the girls to make health nutrition choices and develop healthy dietary practices leading to healthy nutritional status. However, the mean of 3.99 out of a possible highest score of 5 suggest that there is still room for improvement when it comes to changing the girls attitude towards maintaining a positive body weight.

On the other hand, respondents could neither agreed nor disagreed on whether they are NOT influenced easily by advertisements when it comes to making food choices (item 9,

mean= 3.16). This result implies that the majority of adolescent girls in public day secondary schools in Gilgil Sub-County have an indifferent attitude towards the need to resist influence by advertisements when making food choices. These results raise concerns especially because findings from previous section indicates that a good proportion of the girls rely on television, radio, and the internet to access nutrition information. These channels of information expose them to food advertisements that may influence their food choices negatively.

Nonetheless, the respondents on average expressed confidence in their ability to make nutritious food choices (item 10, mean= 3.80). This result suggests that the majority of the adolescent girls in public day secondary schools in Gilgil have a strong sense of self-efficacy related to making food choices. Self-efficacy is essential in motivating individual to make positive changes towards healthy eating habits. However, the mean of 3.80 suggest that there is still a large room and calls for targeted intervention aimed at further increasing the nutrition self-efficacy among the adolescent girls.

In addition, respondents on average displayed positive attitude towards regulating salt intake (item 12, mean= 3.55) and paying attention to the amount of food intake in a meal (item 14, mean= 3.70). These results suggest that most adolescent girls in public day secondary schools in Gilgil are keen on regulating salt intake, which is an important step towards maintaining cardiovascular health and reducing the risk of chronic diseases. The girls are also keen on monitoring the quantity of food intake, which is vital to maintaining a healthy body weight. The mean values however suggest that there is still room for improving the girls' attitude towards these two nutritional issues.

Lastly, respondents were on average indifferent towards taking meals with whole grains (item 11, mean= 3.41) and avoiding unhealthy food in order to remain healthy (item 15,

mean= 3.49). These results suggest that most of the majority of adolescent girls in public day secondary schools may not have a strong preference towards the consumption of whole grains, leaving room for education and promotion to change this attitude. The girls are also indifferent towards avoiding unhealthy foods. This could be due to a lack of awareness about the negative effects of unhealthy foods or a lack of motivation to make changes. Table 14 presents the cross-tabulation between the girls' nutritional attitude and socioeconomic variables.

Table 14

Relationship between Nutritional Attitude and Socioeconomic Factors

Factor	Category	-Ve attitude n (%)	+Ve attitude n (%)	X^2	p-value
Residence	Urban	44 (52.4)	40 (47.6)	14.983	.001
	Rural	87 (29.6)	207 (70.4)		
Mother occupation	Unemployed	20 (71.4)	8 (28.6)	10.825	.029
	Casual labour	5 (62.5)	3 (37.5)		
	Long-term job	24 (50.0)	24 (50.0)		
	Self-employed	99 (33.9)	193 (66.1)		
Father occupation	Unemployed	4 (50.0)	4 (50.0)	4.571	.334
	Casual labour	4 (33.3)	8 (66.7)		
	Long-term job	12 (25.0)	36 (75.0)		
	Self-employed	91 (37.6%)	151 (62.4)		
	N/A	20 (29.4)	48 (70.6)		
Mother education	No education	14 (46.7)	16 (53.3)	24.188	.001
	Primary education	59 (37.1)	100 (62.9)		
	Secondary education	60 (39.7)	91 (60.3)		
	Tertiary education	0 (0.0)	38 (100.0)		
Father education	No education	8 (66.7)	4 (33.3)	9.050	.060
	Primary education	39 (32.2)	82 (67.8)		
	Secondary education	56 (38.4)	90 (61.6)		
	Tertiary education	7 (22.6)	24 (77.4)		
	N/A	21 (30.9)	47 (69.1)		

Results in Table 14 shows that the proportion of girls with positive nutritional attitude in the rural area was 70.4% as compared to 47.6% for girls in urban areas. The chi-square test results (X^2= 14.983, *p*= .001) that the difference in distribution of girls across the two places of residence is statistically significant. These results imply that adolescent girls in rural areas have significantly better nutritional attitude than adolescent girls in urban areas.

Results further showed that the proportion of girls with positive nutrition attitude was highest among girls whose mothers were self-employed (66.1%) followed by those whose mother were in long-term employment (50.0%) and then those whose mothers were in casual labour (37.5%). This proportion was lowest among girls whose mothers were unemployed (28.6%). The chi-square test results (X^2= 10.825, *p*=.029) show that the differences in the distribution of girls across the categories of mothers' occupation was statistically significant. These results indicate the mother occupation has a significant influence on the nutritional attitude of adolescent girls. On the other hand, results show that father occupation does not have a significant influence on the adolescent girls' nutritional attitude (X^2= 4.571, *p*=.334).

On parent education, results showed that the proportion of girls with positive attitude was highest among girls whose mothers had tertiary education (100%) while the proportion among those with secondary education was 60.3% and among those whose mothers had primary level of education was 62.9%. The proportion was lowest among girls whose mothers had no education (53.3%). The chi-square test results (X^2= 24.188, *p*=.001) show that the differences in the distribution of girls across the categories of mothers' education levels was statistically significant. These results indicate that mother education has a significant influence of the nutrition attitude of adolescent girls. On the

other hand, results show that father education level does not have a significant influence on the adolescent girls' nutritional attitude (X^2= 9.050, p=.060).

4.6 Dietary Practices of School-Going Adolescent Girls in Gilgil Sub-County

The fourth objective of the study was to describe the dietary practices of school-going adolescent girls in Gilgil Sub-County. Dietary practices were measured using several indicators. The first was the number of meals that the respondents consumed on a typical day. Table 15 summarizes this information.

Table 15

Distribution of Respondents by Number of Meals

Number of meals	Frequency	Percent
1-2 meals and snacks per day	219	57.9
3-4 meals and snacks per day	139	36.8
5-6 meals and snacks per day	20	5.3

Results in Table 15 shows that the majority of the respondents (57.9%) consumed 1-2 meals and snacks per day. This implies that the majority of adolescent girls in public day secondary schools in Gilgil Sub-County do not the recommended three square meals (breakfast, lunch, and dinner) and two snacks per day (Paoli et al., 2019). The proportion of girls consuming two meals or less n Gilgil is higher than the 25.9% recorded in the study by Kamanu et al. (2019),which focused on adolescents in Ruiru Sub-County. The challenge of accessing the recorded number of meals is more severe among adolescent girls in public day schools in Gilgil Sub-County. About 36.8% of the respondents consumed 3-4 meals and snacks per day while 5.3% consumed 5-6 meals and snacks per day. The study also sought to establish the proportion of girls who skip meals on a regular basis. Table 16 summarizes this information.

Table 16

Proportion of Respondents who skip Meals

Whether respondent skips meals	Frequency	Percent
Yes	183	48.4
No	195	51.6

Results in Table 16 illustrates that 48.4% of the respondents reported that the skip meals on a regular basis. These results suggest that close to half of the adolescent girls in public day secondary skip meals on a regular basis. These results are congruent with the study by Okeyo et al. (2020), which found that female adolescent students in South Africa missed breakfast more frequently than male adolescent students. The proportion of adolescent girl missing meals in Gilgil is also higher than the 33% recorded Kamanu et al. (2019) in Ruiru Sub-County. The study also sought to determine the proportion of girls in public day schools who observe the concept of balanced diet. Table 17 presents this information.

Table 17

Proportion of Respondents who Adhere to the Concept of Balanced Diet

Respondent adheres to Balanced Diet Concept	Frequency	Percent
Yes	218	57.7
No	160	42.3

Results in Table 17 shows that 57.7% adhere to the concept of balance diet. These results imply that the majority of the adolescent girls in public day secondary schools in Gilgil Sub-County adhere to the concept of balanced diet. However, there is room for improvement because more than 40% of the girls do not follow this concept. This finding is congruent with the study by Kamanu et al. (2019) who observed that four out of ten of the adolescents in Ruiru Sub-County did not apply the concept of balanced diet. This implies that a notable section of the adolescents in Kenya do not observe the concept of

balanced diet, which could have a negative effect on their nutrition status. Another practice that the current study sought to interrogate was intake of water by the adolescent girls in Gilgil Sub-County. This information is summarized in Table 18.

Table 18

Distribution of Respondents based on Daily Water Intake

Amount of Water Per Day	Frequency	Percent
Less than 2 litres	130	34.4
2 litres	172	45.5
More than 2 litres	76	20.1

Table18 illustrates that 45.5% of the respondents consume 2 litres of water per day. This implies that less than 50% of the adolescent girls in public day secondary schools in Gilgil Sub-County adhere to the recommended water intake of 2 litres per day. About 34.4 consume less than the recommended amount while 20.1% take more than the recommended amount. The findings are congruent with the study by Kamanu et al. (2019) who observed that 33% of adolescent in Ruiru Sub-County consume less than 2 litres of water per day. The study also used the 24-hours recall individual dietary diversity question to assess the typical diets of the adolescent girls in Gilgil Sub-County. Table 19 present this information.

Table 19

Proportion of Respondents who Consumed each Food Group

No	Food Group	N of Respondents (%)
1	Cereals	314 (83.1)
2	Vitamin a rich vegetables and tubers	187 (49.5)
3	White tubers and roots	188 (49.7)
4	Dark green leafy vegetables	151 (39.9)
5	Vitamin A rich fruits	219 (57.9)
6	Organ meat (iron-rich)	148 (39.2)
7	Flesh meats	159 (42.1)
8	Legumes, nuts and seeds	255 (67.5)
9	Milk and milk products	255 (67.5)
10	Oils and fats	254 (67.2)
11	Sweets	247 (65.3)
12	Coffee/ tea	319 (84.4)

Results in Table 19 illustrate that the most highly consumed food groups were coffee/ tea and cereals with 84.4% and 83.1% of the respondents reported having consumed these food groups respectively. The least consumed food group was organ meat (iron-rich) with only 39.2% of the respondents reporting having consumed this food group. This result raises concern because adolescent is a period where most girls begin to experience the menstrual flow and thus require diets that are rich in iron. Results also indicate low consumption of dark green leafy vegetables with only 39.9% of respondents reporting having consumed this food group. The mean IDD score for the respondents was 7.1323, which is higher than 4.7 recorded in the study by Abebe et al. (2023) that focused on adolescent girls in Nifas Silk Laphto in Ethiopia. The lowest score in the current study was 3 and the highest being 11.This implies that there none of the school going adolescent girls in Gilgil had consumed a diet containing all the 12 food groups. The girls were grouped into two categories based on their IDD score. Those with IDD score

of 6 or below were placed in the below average dietary diversity category while those with scores of 7 or above were placed in the above average dietary diversity category. The threshold figure of 7 was based on the study by Willy et al. (2016) which established that the average IDD score in Kenya is 6.84 or approximately 7. Table 20 summarizes the results of this analysis.

Table 20

Distribution of Respondents based on Dietary Diversity Score

Dietary Diversity Category	Frequency	Percent
Below average IDD (<7)	131	34.7
Above average IDD (>7)	247	65.3

Results in Table 20 shows that 34.7% of the respondents had below average IDD score while 65.3% had above average IDD score. These results suggest that the majority of school going adolescent girls in Gilgil have access to at least 7 food groups, which is average score across the country. However, more than one-third of the girls have an IDD score that is below average. This means that they do not have access to food groups that are accessed by the average household in the country. This may have an adverse effect on the nutritional status.

4.7 Nutritional Status of School-Going Adolescent Girls in Gilgil Sub-County

The fifth objective of the study was to determine the nutritional status of school-going adolescent girls in Gilgil Sub-County. The nutritional status of the girls was assessed by taking anthropometric measurements of the girls' weight in kilograms and height in centimetres. The CDC BMI chart was then used to classify the girls as either underweight, healthy weight, overweight or obese based on the weight and height measurement. Table 21 summarizes the results of this analysis.

Table 21

Distribution of Respondents across the BMI Categories

BMI Category	Frequency	Percent
Underweight	24	6.3
Healthy weight	326	86.2
Overweight	20	5.3
Obese	8	2.2

Results in Table 21 illustrates that 86.2% of the respondents had healthy weight, 6.3% were underweight, 5.3% were overweight and 2.2% were obese. These findings suggest that the majority of school going adolescent girls in Gilgil Sub-County are of healthy weight. These findings are congruent with Machocho et al. (2023), who also found that 82.3% of adolescent girls in Nairobi City were of health weight. The proportion of health girls in the current study (86.2%) is however higher than the 70.1% documented in the study by Andambi et al. (2021) for adolescent girls attending day secondary schools in peri-urban areas of Nairobi City. This implies that the weight status of school going adolescent girls vary from one geographical location to the next. To facilitate further analysis of the nutritional status of the girls, the underweight, overweight, and obese categories were merged and categorized as malnutrition and the heath weight category was renamed to healthy nutritional status. Table 22 summarizes presents the results of this analysis.

Table 22

Distribution of Respondents according to Nutritional Status

Nutritional Status	Frequency	Percent
Healthy nutritional status	326	86.2
Malnourished	52	13.8

Table 22 shows that 86.2% of the respondents were in healthy nutritional state while 13.8% were malnourished. This implies that prevalence of malnourishment among the school going adolescent girls in Gilgil Sub-County is 13.8%. This prevalence is higher than the 7.2% recorded in the study by Getahun et al. (2023), which collected data from adolescent students in Addis Ababa Ethiopia. On the other hand, the prevalence in Gilgil is lower than the 29.9% recorded by Andambi et al. (2021) in peri-urban areas of Nairobi.

4.8 Association between Socioeconomic Characteristics, Nutritional Knowledge, Attitude, Dietary Practices and Nutritional Status of School-Going Adolescent Girls in Gilgil Sub-County.

The last objective of the study was to determine the association between socioeconomic characteristics, nutritional knowledge, attitude, dietary practices and nutritional status of school-going adolescent girls in Gilgil Sub-County. The associated was tested using the logistic regression method. Table 23 presents the results.

Table 23

Factors Associated with Nutritional Status of Adolescent Girls

Factor	Odds Ratio	95% C.I	P value
Socioeconomic factors			
Age			
13-15 years old (Yes/ No)	0.420	0.895-1.197-	.038
16-18 years old (Yes/ No)	2.382	1.118- 5.076	.021
Place of Residence			
Place of Residence (Rural/ Urban)	2.559	1.374- 4.765	.002
Household headship			
Father-headed (Yes/No)	2.143	1.113- 4.127	.020
Mother-headed household (Yes/No)	0.691	0.341- 1.401	.304
Grandparents (Yes/No)	7.792	5.983- 10.147	.001
Father occupation			
Father Unemployed (Yes/No)	.164	0.117- 0.212	.254
Father Casual labourer (Yes/No)	1.166	1.118- 1.215	.160
Father Long-term employment (Yes/No)	0.245	0.122- 0.490	.001
Father Self-employment (Yes/No)	2.355	1.303- 4.257	.004
Mother occupation			
Mother Unemployed (Yes/No)	0.086	0.038- 0.196	.001
Mother Casual labourer (Yes/No)	1.164	1.117- 1.212	.254
Mother Long-term employment (Yes/No)	.649	0.294- 1.434	.282
Mother Self-employment (Yes/No)	4.887	2.648- 9.020	.001
Father education			
Father no education (Yes/No)	0.302	0.088- 1.041	.045
Father Primary Education (Yes/No)	1.326	0.689- 2.553	.397
Father Secondary Education (Yes/No)	2.326	1.176- 4.600	.013
Father Tertiary (Yes/No)	3.244	3.109- 3.545	.001
Mother education			
Mother no education (Yes/No)	0.359	0.149- 0.866	.018
Mother primary education (Yes/No)	1.758	0.938- 3.295	.076
Mother secondary (Yes/No)	1.075	0.589- 1.960	.814
Mother tertiary (Yes/No)	0.834	0.331- 2.106	.701
Economic Status			
Low economic status(Yes/No)	0.425	0.235- 0.768	.004
Middle economic status(Yes/No)	1.450	0.756- 2.641	.222

Factor	Odds Ratio	95% C.I	P value
High economic status(Yes/No)	2.875	0.999- 8.267	.041
Household size			
Small household(Yes/No)	1.170	1.121- 1.221	.066
Average household (Yes/No)	1.583	0.541- 4.637	.398
Large household(Yes/No)	0.385	0.134- 1.11	.068
Nutritional knowledge			
Nutritional knowledge (High/ Low)	1.197	.665- 2.156	.548
Nutritional attitude			
Nutritional attitude (positive/ negative)	3.333	1.519- 7.313	.002
Dietary Practices			
1-2 meals and snacks per day(Yes/No)	0.443	0.245- 0.799	.006
3-4 meals and snacks per day(Yes/No)	1.170	1.121- 1.221	.066
5-6 meals and snacks per day(Yes/No)	1.737	0.964-3.128	.064
Skipping meals(Yes/No)	0.854	0.318- 1.077	.041
Balance diet(Yes/No)	2.475	1.357- 4.515	.003
Less than 2 litres water(Yes/No)	0.470	0.258- 0.857	.012
2 litres of water(Yes/No)	1.210	0.644- 2.275	.554
More than 2 litres water(Yes/No)	3.402	1.187- 9.750	.016
IDD score (high/ low)	2.526	1.396- 4.571	.002

Results in Table 23 illustrates that being younger 13-15 years (OR= 0.42, 95% CI: 1.197-0.895) was significantly associated with a poor nutritional status while being older15-18 years (OR= 2.382, 95% CI: 1.118- 5.076) was associated with greater likelihood of being in healthy nutritional status. These findings is congruent with study by Mostafa et al. (2021), which found that older girls in Bangladesh had greater odds of being healthy than younger girls. The most plausible explanation is that older girls are more likely to be more educated and more informed on nutritional issues.

Place of residence was also significant associated with nutritional status with girls residing in rural areas having 2.559 greater odds of being in a healthy nutritional state (OR= 2.559, 95% CI: 1.374- 4.765). The finding is not congruent with the study by

Arage et al. (2019), which found that girls living in rural areas had greater odds of having stunted growth. The most plausible explanation is that rural homesteads have greater access to food especially because agriculture is a major economic activity in the area. Being from a father-headed household (OR= 2.143, 95% CI: 1.113- 4.127) and grandparent-headed household (OR=7.792, 95% CI: 5.983- 10.147)was significantly associated with greater odds of having a healthy nutritional status.

Father being in long-term employment (OR=0.245, 95% CI:0.122- 0.490) was significantly associated with lower odds of being in a healthy nutritional state while father being in self-employment (OR= 2.355, 95% CI: 1.303- 4.257) was significantly associated with greater odds. The other categories of father employment did not have a significant effect on nutritional status. On the other hand, mother being unemployed (OR= 0.086, 95% CI: 0.038- 0.196) was significantly associated with lower likelihood of being in a healthy nutritional status while mother being self-employed (OR= 4.887, 95% CI: 2.648- 9.020) was associated with greater likelihood.

Having a father with no education (OR=0.302, 95% CI: 0.088- 1.041) was associated with low probability of being in healthy nutritional status while having a father with secondary education (OR= 2.236, 95% CI: 1.176- 4.600) or a father with tertiary education (OR= 3.244, 95% CI: 3.109- 3.545) were associated with greater chances of having a healthy nutritional status. Regarding mother education, having a mother with no education (OR= 0.359, 95% CI: 0.149- 0.866) was significantly associated with lower chances of having a healthy nutritional status. Low education among mothers may affect nutrition status by affect the household access to adequate nutrition. Low education can also impact dietary decisions being made at household given that most of these decisions

are made by mothers. The other categories of mother education were not significantly associated with the nutritional status of the adolescent school going girls.

Girls with low social economic status (OR= 0.425, 95% CI: 0.235- 0.768) were associated with lower odds of having a healthy nutritional status while those with high social economic status (OR= 2.875, 95% CI: 0.999- 8.267) were associated with higher odds of being in a healthy nutritional state. Available data did not support the existence of statistically significant relationship between household size, nutritional knowledge, and the nutritional status of adolescent school going girls in Gilgil Sub-County. However, having a positive nutritional attitude (OR= 3.333, 95% CI= 1.519- 7.313) was significant linked to higher chances of being in a healthy nutritional state. This result is consistent with the study by Hammouh et al. (2023), which found that the nutritional attitude of Jordanian elderly had a significant influence on their nutrition habits and consequently nutrition status. The results are also congruent with the study by Sharma et al. (2019), which found that there was a significant association between nutrition attitude and nutrition self-efficacy of adolescents from the districts of Banda, Kaushambi, and Allahabad in India. Nutritional self-efficacy in turn enables the adolescent to make proper decisions about nutrition.

In regards to dietary practices, taking 1-2 meals and snacks per day (OR= 0.443, 95% CI: 0.245- 0.799), skipping meals (0.854, 95% CI: 0.318- 1.077), and taking less than 2 litres of water a day (OR= 0.47, 95% CI: 0.258- 0.857) were significantly associated with lower likelihood of having a health nutritional status. The finding is congruent with the study by Kamanu et al. (2019), who found that skipping meals significantly associated with greater odds of being overweight. On the other hand, observing the concept of balanced diet (OR= 2.475, 95% CI: 1.357- 4.515), taking more than 2 litres of water a

day (OR= 3.402), 95% CI: 1.187- 9.750) and having a higher individual dietary diversity score (OR= 2.526, 95% CI: 1.396- 4.571) were significant linked to greater chances of having a healthy nutritional status. The results are congruent with the study by Wiafe et al. (2023), who found that the IDD score of adolescent girls rural Ghana was associated with anaemia status. Diverse diet increases the probability of taking in essential nutrients and minerals.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This study examined the determinants of nutritional status of adolescent school going girls in Gilgil Sub-County. This chapter presents a summary of the findings, conclusions, and recommendation.

5.2 Summary

The study sought to realize the five specific objectives:

i. To determine the socioeconomic characteristics of adolescent girls (13-18 years) attending public mixed day secondary schools in Gilgil Sub-County.
ii. To assess the level of nutrition knowledge among adolescent girls (13-18 years) attending public mixed day secondary schools in Gilgil Sub-County.
iii. To determine the nutrition attitude of adolescent girls (13-18 years) attending public mixed day secondary schools in Gilgil Sub-County
iv. To describe the dietary practices of adolescent girls (13-18 years) attending public mixed day secondary schools in Gilgil Sub-County.
v. To determine the nutritional status of adolescent girls (13-18 years) attending public mixed day secondary schools in Gilgil Sub-County.
vi. To determine the association between socioeconomic characteristics, nutritional knowledge, attitude, dietary practices and nutritional status of adolescent girls (13-19 years) attending public mixed day secondary schools in Gilgil Sub-County.

5.2.1 Socio-economic Characteristic of School Going Adolescent Girls in Gilgil Sub-County

Results showed that the average age of adolescent girls in public day secondary schools in Gilgil Sub-County is 16.79. Their ages ranges from 14 years to 18 years. The majority of these girls reside in rural areas and live in households that are headed by their fathers. Most of the girls have self-employed parents mainly in the agriculture sector with most the parents having either the primary of secondary levels of education. Over 90% of the girls are Christians and reside in household that have an average of 6 members. About 46% of the girls are from low income households.

5.2.2 Nutrition Knowledge of School Going Adolescent Girls in Gilgil Sub-County

Results revealed that 57.7% of the adolescent girls in public day secondary schools in Gilgil Sub-County have low nutrition knowledge. The average nutrition score for the study sample was 2.99 out of highest possible score of 6. The majority of the girls reported having access to nutrition information but most accessed this information through television, radio, and the internet. This raises questions regarding the accuracy and comprehensive of the nutritional information accessed by the girls.

5.2.3 Nutrition Attitude of School Going Adolescent Girls in Gilgil Sub-County

The majority of the school going adolescent girls in Gilgil Sub-County have a positive attitude towards various nutritional issues including intake of vegetable and fruits, maintaining a balanced diet, having a healthy weight, and taking enough water. However, the girls on average exhibit an indifferent attitude towards avoiding fast foods, reducing sugar intake, and resisting the influence of advertisement. The mean nutrition attitude score was 3.64 out of a possible highest score of 5 suggesting that some improvements are still needed in the girl's attitude towards nutritional issues.

5.2.4 Dietary Practices of School Going Adolescent Girls in Gilgil Sub-County

About 58% of the school-going adolescent girls take 2 or less meals and snacks in a day, which is lower than the recommend three main meals and two snacks. Close to half of the girls skip a meal while 42% do not adhere to the concept of balanced diet and 45% take the recommended 2 litres of water per day. The girls have an average IDD score of 7 with over 65% of the girls reported having taken a meal with more than 7 food groups in the 24 hours preceding the study.

5.2.5 Nutrition Status of School Going Adolescent Girls in Gilgil Sub-County

The majority of the girls (86.2%) are in healthy nutritional state based on the BMI while 13.8% are malnourished. This implies that the majority of the girl are getting adequate and proper nutrition. However, about 6.3% are underweight, 5.3% are overweight and 2.2% are obese. This is a concern because malnutrition has serious negative effects of the health of adolescent girls including impaired growth and development and increased risk of diseases.

5.2.6 Association between Socioeconomic Characteristics, Nutrition Knowledge, Nutrition Attitude, Dietary Practices, and Nutrition Status of School Going Adolescent Girls in Gilgil Sub-County

The nutritional status of adolescent girls in Gilgil Sub-County is significantly associated with age with statistics showing that younger girls of 13-15 years (OR= 0.42, 95% CI: 1.197- 0.895) had lower likelihood of having a healthy nutritional status than older girls 15-18 years (OR= 2.382, 95% CI: 1.118- 5.076). Place of residence also had a significant effect with girls residing in rural areas (OR= 2.559, 95% CI: 1.374- 4.765) having greater odd of being in healthy nutritional state. Father being in long-term employment (OR=0.302, 95% CI: 0.088- 1.041), mother being unemployed (OR= 0.086, 95% CI:

0.038- 0.196), having a father with no education (OR=0.302, 95% CI: 0.088- 1.041), a mother with no education (OR= 0.359, 95% CI: 0.149- 0.866), low social economic status (OR= 0.425, 95% CI: 0.235- 0.768), taking 1-2 meals and snacks per day (OR= 0.443, 95% CI: 0.245- 0.799), skipping meals (0.854, 95% CI: 0.318- 1.077), and taking less than 2 litres of water a day (OR= 0.47, 95% CI: 0.258- 0.857) were significantly associated with lower likelihood of having a healthy nutritional status.

On the other hand, being from a father-headed household (OR= 2.143, 95% CI: 1.113- 4.127), grandparent-headed household (OR=7.792, 95% CI: 5.983- 10.147), father being in self-employment (OR= 2.355, 95% CI: 1.303- 4.257), mother being self-employed (OR= 4.887, 95% CI: 2.648- 9.020), having a father with secondary education (OR= 2.236, 95% CI: 1.176- 4.600) or a father with tertiary education (OR= 3.244, 95% CI: 3.109- 3.545), a high social economic status (OR= 2.875, 95% CI: 0.999- 8.267), having a positive nutritional attitude (OR= 3.333, 95% CI= 1.519- 7.313) observing the concept of balanced diet (OR= 2.475, 95% CI: 1.357- 4.515), taking more than 2 litres of water a day (OR= 3.402), 95% CI: 1.187- 9.750) and having a higher individual dietary diversity score (OR= 2.526, 95% CI: 1.396- 4.571) were significant linked to greater chances of having a healthy nutritional status.

5.3 Conclusions

Based on the findings, the study concludes that the majority of school-going adolescent girls in Gilgil Sub-County reside in rural areas and in households that are headed by their fathers. Most of the girls have self-employed parents working in agriculture sector, which might have contributed to low-income in their households. Most parents have the primary and secondary level education, which may limit their ability to provide resources and guidance on nutritional issues. Many of the adolescent school-going girls in Gilgil

Sub-County are also from large households with an average of 6 members. This may lead to limited resources for the girls as the few resources available are shared among many household members.

The study also concludes that over half of the school-going adolescent girls in Gilgil Sub-County have low nutrition knowledge. This implies that many girls do not have a solid understanding of proper nutrition and its importance for their health and well-being. While the majority of the girls may have access to nutrition information, there are questions regarding the accuracy and comprehensiveness of the information they are receiving. The majority of the girls rely on nutrition information from television, radio, and the internet. These sources may not always provide reliable and evidence-based information and may perpetuate misconceptions about nutrition.

The study further concludes that the majority of school-going adolescent girls in Gilgil Sub-County have a positive attitude towards important nutritional issues such as consuming vegetables and fruits, maintaining a balanced diet, having a healthy weight, and staying hydrated. However, the girls' attitude towards avoiding fast foods, reducing sugar intake, and resisting the influence of advertisements is indifferent. There is still room for improvement in the girls' attitude towards nutritional issues. Stakeholders should also encourage positive role models and peer-to-peer influences to promote healthier attitudes among the girls.

In addition, the study concludes that the majority of school-going adolescent girls in Gilgil Sub-Countyare not consuming sufficient nutrients to support their growth and development. Most girls take 2 or less meals and snacks per day, which can have a negative impact on their nutritional status, energy levels, and overall health. Despite the majority of the girls having a positive attitude towards the concept of balanced diet, only

42% adhere to this concept. This suggests that while most girls would like to take balanced diet, the lack access to foods that would balance their meal. Despite the limitation, close to two-thirds of the girls take meals with diverse foods groups with majority having meals that contain more than 7 food groups.

Concerning nutritional status, the study concludes that the majority of school going adolescent girls are in health nutritional state based on BMI. However, 13.8% of the girls are malnourished with 6.3% being underweight, 5.3% being overweight and 2.2 being obese. This is a concern because malnourishment at this age can have grave negative and long-term effects on physical and mental health.

Lastly, the study concludes that the nutritional status of school-going adolescent girls in Gilgil Sub-County is significantly associated with five socioeconomic factors: girls' age, place of residence, mother occupation, mother education level, and household size. Being of advanced age, living in rural areas, having highly educated and working mothers, and living in smaller household were associated with greater odds of being in good nutritional state. Nutritional knowledge does not have significant association with nutritional status but nutritional attitude, skipping meals, and dietary diversity have a significant effect on the girls' nutritional status.

5.4 Recommendations

The following are the recommendations of the study.

5.4.1 Policy Recommendations

Policies and programmes aimed at enhancing nutritional status of adolescent girls should consider the dynamics facing girls living in rural areas because they are the majority. The policies and programmes should also target girls in households where mothers have low education level and are in informal occupation. Policymakers should also develop

interventions for improving the literacy levels and livelihood sources of mothers as these have been found to have a significant effect on the nutritional status of girls. Programmes targeting large households and reducing household size should also be considered.

Regarding nutrition information, study findings highlight the need for targeted nutrition education programmes for improving the girls understanding of proper nutrition. These programmes should aim to provide accurate and comprehensive information using multiple channels and formats to reach more girls. There should be partnerships between schools, public health officials, and local organizations to promote nutrition education and awareness among the adolescent girls.

On nutritional attitude, county department of public health should implement education and awareness programmes for enlightening school going adolescent girls on negative impact of fast-food consumption, sugar intake, and advertising influences. Respondents had low scores on these items in the nutrition attitude scale suggesting a need for improvement.

On dietary practices, county department of public health should partner with other stakeholders to provide resources and support to help the girls to access nutritious foods especially those from low-income households. This can be done through implementation of school feeding programmes that will ensure every girl is guaranteed at least one balanced meal per day. Other options that may be explored include cash transfers to low-income households.

The county department of public health should consider partnering with other stakeholders to develop programmes for addressing malnutrition and reduce the

proportion of girls suffering from malnutrition. Programmes that they ought to consider include nutrition education, food fortification, and food supplementation.

Results of inferential analysis suggest that programmes aimed at enhancing the nutritional status of school-going adolescent girls should give priority to girls at the early age of adolescent, girls residing in urban areas, those whose mothers have low education or are unemployed, and those living in large households. The programmes should also prioritize improving the nutritional attitude of the girls and their access to diverse food groups.

5.4.2 Recommendations for Further Research

This study was conducted among girls attending public day secondary schools in Gilgil Sub-County. Future studies should consider replicating the same in public boarding schools and private schools to facilitate comparison. Future studies should also consider replicating the study in other sub-counties for comparison and to support generalization of findings.

This study was purely quantitative hence it was able to establish what situation exists in Gilgil Sub-County in relations to the study variables and how these variables are related. However, quantitative methodologies were limited in terms of providing explanation regarding why the observed relationships exist. Future studies should consider using qualitative method to gain an in-depth analysis on how each variable shapes the nutritional status of the adolescent girls. For instance, a qualitative study may help to clarify why mother occupation and education are significantly associated with the girls' nutritional status but father occupation and education are not.

The study found that many girls rely on television, radio, and the internet for nutrition information, which may not always provide reliance and evidence-based information. A

follow-up study could investigate the credibility and reliability of these sources and identify alternative sources of nutrition information. An experimental study may also be used to examine the efficacy of educational programmes, community outreach, and peer-to-peer education interventions in enhancing the girls' nutritional knowledge and attitude.

REFERENCES

Abebe, T., Mezgebu, G., Feleke, F., & Tamrat, M. (2023). Dietary diversity and associated factors among adolescent girls in Nifas Silk Laphto Sub City, Addis Ababa, Ethiopia, 2021. *BMC Nutrition, 9,* 39. https://doi.org/10.1186/s40795-023-00693-1.

Ali, A., Naabi, F., Al-Hakamani, H., Al-Fahdi, H. & Waly, M. (2020). Assessment of nutritional knowledge, dietary habits, nutrient intake and nutritional status of Omani University Students. *Canadian Journal of Clinical Nutrition, 8*(2), 35-52. https://dx.doi.org/10.14206/canad.j.clin.nutr.2020.02.04.

American Psychiatric Association. (2020). *Eating disorders.* Retrieved from https://www.psychiatry.org/patients-families/eating-disorders.

Andambi, P., Angela, A., & Abong, G. (2021). Dietary intake, physical activity and nutritional status of adolescent girls in secondary schools in Peri-Urban Nairobi, Kenya. *Global Journal of Biology, Agriculture & Health Sciences, 10,* 334.

Arage, G., Assefa, M., & Worku, T. (2019). Socio-demographic and economic factors are associated with nutritional status of adolescent school girls in Lay Guyint Woreda, Northwest Ethiopia. *Sage Open Medicine, 7.* https://doi.org/ 10.1177%2F2050312119844679.

Aurino, E. (2017). Do boys eat better than girls in India? Longitudinal evidence on dietary diversity and food consumption disparities among children and adolescents. *Economics & Human Biology, 25*(1), 99- 11.

Berhe, K., Kidanemariam, A., Gebremariam, G. & Gebremariam, A. (2019). Prevalence and associated factors of adolescent under nutrition in Ethiopia: A systematic review and meta-analysis. *BMC Nutrition, 5*(49). https://doi.org/10.1186/s40795-019-0309-4.

Blum, L., Khan, R., Sultana, M., Soltana, N., Siddiqua, Y., Khondker, R., Sultana, S. &Tumilowicz, A. (2019). Using a gender lens to understand eating behaviours of adolescent females living in low-income households in Bangladesh. *Maternal & Child Nutrition, 15*(4), e12841.

Cebirbay, M., & Bayrak, E. (2022). Fruit and vegetable consumption, attitudes and knowledge in preschool children and adolescents. *BAUN Health Science Journal, 11*(3), 389- 396. https://doi.org/10.53424/balikesirsbd.1097015.

Centers of Disease Prevention. (CDC). About Child and Teen BMI. https://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_children s_bmi.html

Cunningham, K., Pries, A., Erichsen, D., Manohar, S. & Nielsen, J. (2020). Adolescent girls nutritional status and knowledge, beliefs, practices, and access to services: An assessment to guide intervention design in Nepal. *Current Developments in Nutrition, 4*(8), 129.

Das, J. K., Salam, R. A., Thornburg, K. L., Prentice, A. M., Campisi, S., Lassi, Z. S., ... & Bhutta, Z. A. (2017). Nutrition in adolescents: physiology, metabolism, and nutritional needs. *Annals of the New York Academy of Sciences, 1393*(1), 21-33.

Deka, M.K., Malhotra, A.K., Yadav, R. and Gupta, S., 2015. Dietary pattern and nutritional deficiencies among urban adolescents. *Journal of family medicine and primary care*, *4*(3), pp.364.

Fentie, K., Wakayo, T., & Gizaw, G. (2020). Prevalence of anemia and associated factors among secondary school adolescent girls in Jimma Town, Oromia Regional State, Southwest Ethiopia. *Anemia*, *2020*.

Fentie, K., Wakayo, T., & Gizaw, G. (2020). Prevalence of anemia and associated factors among secondary school adolescent girls in Jimma town, Oromia regional state, Southwest Ethiopia. *Anemia*, *2020*.

Freedman, D. S., & Berenson, G. S. (2017). Tracking of BMI z scores for severe obesity. *Pediatrics*, *140*(3).

Galgamuwa, L., Iddawela, D., & Dharmaratne, S. (2017). Nutritional status and correlated socioeconomic factors among preschool and school children in plantation communities in Sri Lanka. *BMC Public Health, 17,* 377. https://doi.org/10.1186/s12889-017-4311-y.

Getahun, G., Assfaw, A., Muhammad, E., &Shitemaw, T. (2023). Prevalence and correlates of stunting and thinness among adolescent students in Lidetasubcity, Addis Ababa, Ethiopia: a cross-sectional study. *BMJ Open*, *13*: e065347. Doi: 10.1136/bmjopen-2022-065347.

Gezaw, A. Melese W., Getachew, B. & Belachew, T. (2023). Double burden of malnutrition and associated factors among adolescent in Ethiopia: A systematic review and meta-analysis. *PLoS ONE, 18*(4), e0282240. https://doi.org/ 10.1371/journal.pone.0282240.

Golley, R. K., Maher, C. A., & Matricciani, L. (2017). Food sources of nutrients among Australian adolescents. *Nutrients, 9*(4), 429. https://doi.org/10.3390/nu9040429.

Green, K., &Chenarides, L. (2020). Using a sensory learning framework to design effective curricula: Evidence from indigenous nutrition education programs. *Sustainability*, *12*, 7077.

Gronhoj, A., Larsen, T., Chan, K. & Tsang, L. (2013). Using theory of planned behaviour to predict healthy eating among Danish adolescents. *Health Education*, *113*(1), 4-17.

Hadush, G., Seid, O., &Wuneh, A. G. (2021). Assessment of nutritional status and associated factors among adolescent girls in Afar, Northeastern Ethiopia: a cross-sectional study. *Journal of Health, Population and Nutrition*, *40*(1), 1-14.

Hammouth, F., Abdullah, M., Al-Bakheit, A., Al-Awwad, N., Dabbour, I. & Al-Jawaldeh, A. (2023). Nutrition knowledge, attitudes, and practices (KAP) among Jordanian elderly: A cross-sectional study. *Nutrients, 15*(9), 2220. https://doi.org/10.3390/nu15092220.

Hamulka, J., Wadolowska, L., Hoffmann, M., Kowalkowska, J., & Gutkowska, K. (2018). Effect of an education program on nutrition knowledge, attitudes toward nutrition, diet quality, lifestyle, and body composition in Polish teenagers. The ABC of healthy eating project: Design, protocol, and methodology. *Nutrients*, *10*(10), 1439.

Harika, R., Faber, M., Samuel, F., Mulugeta, A., Kimiywe, J., & Eilander, A. (2017). Are low intakes and deficiencies in iron, vitamin A, zinc, and iodine of public health concern in Ethiopian, Kenyan, Nigerian, and South African children and adolescents?. *Food and nutrition bulletin*, *38*(3), 405-427.

Heise, L., Greene, M. E., Opper, N., Stavropoulou, M., Harper, C., Nascimento, M. ... & Gupta, G. R. (2019). Gender inequality and restrictive gender norms: framing the challenges to health. *The Lancet*, *393*(10189), 2440-2454.

Hussien, F., Mebratu, W., Ahmed, A., Mekonnen, T., Hassen, A., Asfaw, Z., Hassen, H., & Abate, K. (2021). Performance of individual dietary diversity score to identify malnutrition among patients living with HIV in Ethiopia. *Scientific Reports*, *11*(1), 18681. https://doi.org/10.1038%2Fs41598-021-98202-6.

Igras, S. M., Macieira, M., Murphy, E., & Lundgren, R. (2014). Investing in very young adolescents' sexual and reproductive health. *Global public health*, *9*(5), 555-569.

Jeihooni, A., Jormand, H., Saadat, N., Hatami, M., Manaf, R. & Harsini, P. (2021). The application of the theory of planned behaviour to nutritional behaviours related to cardiovascular disease among the women. *BMC Cardiovascular Disorders, 21*: 589.

Kamanu, T. W. (2019). *Nutrition Knowledge, Dietary Practices And Nutrition Status Of Secondary School Adolescents (13-18 Years) In Ruiru Sub County, Kenya* (Doctoral dissertation, University of Nairobi).

Kansra, A. R., Lakkunarajah, S., & Jay, M. S. (2021). Childhood and adolescent obesity: a review. *Frontiers in Pediatrics*, *8*, 581461.

Kenya National Bureau of Statistics (2019b). *2019 Kenya Population and Housing Census*. Government Printer.

Kenya National Bureau of Statistics. (2019a). *Basic report on well-being in Kenya: Findings from contributory household questionnaire*. Retrieved from http://www.knbs.or.ke/

Kigaru, D. M. D., Loechl, C., Moleah, T., Macharia-Mutie, C. W., & Ndungu, Z. W. (2015). Nutrition knowledge, attitude and practices among urban primary school children in Nairobi City, Kenya: a KAP study. *BMC nutrition*, *1*(1), 1-8.

Leroy, J.L., Ruel, M., Sununtnasuk, C. and Ahmed, A., 2018. Understanding the determinants of adolescent nutrition in Bangladesh. *Annals of the New York Academy of Sciences*, *1416*(1),pp.18-30.

Madjdian, D. S., Azupogo, F., Osendarp, S. J., Bras, H., & Brouwer, I. D. (2018). Socio-cultural and economic determinants and consequences of adolescent undernutrition and micronutrient deficiencies in LLMICs: a systematic narrative review. *Annals of the New York Academy of Sciences*, *1416*(1), 117-139.

Maehara, M., Rah, J. H., Roshita, A., Suryantan, J., Rachmadewi, A., &Izwardy, D. (2019). Patterns and risk factors of double burden of malnutrition among adolescent girls and boys in Indonesia. *PLoS One*, *14*(8), e0221273.

Mostafa, I., Hasan, M., Das, S., Khan, S., Hossain, I., Faruque, A., & Ahmed, T. (2021). Changing trends in nutritional status of adolescent females: a cross-sectional study from urban and rural Bangladesh. *BMJ Open, 11*(2), e044339. https://doi.org/10.1136%2Fbmjopen-2020-044339.

Najam, W., Walsh, C., & Theron, W. (2023). Nutrition knowledge, attitudes, beliefs and practices: a comparison of urban and rural adults in the Free State province of South Africa. *South African Journal of Clinical Nutrition, 36*(4), 154- 161. https://doi.org/10.1080/16070658.2023.2175456.

Nakuru County Nutrition Action Plan CNAP 2020/21-2024/25 (2020). Nakuru County. https://www.nutritionintl.org/wp-content/uploads/2021/08/Nutrition-International-KEN-06-Nakuru-CNAP-1.pdf

Newman, A. (2021). Expanding access to secondary education: Evidence from a fee reduction and capacity expansion policy in Kenya. *Economics of Education Review, 83,* 102127. https://doi.org/10.1016/j.econedurev.2021.102127.

Newton, P., Silva, A. & Peters, L. (2020). A pragmatic master list of action verbs for Bloom's taxonomy. *Frontiers in Education, 5*, 107.

Ngugi, N. B. (2019). Influence of Principals'leadership Behaviour Practices on Students'academic Performance in Public Secondary Schools Gilgil Nakuru County, Kenya (doctoral dissertation, school of education, Kenyatta University).

Nguu-Gutu, C., Imungi, J. & Ngatia, E. (2017). Socioeconomic characteristics of and snacking among high school adolescents in Nairobi, Kenya. *IOSR Journal of Nursing and Health Science, 6*(3), 21-31.

Ntwenya, J.E., Kinabo, J., Msuya, J., Mamiro, P. and Majili, Z.S. (2015). Dietary patterns and household food insecurity in rural populations of Kilosa district, Tanzania. PLoS ONE, 10(5): e0126038.

Nwosu, A., Nwosu, B., Ezemenahi, S., Nwosu, D., Nwosu, C., Azudialu, B., Ojiakor, C., Umeh, U., Izuchukwu, E., Ofiaeli, C., &Ulochukwu, C. (2024). Anthropometric predictors of health-related quality of life in obese patients attending a tertiary hospital in Nnewi, South-East Nigeria: A cross-sectional study. *Nigerian Journal of Clinical Practice, 27*(3), 376- 382.

Okeyo, A., Seekoe, E., Villiers, A., Faber, M., Nel, J., & Steyn, N. (2020). Dietary practices and adolescent obesity in secondary school learners at disadvantaged schools in South Africa: Urban-rural and gender differences. *International Journal of Environmental Research and Public Health, 17*(16), 5864. doi: 10.3390/ ijerph17165864.

Paoli, A., Tinsley, G., Bianco, A., & Moro, T. (2019). The influence of meal frequency and timing on health in humans: The role of fasting. *Nutrients, 11*(4), 719. https://doi.org/10.3390%2Fnu11040719.

Pratt, M., &Canavera, M. (2017). Healthy Diets, Academic Success and Graduation. *Education Policy Analysis Archives, 25*(39). https://doi.org /10.14507/ epaa. 25.2392.

Rapando, C., Nyagero, J., & Wakhu, F. (2017). Feeding Habits associated with overweight and obesity amongst secondary School students in Private and Public schools in Langata Nairobi Kenya. *International Journal of Scientific and Research Publications, 7*(5), 498- 505.

Sahoo, K., Sahoo, B., Choudhury, A. K., Sofi, N. Y., Kumar, R., &Bhadoria, A. S. (2015). Childhood obesity: causes and consequences. *Journal of family medicine and primary care, 4*(2), 187.

Salam, R., Das, J., Irfan, O., Ahmed, W., Sheikh, S. & Bhutta, Z. (2020). Effects of preventive nutrition interventions among adolescents on health and nutritional status in low-and-middle-income countries: A systematic review. *Campbell Systematic Review, 16*(2), e1085.

Samruayruen, K. &Kitreerawutiwong, N. (2022). Exploration of the definition and components of food and nutrition literacy among junior secondary school students: A qualitative study. *BMC Nutrition, 8*(27).

Schmidt N. A. & Brown J. M. (2019). *Evidence-based practice for nurses: Appraisal and application of research* (4th ed.). New York, NY: Jones & Bartlett Learning.

Sharma, S., Akhtar, F., Singh, R. & Mehra, S. (2019). Relationships between nutrition-related knowledge, attitude, and self-efficacy among adolescents: A community-based survey. *Journal of Family Medicine and Primary Care, 8*(6). https://doi.org/10.4103%2Fjfmpc.jfmpc_217_19.

Taghipour, A., Miri, M., Sepahibaghan, M., Shahroodi, V. & Monfared, L. (2016). Prediction of eating behaviours among high-school students based on the constructs of theory of planned behaviour. *Modern Care Journal, 13*(4), e58186.

UNICEF. (2021). Social and Behavior Change Communication Strategy. *Improving Adolescent Nutrition in Indonesia.* https://www.unicef.org /indonesia/media/ 9201/file /Social%20behavioural%20change%20communication%20strategy.pdf

Usman, A., Javed, M., Amjad, A., Jalil, A., Shaheen, I. and Amjad, U., (2017). Food, City and Young Globavores: perceptions of Pakistani urban youth about food choices and healthy eating. *The Anthropologist, 27*(1-3), 143-151.

Veronika, A., Puspitawati, T. & Fitriani, A. (2021). Associations between nutrition knowledge, protein-energy intake and nutritional status of adolescents. *Journal of Public Health Research, 10*(2), 2239.

Virdi, N. K., Joshi, H., & Mittal, M. (2017). Anthropometric and nutritional profiles of adolescents belonging to the three subgroups of urban slums of Amritsar City. *Anthropologischer Anzeiger, 74*(1), 1-11. https://doi.org /10.1127 /anthranz /2017/0675.

Waaswa, A., Nkurumwa, A., Kibe, A., & Kipkemoi, N. (2021). Communicating climate change adaptation strategies: Climate-smart agriculture information dissemination pathways among smallholder potato farmers in Gilgil Sub-County, Kenya. *Heliyon, 7*(8), e07873. https://doi.org/10.1016/j.heliyon.2021.e07873.

Wandia, F., Ochola, S., & Ogada, I. (2020). Physical and nutrition education intervention improves body weight status of adolescents in Uasin Gishu County, Kenya: A cluster-randomized controlled trial. *Current Research in Nutrition and Food Science.* http://dx.doi.org/10.12944/CRNFSJ.8.1.30.

WHO. (2022). Anemia. https://www.who.int/health-topics/anaemia#tab=tab_1

Wiafe, M., Apprey, C. & Annan, R. (2023). Impact of nutrition education and counselling on nutritional status and anaemia among early adolescents. A randomized controlled trial. *Human Nutrition & Metabolism, 31,* 200182.

Wiafe, M., Apprey, C., & Annan, R. (2023). Dietary diversity and nutritional status of adolescents in rural Ghana. *Nutrition and Metabolic Insights, 16,* 1178. https://doi.org/10.1177%2F11786388231158487.

Willy, K., Judith, K., & Peter, C. (2016). Dietary diversity, nutrient intake and nutritional status among pregnant women in Laikipia County, Kenya. *International Journal of Health Sciences and Research, 6*(4), 378- 385.

World Bank (2023). *Kenya poverty and equity assessment 2023. From poverty to prosperity: Making growth more inclusive.* World Bank Publications.

World Health Organization. (2019). *Adolescents: health risks and solutions*. Retrieved from https://www.who.int/news-room/fact-sheets/detail/adolescents-health-risks-and-solutions.

Zhang, P., Sun, X., Jin, H., Zhang, F., Guo, Z., & Yang, Y. (2019). Comparison of the four anthropometric indexes and their association with stroke: A population-based cross-sectional study in Jilin Province, China. *Frontiers in Neurology, 10.*1304. https://doi.org/10.3389%2Ffneur.2019.01304.

Kenya National Bureau of Statistics (2022). Kenya demographics and health survey 2022. KNBS.

United Nations (2023). The sustainable development goals report; Special edition. United Nations Statistics Division.

APPENDICES

Appendix I: Students' Informed Consent Form

KABARAK UNIVERSITY RESEARCH ETHICS COMMITTEE

ADULT INFORMED CONSENT FORM (TEMPLATE)

(The form is written in English language but can be translated to Kiswahili or any other appropriate language)

STUDY TITLE: DETERMINANTS OF NUTRITIONAL STATUS OF ADOLECENT GIRLS (13 – 18 YEARS) ATTENDING PUBLIC MIXED DAY SECONDARY SCHOOLS IN GILGIL SUB-COUNTY, NAKURU, KENYA

PI: George Ndichu Munjuga Affiliated Institution: Kabarak University

Co-investigator(s): Dr. Miriam A. Muga (PhD) Affiliated Institution(s): Kabarak University

Co-investigator(s): Dr. Michael Walekhwa (PhD) Affiliated Institution(s): Kabarak University

INTRODUCTION

You are invited to participate in this research study being undertaken by the above listed investigators. This form will help you gather information about the study so that you can voluntarily decide whether you want to participate or not. You are encouraged to ask any question regarding the research process as well as any benefit or risk that you may accrue by participating. After you have adequately been informed about the study, you will be requested to either agree or decline to participate. Upon agreeing to participate in the study, you will be further requested to affirm that by appending your signature/thumbprint on this form. Accepting or declining to participate in this study does not in any way waive the following rights which you're entitled to:

a) Voluntary participation in the study;
b) Withdrawing from the study at any time without the obligation of having to give an explanation and;
c) Access to services which you're entitled to

A copy of this form will be provided to you for your own records

Should I continue YES/NO _____

This study has been reviewed and approved by Kabarak University Research Ethics Committee (KUREC)

What is the Purpose of the Study?

The main reason(s) for conducting this study is to answer the following questions:

1. What are the socioeconomic characteristics of school-going adolescent girls (13-19 years) in Gilgil Sub-county?
2. What is the level of nutrition knowledge among school-going adolescent girls (13-19 years) in Gilgil Sub-county?
3. What is the the nutrition attitude of school going adolescent girls (13-19 years) in Gilgil Sub-county?
4. What are the dietary practices of school-going adolescent girls (13-19 years) in Gilgil Sub-county?
5. What is the nutritional status of school-going adolescent girls (13-19 years) in Gilgil Sub-county?
6. What is the association between socioeconomic characteristics, nutritional knowledge, attitude, dietary practices and nutritional status of school-going adolescent girls (13-19 years) in Gilgil Sub-county?

(In order to answer these research questions, you are requested to voluntarily answer question(s) and/or accept some procedures performed on you)

Who can Take Part in the Study?

Secondary school adolescent girls' students from Gilgil Sub-County Secondary Schools aged 13 to 18 years who will willingly consent to participate in the research and with parents' consent. Adolescent girls who meet the inclusion criteria but have a chronic illness will not take part in the study

The sample size for the study 420 adolescent girls

In Case You Agree to Participate in the Study, What Will Happen?

This is what is going to happen once you have agreed to participate in the study:

- *First, the study will only take about 30 minutes of your time. The data collection exercise will be conducted between 4pm and 5.30pm after their classes to avoid interference with normal learning calendar.*

- *Second, a qualified and well-trained interviewer will ask you questions in a private place where you will feel comfortable. In case there is any question you feel uncomfortable responding to, you will not be coerced to respond. The questions will be on the following areas: (list the areas below)*
  1. Your demographic information such as age and number of household members
  2. Your nutritional knowledge
  3. Your nutritional attitude
  4. Your dietary practices

- *Third, after the interview, A digital Seca ®813 scale will be used to measure your body weight barefooted and in light garments to the nearest 0.1kg. Your height will be measured barefooted in a standing position with a portable Seca ® 213 height board with a sliding head bar to the nearest 0.1cm. You will be asked to stand upright, feet flat on the ground, back and buttocks straight and contacting the wall, for height measurement. All measurements will be taken twice and averages will be computed. This information will be used to compute BMI, which is used to determine nutritional status.*

- *Last, you are requested to provide your contact details (phone number or any other reliable form of contact). This will help reach you in case new information regarding the study emerges. Other reason(s) for requesting your contact details is (are)*

- *The contact details you will provide shall remain confidential to the lead researcher (PI).*

What Potential Risks are Associated with Participation in this Study?

Any research involving human subjects has the potential of imposing a number of risks/harms or discomfort including psychological, physical, emotional, environmental, cultural etc.

One of the foreseeable risks is that some of the sampled girls might refuse to fill in administered questionnaires in fear that they might be stigmatized especially those without privileged of getting the three meals from their homes. This will be mitigated through assuring that your data is not accessed by any other person apart from the researcher. The measurement will be done one student at a time in a private room to protect each student's privacy.

Privacy & Confidentiality

Privacy is the right of an individual to have some control over how his or her personal information/data is collected, used, and/or disclosed. Confidentiality is the duty to ensure information (data) is kept secret only to the extent possible/reasonable.

The measurement will be done one student at a time in a private room to protect each student's privacy. All questionnaires will be stored in a lockable cabinet in a private room only accessible to the researcher. Data entered in the software (excel file) will be stored in a computer. All files will be password protected. Data will be stored for a period of 5 years thereafter it will be destroyed by shredding.

In case you aren't comfortable answering any of the questions during the interview because of feeling embarrassed or uncomfortable, it will be within your rights to decline. Otherwise every measure has been taken to ensure that the interview is conducted in a private area with minimal to no interference so that you feel comfortable.

If at all you suffer any injury, illness or complication(s) by participating in this study, kindly contact us immediately using the contact details provided at the bottom of this form. You will be attended to by the study clinician and if there is need for further assessment or treatment you will be referred accordingly

What Benefits are you Going to Accrue by Participating in the Study

The study will assist your and other school going adolescent girls to understand your nutrition status, knowledge, attitude, and dietary practices and how these aspects are related. This understanding may be useful in assisting you to make better nutritional decisions that will enhance nutritional status.

The study will also enlighten the school administration, parents, and other stakeholders in the health and education sectors regarding the nutritional status of school going adolescent girls in Gilgil Sub-County and associated factors. This knowledge will enable them to develop programmes that will help improve the nutritional status of adolescent girls in this area.

What Will it Cost You to Participate in the Study?

The only cost of this study to your as a participants is time. The study will take about 30 minutes of your time. There will be no payment for participation.

In Case I Have any Further Questions/ Concerns in Future Whom Should I Contact?

In the event that you need further clarification or questions regarding your continued participation in the study feel free to contact the PI through telephone number 0722 696 943. In case of concerns regarding your rights and/or obligations as a research participant do not hesitate to contact the secretary, KUREC on {*KUREC contact*}

What Alternative Options are Available to Me?

The decision on whether to participate or not is absolutely voluntary. You will be free to withdraw from the study at any point during the study without providing any explanation.

How Will the Findings of this Study be Communicated or Shared?

The findings of the study will be communicated to you by availing a detailed report to school administration. The researcher will also work with the school administration to organize a talk with the students where the implication of the findings will be explained. Findings of the study will also be published on a peer reviewed journal.

Statement of Consent

I have comprehensively read the consent form or/the information has been comprehensively read to me by the researcher. I have understood what the study is about and all the questions and concerns that I had have been responded to in a clear and concise. The study benefits and foreseeable risks have been explained to me. I totally understand that my decision to participate in this study is voluntary and I have the right to withdraw at any point during the study.

I freely consent to participate in this study

Signing this form does not in any way imply that I have given up the rights am entitled to as a participant

I agree to participate in this research YES_____ NO_____

I agree to provide my contact details for follow-up YES_____ NO _____

Participant's Name _____

Participant's Signature/Thumb print_____Date _____

Appendix II: Questionnaire

A. Demographic And Socioeconomic Characteristics

*Tick the applicable answer in the checkbox provided

1. Kindly indicate your form:

□ Form 1 □ Form 2 □ Form 3 □ Form 4

2. Kindly indicate your date of birth: Date_ _Month_ _ Year _ _ _ _

3. Where do you live?

□ Rural

□ Urban

□ Other (specify) …….

4. Who heads your family?

1 Mother

2 Father

3 Other (specify) …….

5. What is your mother's occupation?.....

6. What is your father's occupation? …….

7. What is your fathers' education level?

□ No education □ Primary □ Secondary □ Tertiary □NA

8. What is your mother's education level?

□ No education □ Primary □ Secondary □ Tertiary □NA

9. How many people live in your house, both adults and children including your parents?

10. Kindly indicatewhether as a family, you own the following assets.

S/N	Asset	No	Yes
1	Land		
2	Own house (not rental)		
3	Vehicles		
4	Livestock		
5	Refrigerator		

10. Which religious group do you belong to:

None [ ] Christianity [ ] Islam [ ] Other (please specify) _____

B. Nutrition Knowledge Questionnaire

1. Which of the following represent five food groups?

- Protein, Vegetables, Milk, Grains, Fruits
- Protein, Vegetables, Dairy, Bread, Fruits
- Protein, Sweets, Dairy, Grains, Fruits
- Meat, Daily, Grains, Fruits

2. Which of the following foods are high protein?

- Nuts, beans, pawpaw
- Sausage, green gram, kachumbari
- Mango, avocado, liver
- Liver, eggs, fish

3. Which of the following foods are high energy?

1 Rice, Ugali, Beans
2 Githeri, peas, porridge
3 Chapati, potatoes, ugali
4 Bread, sausage, tea

4. Which minerals help bone development?

- Vitamin D and Selenium
- Vitamin B and Iron
- Vitamin D and Calcium
- Vitamin E and Calcium

5. Which of the following vitamin and mineral address anaemia?

- Calcium and folate
- Calcium and Iron
- Iron and folate
- Iron and vitamin A

6. Do you think the weekly iron and folic acid supplementation (WIFs) are important?

Yes [ ] No[ ]Not sure[ ]

7. Have you received any nutrition messages?

Yes [ ] No [ ]

8. If **Yes,** what was the source?

- Health workers
- Family & peers
- Local authorities
- School/teacher
- Child's health card
- TV
- Radio
- Newspaper/Gazette
- Other (specify).....

C. Nutrition Attitude

Please rate your level of agreement with the statements. Use the scale: 1 - Strongly disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly agree.

S/N	Statement	1	2	3	4	5
1	I enjoy eating a variety of fruits.					
2	I enjoy eating vegetables in every meal					
3	I believe it is important to have a balanced diet for good health.					
4	I pay attention to the nutritional value of the foods I consume.					
5	I often choose healthier options when given a choice.					
6	I believe eating fast food regularly is detrimental to my health.					
7	I am concerned about maintaining a healthy weight.					
8	I believe that drinking enough water is essential for good health.					
9	I am NOT influenced easily by advertisements when it comes to making food choices.					
10	I feel confident in my ability to make nutritious food					

	choices.					
11	I believe that taking meals with whole grain is beneficial to my health					
12	Eating diets high in salt is bad for health					
13	I pay attention to the amount of sugar that I take in a day					
14	I pay attention to the amount of food that I take in a meal					
15	I avoid some foods in order to remain healthy					

D. Dietary Practices Questionnaire

1. How many meals and snacks do you eat daily?

- 1-2 meals and snacks per day
- 3-4 meals and snacks per day
- 5-6 meals and snacks per day
- More than 6 meals and snacks per day

2. Do you skip meals?

Yes [ ] No [ ]

3. Do you think you apply the concept of a balanced diet when you choose your food?

Yes[ ] No[ ]

4. How much water do you take per day in litres?

- < 2 litres
- 2 litres
- >2 litres

5. Which food would you prefer eating depending on how it has been prepared?

- Boiled
- Baked
- Fried
- Steamed

Individual Dietary Diversity (IDDS) Questionnaire

***Please report the meals and snacks that you ate yesterday since morning until the night, whether you were at home, or outside home.**

NO	Food group	Examples	Yes=1 No=0
1	Cereals	Bread, noodles, biscuits, cookies or any other food made from millet, sorghum, maize, rice, wheat + any local foods e.g ugali, porridge or pastes or other locally available grains	
2.	Vitamin a rich vegetables and tubers	Pumpkin, carrots, squash or sweet potatoes that are yellow or orange inside + other locally available vitamin A rich vegetables	
3.	White tubers and roots	White potatoes, white yams, cassava or foods made from roots	
4.	Dark green leafy vegetables	Sweet pepper, dark green leafy vegetables, including wild ones + locally available vitamin A rich leaves such as cassava leaves awild vegetables, etc	
5.	Vitamin A rich fruits	Ripe mangoes, papayas + other locally available vitamin A- rich fruits and other fruits	
6.	Organ meat (iron-rich)	Liver, kidney, heart or other organ meats or blood-based foods	
7.	Flesh meats	Beef, pork, lamb, goat, rabbit wild game, chicken, duck or other birds, Fresh or dried fish or shellfish, Eggs	
8.	Legumes, nuts and Seeds	Beans, peas, lentils, nuts, seeds or foods made from these	
9.	Milk and milk Products	Milk, cheese, yogurt or other milk products	
10.	Oils and fats	Oil, fats or butter added to food or used for cooking	
11	Sweets	Sugar, honey, sweetened soda or sugary foods such as chocolates, sweets or candles	
12.	Coffee/tea	Tea (black, green herbal) or coffee	

E. **Anthropometry**

Age	**Weight** **Nearest 0.5 kg**				**Height** **Nearest 0.1cm**				**BMI**
	1	**2**	**3**	**Average**	**1**	**2**	**3**	**Average**	

Appendix III: Sampling Frame

S/N	Name of School	Number of Girls	Zone
1	Mugaa Secondary School	224	Elementaita
2	Muthaiti Mixed Secondary	164	Elementaita
3	Lake Elementaita Secondary School	123	Elementaita
4	Miti Mingi Secondary	342	Elementaita
5	Kongasis Secondary School	179	Elementaita
6	Munanda Secondary School	229	Elementaita
7	Muriricua Secondary School	171	Elementaita
8	Nderit Secondary School	132	Elementaita
9	Ndibai Secondary School	142	Elementaita
10	Tangi Tano Secondary School	142	Elementaita
11	Morop Secondary School	201	Elementaita
12	Gitare Secondary School	163	Karunga
13	Kahuho Secondary School	259	Karunga
14	Karunga Secondary School	352	Karunga
15	Ngecho Secondary School	172	Karunga
16	Ngeteti Secondary School	643	Karunga
17	Ngumo Secondary School	278	Karunga
18	Woodard Langalanga Secondary School	265	Karunga
22	Gilgil Town Secondary School	211	Karunga
28	Gilgil Day Secondary School	209	Karunga
30	Koelel Secondary School	216	Karunga
19	Echariria Secondary School	273	Mbaruk-Eburu
20	Gilgil Garrison Secondary school	291	Mbaruk-Eburu
21	Oljorai Secondary School	222	Mbaruk-Uburu
23	N.Y.S. Secondary	169	Mbaruk-Uburu
24	Kekopey Secondary	239	Mbaruk-Uburu
25	Ndogo Secondary School	71	Mbaruk-Eburu
26	Arthur Magugu Secondary	129	Mbaruk-Eburu
27	Eburu Secondary School	247	Mbaruk-Eburu
29	Kiungururia Secondary School	196	Mbaruk-Eburu
31	Lady Ann Delemere	285	Mbaruk-Eburu
32	Thugunui Secondary School	182	Mbaruk-Eburu
33	Kariandusi Secondary School	72	Mbaruk-Eburu
34	Kamathatha Secondary School	126	Mbaruk-Eburu
	Total	**7319**	

Appendix IV: KUREC Approval Letter

KABARAK UNIVERSITY RESEARCH ETHICS COMMITTEE

Private Bag - 20157
KABARAK, KENYA
Email: kurec@kabarak.ac.ke

Tel: 254-51-343234/5
Fax: 254-051-343529
www.kabarak.ac.ke

OUR REF: KABU01/KUREC/001/04/01/24

Date: 19th January, 2024

George Ndichu,
REG No.: GMND/M/2311/09/20
Kabarak University,

Dear George,

RE: DETERMINANTS OF NUTRITIONAL STATUS OF ADOLESCENT GIRLS (13 – 18 YEARS) ATTENDING PUBLIC MIXED DAY SECONDARY SCHOOLS IN GILGIL SUB-COUNTY, NAKURU, KENYA

This is to inform you that ***KUREC*** has reviewed and approved your above research proposal. Your application approval number is ***KUREC-040124.*** The approval period is 19***/01/2024 – 19/01/ 2025.***

This approval is subject to compliance with the following requirements:

i. All researchers shall obtain an introduction letter to NACOSTI from the relevant head of institutions (Institute of postgraduate, School dean or Directorate of research)
ii. The researcher shall further obtain a RESEARCH PERMIT from NACOSTI before commencement of data collection & submit a copy of the permit to **KUREC.**
iii. Only approved documents including (informed consents, study instruments, MTA Material Transfer Agreement) will be used
iv. All changes including (amendments, deviations, and violations) are submitted for review and approval by ***KUREC***
v. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to ***KUREC*** within 72 hours of notification;
vi. Any changes, anticipated or otherwise that may increase the risk(s) or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to ***KUREC*** within 72 hours;
vii. Clearance for export of biological specimens must be obtained from relevant institutions and submit a copy of the permit to KUREC;
viii. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal and;
ix. Submission of an executive summary report within 90 days upon completion of the study to ***KUREC***

Sincerely,

Prof. Jackson Kiteu PhD.
KUREC-Chairman

Cc Vice Chancellor
DVC-Academic & Research
Registrar-Academic & Research
Director-Research Innovation & Outreach
Institute of Post Graduate Studies

Appendix V: NACOSTI Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 843243

Date of Issue: 15/February/2024

RESEARCH LICENSE

This is to Certify that Mr.. George Ndichu Munjuga of Kabarak University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nakuru on the topic: DETERMINANTS OF NUTRITIONAL STATUS OF ADOLESCENT GIRLS (13 – 18 YEARS) ATTENDING PUBLIC MIXED DAY SECONDARY SCHOOLS IN GILGIL SUB-COUNTY NAKURU KENYA for the period ending : 15/February/2025.

License No: **NACOSTI/P/24/33129**

843243

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

See overleaf for conditions

Appendix VI: Ministry of Education Authorization Letter

MINISTRY OF EDUCATION
State Department for Basic Education

Telephone: 0722810864
Email: cdenaburucounty@gmail.com

COUNTY DIRECTOR OF EDUCATION,
NAKURU COUNTY
P O BOX 259
NAKURU

When replying please Quote:
Ref No. CDE/NKU/GEN/4/1/21 VOL IV/III **Date:** 6th March, 2024

TO WHOM IT MAY CONCERN

RE: RESEARCH AUTHORIZATION – MR. GEORGE NDICHU MUNJUGA

Reference is made to the above named individual letter dated 19th January, 2024 seeking permission to conduct research in Nakuru County having been approved by NACOSTI through Research Reference No.843243 and license No. NACOSTI/P/24/33129 dated 15th February, 2024.

Permission is hereby granted to him to carry out research on topic "DETERMINANTS OF NUTRITION STATUS OF ADOLESCENT GIRLS (13-18YEARS) ATTENDING PUBLIC MIXED DAY SECONDARY SCHOOLS IN GILGIL SUB-COUNTY NAKURU KENYA" for the period ending 15th February, 2025.

The findings of the research to be shared with this office when through with the research.

Kindly accord him the necessary assistance

For: COUNTY DIRECTOR
OF EDUCATION
NAKURU
Date.....

LILIAN ANODE
FOR COUNTY DIRECTOR OF EDUCATION
NAKURU

My Education My Future *My Education My Future*

Appendix VII: Evidence of Conference Participation

KABARAK UNIVERSITY

Certificate of Participation

Awarded to

GEORGE NDICHU

For successfully participating in the 15th Annual Kabarak University International Research Conference held from 13th-14th May 2025 and presented a paper entitled ***"Nutrition Knowledge, Attitude and Nutritional Status of Adolescent Girls (13 – 18 Years) Attending Public Mixed Day Secondary Schools in Gilgil Sub-County, Nakuru, Kenya."***

Conference Theme

Translation of Health Research and Innovation into Policy and Practice.

Prof. Pamela Kimeto Tinge'i
Dean, School of Medicine & Health Sciences

Dr. Phillip Nyawere
Ag.Director - Research, Innovation and Outreach

Kabarak University Moral Code

As members of Kabarak University family, we purpose at all times and in all places, to set apart in one's heart, Jesus as Lord.

(1 Peter 3:15)

Kabarak University is ISO 9001:2015 Certified

Appendix VIII: List of Publication

AFRICAN JOURNAL OF NUTRITION AND DIETETICS

Open Access

https://doi.org/10.58460/ajnd.v3i2.120

RESEARCH ARTICLE

MJM BIOLABS

Dietary Practices and Nutritional Status of Adolescent Girls (13 – 18 Years) Attending Public Mixed Day Secondary Schools in Gilgil Sub-County, Nakuru, Kenya

George Ndichu[1*], Miriam Muga[2] and Michael Walekhwa[3]

Authors Affiliation

[1] Department of Health Services, County Government of Nakuru
[2] Department of Nutrition and Dietetics, School of Medicine and Health Sciences, Kabarak University
[3] Department of Biomedical Sciences, School of Medicine and Health Sciences, Kabarak University

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Article History
Submitted: 28th October 2024
Accepted: 27th November 2024
Published Online: 10th April 2025

To read this paper online, please scan the QR code below:

ABSTRACT

Adolescent girls are nutritionally vulnerable because of their bodies require high nutrients to grow, have high risk-taking propensity and are predisposed to pressure from peers. Therefore, this study's main aim is to determine the association between dietary practices and nutritional status among school-going adolescent girls. The study targeted the population of adolescent girls (13-18 years) in 34 public mixed day secondary schools in Gilgil Sub-County. A sample of 420 girls was obtained from six schools using a multi-stage sampling process. Data on dietary practices was collected using a structured questionnaire while data on nutritional status was collected using anthropometric tools. The data was summarized using descriptive statistics while the logistic regression was used to check the association between dietary practices and nutrition status at the 0.05 level of significance. Results showed that the majority of school going adolescent girls are in a healthy nutritional state based on BMI. However, 13.8% of the girls are malnourished with 6.3% being underweight, 5.3% being overweight and 2.2 being obese. Taking 1-2 meals and snacks per day (OR= 0.443, 95% CI: 0.245- 0.799), skipping meals (0.854, 95% CI: 0.318- 1.077), and taking less than 2 litres of water a day (OR= 0.47, 95% CI: 0.258- 0.857) were significantly associated with lower likelihood of having a healthy nutritional status. On the other hand, observing the concept of balanced diet (OR= 2.475, 95% CI: 1.357- 4.515), taking more than 2 litres of water a day (OR= 3.402, 95% CI: 1.187- 9.750) and having a higher individual dietary diversity score (OR= 2.526, 95% CI: 1.396- 4.571) were significantly linked to greater chances of having a healthy nutritional status. Based on the findings, the study concluded that most school going adolescent girls in the study area are in healthy nutritional status but about 14% of the girls are malnourished. Nutritional status of the girl is significantly determined by dietary practices like number of meals per day, water intake, quality and diversity of diet. The study recommends that policies and programmes aimed at improving the nutritional status of school going adolescent girls should focus on improving the girls' access to meals with diverse foods groups.

Keywords: Dietary practices, nutritional status, adolescents, girls.

How to Cite this paper: Ndichu, G., Muga, M., & Walekhwa, M. (2024). Dietary Practices and Nutritional Status of Adolescent Girls (13 – 18 Years) Attending Public Mixed Day Secondary Schools in Gilgil Sub-County, Nakuru, Kenya. African Journal of Nutrition and Dietetics, 3(2). https://doi.org/10.58460/ajnd.v3i2.120