NUTRITIONAL KNOWLEDGE AND PRACTICES AMONG CATARACT PATIENTS ATTENDING SABATIA EYE HOSPITAL, KENYA

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A Thesis Submitted in Partial Fulfillment of the Requirements for the Award of the Degree of Master of Science in Public Health Nutrition of Masinde Muliro University of Science and Technology

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DECLARATION

I declare that this thesis is my original work, prepared with no other than the indicated sources and support and it has not been presented elsewhere for a degree or any other award.

Signature _____ Date _____

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HPN/G/01-58010/16

CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance of Masinde Muliro University of Science and Technology a thesis/dissertation entitled: **'Nutritional knowledge and practices among cataract patients attending Sabatia eye hospital, Kenya'**

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DEDICATION

Special dedication to my mother, Rebecca Andisi Keseko, for the moral support and understanding during the entire period of the research work and writing this thesis.

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ABSTRACT

Cataract, the leading cause of blindness and visual impairment globally, induces damage to the eye through mechanisms like oxidative stress. Antioxidants are the first line of defense against oxidative stress and are primarily obtained through diet. High intake of food sources of antioxidants has a protective association with the incidence and progression of cataract while poor intake of foods rich in antioxidants has a negative association with the incidence and the progression of cataract. The general objective of this study was to establish the nutritional knowledge and practices among cataract patients attending Sabatia Eye Hospital, Kenya. An analytical cross-sectional study was conducted on a sample size of 144 patients and the study area and study population were purposively selected. Using a structured questionnaire, data was collected on demographic and socio-economic characteristics, nutritional knowledge and nutritional practices among the patients. Data collected was subjected to analysis using Social Package for Statistical Sciences version 20 and presented using tables and figures. The study findings showed that 59% (n=85) of the respondents were female and the most represented age group was 60 years and above with a frequency of n=116 (80.6%). Almost half of the respondents (n=69, 47.9%) attained only primary education followed by 20.1% (n=29) who attained secondary education. The main source of income for most of the respondents (n=68, 47.2%) was farming and 49.3% (n=71) received less than 5,000 shillings per month. The mean score on knowledge (56.1) was used as the knowledge threshold to put patients into two levels: below average and above average. Less than half, 42.4% (n=61) scored above average on knowledge. In terms of practices, the most frequently consumed antioxidant rich food source was green leafy vegetables consumed by about 66.7% (n=96) at a frequency of once per day. Beans were the highest consumed phytochemical food source by 59.6% (n=82); 3 – 6 times a week and whole grains as a fiber source by 82.6% (n=119) patients once per day. The average individual dietary diversity score was moderate; 6.5 with the most consumed food group being cereals. However, antioxidant rich food groups had the least scores in the diet diversity. The use of nutrient supplements was poorly reported with about 93.8% (n=135) indicating that they never use nutrient supplements. Relationship between the variables of the study indicated that there was a significant positive association between nutritional knowledge and dietary diversity *(r(144)=.243, p=0.003)* and between dietary diversity score and income level which was *(r(144)= .334, p=0.001).* The study concluded that the patients' nutritional knowledge exists but not to all and the frequency of consumption and the diet diversity of antioxidant rich foods is low. Based on the findings, the study recommended for sensitization on frequency of intake of antioxidant food sources to be done at the community and hospital level through a multidisciplinary approach. The study further recommended for a follow up study to be done at the household level to assess other aspects of practice such as food preparation which has an effect on nutrient status of food.

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LIST OF ABBREVIATIONS AND ACRONYMS

ARC: Age Related Cataract

AREDS: Age Related Eye Disease Study

AMD: Age Related Macular Degeneration

BMI: Body Mass Index

DDS: Dietary Diversity Score

FBDG: Food Based Dietary Guidelines

IDDS: Individual Dietary Diversity Score

MMUST: Masinde Muliro University of Science and Technology

NACOSTI: National Commission for Science Technology and Innovation

RCT: Randomized Controlled Trial

WHO: World Health Organization

OPERATIONAL DEFINITION OF TERMS

Cataract – Clouding of the lens in the eye leading to a decrease in vision

Dietary diversity – The total number of food groups consumed by an individual in a specified period of time

Meal – Food that is prepared and eaten usually at a specific time in a large quantity as opposed to a snack

Nutritional knowledge – Knowledge of concepts related to nutrition such as knowledge of foods and their relationship with disease

Nutritional practice – An action taken in terms of dietary intake such as frequency of consumption of a food, diet diversification and the intake of nutrient supplements

Nutrient supplement – Any dietary supplement that is intended to provide nutrients that may otherwise not be consumed in sufficient quantities such as vitamins, minerals or other nutritional substances

Snack - A food item eaten in between meals

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Cataract is the leading cause of blindness at 51% (World Health Organization, 2010) at the global level and it is therefore a problem of significance in the public health domain. Hong *et al.,* (2015) in their study on the association between visual impairment and depressive symptoms concluded that blindness affects communities by resulting in decreased quality of life and it affects the productivity of both the blind and that of the people taking care of them. This points out the burden of blindness to the society especially at the community and the family level.

As the case is in most developing countries in the world, in Saudi Arabia, cataract is responsible for 52.6% of blindness and 20.6% of visual impairment according to a publication by Moustafa *et al.,* (2015). Naidoo *et al.,* (2014) in a review of population based surveys estimated that in Sub-Saharan Africa, cataract was the major cause of blindness at 35% by the year 2010. Similar to Naidoo et al., (2014), Khairallah *et al.,* (2015) documented that cataract was the major cause of blindness in all countries in Sub-Saharan Africa region except for two countries namely Cameroon and Uganda. In Kenya, a rapid assessment of avoidable blindness conducted among people aged 50 years and above by Mathenge *et al.,* (2007) established that cataract was the major cause of blindness at 42%. Despite cataract being majorly responsible for blindness and visual impairment, it is exciting to point out that approximately 80% of vision impairment globally is considered avoidable (WHO, 2018).

Cataract is the clouding of the lens of the eye or the opacification of the eye lens. It is caused by various factors such as those that aggregate and change the lens protein because of chemical reactions which lead to oxidative damage of the lens. Raman *et al.,* (2016) points out that

cataracts induce damage to the eye through mechanisms of oxidative stress. In addition, cataracts arise due to different factors. According to Mamatha and Nidhi (2015), they are associated with aging, female gender, genetics and other factors like diabetes, hypertension, body mass index (BMI) and lower education levels. Prokofyeva *et al.*, (2013) in their study on cataract prevalence and prevention in Europe showed that there is a strong link between nuclear cataract and poor dietary intake besides lower socio-financial status, nonprofessional status and lower standards of education. The Age Related Eye Disease Study (AREDS) indicated that increasing age, diabetes, change in weight and smoking status are related to an increased risk of cortical cataract, whereas male gender, white ethnicity and college education were associated with decreased risk of cortical cataract (Chang *et al.*, 2011). Age, gender, diabetes, weight status and education status appear severally in the above cited examples and they could be some of the factors that indirectly contribute to the oxidative damage of the lens. Data on demographic and socio-economic characteristics is therefore important for this study.

The main treatment to cataract is surgery which is not available to all because of the cost implications (Lee and Afshari, 2017). In addition, the surgery does not always have equal outcomes due to postoperative complications (Kaur *et al.*, 2017). Another limiting factor to treatment is the number of ophthalmologists against the population. Lewallen *et al.*, (2015) estimates that averagely, there is one ophthalmologist per one million people in sub-Saharan African population. Alfredo *et al.*, (2017) factors out that the timing of cataract extraction depends on different factors that can speed up or postpone surgery. Nutrition is one of these factors that interrelate well with eye health in the context of cataract as evidenced via its role in delaying cataract progression. The AREDS as reported by Glaser *et al.*, (2015); on the association of dietary lutein plus zeaxanthin and B vitamins with cataracts is a great example that

can be pointed out. The findings of the study confirmed that high intake of antioxidants and B vitamins have a protective association with the incidence and the progression of cataract indicating that nutrition is good for delay cataract onset and progress. Research is therefore showing the key role of nutrition in cataract incidence and progression but there is limited data on nutritional knowledge and practices among cataract patients.

1.2 Statement of the Problem

The burden of cataract at both the global and national level pauses a big challenge because it is the leading cause of blindness and visual impairment. Nevertheless, it is important to note that some of the most important recent findings in cataract epidemiology are its strong association with nutrition components. Raman *et al.,* (2015) pointed out that antioxidants are the first line of defense against oxidative stress (which aids in cataract progression) and are primarily obtained through diet. Adequate intake of antioxidants and multivitamins has been shown to have a major effect on delaying cataract progression, (Dherani *et al.,* 2008; Vu *et al.,* 2006).

Alexandria (2017) in a review on nutrition and vision recommends for the analysis of dietary patterns of individuals with eye disease in order to provide data that will inform public health guidelines on nutrition and vision. Such information will be important for researchers who may want to establish or develop diet based therapies. Andrea *et al.,* (2017) on the association between dietary intake of antioxidants and ocular disease recommends for dietary advice towards public health guidelines in the context of cataract. Data on nutrition and diet is therefore crucial for informing public health guidelines on eye health. This study therefore proposed to establish nutritional knowledge and practices among cataract patients attending Sabatia Eye Hospital in Kenya as follow upon these recommendations in order to inform the development of dietary guidelines towards cataract in Kenya.

1.3 Justification of the Study

As the country gears itself in the implementation of the big four agenda, universal health care has been prioritized and the focus has to be on preventive and primary health care as stated in the Alma-Ata principles. The main area of this study was nutrition which is a key component of preventive and primary healthcare and therefore makes it relevant to this agenda. The objectives of the study were also in line with health targets of Sustainable Development 3 which focuses on ensuring healthy lives and promotes wellbeing for all at all ages in terms of addressing the non-communicable diseases. Cataract has been listed as one of the non-communicable eye diseases and this study aims at informing nutrition strategies towards addressing cataract. One of Vision 2020 Global Initiative priority areas is optimal control of priority diseases. Cataract represents more than 50% of all avoidable blindness in Africa. Information about nutritional knowledge and practices is therefore desirable for planning towards optimal control of the disease through a public health nutrition approach. The initiative also aims at developing and implementing comprehensive strategies towards eye health promotion and a multi-sectorial approach involving nutrition will contribute towards the same which will lessen the economic burden of the disease. Lastly, information obtained from this study is therefore informative to the national policies on eye health care besides adding new knowledge to existing literature on nutritional knowledge and practices in the context of cataract.

1.4 Research Objectives

1.4.1 General Objective:

To establish nutritional knowledge and practices among cataract patients attending Sabatia Eye Hospital, Kenya.

1.4.2 Specific Objectives:

i. To establish the demographic and economic characteristics among cataract patients attending Sabatia Eye Hospital
ii. To determine nutritional knowledge levels among cataract patients attending Sabatia Eye Hospital
iii. To assess the nutritional practices among cataract patients attending Sabatia Eye Hospital
iv. To establish the relationship between nutritional knowledge and practices among cataract patients attending Sabatia Eye Hospital

1.5 Research Questions

The study sought to answer the following research questions:

i. What are the demographic and economic characteristics among cataract patients attending Sabatia Eye Hospital?
ii. What are the nutritional knowledge levels among cataract patients attending Sabatia Eye Hospital?
iii. What are the nutritional practices among cataract patients attending Sabatia Eye Hospital?
iv. What is the relationship between nutritional knowledge and practices among cataract patients attending Sabatia Eye Hospital?

1.6 Significance of the Study

Most importantly, the cataract patients will benefit from this study in terms of nutrition being incorporated into eye health care based on the established gaps. The results of this study are significant to the national nutrition plan strategies e.g. the strategy that aims to improve knowledge, attitudes and practices on optimal nutrition which is expected to contribute towards

improving nutrition practices in the lifespan of Kenyans. This study also documents on gaps in nutritional knowledge and practices that need to be addressed by referral or consultation by various practitioners or awareness creation or any other appropriate way thereby being of significance to the ministry of health. The findings from this study will also be important for informing the development of nutrition programs towards eye health, their implementation and evaluation.

1.7 Limitation of the Study

This study depended on the memory of the respondents to report on their food frequency intake and hence was prone to memory errors. This was controlled for by further including the assessment of the respondents dietary diversity score to get a more representative picture of the respondents' dietary patterns. In addition, the evaluation of the economic status of the respondents focused on a limited number of economic indicators. Another limitation was that there is paucity of literature on patients' nutritional knowledge and practices in relation to cataract incidence and progression. Most studies that have been conducted on nutrition knowledge and practices have evaluated athletic populations, maternal and child feeding, school children and cancer patients besides other medical conditions but little has been documented in the case of cataract. This study therefore also reviewed literature from studies that have evaluated nutrition knowledge and practices on populations other than those with cataract in order to make it richer.

1.8 Delimitation of the Study

The study was delimited to patients in the eye hospital and specifically cataract patients were involved in the study because they were what the scope of the study was looking at. In addition, home visits were not conducted for the sake of follow up on the nutrition practices of the patients at home that they had reported due to limited time and resources.

1.9 Theoretical Model

The concept of this study was based on the Health Belief Model. The Health Belief Model (HBM) was developed in order to help understand why people did or did not use preventive services that were offered by public health departments in the 1950's, and has evolved to address newer concerns in disease prevention and detection. The model theorizes that people's beliefs about whether or not they are at risk of a disease or health problem, and their perceptions of the benefits of taking action to avoid it, play a role in influencing their readiness to take action. The extensive use of this model in research continues to show its validity. The model has four key constructs including perceived susceptibility and perceived severity of disease, perceived benefits and perceived barriers of changing to a new behaviour, cues to action and self-efficacy.

In the construct of perceived susceptibility and perceived severity of a disease, the health belief model proposes that individuals who perceive a given health problem as serious and perceive that they are susceptible to the problem worsening are more likely to engage in behaviors to prevent the health problem from occurring or worsening. In this context, the patients' knowledge on nutrition and cataract and their practices on the same may vary as a result of their perceived susceptibility and severity.

If an individual believes that a particular action e.g. use of nutrient supplements will reduce susceptibility to a health problem or decrease its seriousness i.e. cataract, then he or she is likely

to use the nutrient supplements regardless of objective facts regarding the effectiveness of the action. This is on the construct on perceived benefits and perceived barriers of changing to a new behaviour (Rosenstork (1974). The health belief model points out examples of cues to action including mass media campaigns, reminders from others, consulting and even practitioner advice. In this study, the researcher is interested in finding out who informs the nutritional practices among the cataract patients.

The self-efficacy construct was added to the health belief model in an attempt to better explain individual differences in health behaviors (Rosenstock, 1988). Perceptions can be affected by individual characteristics like demographics (e.g. age, sex, race, ethnicity and education), structural (e.g. knowledge about a disease among other factors) and psychosocial variables (e.g. social class and personality among others) as per Rosenstock (1974). It is important to point out that more recently, the HBM has been applied to understand patients' responses to disease, their compliance with medical regimens, and behaviors that relate to chronic illnesses, which may require long-term behavior maintenance besides the initial behavior change (Carpenter, 2010). This model was therefore relevant to this study which was looking at the patients' response to cataract in terms of nutritional knowledge and practices.

1.10 Theoretical Framework

Figure 1.1 below presents the theoretical framework which shows a summary of the link between dependent and independent variables of this study basing on some of the constructs of the HBM. The indication from the framework is that nutritional knowledge influences nutritional practices with regards to demographic and socio-economic factors such as age, gender, education and income.

The link between variables of this study basing on the constructs of HBM

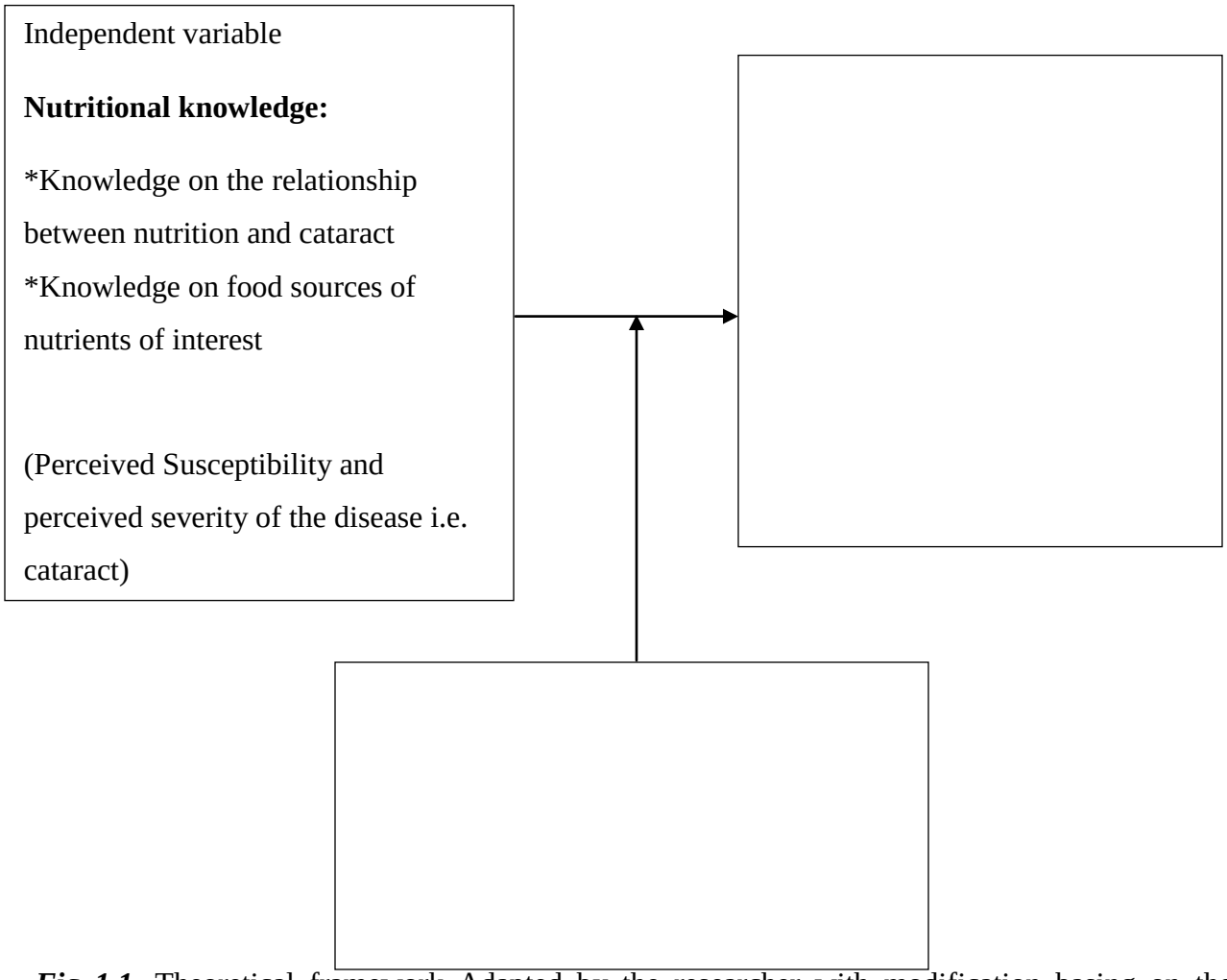

Fig 1.1. Theoretical framework Adapted by the researcher with modification basing on the constructs of HBM. (*Source*: Author)

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviewed literature in line with the problem of the study and the research objectives. It covered the following areas: demographic and economic characteristics and cataract, nutritional knowledge narrowed down to aspects to be assessed in this study such as relationship between nutrition and cataract, nutrients associated with delaying and hastening cataract progression and nutritional practices.

2.2 Demographic and Economic characteristics among Cataract patients

The prevalence of blindness due to cataracts varies from country to country yet 49% of the total disability adjusted-life years have been reported owing to cataracts, especially in developing countries (Rao *et al.*, 2011). Several lifestyles, demographic and socio-economic characteristics, have been reported to affect the risk of cataracts.

In an analysis involving multiple variables for Age Related Cataract (ARC) (Nirmalan *et al.*, 2004), a strong association between cataract and factors such as female sex, increase in age and illiteracy besides other factors was found. In the same analysis, studies reported that a lower educational level was associated with a higher prevalence of cataract. This could be attributed to confounding variables such as illnesses, nutritional factors and exposure to sunlight. Women have also been found to present with cataract more than men as evidenced by studies reported by Stevens, White and Flaxman *et al.,* (2013); Rius *et al.,* (2012); Aboobaker and Courtright (2016). BMI has also been previously reported by Rautiainen *et al.,* (2014) to be associated to cataract and this association is confounded by lower socio-economic status among other variables. Rautiainen *et al.,* (2014) also linked increasing age with high prevalence of cataract. It was also

indicated in a much earlier study by Caulfield *et al*, (1999) that there is an increase of cataract risk with low socio-economic status. Rius *et al.,* (2012) also found that people with low vision had less income. The first objective of this study sought to find out some of the demographic and economic characteristics as co-variates. Data on demographic characteristics and socio-economic characteristics was therefore a necessary aspect to be included in this study in order to determine their relationship with the main variables for this particular population and also compare with the findings of other studies.

2.3 Nutritional knowledge

Studies show that nutritional knowledge affects the quality of food intake and also healthy choices of purchased food (O'Brien & Davies, 2007; Verbeke, 2008). Advancement of individual nutrition knowledge provides new information which may stimulate changing of attitude and subsequently result in enhancement of dietary practices (De Vriendt *et al*., 2009). The measurement of nutrition knowledge has been found to be challenging (Parmenter and Waller, 2000). Most studies that have assessed nutrition knowledge have used written questionnaires, although many of these are considered inadequate or have no validation. The participants' level of literacy is also a determinant of the responses and this is more limited with lower levels of education and socio-economic status according to Adams *et al.,* (2009). Types of nutrition knowledge assessed also vary widely across instruments, since some look at general concepts while others look at specific aspects of nutrition such as fat or fiber as seen in a study on consumers' knowledge of healthy diets and its correlation with dietary behaviour by Dickson-Spillmann and Siergrist (2011). This study looked at general concepts by assessing the nutrition knowledge of cataract patients on foods that have a strong relationship with cataract incidence or progression.

2.3.1 Relationship between Nutrition and Cataract

Raman *et al.,* (2016) looked at food components and ocular pathophysiology and established that cataracts induce damage to the eye through the mechanism of oxidative stress. This stress may help the cataracts to progress because it facilitates the damage of the cellular eye components leading to the accumulation of advanced glycation end products which lead to the increase in lens opacity. A much earlier study by Taylor *et al.,* (1995) led to the conclusion that oxidative damage to the lens cell membrane is an important factor in the initiation and the progression of cataract. Vinson *et al.,* (2006), points out that free radicals can exceed naturally occurring antioxidants and consequently cause oxidative stress because of various factors such as excessive alcohol consumption, smoking, excessive exposure to sunlight, improper diet and diabetes. Raman *et al.,* (2016) further states that antioxidants are the first line of defense against oxidative stress from the AREDS which has also shown that antioxidant therapy reduces AMD progression by 25%.

The findings mentioned above show a great relationship between nutrition and cataract with regards to oxidative stress. It is also important to note that plasma antioxidant capacity can be increased by consuming a diet that is rich in food sources of the antioxidants. Various studies have established a protective association of cataract with carotene, vitamin C, vitamin E, lutein, zeaxanthin and B vitamins as discussed in the next section. Delcourt *et al.*, (2010) reports that an antioxidant rich diet is significant in delaying the progression of cataract. Findings from the above mentioned studies support the evidence that nutrition plays a key role in cataract incidence and progression. A systematic literature review by Akanksha, (2016) on public health nutrition and cataract identified that majority of the studies done on the relationship between nutrition and cataract used methods such as randomized clinical trials, case-control studies, randomized

double blind placebo controlled trials or population based prospective cohorts. However, this study took a cross-sectional approach as the research design. Despite the findings on the link between nutrition and cataract, further existing knowledge and practices of patients have not been clearly established yet the burden of cataract is significant. Information from this study will fill this gap and inform strategies towards addressing the burden of cataract in the Kenyan population.

2.3.2 Nutrients associated with delayed cataract progression

Cataract incidence and progression has been associated with dietary antioxidant intake (Kelly *et al.,* 2005). The principal nutrients possessing properties to quench free radicals are vitamins C and E. This literature review also looked at findings on antioxidants lutein and zeaxanthin. Nutrients such as vitamin E, vitamin A and antioxidants lutein and zeaxanthin have been explored to establish their effect on cataract progression and mostly cohort studies have been successful in finding a protective effect according to Jacques *et al.,* (2005). Various studies on the effect of vitamin C intake, vitamin C supplementation and serum vitamin C concentrations have often given inconsistent results. Some studies have found protective effects while others have found no overall effect (Mares *et al.,* 2010).

2.3.2.1 Vitamins C and E and effect on Cataracts

Also known as ascorbic acid, vitamin C is a water soluble antioxidant vitamin that protects the lens from destruction that happens as a result of photo-oxidation. Shui *et al.,* (2009) associates the presence of a significant concentration of this vitamin in the aqueous humor in order to reduce oxidation products in the lens. A systematic review by Akanksha, (2016) points out that most studies have investigated the use of vitamin C in combination with other nutrients and have suggested that further research to be done in the use of various nutrients in monitoring cataract

incidence and progression. From the same review, a study found that use of both diet and vitamin C over a period of ten years reduced the incidence of cataracts. Although this study looked at intake of vitamin C rich foods retrospectively, it was for a shorter period of time. Yonova-Doing *et al.*, (2016) on genetic and dietary factors influencing progression of nuclear cataract found that dietary vitamin C was protective against both nuclear cataract at baseline and nuclear cataract progression. In most geographical regions in Kenya, fruits and vegetables are the most available sources of vitamin C.

Also known as alpha-tocopherol, vitamin E is a fat soluble vitamin. Just like vitamin C, it is widely distributed in plant foods but is particularly concentrated in plant oils. Animal fats contain small amounts of this vitamin. It functions by scavenging for free radicals and preventing lipid peroxidation. To measure nutritional status in relation to this vitamin, plasma tocopherol is considered. In the eye, vitamin E is found within the lens fibers and membranes where it is able to reduce photo peroxidation of lipids within the lens. According to findings from a study Zhang *et al.*, (2015) dietary vitamin E intake (including seeds as sources), dietary and supplemental vitamin E intake and high serum tocopherol levels were significantly associated with decreased risk of cataract progression. The above reviewed studies prove the link between vitamin C and E intake and cataract incidence or progression. However, intake of foods rich in this vitamins in the context of cataract has not been documented. The current study therefore looked at frequency of food consumption and diet diversification of foods rich in vitamin C and E among the cataract patients.

2.3.2.2 Lutein and Zeaxanthin

Lutein and zeaxanthin are carotenoids from various food sources such as dark green leafy vegetables and egg yolks. The ratio of lutein and zeaxanthin in green vegetables has been

reported to range from 12 to 63, the highest being in kales, while in yellow-orange fruits and vegetable this ratio ranges between 0.1 and 1.4 (Humphries and Khachik, 2003). In a study assessing phytochemicals and antioxidant activity of milled fractions of different wheat varieties including cereal grains, lutein and zeaxanthin were the most common antioxidants with lutein being the dominant carotenoid compound besides other compounds such as α and β-carotene, β-cryptoxanthin,. In common wheat flour (known to be low in carotenoids), the bran/gem fraction had more lutein, more zeaxanthin, and more β-cryptoxanthin than the endosperm fractions (Adom *et al.,* 2005). This study looked at whether the cereals consumed by the respondents were whole i.e. had the bran fraction and whether the patients knew their role in cataract progression.

Besides risk reduction for certain types of cancers and heart diseases, lutein and zeaxanthin have shown protective role in eye health as evidenced by an inverse relationship with cataract and even AMD. According to Ma *et al.*, (2014), they prevent oxidative stress and lipid peroxidation in the epithelial cells. The Nurses' Health Study examined the relationship between dietary intake and cataract extraction and the indication from the findings was that frequent intake of lutein rich spinach and kale had a strong positive association with decreased risk of cataract extraction (Chasan *et al.*, 1999).

Moeller *et al.*, (2008) indicated that a high dietary intake of lutein and zeaxanthin would lower the incidence of nuclear cataracts by 23%. An approximate intake of 4-6mg per day was linked to reduced rates removal of cataracts showing that dietary intake also has an effect on delaying the progression. This study looked at knowledge on foods that slow cataract progression and the frequency of consumption of dark green vegetables and egg yolks as the most available sources of lutein and zeaxanthin.

2.3.3 Nutrients associated with increased cataract progression

Just like prior mentioned examples, results from a case-controlled study in Athens, Greece assessing the association between diet and cataract showed a protective association of cataract with carotene, vitamin C and E. Nevertheless, from the same study, a higher carbohydrate intake was linked to increased risk of cortical cataract and a higher glycemic index to nuclear cataract. Additionally, participants were susceptible to eye conditions related to oxidative stress when they had a high consumption of meat and related nutrients like cholesterol, (Theorodopoulou *et al.,* 2014). Another great on the association of dietary carbohydrate intake and dietary glycemic index and the risk of age-related cataract is seen from a study conducted by Wu *et al*, (2014). The results of his study showed that the study participants who had a higher dietary intake of food sources of carbohydrate and foods with a high glycemic index had an increased risk of cataract.

It has been indicated from other studies that the risk of cataract is increased by a high total fat and cholesterol intake. For example, in a case-control study on the relationship between diet and cataract, results showed that diet has an appreciable role in the risk of cataract extraction, just like other previously mentioned studies. Higher intakes of butter, total fat and salt intake showed a significant increase in risk as per Tavani *et al.*, (1996). In another hospital based case control study in China, participants with higher intake of polyunsaturated fatty acid intake had 2.7 times a higher risk of nuclear cataract (Lu *et al.*, 2013). It is however important to note that results regarding fat intake and cataract are not consistent such as findings from the Beaver Dam cohort study that found no relationship between the prevalence of nuclear opacity and total fat intake, (Mares-Perlmann, 1995). High dietary meat intake (not lean) conversely appeared to increase cataract (Andrea, 2017).

Cataracts can also develop subsequently from hypertension which is strongly associated with excessive sodium intake as stipulated by Horng *et al.,* (2014). A good example is study by Mirsamadi and Nourmohammadi (2003) which showed a strong positive and significant correlation between cataract development and excessive sodium intake. This is because excessive intake of sodium can cause hypertension and consequently result in cataracts. Excessive caffeine consumption, low glycemic index diets also have a negative association with the incidence and the progression of cataract. This study sought to find out knowledge of foods that have a negative association with cataract incidence and progression and also food frequency intake of these foods.

2.4 Nutritional practices

Nutritional practices discussed are food frequency, diet diversity and the use of nutrient supplements.

2.4.1 Food frequency and diet diversity

Various studies have assessed various dietary practices such as food frequency intake and dietary diversity. Muthike *et al.,* in their study focused on cancer patients but assessed food frequency including antioxidant intake since antioxidants supplements can repair the tumor cells that have been destroyed by the therapy whether chemotherapy or radiotherapy thus counteracting the treatment yet they must be taken with a lot of caution. This study also assessed the antioxidant food frequency of cataract patients since antioxidants quench free radicals in the lens. Kigaru *et al.,* (2015) in their study focused on primary school children because of the rapid changes in childhood dietary patterns that pose health risks such as obesity yet early life dietary habits stand a higher chance of lasting even into adulthood. Frequency of consumption of food groups assessed included sweetened drinks and fast foods, fruits, nuts and milk. Another study focused

on maternal nutrition knowledge and child feeding practices linked with nutrition status which are all essential in the growth and development of a child (Julie *et al.,* 2016). The above mentioned studies (Kigaru *et al.,* 2015 and Julie *et al.,* 2016) did not use dietary diversity in assessing dietary patterns. This study used dietary diversity to get more elaborate results. Despite the strong relationship between nutrition and cataract, little has been done on establishing the practices among cataract patients. Spronk *et al.,* (2016) reviewed the relationship between nutrition knowledge and dietary intake and the studies included in the review were either from community surveys or athletic populations. IDDS was used as a proxy measure of the nutritional quality of a diet basing on conclusions by LaVicchia and Tavani, (2001).This study therefore aimed at filling this gap where relationship between nutritional knowledge and practices among cataract patients has not been established.

2.4.2 Use of Nutrient Supplements

Antioxidant vitamin supplementation has been studied (in the AREDS II) as a means for prevention for formation or slowing the progression of cataract. A baseline randomized controlled trial on daily usage of multivitamins indicated a slowed down progress of nuclear cataract but an increase in risk for posterior sub-capsular cataract (Chew *et al.,* 2012). The controlled clinical trial where separate clinical trials assessed multivitamin and mineral use (where n = 2141), and a combination of retinol and zinc, riboflavin and niacin, vitamin C and molybdenum, selenium, vitamin E, and beta-carotene (where n = 3249) had similar findings. The study used a factorial design with these four different vitamin/mineral combinations. Findings from the studies showed that, the risk of nuclear cataract progression was decreased by at least 36% and 44%, for multivitamins and combination, respectively, in 5 to 6 years. On the other hand, there appeared to be an increased risk of posterior sub-capsular cataract with the use of

riboflavin/niacin combination (Chew *et al.*, 2013). Conclusively, from this population, the results of the two trials suggested that vitamin/mineral supplements may be beneficial for slowing the progression of lens opacities. Another RCT by Christen *et al.,* (2014) investigated the effect of long-term use of multivitamin supplements and concluded that the long term daily use of multivitamins decreased the risk of cataract significantly. In contrast to the mentioned studies, individual nutrients were not evaluated in this study. This study sought to find out the general use of nutrient supplements, how often it was used and the source of the nutrient supplements.

2.5 Summary of Literature Review

The reviewed literature suggests that the role of nutrition approaches in the epidemiology of cataract is inevitable. Patients can easily reach their dietary consumption goals since most of the nutrients especially antioxidants can be obtained from similar food sources. The reviewed studies captured the relationship between diet and cataract but they did not factor in the knowledge and practice status of patients in order to ascertain that recommendations from prior research are effective. This study therefore sought to fill this gap by establishing nutrition knowledge and practices among cataract patients attending Sabatia eye hospital and provide baseline information for nutrition interventions in the Kenyan scenario.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research design that was used by the researcher in establishing the nutritional knowledge and practices among cataract patients. It discusses the study setting, study design, study population, sample size determination, sampling procedure, data collection, analysis and presentation, validity and reliability of the research instruments and logistical and ethical considerations.

3.2 Study Setting

The study was conducted in Sabatia Eye Hospital which is an independent nonprofit hospital located in Sabatia sub-county, Vihiga County, Kenya. The hospital was selected for this study because it specializes in Eye care with a mission to provide quality and accessible eye care services to all. Through the hospitals' outreach programs they are able to serve the larger Western Kenya, parts of Rift Valley and the neighboring counties. The hospital is located along Chavakali - Kapsabet road near Wodanga market, which is approximately 5 kilometers from Chavakali town. A map of the location of the study setting is displayed in Appendix III of this document.

3.3 Study Design

The study design that was used is the analytical cross-sectional research design because the research entailed collecting data and making comparisons between phenomena from the data at the same time of study.

3.4 Study Population

The study population was patients with cataract attending Sabatia Eye Hospital. The hospital receives patients with different complications e.g. diabetic retinopathy, refractive errors, glaucoma, cataract, allergies amongst other eye diseases.

3.5 Inclusion and Exclusion criteria

3.5.1 Inclusion criteria

Patients newly diagnosed with cataract and those on follow up and gave their consent were included in the study.

3.5.2 Exclusion criteria

Patients who had a combination of cataract with other eye diseases were excluded from the study e.g. cataract with Age-related Macular Degeneration (AMD).

3.6 Sampling Procedure

Sabatia Eye Hospital was purposively selected because it caters for patients from western, Nyanza and rift regions of the country and therefore receives majority of the eye patients and offers a wide range of services. Cataract patients were also purposively sampled from the other eye patients because they were what the scope of the study was looking at.

3.6.1 Sample Size Determination

Systematic random sampling technique was used to select patients to be included in the study. The first sample was picked randomly and the remaining picked at predetermined intervals. Odd or even numbers were used to choose the intervals for sampling. A coin was tossed whereby, head dictated that we begin with the first number in the arithmetic progression of odd-number intervals while tail demanded that we begin with even numbered digit and follow the arithmetic

progression in that mode until a point of saturation. A total of 144 patients were sampled. Cochran formulae was used in calculating sample size (Singh & Masuku, 2014) for the population proportion representing cataract prevalence whereby;

$$n_o = \frac{z^2 pq}{e^2}$$

Where n_o is the estimated population sample.

z^2 is the abscissa of the normal curve that cuts off an area α at the tails (1 - α equals the desired confidence level, e.g., 95%) = 1.96

e is the desired level of precision = 0.05

p is the estimated proportion of an attribute that is present in the population = 0.43 (Karimurio, 2000)

q Is 1-p = 0.57

$$n_o = \frac{(1.96^2)(0.43)(0.57)}{0.05^2}$$

= 376

Since the sample size was small, it was adjusted using finite population for proportions. Basing on the hospital records (2016 to 2018), averagely 226 patients are seen per month. The sample size was therefore adjusted using the equation:

$$n = \frac{n_o}{1 + \frac{(n_o - 1)}{N}}$$

$$= \frac{376}{1 + \frac{(376 - 1)}{226}}$$

= 144 patients.

3.7 Data collection tools

A structured questionnaire was used to collect data and it was divided into three parts: data on demographic and economic characteristics; data on nutritional knowledge and data on nutrition practices. Quantitative data on food frequency and diet diversity was collected using food frequency table and dietary diversity score sheet. The first section required responses about the patients demographic and economic characteristics; age group, gender, residence, education level and income aspects. Secondly, in the nutrition knowledge section, questions were tailored to assess the patients' basic knowledge on nutrition and cataract relationship and there were multiple choices for responses. This section did not assess the complex aspects of specific nutrients and their relationship with cataract. In the third section, nutrition practices were assessed using a food frequency table and dietary diversity score sheet.

A food frequency table can be used to measure the general usual intake of a specific food over a certain period of time. In this study, respondents were asked to report frequency of a list of foods in a specified period of time (e.g. once per day). The food frequency table was adopted and modified from Muthike *et al.*, (2015) whose study assessed nutritional knowledge in association with dietary practices of cancer patients. This table was considered because of the food group classifications that were relevant to this study.

Assessment of dietary diversity was accomplished by a dietary diversity questionnaire; a user-friendly and low cost assessment tool consisting of a simple count of food groups that a respondent has consumed over specific time frames such as the preceding 24 hours. There are other various timeframes for recall that are valid, such as the previous 3 or 7 days, and in the case of some foods, the previous month (FAO, 2010).

3.8 Data collection procedure

First and foremost, the researcher did a brief introduction of the study after creating rapport with the respondents and sought for their informed consent. A face to face interview was conducted in the refraction room (which was made available for the researcher by the hospital) where activity was minimal in order to ensure a comfortable and private environment for the respondents. Data was collected from the respondents by asking them the questions listed in the questionnaire. The responses were filled in the structured questionnaire for each respondent after which the researcher thanked the patients for their participation in the study. Data collection materials and questionnaires were stored in secure plastic folders.

3.9 Test of validity

Validity of an instrument refers to how well the instrument measures what it is supposed to measure. According to Bolarinwa (2015), the usual procedure in assessing the content validity of a measure is by the use a professional or an expert in a particular field. Validity of the research instrument was ensured first by giving to a panel of competent researchers in the field of nutrition at Masinde Muliro University of Science and Technology (MMUST) and their feedback was put into consideration e.g. consistency of the formatting of the questionnaire with the variables of the study. Furthermore, in order to ascertain that the research instruments were reliable and valid in meeting the study objectives, a pretest was conducted prior to the main study on patients attending Kisumu eye clinic. Patients attending this clinic did not come to Sabatia Eye Hospital for further medical examination. A test sample of 10% of the study sample size was used (i.e. 14 patients) from the eye clinic were interviewed voluntarily during the pre-testing of the questionnaire. During the pre-test, the time taken to complete a questionnaire was noted besides the comprehension of questions and this was used to modify the tools accordingly.

The pre-test results were analyzed and used to improve on the content of the tools in terms of both content and structural validity. The patients used in the pre-test did not form part of the actual study.

3.10 Test of reliability

Reliability is the degree to which an assessment tool produces stable and consistent results. To ensure this, the respondents were subjected to the same types of questions during the same period of time. Consistency of the data instrument was tested by administering the instrument twice to the respondents to check on the uniformity of their responses. Using Statistical Package for Social Sciences (SPSS) version 20, Cronbach's alpha was used to strengthen the reliability of the assessment tool and the reliability coefficient was found to be 0.701. A Cronbach reliability coefficient of .70 or higher is considered acceptable (Thomas, Silverman & Nelson, 2015).

3.11 Data analysis

Data was entered, coded and cleaned using SPSS version 20. Each response from the questionnaire was assigned numerical values for the purposes of analysis. Descriptive statistics (frequencies and percentages) were computed for demographic and economic data as shown in table 3.1 below. Analysis was stratified by age, gender, knowledge score, and nutritional practices. For the preliminary analysis of the responses on the knowledge questions, scoring was done to indicate that the patient either 'knows' or 'does not know'. If the question had a single correct answer, the options were either knows or does not know. If the question had several correct answers; the options were 'knows' (if the respondent gave one, some or all possible correct answers) or 'does not know' if the respondent gave no correct answers. The number of correct responses was then totaled to indicate the number of correct answers provided. The indicators used to quantify knowledge were percentages i.e. the percentage of the respondents

who knew or did not know the correct answer to a question. The mean score (average) was then used to determine the knowledge levels among the respondents. Two levels were used i.e. those who scored above average and those who scored below average.

In this study, the indicator of food frequency of the specific food items was the percentage of respondents who consumed that specific food item over the specified time period. The indicator of dietary diversity, the dietary diversity score (DDS), was calculated by summing the number of food groups consumed by the individual respondent over a 24 hour recall period. The indicators of food intake (specific food groups) were reported in terms of number/ percentage of respondents consuming specific food items or food groups the previous day e.g. number or percentage of respondents who consumed at least one vitamin-A-rich fruit the previous day.

Pearson's correlation coefficients at 0.05 significance level was computed to determine if nutritional knowledge was associated to practice (food frequency and dietary diversity) and if IDDS was associated to income level. Table 3.1 below is a summary of the data analysis of this study.

Table 3.1.
Summary of Data Analysis

Demographic and socio-economic characteristics		
Variables	**Description**	**Data analysis**
Gender	Male or female	Frequency
Age	Categories of age	Frequency
Number of visit	1st, Follow up visit	Mode
Education	Level of education	Frequency
Income	Amount of money received in a month	Percentage, Pearson's correlation with dietary diversity
Nutrition knowledge		
Nutritional knowledge	Knowledge score	Percentage, mean Pearson's Correlation
Nutritional Practices		
Food Frequency	No of times a type of food is consumed	Frequency, Percentages
Dietary diversity	Variety of foods taken in a certain period	Frequency, Percentages Pearson's Correlation
Use of nutritional supplements	Type and Utilization	Frequency/percentages

Findings from the various variables of the study were presented using tables and figures.

3.12 Logistical and ethical considerations

Approval for this study was sought from MMUST Directorate of Post graduate studies (Appendix IV). Research clearance was sought from MMUST Institutional Ethical Review Committee (IERC) (Appendix V) and a research permit obtained from National Commission for Science Technology and Innovation (NACOSTI) (Appendix VI). The researcher also sought permission from the hospitals' administration (Appendix VIII).

Participation consent was sought from the respondents after clearly explaining the objectives of the study. The information obtained from the respondents was encrypted and handled with confidentiality. The patients who took part in the study did so voluntarily and the choice of the respondents was also respected in case they decide not to take part in the study in order to address the principle of autonomy.

The researcher upheld the principle of beneficence/maleficence by ensuring that the entire process brought no harm and maximized research benefits while minimizing any risks to the participant. The researcher also addressed the principle of justice by being readily available to assist the respondents so that their time was not wasted and treated the respondents equally. Additionally, the participants were selected using the criteria outlined in the study for the purposes of research and not basing on the ease of obtaining consent. Every participant had an equal chance of taking part in the study. Lastly, there were no incentives for taking part in the study and the participants were informed that the study was solely for purposes of academic requirements.

CHAPTER FOUR

PRESENTATION OF RESULTS

4.1 Introduction

This chapter presents the results of the study conducted among cataract patients attending Sabatia Eye Hospital, Kenya on nutritional knowledge and practices. The chapter is organized by the presentation of subsequent findings from analyses as per objective. This study did not report any missing data.

4.2 Demographic and economic characteristics among cataract patients attending Sabatia Eye Hospital, Kenya

4.2.1 Demographic characteristics

The study asked the respondents to indicate their demographic characteristics based on their gender, age bracket, highest education level and their residence. A total of 59% (n=83) of the respondents were female and the most represented age group was 60 years and above with a frequency of 116 (80.6%). Those aged 50-59 years were about 13.9% (n=20) while the remaining were below 49 years of age (n=8, 5.6%). Majority of the respondents (n=69, 47.9%) attained only primary school education followed by 20.1% (n=29) who attained secondary school education. 16.7% (n=24) of the respondents reported to have never gone through any formal education. In terms of residence, more than half of the respondents (n=78, 54.2%) resided in the Western region of the country while 21.5% (n=31) and 24.3% (n=35) were from Nyanza and Rift valley regions respectively. The table 4.1 below is a summary showing the demographic characteristics of the respondents.

Table 4.1.
Demographic Characteristics

DEMOGRAPHICS	FREQUENCY	PERCENTAGE (%)
GENDER	N=144	
Male	59	41
Female	85	59
AGE		
<30 years	2	1.4
30-39years	1	0.7
40-49 years	5	3.5
50-59 years	20	13.9
60 years and above	116	80.6
EDUCATION		
Primary school	69	47.9
Secondary school	29	20.1
College	17	11.8
University	5	3.5
None	24	16.7
RESIDENCE		
Western region	78	54.2
Nyanza region	31	21.5
Rift valley region	35	24.3

4.2.2 Economic Characteristics

In order to establish the economic characteristics of the respondents; sources of income and income level were assessed.

4.2.2.1 Respondents source of Income

Figure 4.1 below gives a picture of the representation of the respondents' source of income. They were either salaried (n= 18, 12.5%), farmers (n=68, 47.2%), owning a business (n=24, 16.7%) or had some form of other support like pension or support from family members (n=34, 23.6%).

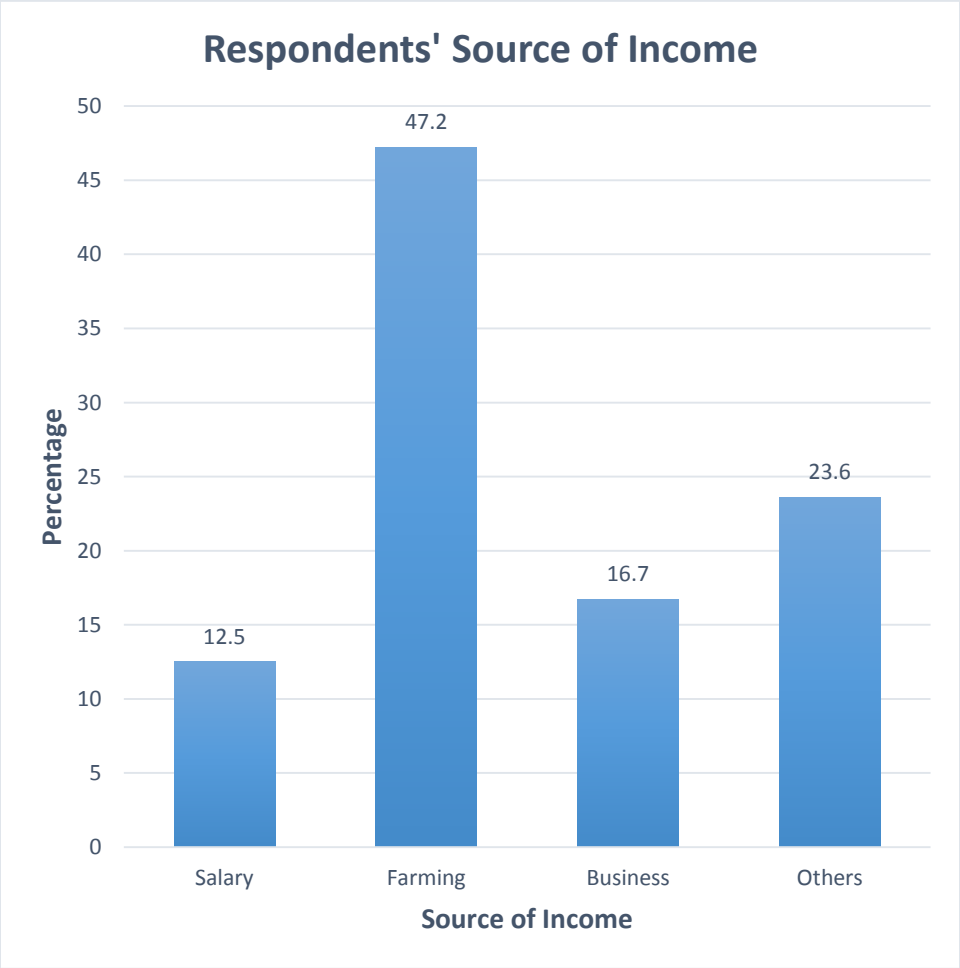

Figure 4.1. Patients Source of Income

4.2.2.2 Monthly Income Level

Figure 4.2 below shows the monthly income level classifications that the respondents fall under. There is a downward trend as the income class increases depicting a poor economic status among majority of the patients. About half (n=71, 49.3%) of the respondents received less than 5,000 shillings per month and 32.6% (n=46) received between 5,000-10,000 shillings per month. Very few, 4.9% (n=7), were able to receive more than 20,000 shillings per month.

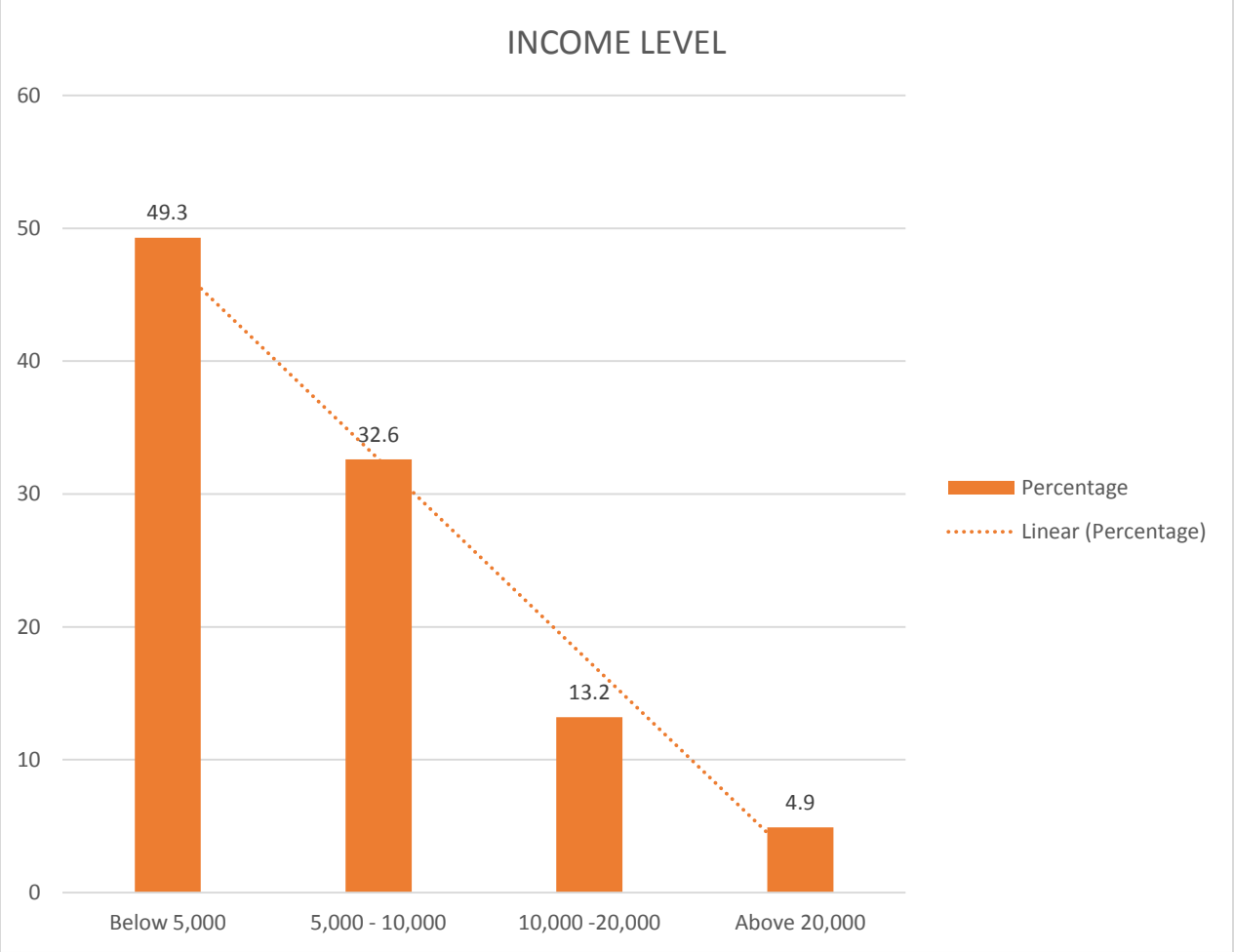

Figure 4.2. Monthly Income Level

4.3 Nutritional Knowledge levels among cataract patients attending Sabatia Eye Hospital, Kenya

The level of nutrition knowledge was determined using multiple choice questions concerning different aspects of nutrition including: factors leading to cataract progression, relationship between diet and disease, foods that contribute to cataract progression and foods that delay cataract progression. For each question, a correct response (indicating that the patient knows) was coded as 1 and an incorrect question (indicating that the patient does not know) as 0. The total score was calculated from all the correct responses. This was then converted to a percentage. Those who scored below the mean score were categorized as having low nutrition knowledge, while those who scored above the mean score were categorized as having high nutrition knowledge. Table 4.2 below is a summary of the number of knowledge items and the proportion of the respondents with correct answers in various nutrition knowledge aspects.

Table 4.2.
Proportion of the respondents with correct answers

Nutrition Knowledge aspect tested	**No. of Items**	**% who gave correct answers**
Factors leading to cataract progression	4	67.4% (n=97)
Relationship between diet and disease	2	78.5% (n=113)
Foods that delay cataract progression	4	55.6% (n=80)
Foods that promote cataract progression	4	**27.8%** (n=40)

The first section assessed patients knowledge on factors associated with cataract progression. About 32.6% (n=47) of the patients could not point out any of the factors known to lead to cataract progression. 22.9% (n=33) associated it with age, 27.1% (n=39) associated it to diabetes or hypertension, and 9.0% (n=13) linked it to unhealthy eating lifestyle while the remaining 8.3% (n=12) pointed out excessive alcohol consumption and smoking.

On the relationship between diet and disease, 78.5% (n=113) of the patients pointed out that healthy diet is important for eye health while the remaining 21.5% (n=31) did not know. Section two checked on the patients' knowledge on foods that have a positive (delaying) effect on cataract progression. Majority of the patients (n=80, 55.6%) selected daily intake of fruits and vegetables as the best foods while 38.2% (n=55) were not certain hence selected none. Two point eight percent (n=4) and 3.5% (n=5) chose high intake of fatty meats and refined cereals respectively. However, on the section that tested the patients' knowledge on foods that promote cataract progression, 50% (n=72) of the patients were not certain of the food group to select. A total of 27.8% (n=40) selected high intake of fatty meats while 20.8% (n=30) selected whole cereals and the remaining (n=2, 1.4%) selected fruits and vegetables depicting better knowledge levels amongst about a quarter of the patients. The correct scores for all the sections were computed for each individual respondent and were used to determine the mean and median scores i.e. mean score of 56.1, a median score of 50 and standard deviation of 0.2885. The mean score was slightly higher than the median score indicating a weak positive skew in the distribution of the data. The standard deviation showed that there were no major deviations from the mean. Table 4.2 below highlights the summary of the knowledge scores for the mean, median and standard deviation.

Table 4.3.
Knowledge Scores

Knowledge score		
N	Valid	144
Mean		56.1
Median		50.0
Std. Deviation		0.2885

The mean score (average) was then used to determine the knowledge levels among the respondents. Two levels were used i.e. above average and below average. The patients who scored above average in terms of knowledge were 42.4% (n=61) while slightly more than half scored below average (mean =56.1) i.e. 57.6% (n=83) as shown in table 4.3 below. This indicated that basic knowledge on nutrition and cataracts exists but not to all the patients.

Table 4.4.
Knowledge Group

Knowledge group	**Frequency**	**Percentage**
Below average	83	57.6
Above average	**61**	**42.4**
Total	144	100

4.3.1 Sources of Nutritional Knowledge on Food Choices

The patients were required to identify their source of information on food choices concerning eye health and the results are as shown in table 4.4 below. Those who obtained their information from doctors were 11.8% (n=17) while those who received it from the eye specialists were 0.7% (n=1). A few (14.6%, n=21) were able to consult a nutritionist and some (7.6%, n=11) other media such as radio or other social media. The study findings indicated that the social environment is very key in influencing ones food choices since 65.3% (n=94) of the respondents selected 'other'. When asked to specify 'other' some pointed out avenues such as family and friends and group meetings.

Table 4.5.

Source of Information on Food Choices

Source of Information	Frequency	Percent (%)
General Practitioner	17	11.8
Eye specialist	1	0.7
TV/Newspaper/other social media	11	7.6
Nutritionist	21	14.6
Other	94	**65.3**

4.4 Nutritional practices among cataract patients attending Sabatia Eye Hospital, Kenya

4.4.1 Food Frequency

The respondents' food frequency intake was assessed using a food frequency questionnaire adapted and modified from a prior study. The foods were divided according to their nutrient contribution to the body such as antioxidants, phytochemical; their classification such as fats, fiber, vitamins, trace elements; and also as meats: red and white meat; and alcohol. All these groups have a component that is directly or indirectly related to cataract as identified in the previous chapter.

In the antioxidant category, green leafy vegetables were the most consumed at a frequency of once per day at 66.7% (n=96) and 23.6% (n=34) consuming the same more than once per day. More than half of the respondents consumed oranges and egg yolks twice per month or less (n=81, 56.9% and n=74, 51.4% respectively) while close to half of the respondents never consumed lemons and raw carrots (n=67, 46.5% and n=61, 42.4% respectively). The most consumed phytochemical food source at a frequency of 3 to 6 times a week was beans by about 82 of the respondents; (56.9%) followed by lentils at 13.2% (n=19) at the same frequency. More than half (n=74, 51.4%) of the patients reported to never use the polyunsaturated or monounsaturated cooking oil likely because of its cost implication. However, 41% (n=59) used it at least once per day.

The most consumed fiber food sources were the whole grains, consumed once per day by 82.6% (n=119) of the respondents. Frequency of fruit consumption was highest on once per day basis (n=49, 34.7%) and 3-6 times per week by about 47 of the respondents (32.6%). Sadly, seeds were least consumed fiber food sources because 68.1% (n=98) of the patients reported to dispose seeds and not consume them. Under the trace elements section, cereals were the most consumed

(n=138, 95.6%) on a once per day basis followed by milk at 67.4%. Maize was the most consumed cereal followed by rice. Notably, the patients who reported to consume milk on a once per day basis said to consume it in the form of milk tea. These were 67.4% (n=97) of the patients. Most of the meats (fish, beef, chicken) were consumed at a frequency of twice per month or less except mutton of which 92.4% (n=133) of the patients never ate. Few patients treated themselves to alcoholic drinks once or twice per week (n=9, 6.3%) or twice per month or less (n=13, 9.7%). Table 4.6 below is a summary of the findings on food frequency.

Table 4.6.

Food Frequency Table

Food item as the source of:	**Once per day (%)**	**>once per day (%)**	**3-6 times per week (%)**	**1or 2 per week (%)**	**Twice per month or less (%)**	**Never (%)**
Antioxidants: Oranges	2.1	0	4.2	4. 9	56.9	31.9
Green leafy vegetable e.g. lettuce	66.7	23.6	0	8.3	1.4	0
Eggs (yolks)	0	0	31.9	4.2	51.4	0
Lemons	13.9	0.7	5.6	2.8	30.6	46.5
Raw carrots	2.1	0	8.3	0.7	46.5	42.4
Grapes	0.7	0	0.7	0	6.9	91.7
Garlic	25.0	2.1	9.7	1.4	30.6	31.3
Phytochemicals						
Peas	0	0	1.4	0	9.7	88.9
Lentils	0	0	13.2	3.5	53.5	29.9
Beans	0.7	0	56.9	13.9	20.8	7.6
Soybeans	0.7	0	7.6	0	21.5	70.1
Unsatured cooking oil						
Elianto, rina, olive or soya oil	41.0	2.8	1.4	0.7	2.8	51.4
Fiber: Fruit	34.7	4.9	32.6	16.0	11.1	0.7
Whole grains	82.6	3.5	2.8	6.9	3.5	0.7
Whole meal porridge	25.0	2.1	17.4	2.8	47.9	4.9
Seeds	3.5	0.7	4.9	1.4	21.5	68.1
Trace elements Zn,copper,Calcium:						
Meat	0	0	6.3	0.7	63.2	29.9
Cereals	95.6	2.8	0.7	0.7	0	0
Fish	1.4	0	25.7	6.3	60.4	6.3
Milk /yoghurt	67.4	1.4	9.7	5.6	14.6	1.4
Red meat:						
Beef	0	0	14.6	1.4	72.9	11.1
Mutton	0	0	0.7	0	6.9	92.4
White meat:						
Chicken	0	0	3.5	1.4	85.4	9.7
Fish	1.4	0	25.7	6.3	60.4	6.3
Alcoholic drink: wine/beer/vodka	0	0	6.3	0.7	9.7	83.3

4.4.2 Individual Dietary Diversity

The food groups that were looked at include: cereals, white roots and tubers, carotene rich vegetables and tubers, dark green leafy vegetables, other vegetables, vitamin A rich fruits, other fruits, organ meats, flesh meats, eggs, fish, legumes, nuts and seeds, milk & milk products and oils & fats; a total of 14 food groups. The most consumed food groups were cereals by all the respondents (100%), dark green vegetables (n=143, 99.3%), other vegetables by 93.8% (n=135), milk and milk products (n=124, 86.1% and oils and fats (n= 141, 97.9%). Table 4.6 below gives the percentage of patients who had access to the individual food groups.

Table 4.7.
Percentage of Respondents per Food Group

Food Group	N	Yes (%)
Cereals	144	100
White roots and tubers	20	14
Carotene rich vegetables & tubers	16	23
Dark green leafy vegetables	143	99.3
Other vegetables	135	93.8
Vitamin A rich fruits	18	13
Other fruits	32	22
Organ meats	25	17.4
Flesh meats	16	11.1
Eggs	27	18.8
Fish	28	19.4
Legumes, nuts and seeds	105	72.9
Milk and milk products	124	86.1
Oils and fats	141	97.9

The food groups that are rich in nutrients indicated to have a delaying effect on cataract progression such as carotene rich vegetables and tubers, vitamin A fruits, eggs and other fruits had the least scores. The graph below (figure 4.5) was derived from the table 4.6 above to give a distinctive pictorial representation of the patients' responses on the select food groups. Majority of the patients did not eat from carotene rich vegetables, other fruits, organ meats and eggs which are rich sources of primary antioxidants in boosting plasma antioxidant capacity.

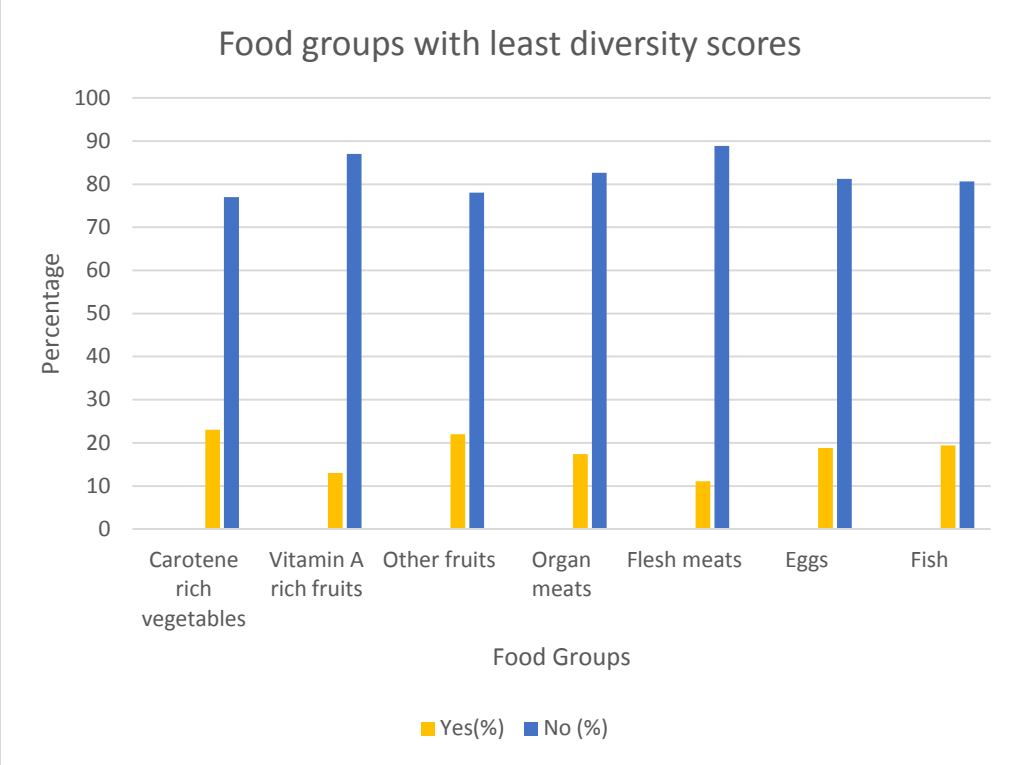

Figure 4.3. Food Groups with the least diversity scores

DDS was calculated by summing up the number of unique food groups consumed during the past one week as described by FAO, (2009). If an individual ate any quantity of any food group at least once per day, it was taken into count. Therefore, DDS was calculated without considering a minimum intake for the food group. The minimum Individual Dietary Diversity Score (IDDS) was 3 and maximum 10. The mean IDDS was 6.5 with a standard deviation of 1.37.

Distribution of the patients by dietary diversity score was as follows in table 4.6 below using FAO cut off points of 1997. Majority of the respondents (74.3%) had a moderate diversity score while only 23.6% had a high dietary diversity score.

Table 4.8.
Dietary Diversity Score Distribution

Dietary Diversity Score	**CLASSIFICATION**	**FREQUENCY**	**%**
1-3	Low	3	2.1
4-7	Moderate	107	74.3
8 and more	High	34	23.6

4.4.3 Use of Nutrient Supplements

The respondents were required to indicate whether they had used any nutrient supplements and if so, how often. The figure 4.3 below displays the frequency of the use of nutrient supplements by the patients. About 6% (n=9) of the respondents explained to use nutrient supplements at the frequency of once in a while and identified them as either multivitamin supplements or B-complex vitamin. The remaining 94% (n=135) did not use nutrient supplements at all. The researcher expected responses on nutrient specific supplements e.g. vitamin E supplements or a combination of various nutrients.

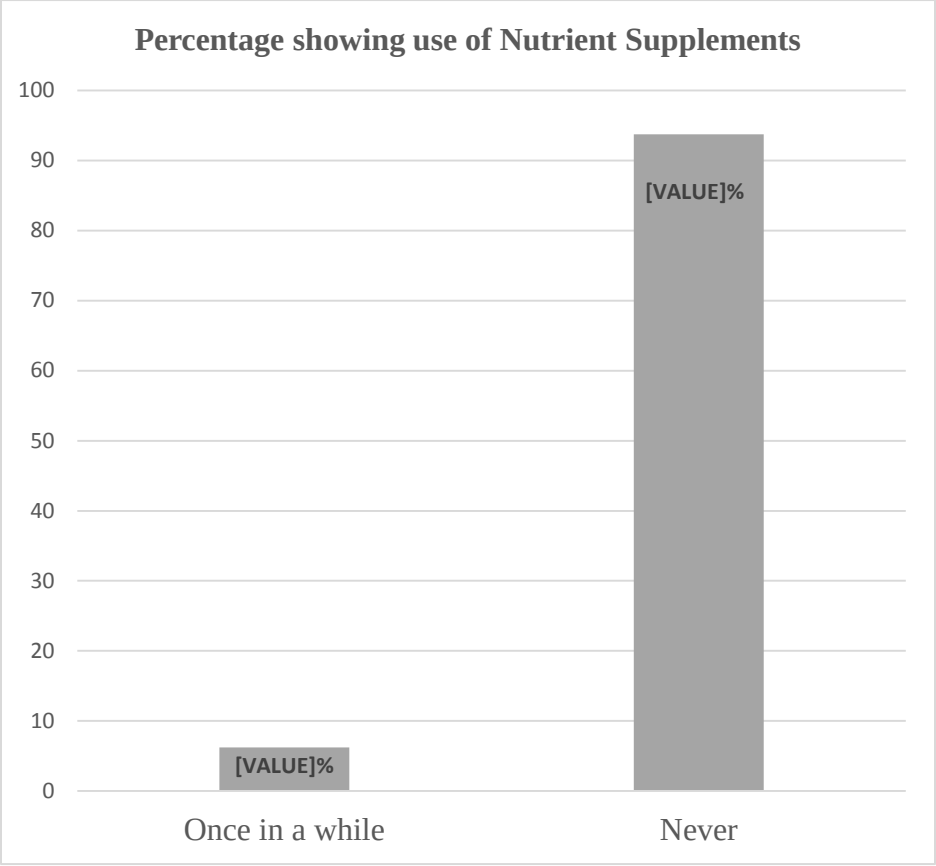

Figure 4.4. Frequency of Use of Nutrient Supplement

4.5 Relationship between Nutritional Knowledge and Practices

This study went a step further to find out the nature of relationship between nutritional knowledge and frequency of food intake; relationship between nutritional knowledge and dietary diversity and relationship between IDDS and income level.

4.5.1 Nutritional Knowledge and Frequency of Food Intake

A Pearson's product moment correlation was computed to assess the relationship between nutritional knowledge and frequency of food intake. There was a negative association between nutritional knowledge and orange and raw carrot intake; (*r (144) =-.259, p=.002)* and *(r (144) =-.221, p=.008)* respectively. No significant associations were found between nutrition knowledge and frequency of other antioxidant rich foods. Additionally, there was no statistical significant association between knowledge and the other food groups in the food frequency table. Table 4.9 below therefore summarizes the correlations between nutritional knowledge and frequency of antioxidant-rich food intake where associations were significant. ** indicates correlation is significant at the 0.01 level (2-tailed).

Table 4.9.
Relationship between Nutritional Knowledge and Frequency of Antioxidant-rich Foods Intake

Nutrition Knowledge Score	Pearson correlation	Significance
Oranges	**-.259****	.002
Green leafy vegetables	.127	.131
Egg yolks	-.099	.236
Lemons	-.142	.090
Raw carrots	**-.221****	.008
Grapes	-.130	.119
Garlic	-.159	.057

4.5.2 Relationship between Nutritional Knowledge and Individual Dietary Diversity Score

Pearson's' product moment correlation was also run in order to find out the nature of relationship between nutritional knowledge and IDDS. Correlation between nutritional knowledge and IDDS was found to be significant, *(r(144)=.243, p=.003)* meaning that there was a positive association between nutritional knowledge and IDDS such that as the knowledge level increased so did the dietary diversity score as shown in table 4.10 below:

Table 4.10.

Relationship between Nutritional Knowledge and Dietary Diversity Score

			IDDS	**NK**
Pearson's Correlation	IDDS	Correlation Coefficient	1.000	.243**
		Sig. (2-tailed)	.	.003
		N	144	144
	Nutrition knowledge score	Correlation Coefficient	.243**	1.000
		Sig. (2-tailed)	.003	.
		N	144	144

**. Correlation is significant at the 0.01 level (2-tailed).

4.5.3 Relationship between IDDS and Income level

Relationship between IDDS and the income level was also computed using Pearson's correlation. Correlation between IDDS and income level was found to be significant, *(r (144) = .334, p=0.001)* meaning that there was a positive association between income level and IDDS such that as income level increased so did the dietary diversity score as shown in table 4.11 below.

Table 4.11.
Relationship between IDDS and Income level

			IDDS	Income level
Pearson's correlation	IDDS	Correlation Coefficient	1.000	.334**
		Sig. (2-tailed)	.	.000
		N	144	144
	Income level	Correlation Coefficient	.334**	1.000
		Sig. (2-tailed)	.000	.
		N	144	144

**. Correlation is significant at the 0.01 level (2-tailed).

CHAPTER FIVE

DISCUSSION OF THE RESULTS

5.1 Introduction

This study involved 144 cataract patients attending Sabatia Eye Hospital and sought to assess their nutritional knowledge and practices. The patients had either nuclear cataract, cortical cataract or posterior sub-capsular cataract (PSC), and were either on follow up or on their first visit for at least one lens. This chapter discusses the results of the study and provides a comparison between this study's findings and how they relate with those of studies already done including those reviewed in chapter two of this manuscript. The results are discussed per objective.

5.2 Demographic and Economic characteristics among cataract patients attending Sabatia Eye Hospital, Kenya

In this study, respondents aged above 60 years formed the majority. Age, besides other factors such as exposure to ultraviolet light, corticosteroid use and smoking is a recognized risk factor associated with cataract formation, (Rautiainen *et al.*, 2014). Also, 59% of the respondents were female, a percentage slightly higher than the males. Similar findings were by Nirmalan *et al.*, (2004) who besides reporting that those aged >70years were 79.4% of the respondents; their study also indicated that males (45.3%) had lower odds for cataract than females (54.9%). Majority of studies related to cataract have found that more women have cataracts than men according to a systematic review on barriers to cataract surgery (Aboobaker and Courtright, 2016). Lee and Afshari, (2017) gave possible explanations such as women having more health seeking behaviour than men or women living longer than men thereby having more time to develop cataracts. According to a study by Rius *et al.*, (2012) that investigated this by controlling

for age, women were still found to have higher rates of cataract than men. The same study also indicated a correlation between visual impairment and lower education levels and the results of this study support this finding since almost half of the patients had attained only primary education while some did not have any formal education.

Majority of the patients came from the Western region while a few from the rift region. This is probably because of the many outreach programs that have been conducted in this region thereby encouraging most of the residents to seek eye healthcare. Murthy *et al.,* (2012) and Kempen, (2011) brought it out clearly that besides satellite clinics, outreach programs have also been effective in the provision of education and eye care in the rural/remote areas in the developing countries.

This study also established the income sources and income levels of the respondents. Majority were farmers at a small scale level. This can also be explained by the fact that majority of the respondents were residents of Western region, which is known for agricultural activities mainly farming with maize as the main crop grown. Studies have also shown that people with low vision had less income (Nirmalan *et al.,* 2004). About 49.3% of the respondents received less than 5000 shillings per month while only 4.9% received more than 20, 000 shillings per month. Caulfield *et al.,* (1999) states that cataract risk has been shown to increase even with low socioeconomic status. This could be explained by the inability to access treatment because of the cost implications. According to Lee and Afshari (2017), the cost of surgery is still a barrier to treatment and it represents a significant expenditure for those in lower socio-economic levels.

5.3 Nutritional Knowledge among cataract patients attending Sabatia Eye Hospital, Kenya

All the items evoked different responses from the respondents but indicated that most of the patients had an idea of the role of nutrition in eye health. Widespread knowledge was seen in the relationship between diet and disease.

5.3.1 Nutritional Knowledge

According to Worsely and Anthony (2002), measurement of nutrition knowledge is slightly more complex than summing up simple true or false scores. Using validated methods, it is possible to ask questions and count the number of correct answers in order to assess knowledge and distinguish true from false beliefs. In this study, majority of the patients had knowledge that healthy diet is a key component for promoting eye health as evidenced by Delcourt *et al.,* (2004); Raman *et al.,* (2016). A mean score of 56.1 indicated good knowledge levels among the patients with 42.4% scoring a general score above average. Similar to the findings of this study, a study on nutrition related knowledge and attitudes reflected in lifestyle and health among elderly people across five European countries found that a significant higher proportion of the participants had good nutrition related knowledge when they were of younger age (<75 years); had a higher level of education (college and university) and lived in a suburban area, (Jeruszka-Beliak *et al,* 2018). Another study on nutritional knowledge and nutritional status among diabetes type 2 patients in Kikuyu Mission hospital, Kenya revealed low nutritional knowledge (69.3%) and a high prevalence of obesity among the respondents unlike this study. The mean nutrition knowledge score was 32 ± 13 and the median was 30. The minimum score was 15 percent while the maximum score was 68 percent. In the knowledge section, questions tested the respondents on knowledge on food sources of foods that help control the blood sugar, foods rich

in vitamin C, foods rich in vitamin A and low glycemic index foods; factors considered when choosing food and the meaning of a balanced diet. (Wahome and Kiboi, 2016)

Knowledge on factors that lead to cataract progression was good since more than half of the respondents gave correct responses. Theorodopoulu *et al,* (2014) explains the relationship between foods loaded with vitamins and minerals and foods with high fat or cholesterol levels and cataract development and progression. However, half of the patients did not know the foods that could be responsible for the progression of cataract development.

5.3.2 Sources of Knowledge on food choices

A study on the self-reported clinical practice behaviors of Australian Optometrists as related to smoking, diet and nutritional supplementation indicated that only 62.2% (n=176) of the practitioners counselled their patients on matters diet. Those who did it on a routinely basis were almost 40 percent of the practitioners. In addition, their findings did not find any significant association between the gender of the practitioner and counselling on diet ($p>0.05$) (Downie and Keller, 2015), an aspect this study excluded. Majority of these practitioners (n=227, 80.2%) also reported to recommend for nutritional supplements. Similarly, in this study such a minimal percentage of the respondents reported to get advice regarding nutrition from the eye specialists. This could be because of a relatively weak understanding of the importance of nutrition for eye health or that dietary assessment is perceived as complex and beyond the scope of routine practice for them.

The sources of information on food choices regarding eye health care showed that besides nutritionists and general doctors, the social environment of an individual has an impact on decision making. More than half of the respondents attributed their sources of information to

family and friends, church group gatherings and common community forums such as women groups. However, the eye specialists did not give much advice regarding food choices thereby depicting a need for empowerment on nutrition related matters that could have a positive impact on their patients' health. This is because of the lack of simple nutrition evaluation tools among ophthalmic practitioners to effectively address key aspects of diet that are crucial for health. Addressing this issue, along with providing associated education programs, may enable such discussions about diet and nutrition to be implemented more readily into optometric practice.

5.4 Nutritional practices among cataract patients attending Sabatia Eye Hospital, Kenya

The nutritional practices that this study looked at include food frequency intake of various foods, dietary diversity and use of nutrient supplements.

5.4.1 Food frequency

A significant and growing body of observational research suggests that an appropriate nutritional intervention may offer a way to decrease the risk of cataract according to Weikel *et al.*, (2014). Accordingly, the association between cataract progression and nutritional exposure is a matter of great scientific interest. This study established the food frequency intake of foods categorized into the following groups: antioxidants, phytochemicals, fats, fiber, vitamins, trace elements, red and white meat and alcoholic drinks. Dietary antioxidants (vitamins C, E and beta carotene) are found mainly in fruits and vegetables. A case-control study on healthy eating index in patients with cataract by Matin *et al.*, (2014) assessed the dietary intake of respondent's using food frequency questionnaire which included consumption frequency of 147 foods per day, week, month or year. In addition, amount of nutrient was estimated and converted to grams for each individual, contrary to this study. Ravindran *et al.*, (2011) in a cross-sectional analysis of elder Indians n= 5,638 found that those respondents with highest plasma levels of vitamin C had a reduced risk of cortical cataract by 35% when compared with those having low plasma levels.

In this study, the most consumed antioxidant food source were the green leafy vegetables with 66.7% and 23.6% consuming once per day or more than once per day respectively. The consumption and utilization of vegetables could be because the vegetables were in season and their prices were lower. Their popularity in consumption could also be because of familiarity with them. The most identified vegetables were pumpkin leaves, spider plant (saget), solanum

(managu), amaranth, crotalaria (mito) and jute (mrenda) which were available because of the rainy season.

Kigaru *et al.*, (2015) in their study on nutrition knowledge, attitude and practices among urban primary school children in Nairobi City, Kenya assessed food frequency using a 7 day food frequency questionnaire. Regarding the consumption of fruits, only 9.4 % reported to have consumed fruits 4–7 times in the previous 7 days prior to data collection as reported from food frequency questionnaire. About 33.2 % had consumed fruits 2–3 times in 7 days while 48.5 % had consumed fruits only once in 7 days. Nutrition knowledge had no significant relationship ($P > 0.05$) with dietary practices.

Oranges, egg yolks and raw carrots were mostly consumed at a frequency of twice per month or less indicating that they could be having very little effect on the plasma antioxidant capacity. Bohn, (2008) when looking at bioavailability of non-pro-vitamin A carotenoids stated that the major factors that influence the absorption of carotenoids including lutein and zeaxanthin from food include the nature of the food matrix, e.g., in natural format, cooked or supplement, the amount and nature of the dietary fat, which aids in the solubilisation of released carotenoids, the phospholipids, dietary fiber and lastly the nature of carotenoids. Garlic onions are rich in sulphur which is necessary for the production of glutathione (Jacques *et al.,* 2005), an important antioxidant necessary for the maintenance of healthy sight yet they were among the less frequently consumed foods.

Majority of the respondents never consume peas and soybeans while lentils were eaten twice per month or less. Soy contains essential fatty acids, phytoestrogens, vitamin E and natural anti-inflammatory agents. One of the reasons for the low intake of most phytochemicals and antioxidant food sources was that they are expensive. Unsaturated fats were frequently used on a

once per day basis by 41% of the respondents indicating good practices on use of unsaturated fats versus use of saturated fats among the rural population. 82.6% of the respondents consumed whole grains on a daily basis the main food being ugali. Majority of the residents in the western region have been reported to consume ugali as a favorite meal on a daily basis. Moeller *et al.*, (2004) indicated that consumption of whole grains can reduce lens opacity. However another study showed that people with high intake of carbohydrates are at risk of cortical cataract, Chiu *et al.*, (2005).

The recommended fruit intake is on a daily basis. However, only 39.6% managed to consume fruits on a daily basis. When patients were asked to indicate their seed intake, majority of them were surprised and 68.1% indicated that they threw away the seeds from their meals e.g. pumpkin seeds. Zhang *et al.*, (2015) however showed that dietary seed intake to have a delaying effect on the progression of cataract indicating that the patients could be missing out on this.

Trace elements such as zinc, selenium, copper or calcium were mostly obtained from cereals on a daily basis followed by fish (25.7%) consumed on a once or twice per week frequency. Milk was consumed by a larger proportion of the respondents but mostly in the form of milk tea. Respondents who indicated to take milk on a once per day frequency indicated that it was in form of milk tea. Most patients were farmers with cows which provided milk daily for household consumption. Yan *et al.*, (2016), on the risk of tea and age related cataracts found a significant protective role of tea ingestion against cataracts in older people. The results of the study indicated that average daily intake of two cups of tea with a moderate concentration may inhibit ARC. Tea extracts have flavonoids which inhibit free radical generation and also scavenge for free radicals and are considered to be more effective than antioxidants from fruits and vegetables (Vinson *et al.*, 1995). Furthermore, their study focused on green tea and black tea but did not

point out whether respondents were consuming milk tea too. The same study pointed out that the protective effect of tea on cataracts might be dependent on its concentration. Mutton was rarely reported for consumption probably because of little preference over beef as red meat choice for the respondents. Chicken was also consumed twice per month or never by 85.4% of the respondents. It is considered a ceremonial meal in the western region thereby this could explain why it is rarely consumed.

5.4.2 Dietary diversity

Dietary diversity consisting of food groups classified as sources of energy (cereals, tubers, roots), protein providers (pulses, solid food of animal origin), mineral suppliers (pulses, other legumes, vegetables, solid food of animal origin, milk), and vitamin sources (vegetables, green vegetables, fruits, solid food of animal origin) can be recommended as the indicator of healthy diet. Individual dietary diversity (IDDS) is a proxy measure of the nutritional quality of an individual's diet and more particularly the micronutrient adequacy of a diet (LaVicchia and Tavani, 2001). Rathnayake *et al.*, (2012) in their study using a single 24 hour recall concluded that dietary diversity score is a useful proxy indicator of nutrient adequacy of rural elderly people and the performance of indicators improves when quantity of food consumed is considered. One of the limitations of this study is that it did not include the quantities of foods when estimating the dietary diversity score. Dietary diversity score was based on 14 groups to determine the proportion of respondents scoring low, average and high scores.

Cereals, dark green leafy vegetables, other vegetables, milk and milk products and oils and fats were the most consumed food groups because of their availability. Habe and Krawinke (2016) say that cereals form major component of the diet in North, East and South Africa maize, sorghum and millet being predominant in East and South Africa. Matin *et al.*, (2014), in their

study the results showed that being on a diet according to the food guide pyramid and the healthy eating index is correlated with a reduced risk of cataract. The scores of fruits, vegetables, sodium and also food diversity in patients with cataract was lower than that in the control group. Conclusively, the study findings indicated that a high intake of fruits and vegetables reduced the risk of cataract incidence and progression thereby confirming the results of other studies. This study indicated that fruit and vegetable intake was high on a daily basis but did not quantify the amounts to establish effect on plasma antioxidant status. In addition, the methods of preparation could be inadequate hence not being effective. Furthermore, the study by Matin *et al.,* (2014) assessed sodium intake and established that the score of sodium intake in patients with cataract was much lower than that of individuals without cataract. Sodium intake has been shown to be associated with an increased risk of posterior subscapular cataract. This study did not assess sodium intake.

The foods of interest that were least consumed were carotene rich vegetables, Vitamin A rich fruits, other fruits, organ and flesh meats and eggs. According to Handleman *et al.*, (1999) the concentrations of lutein and zeaxanthin in chicken egg yolk are 292 ± 117 μg/yolk and 213 ± 85 μg/yolk (average weight of yolk is about 17–19 g), respectively and are likely dependent on the type of feed, found mainly in on-esterified form with minute amounts of lycopene and β-carotene. Chicken egg yolk is deemed a better source of lutein and zeaxanthin compared to fruits and vegetables because of its increased bioavailability due to the high fat content in eggs. Results of a study by Appleby *et al*., (2011) showed that the risk of cataract among female and male who consumed high levels of meat and dairy products (>100g per day) was higher than that of vegetarian and people who consumed less meat than others. Majority of the respondents were elderly with tooth problems hence eating meat was limited because of limited chewing. Diverse

diets have been shown to protect against chronic diseases and improve health status (McCollough *et al.,* 2002). The mean dietary diversity was 6.5, an average score. This could be used as a predictor of patient health because an increased dietary diversity has been shown to be linked to higher energy intake, body composition and serum albumin, iron, folate among other biochemical markers according to Bernstein *et al.,* (2002). It would however be of significance if follow up is done to the households to determine the effect of food preparation on nutrient density of food in order for it to have an impact on plasma nutrient status. The reason for a reasonable diversity score despite the low monthly income among most of the respondents could be because of the season. This study was carried out at a time of harvest indicating that most of the households had access to variety of foods. Similar to this study, a study by Muthike *et al.,* (2015) used the FAO cutoff points to classify Dietary Diversity Scores. However, the reported IDDS consisted of a total of nine food groups. A DDS score ranging 1-3 was considered low, 4-7 was considered moderate and ≥8 as high. More than two thirds (62.3%) of the patients had adequate DDS and cereals had the highest score of 92%.

5.4.1 Use of Nutrient supplements

Many studies have been conducted to establish the role of nutrient supplements in cataract risk. This study unfortunately reported poor usage of nutritional supplements among the cataract patients and on such a low frequency yet Christen *et al.,* (2014) and Chew *et al.,* (2012) in their studies showed that daily usage of multivitamins slowed down the progress of both nuclear and cortical cataracts. Christen *et al.,* (2014) in their study gave subjects multivitamins such as vitamin E, C and beta carotene. In this study, only 6.25% (n=9) of the respondents reported to use nutrient supplements once in a while identified as either multivitamin supplements or B-complex vitamin for other health conditions other than cataract. This is because the patients lack

knowledge on the use of nutrient supplements for delaying cataract progression and may not be able to use them consistently because they are costly.

5.5 Relationship between Nutritional Knowledge and Practices

5.5.1 Relationship between Nutritional Knowledge and Food Frequency

In this study the relationship between nutrition knowledge of cataract patients and their practices was obtained in order to examine whether higher level of nutritional knowledge contributed to healthier nutritional practices. A systematic review on the relationship between nutrition knowledge and dietary intake (Spronk *et al.*, 2014) examined adults with a mean age of eighteen or more years providing a quantitative assessment of both nutrition knowledge and dietary intake and their association statistically. 48% of the studies used food frequency questionnaire to assess dietary intake while the rest used either a 24 hour recall, an adapted existing food pattern questionnaire, an author-designed questionnaire or a fat fibre screen. Just like some studies within the same review, this study only probed certain nutrients/food groups. Most of the articles reviewed (n=29) were those of studies conducted in community populations whereby 65.5% reported a significant positive but weak ($r<0.5$) association between nutrition knowledge and dietary intake mostly a higher intake of fruit and vegetables and a lower fat intake. Other significant associations included higher nutrition knowledge and greater intake of cereals or fish and lower intake of sweetened drinks. Contrary to the findings of the review, this study showed no association between nutritional knowledge and green leafy vegetable intake but there was a very weak negative association between nutritional knowledge and frequency of antioxidant food source intake.

The findings of this study may not support those of previous studies which stated that higher nutrition knowledge results in healthier dietary intake especially fruit and vegetables (Wardle *et*

al., 2000), cereals, dry vegetables, cheese and unsaturated fat (Dallongeville *et al.*, 2001). A study on the relationship between nutrition knowledge and healthy attitude and practice during pregnancy by Mitra *et al.,* 2012 showed that nutrition knowledge of pregnant women was significantly associated with healthier choice of foods for their daily meal (lunch and dinner) and type of drinks, rare consumption of fast foods, and frequent consumption of chicken and healthy use of vitamin and mineral supplements.

Association between nutritional knowledge and egg-yolk and lemon consumption was not found to be statistically significant. Worsely (2002) further states that majority of the reviewed models on human behaviors in relation to dietary behaviors have shown that nutrition knowledge is only one among many factors that influence dietary behaviors. Other aspects include perceived consequences of the behaviour as seen in the health belief model and even skills like knowing how to cook. On the other hand, Spronk *et al.,* (2014) emphasizes that other than nutrition knowledge, food security, food availability, cooking and food preparation skills and even motivation to embrace a healthy eating lifestyle influence the ability to actually operationalize nutritional knowledge. The conclusion is that the specific influence of nutrition knowledge on dietary intake is an important research question.

The intake of multiple combinations of a variety of foods is necessary in order to achieve a healthy diet. Nutritional adequacy necessitates that intake of a specific food is combined with other foods. In practice, the set of food combinations which provide nutritional adequacy are limited by the level of food production sustainable in a given ecological setting. In addition, there are economic constraints that limit food supply at the household level. The development of food-based dietary guidelines (FBDGs) (WHO, 1996) recognizes

this and focuses on how a combination of foods can meet nutrient requirements rather than on how each specific nutrient is provided in adequate amounts.

FBDGs are very key when educating the general public on selection of foods. Given the role of antioxidants and phytochemicals in cataract incidence and progression, there is the need for dietary diversification as supported by the knowledge of the interrelationships of various food components. This will enhance the nutritional value of foods by improving the utilization of some nutrients. A good example is fruits rich in ascorbic acid that will enhance the absorption of non-haem iron. The elderly are mostly affected by cataract as the results of this study have shown. These are people who are inactive, have decreased lean body mass and mostly have a decreased energy intake and thereby require increased micronutrient density. Addition of micronutrient rich foods to a white based diet on the recommended nutrient density of vitamin A, vitamin C, folate, iron and zinc will have a positive impact for such populations. Consumption of the plain white rice over a long period of time is likely to result in low plasma antioxidant status unless diversification is done

For example, a typical portion of cooked carrots of 50 grams added to a daily diet would provide 500mg retinol equivalents, meeting the recommended nutrient density for this vitamin. The biological activity of pro-vitamin A varies among different plant sources such that fruits and vegetables like carrots, mangoes, pawpaw and melons contain large amounts of nutritionally active carotenoids. Including a regular portion of these foods in an individual's diet may provide 100% or more of the daily requirement for retinol equivalents. In addition, vitamin A is also found in animal food sources and is highly bioavailable. It is therefore important to consider the possibility of meeting vitamin A requirements by including animal food sources in the diet. A

good example is through providing minor amounts of fish or chicken liver (20–25g) in the diet which provides more than the recommended vitamin A nutrient density.

5.5.2 Relationship between Nutritional Knowledge and Dietary Diversity score

Correlation between Individual Dietary Diversity Score (IDDS) and nutritional knowledge was found to be significant *(r(144)=.243, p=0.003)* meaning that there was a positive association between nutritional knowledge and IDDS such that as knowledge level increased so did the dietary diversity score. A good understanding of carotenoid/antioxidant release, absorption, transportation and accumulation in the eye is necessary in order to evaluate its effects or benefits. This study examined very basic knowledge and did not narrow down to specific nutrients and their mode of action. A study on nutritional knowledge and dietary diversity of cancer patients at the cancer treatment center, Kenyatta National Hospital, Kenya did not find any significant association between nutrition knowledge and dietary diversity since the Pearson correlation between the two valuables was assessed indicated so, *(r(128), p= .131,).* This related with other studies which showed a weak positive association due to confounding factors that include food accessibility and the metabolic state of the body (Muthike *et al*, 2015).

5.5.3 Relationship between Individual Dietary Diversity Score and Income level

Correlation between IDDS and income level was found to be significant (*r(144)=.334, p=0.01*) meaning that there was a positive association between income level and IDDS such that as income level increased so did the dietary diversity score. Interestingly, majority of the respondents received below 5000 shillings per month yet the mean dietary diversity score was fairly high. Timothy and Pablo, (2006) in linking biodiversity, diet and health in policy stated clearly that most of the world's poorest households live in countries harboring the largest amounts of biodiversity thereby making it difficult to address issues like poverty. This could be

true from the results of this study since the dietary diversity scores are quite high despite the low monthly incomes.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS FROM THE STUDY

6.1 Introduction

This chapter outlines a summary of the findings presented in chapter four of this write up. The summary was presented as per objective. Recommendations based on the study findings were also suggested in order to benefit the study target, contribute to possible future research, and influence policy and nutrition program development.

6.2 Summary of Key findings

The general objective of this study was to establish nutritional knowledge and practices among cataract patients attending Sabatia Eye Hospital, Kenya.

6.2.1 Demographic and Economic characteristics among cataract patients attending Sabatia Eye Hospital, Kenya

The first research question sought to find out the demographic and economic characteristics of cataract patients attending Sabatia eye hospital. Majority of the respondents were aged above 60 years, a trend that has been established even in other studies since age besides other factors is associated with cataract formation. More than half of the respondents were female concurring with findings of other studies that have reported more women to have cataracts than men. In terms of education level, almost half of the respondents reported to have attained primary school education while 16.7% indicated to not have acquired any formal education. Majority of the respondents also came from the western region as justified by the frequent number of hospital outreaches and sensitization on cataract surgery to the community prior to the study period. Majority of the respondents indicated to practice farming especially at a small scale level and

almost half of the respondents obtained an income of less than 5000 Kenyan shillings on a monthly basis.

6.2.2 Nutritional Knowledge levels among cataract patients attending Sabatia Eye Hospital, Kenya

The second research question enquired on the nutritional knowledge levels among the cataract patients. The overall nutrition knowledge of patients attending Sabatia Eye Hospital is relatively adequate since almost half of the respondents scored above average. Only 32.6% could not point out factors associated with cataract incidence and progression but majority could point out that there is a link between nutrition and cataract. More than half of the respondents were able to link high fruit and vegetable intake with slowed down cataract progression. However, at least half of the patients did not have adequate knowledge on the foods that have a negative association with cataract incidence or progression. The main source of information on food choices for more than half of the patients was neither nutritionist, doctor nor an eye specialist but the social surrounding such as family and friends.

6.2.3 Nutritional practices among cataract patients attending Sabatia Eye Hospital, Kenya

The third research question sought to find out the nutritional practices among the cataract patients. The nutritional practices included were the use of nutrient supplements, food frequency and diet diversity. In the antioxidant category, green leafy vegetables had the highest frequency of consumption while oranges, egg yolks, raw carrots and lemons were the least consumed. The most consumed phytochemical food source was beans and more than half of the respondents indicated to never use unsaturated cooking oil. Whole grains were the most consumed fiber food source while seeds had the least frequency of consumption. Most of the meats were less frequently consumed (twice per month or less) and alcoholic drinks also had a small frequency

of consumption. The minimum individual dietary diversity score was 5 and the maximum 13. The mean dietary diversity score was 6.5, a moderate score indicating diverse diets among the patients. However, further analysis indicated that the scores were lowest for antioxidant rich foods such as eggs and carotene rich vegetables.

6.3 Conclusion

The following were the conclusions the researcher made from the study findings. The first objective of this study aimed to find out the demographic and economic characteristics of the respondents. The results support reports from prior studies that have linked cataract to age, gender, lower education levels and lower economic status.

The second objective of the study aimed to establish the nutritional knowledge level among the respondents. The results indicated that nutritional knowledge exists (a mean score of 56.1), especially on the relationship between diet and disease since almost 42.4% of the patients scored above average. Interestingly, the main source of information on food choices was the social environment of an individual such as family and friends besides community gathering

The third objective aimed at finding out the nutritional practices among the patients. A big proportion indicated to never use nutrient supplements while those who use them did not target cataract but for other health purposes. The frequency of food consumption showed that green leafy vegetables were the highest consumed antioxidant food source. This is probably because of the rainy season whereby there is abundance of vegetables and it is the time when the study was conducted. In terms of dietary diversity, carotene rich vegetables and tubers, organ meats and eggs; food sources of nutrients that delay cataract progression; were the least consumed foods.

6.4 Recommendations

The following recommendations were made based on the study findings.

6.4.1 Recommendations for policy

This study recommends that the National Nutrition Action Plan should give provision for objectives addressing nutritional knowledge and practices in the context of cataract patients. The information provided in the policy should focus on details on diet-disease relationship since it is what the patients are most inadequate in.

The government through the ministry of health and the ophthalmic division can adopt a multidisciplinary approach in eye health service provision especially in outreaches which are normally done at the community level. Public health nutrition will encourage preventive nutrition and in the long run help curb the burden of cataract and other ocular conditions.

6.4.2 Recommendations for practice

Most of the patients indicated to practice farming. Through agricultural extension officers, kitchen gardens can be introduced where antioxidant rich food sources such as carrots, garlics, peas, passion fruits, tree tomatoes amongst others are cultivated. This will boost intake at the household level. Kitchen gardening can be integrated with nutrition education on diet disease relationship.

The use of nutrient supplements would be a worthwhile venture because preparedness for cataract surgery varies from person to person. This can begin at the hospital level.

The study also recommends that the ophthalmic practitioners refer their patients for nutrition consultation where necessary. They can also obtain formal training on nutritional aspects related to eye health through forums such as continuous professional development and workshops.

6.4.3 Recommendations for further research

Further research can take a longitudinal approach in order to follow up the patients' nutritional practices at home.

Future research can target both the patients and the ophthalmic practitioners and also assess their attitudes on the use of nutrition in the management of cataracts.

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APPENDICES

APPENDIX I: LETTER OF INTRODUCTION AND CONSENT

Dear respondent,

My name is Keseko Enid, a student at Masinde Muliro University of Science and Technology. I am undertaking a study on nutritional knowledge and practices of cataract patients attending Sabatia Eye Hospital.

Your participation will be highly appreciated. Whatever information you provide will be treated with confidentiality and will not be used for other purposes other than the purpose of this study and your answers and name will not be revealed. This is not to evaluate you so please do not feel pressured to give a specific response. We would like you to answer the questions honestly.

Participation in this study is voluntary and for this reason, the participant shall release all researchers involved in the study from any liability on any arising issues subsequently occurring in connection with the study. If for any reason you no do not wish to participate in the study, you may choose not to. You are free to ask any questions regarding this study before consenting to participate.

Thank you.

Keseko Enid, Chief Researcher

Telephone: 0713394028

Kindly indicate your willingness to participate in the study

Respondents consent: (Yes) (No)

PARTICPATION CONSENT FORM

I (IP Number) have accepted that I will take part in this study. I have read the information in the introducing letter and had a chance to ask questions which were answered to my satisfaction. I hereby give consent of my participation in the study.

Signature

Date

APPENDIX II: STRUCTURED QUESTIONNAIRE

Date Residence [ ] 1st visit [ ] Follow up visit

Please circle where appropriate.

I. DEMOGRAPHIC AND ECONOMIC INFORMATION

Gender	01 – Male 02 – Female
Age bracket	01 – <30 years 02 – 30 to 39 years 03 – 40 to 49 years 04 – 50 to 59 years 05 – 60 years and above
What is your highest level of education?	01 Primary 02 Secondary 03 College 04 University
What are the sources of income for your household?	01 Salary 02 Farming 03 Small business 04 Others (specify)
What is the approximate monthly income?	01 Below 5000 02 5000 – 10000 03 10000 – 20000 04 Above 20000

II. NUTRITIONAL KNOWLEDGE

Which one do you consider to contribute to cataract progression?	01 - Age 02 - Diabetes/hypertension 03 – Unhealthy eating lifestyle 04 - Excessive alcohol consumption and smoking
Is a healthy diet important in maintaining your eye health?	01 – Yes 02 – No
Which of the following foods when consumed in high amounts will help delay cataract progression?	01 – Fatty Meats 02 – Fruits and vegetables 03 – Refined cereals 04 – Don't know
Which of the foods when consumed in high amounts promotes cataract progression?	01 – Fatty Meats 02 – Fruits and vegetables 03 – Whole cereals 04 – Don't know
What is your source of information on food choices concerning your eye health?	01 - General doctor 02 – Eye specialist 03 - TV/Newspaper/other social media 04 - Nutritionist 05 – Other
How often do you use nutrient supplements? Which type of supplements are they?	01 - Daily 02 - Monthly 03 - Once in a while 04 - Never

III. NUTRITIONAL PRACTICES

FOOD FREQUENCY TABLE

For each food item, indicate with a tick the category that best describes the frequency with which you usually eat that particular food item.

Food item as the source of:	Once per day	More than once per day	3-6 times per week	Once or twice per week	Twice per month or less	Never
Antioxidants Oranges						
Green leafy vegetable e.g. lettuce						
Eggs (yolks)						
Lemons						
Raw carrots						
Grapes						
Garlic						
Phytochemicals						
Peas						
Lentils						
Beans						
Soybeans						
Polyunsaturated fats and monounsatured Elianto oil						
Rina oil						
Avocado						
Olive oil						
Soya oil						
Fiber: Fruit						
Whole grains						
Whole meal porridge						
Seeds						
Green leafy vegetables						
Trace elements zinc, selenium, copper, Calcium:						

Meat						
Cereals						
Fish						
Milk /yoghurt						
Red meat:						
Beef						
Mutton						
White meat:						
Chicken						
Fish						
Alcohol:						
Wine						
Beer						
Vodka						
Whisky						

Source: Adopted and modified from Muthike et al, (2015) Nutritional knowledge in association with dietary practices of cancer patients.

INDIVIDUAL DIETARY DIVERSITY SCORE SHEET

Please describe the foods (meals and snacks) that you ate or drank yesterday during the day and night, whether at home or outside the home. Start with the first food or drink of the morning.

(Write down all foods and drinks mentioned. When composite dishes are mentioned, ask for the list of ingredients. When the respondent has finished, probe for meals and snacks not mentioned)

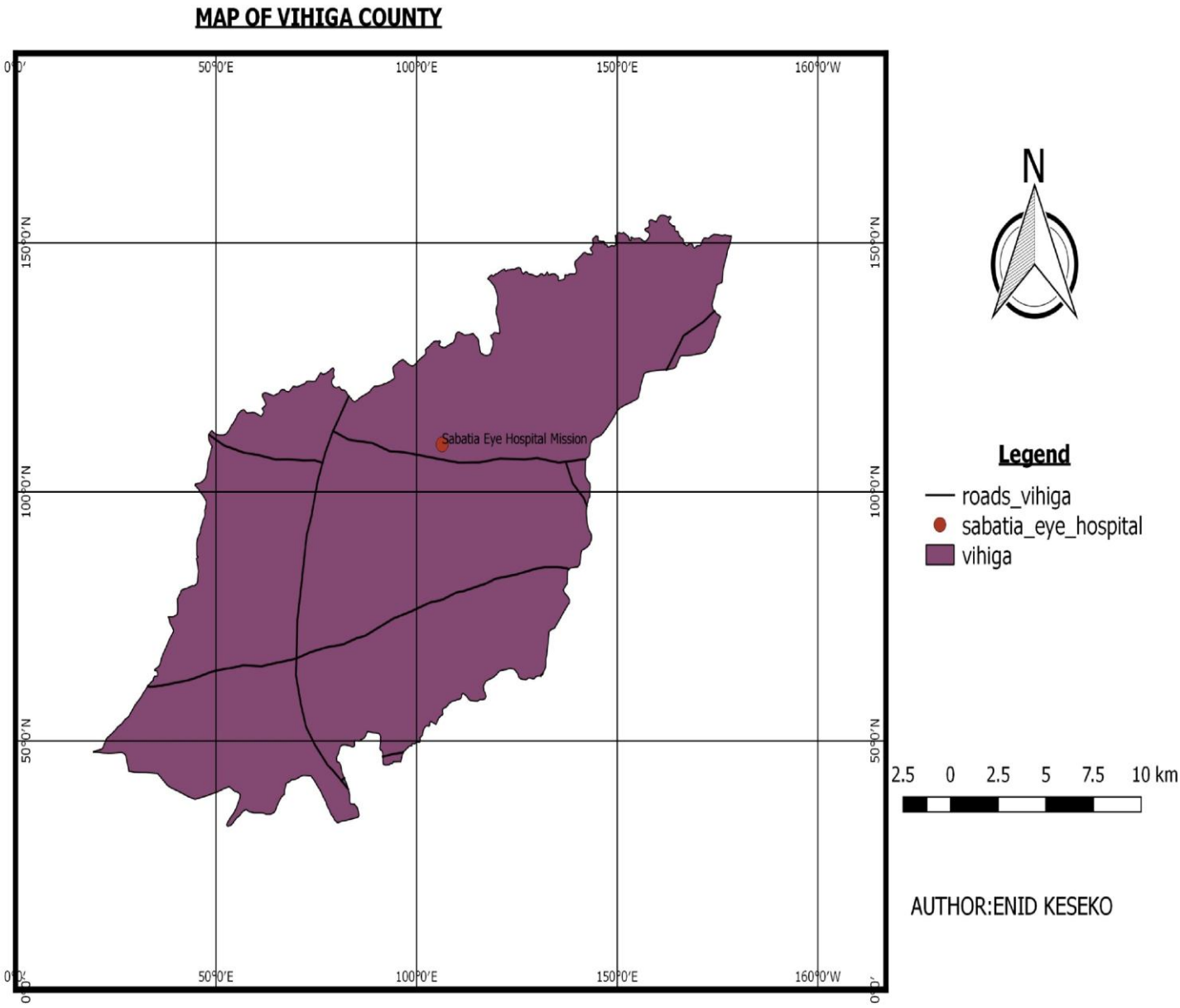
Breakfast	Snack	Lunch	Snack	Dinner	Snack

Serial No.	**Food groups**	**Examples**	**Yes=1** **No=2**
1	**Cereals**	Maize, rice, wheat, sorghum, millet/foods made from these (ugali, porridge etc.)	
2	**White roots & tubers**	White potatoes, white yam, white cassava or other foods that are tubers	
3	**Vitamin A rich Vegetables & Tubers**	Pumpkin, carrot, squash, orange flesh sweet potato	
4	**Dark green leafy vegetables**	Kale, spinach, amaranths and any other	
5	**Other vegetables**	Tomatoes, onions, eggplant and any other	
6	**Vitamin A rich fruits**	Ripe mango, ripe pawpaw, watermelon and any other/ their juices	
7	**Other Fruits**	Other fruits and their juices	
8	**Organ meats**	Liver, kidney, heart and any other	
9	**Flesh meats**	Beef, goat, chicken, pork, rabbit etc.	
10	**Eggs**	Eggs from ducks, chicken	

11	**Fish**	Fresh or dried fish, omena	
12	**Legumes, nuts and seeds**	Beans, peas, lentils, nuts, seeds/ food (peanut butter)	
13	**Milk &milk products**	Milk, yoghurt, cheese, butter, ghee	
14	**Oils and fats**	Oils, butter/margarine added to food /during cooking	
Individual		Did you eat anything (meal or snack outside home yesterday?	

Source: Adapted from FAO Guidelines for measuring household and individual dietary diversity (2010).

APPENDIX III: MAP SHOWING LOCATION OF AREA OF STUDY



APPENDIX IV: DIRECTOR OF POSTGRADUATE STUDIES APPROVAL

APPENDIX V: IERC RESEARCH APPROVAL

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

Tel: 056-30870
Fax: 056-30153
E-mail: directordps@mmust.ac.ke
Website: www.mmust.ac.ke

P.O Box 190
Kakamega – 50100
Kenya

Directorate of Postgraduate Studies

Ref: MMU/COR: 509099

17th May, 2019

Keseko Enid Alivitsa,
HPN/G/01-5810/16,
P.O. Box 190-50100,
KAKAMEGA.

Dear Ms. Alivitsa,

RE: APPROVAL OF PROPOSAL

I am pleased to inform you that the Directorate of Postgraduate Studies has considered and approved your Masters Proposal entitled: "***Nutritional Knowledge and Practices among Cataract Patients attending Sabatia Eye Hospital, Kenya***" and appointed the following as supervisors:

1. Prof. Asenath Sigot - SPHBST, MMUST
2. Dr. Jane Situma - SONMAPS, MMUST

You are required to submit through your supervisor(s) progress reports every three months to the Director Postgraduate Studies. Such reports should be copied to the following: Chairman, School of Public Health, Biomedical Sciences and Technology Graduate Studies Committee and Chairman, Nutritional Sciences Department. Kindly adhere to research ethics consideration in conducting research

It is the policy and regulations of the University that you observe a deadline of two years from the date of registration to complete your master's thesis. Do not hesitate to consult this office in case of any problem encountered in the course of your work.

We wish you the best in your research and hope the study will make original contribution to knowledge.

Yours Sincerely,

DEAN
SCHOOL OF GRADUATE STUDIES
MASINDE MULIRO UNIVERSITY
OF SCIENCE & TECHNOLOGY
Date..... Sign.....

Prof. John Obiri
DIRECTOR, DIRECTORATE OF POSTGRADUATE STUDIES

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY
Tel: 056-31375 P. O. Box 190-50100
Fax: 056-30153 Kakamega, Kenya
E-mail: ierc@mmust.ac.ke
Website: www.mmust.ac.ke

Institutional Ethics Review Committee (IERC)

Ref: MMU/COR: 403012 vol2 (22) **Date: 14th** June, 2019

Enid Alivitsa Keseko
Masinde Muliro University of Science and Technology
P.O. Box 190-50100
KAKAMEGA

Dear Ms. Alivitsa

RE: Nutritional knowledge and practice among cataract patients attending Sabatia Eye Hospital, Kenya- MMUST/IERC/36/19

Thank you for submitting your proposal entitled as above for initial review. This is to inform you, that the committee conducted the initial review and approved (with no further revisions) the above Referenced application for one year.

This approval is valid from **14th June, 2019 through to 14th June, 2020**. Please note that authorization to conduct this study will automatically expire on **14th June, 2020**. If you plan to continue with data collection or analysis beyond this date please submit an application for continuing approval to the MMUST IERC by **14th May, 2020.**

Approval for continuation of the study will be subject to submission and review of an annual report that must reach the MMUST IERC secretariat by **14th May, 2020**. You are required to submit any amendments to this protocol and any other information pertinent to human participation in this study to MMUST IERC prior to implementation.

Please note that any unanticipated problems or adverse effects/events resulting from the conduct of this study must be reported to **MMUST IERC**. Also note that you are required to seek for research permit from **NACOSTI** prior to the initiation of the study.

Yours faithfully,

Dr. Gordon Nguka (PhD)
Chairman, Institutional Ethics Review Committee

Copy to:
- The Secretary, National Bio-Ethics Committee
- Vice Chancellor
- DVC (PR&I)
- DVC (A & F)

APPENDIX VI: NACOSTI RESEARCH PERMIT

THIS IS TO CERTIFY THAT:
MS. ENID ALIVITSA KESEKO
of MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY, 0-50309 KAIMOSI,has been permitted to conduct research in *Vihiga County*

on the topic: *NUTRITIONAL KNOWLEDGE AND PRACTICES AMONG CATARACT PATIENTS ATTENDING SABATIA EYE HOSPITAL*

for the period ending:
29th July,2020

Permit No : NACOSTI/P/19/89190/31555
Date Of Issue : 30th July,2019
Fee Recieved :Ksh 1000

.....
Applicant's Signature

.....
Director General
National Commission for Science, Technology & Innovation

APPENDIX VII: LETTER OF AUTHORIZATION FOR RESEARCH

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/19/89190/31555**

Date: **30th July, 2019.**

Enid Alivitsa Keseko
Masinde Muliro University of Science
And Technology
P.O. Box 190-50100
KAKAMEGA.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Nutritional knowledge and practices among cataract patients attending Sabatia Eye Hospital."*** I am pleased to inform you that you have been authorized to undertake research in **Vihiga County** for the period ending **29th July, 2020.**

You are advised to report to **the County Commissioner, the County Director of Health Services, and the County Director of Education, Vihiga County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

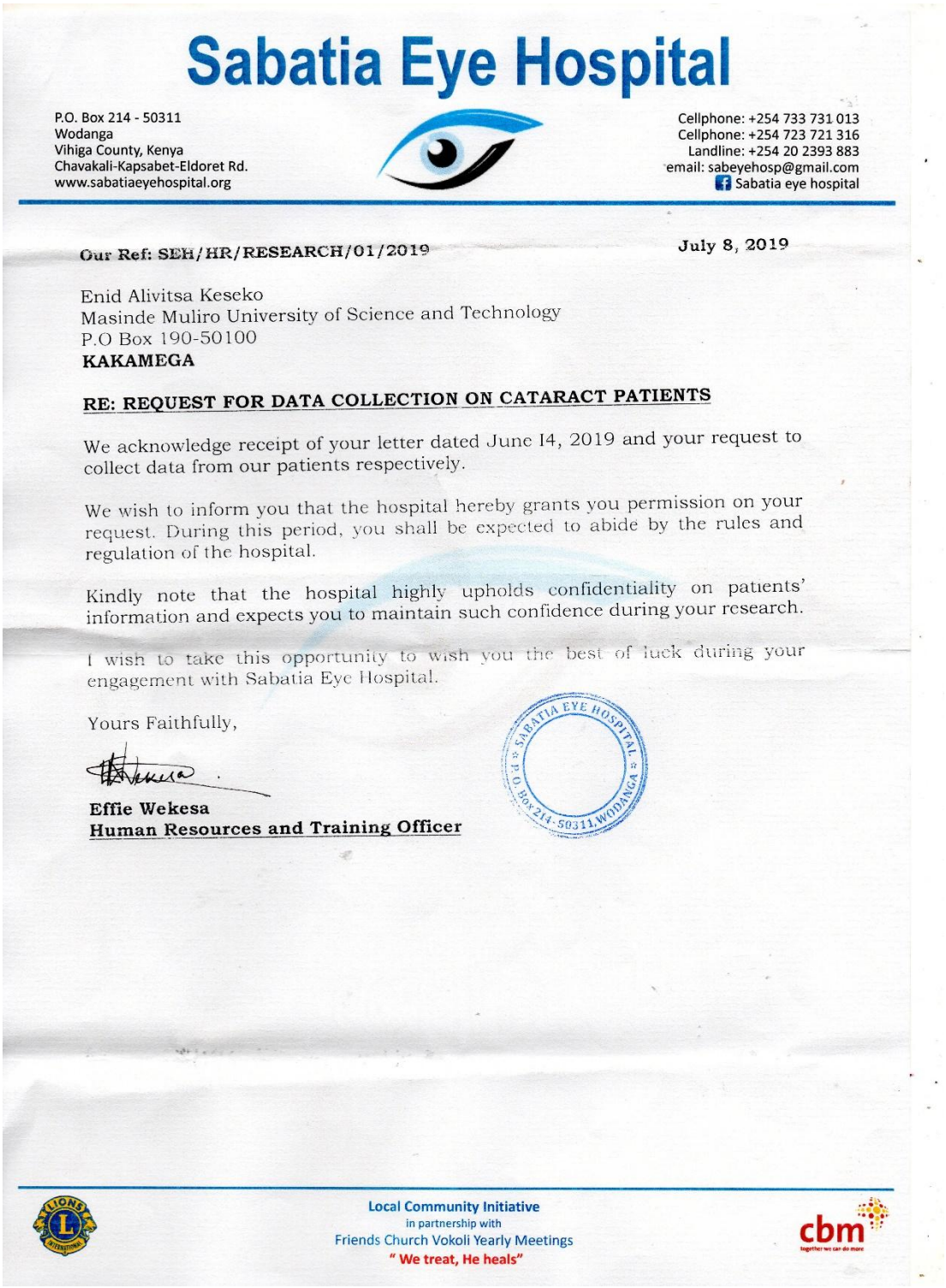
GODFREY P. KALERWA., MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Vihiga County.

The County Director of Education
Vihiga County.

APPENDIX VIII: SABATIA EYE HOSPITAL RESEARCH APPROVAL



Sabatia Eye Hospital

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Landline: +254 20 2393 883
email: sabeyehosp@gmail.com
Sabatia eye hospital

Our Ref: SEH/HR/RESEARCH/01/2019 **July 8, 2019**

Enid Alivitsa Keseko
Masinde Muliro University of Science and Technology
P.O Box 190-50100
KAKAMEGA

RE: REQUEST FOR DATA COLLECTION ON CATARACT PATIENTS

We acknowledge receipt of your letter dated June 14, 2019 and your request to collect data from our patients respectively.

We wish to inform you that the hospital hereby grants you permission on your request. During this period, you shall be expected to abide by the rules and regulation of the hospital.

Kindly note that the hospital highly upholds confidentiality on patients' information and expects you to maintain such confidence during your research.

I wish to take this opportunity to wish you the best of luck during your engagement with Sabatia Eye Hospital.

Yours Faithfully,

SABATIA EYE HOSPITAL P.O. Box 214-50311, WODANGA

Effie Wekesa
Human Resources and Training Officer

Local Community Initiative
in partnership with
Friends Church Vokoli Yearly Meetings
" We treat, He heals"

cbm