PREVALENCE OF DIETARY SUPPLEMENTS USE AND DIETARY PRACTICES AMONG TEACHERS IN PUBLIC SECONDARY SCHOOLS IN KIKUYU, KIAMBU COUNTY, KENYA

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE (FOOD, NUTRITION AND DIETETICS) IN THE SCHOOL OF PUBLIC HEALTH AND APPLIED HUMAN SCIENCES OF KENYATTA UNIVERSITY

MAY, 2019
DECLARATION

This thesis is my original work and has not been presented for a degree in any other University, or for any other award.

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DEDICATION

I dedicate this thesis to my beloved parents, George and Mary Gikwa. Anything good that has come to my life has been because of your example, guidance and love.
ACKNOWLEDGEMENT

First and foremost, I thank my God, my good Father. I have experienced your guidance day by day.

Secondly, I would like to sincerely express my gratitude to my supervisors Prof. Judith Kimiywe and Dr. Eunice Njogu for the continuous support of my masters study and research, for your patience, positive criticism, encouragement, enthusiasm, and immense knowledge. Your guidance helped me in all the time of research and writing of this thesis. I am also indebted to my good friends who have acted as a source of encouragement and cheerleaders to see me succeed.

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ABBREVIATIONS AND ACRONYMS

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<th>Definition</th>
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<tbody>
<tr>
<td>ADA</td>
<td>American Dietetic Association</td>
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<tr>
<td>CVD</td>
<td>Cardio Vascular Diseases</td>
</tr>
<tr>
<td>DD</td>
<td>Dietary Diversity</td>
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<td>DDS</td>
<td>Dietary Diversity Score</td>
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<td>DS</td>
<td>Dietary Supplement</td>
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<tr>
<td>DSHEA</td>
<td>Dietary Supplement Health and Education Act</td>
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<tr>
<td>FANTA-2</td>
<td>Food and Nutrition Technical Assistance II Project</td>
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<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
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<td>FFQ</td>
<td>Food Frequency Questionnaire</td>
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<tr>
<td>FVs</td>
<td>Fruits and Vegetables</td>
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<tr>
<td>IDA</td>
<td>Iron Deficiency Anemia</td>
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<tr>
<td>IDDS</td>
<td>Individual Dietary Diversity Score</td>
</tr>
<tr>
<td>IEC</td>
<td>Information, Education and Communication</td>
</tr>
<tr>
<td>IFAS</td>
<td>Iron Folic Acid Supplement</td>
</tr>
<tr>
<td>NACOSTI</td>
<td>National Commission for Science, Technology and Innovation</td>
</tr>
<tr>
<td>RNIs</td>
<td>Recommended Nutrient Intakes</td>
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<tr>
<td>SES</td>
<td>Social Economic Status</td>
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<tr>
<td>SPSS</td>
<td>Statistical Package for Social Sciences</td>
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<tr>
<td>SSA</td>
<td>Sub Saharan Africa</td>
</tr>
<tr>
<td>VMNHS</td>
<td>Vitamin, Mineral and Nutritional and Herbal Supplements</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
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OPERATIONAL DEFINITION OF TERMS

A dietary supplement: A commercial product intended to supplement the diet to provide vitamins, minerals and essential oils that are perceived to be missing by an individual consumer; or not being consumed in sufficient quantities in an individual’s diet. It is intended for ingestion as a pill, capsule, tablet, powder or liquid form.

Dietary diversity: The number of different foods or food groups consumed over 24 hour recall period.

Nutrient intake: Intake of vitamin A, B6, C, D, E, calcium, iron and zinc.

Dietary practices: Nutrient intake, dietary diversity and food consumption patterns.

Food consumption patterns: Frequency of intake of selected foods within a week.

Individual dietary diversity scores: Created by summing up fourteen (14) food groups consumed by an individual participant over a reference period of 24 hour (FAO, 2008).

Profiled groups: Studies done on disease related populations or a group of people with similar characteristics.
ABSTRACT

The dietary supplements market is growing at an alarming rate despite dietary source being acknowledged as the primary and priority source of nutrients. Kenya’s dietary supplements market has experienced a steady growth since 2009 owing to increasingly busy lifestyles, growing health consciousness and disposable income among the general population. Little has been documented about use of dietary supplements in Kenya despite their increase in popularity. The purpose of this study was to determine the prevalence of dietary supplements use and dietary practices among teachers in public secondary schools in Kikuyu, Kiambu County. Teachers were chosen to represent the general population because it’s a homogeneous group, with average Kenyan income, evenly distributed across the country and hence opinion shapers in the community. The study adopted cross-sectional analytical study design with qualitative and quantitative methods in data collection, analysis and presentation. Researcher administered questionnaire and key informant interview guides were used to elicit information from the participants. Simple random sampling was used to select a sample of 178 teachers from 17 public secondary schools located in Kikuyu Sub-County while purposive sampling was used to select a sample of the key informants. Data was analyzed using SPSS version 22. Data from the 24 hour dietary recall was analyzed using Nutri-survey to obtain specific nutrients consumed. A P-value of \(<0.05\) was considered statistically significant. The mean age of the teachers was 38.53 ± 9.75 years with most being between the ages of 41-50 years. Majority of the participants were females (60.7%), married (65.7%) had an undergraduate university degree (67.4%), and earned an average household income of >Ksh 50,000 (53.9%). Out of the possible 14 food groups, the mean DDS was 7.42 ± 1.40. The mean intakes for vitamin A, B6, iron and zinc (2300±4432, 1.43 ± 0.69; 28.39 ± 24.7; 14.40 ± 5.30 respectively) were found adequate as opposed to those of vitamin C, D and E as well as calcium (55.30 ± 27.09; 6.906 ± 4.59; 10.12 ± 5.697 and 703.04 ± 420.87 respectively) that fell below the RNIs. Consumption patterns showed high intake of starchy staples with rice and *ugali* having the highest intakes. There was moderate intake of proteins with high consumption of animal source foods while consumption of fruits and vegetables was low and moderate respectively. The prevalence of dietary supplements use was 28.7% with the most commonly consumed supplements being omega 3 and 6 (60.8%), calcium (56.9%) and multivitamins (19.6%). The main reasons for supplements use were medical reasons (59.6%), prevent deficiencies (29.8%) and to promote good health (25.5%). Key informants were used to give an insight on DS use. The main sources of information on dietary supplements use were health workers (68.6%) and internet (62.7%). Dietary supplements use was significantly associated with age (P<0.001), gender (P<0.000), marital status (P<0.006) and household income (P<0.049), with those above 40 years of age being 3.25 times more likely to use DS (AOR:3.2;C.I:1811-8.956; P value=0.023). Chi square test further showed that DDS was significantly associated with DS use (P<0.045). Furthermore, there was significant relationship (p<0.05) between nutrient intake (vitamin A, C, iron and calcium) and dietary supplements use. Due to the increased number of people (28.7% prevalence) using dietary supplements among the general population, there is need for a solid foundation of regulatory framework to forestall consumer exploitation and promote their safety as well as prevent abuse of the products by consumers.
CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

The Global market for dietary supplements appear to be growing at an alarming rate (Valavanidis, 2016). Over the last decade, sales of dietary supplements have soared due to swelling demand and many new companies have now invested in the dietary supplements (DS) industry. More people appear to be appreciating the value of good health (Euro monitor International, 2017). It is reported that upsurge in lifestyle diseases, healthcare costs and the ever growing aging population are some of the factors driving the growth in the DS industry in different places across the world (Aryeetey & Tamakloe, 2015; Fransen et al., 2016; Ministry of Health, 2017).

Universally, the sales of dietary supplements are estimated to be $50 billion, with an annual forecast growth of up to 4% by the year 2018 with Singapore, Hong Kong and Norway leading in their usage and spending in household consumption and use (Euro monitor International, 2014). In the United States, The Council Responsible for Nutrition reports that 68% of US adults are taking supplements with multivitamins being the most commonly used (taken by 52% of DS users) followed by vitamin D (20%), omega 3 fish oil (19%), calcium (18%) and vitamin C (17%) (CRN, 2013). In South Africa, the dietary supplements market is estimated to be worth R7 billion, with main categories being fish oils, vitamins, minerals, herbs, fiber and probiotics (Euro monitor, 2014). Those who buy into the country’s health and fitness trends and those with large disposable income are the major consumers of healthcare products and dietary supplements (Gabriels et al., 2011).
In Kenya, according to Euro monitor Kenya, (2014), the consumption of various brands of dietary supplements in the country has increased since 2009 as individuals become more mindful of their health, coupled with rising disposable incomes. Besides, people seem to increasingly adopt busier lifestyles that militate against good dietary practices (Kearney, 2010; Berkum, Linderhoff, & Achterbosch, 2017).

For promotion of good health, it is important to ensure adequate intake of essential nutrients by having a variety of foods and increasing the number of food groups consumed (Ministry of Health, 2017). Dietary intake is correlated with a series of positive health outcomes of public health concerns. A diet that meets recommendations for both food groups (Melina et al., 2016) and nutrients (Institute of Medicine Food and Nutrition Board, 2000), and which is associated with disease prevention and promotion of optimal health, is considered a high-quality diet (Kranz, 2006). Further, nutrient dense diets have been linked to lower risk of obesity in children (Kranz, 2008; Tulchinsky, 2010) and other chronic diseases (Daaboul & Siverstein, 2004).

Access to good quality diet that is adequate in terms of nutrients is essential for human health, productivity and employment output (WHO, 2015). A non-diversified, low quality diet can impact negatively on an individual’s health and wellbeing since it may not meet his/her micronutrient requirements (FANTA, 2011; Habte & Krawinkel, 2016; Nithya & Bhavani, 2018). Dietary supplements can help bridge the gap between dietary intakes and the recommended nutrient intakes (RNIs) for various micronutrients in situations where the latter may not be easily attainable through normal diet (Shao et al., 2017). The use of dietary supplements, however, should not
make up for poor food choices and inadequate diets (Burke et al., 2012). A well-chosen diet will promote an adequate intake of all nutrients.

1.2 Problem Statement

Increasing awareness about the functions of micronutrients in promotion of good health has resulted in a huge growth in the production, marketing and consumption of dietary supplements globally (Miller & Welch, 2013; Dickson & Mackay, 2014). In Kenya, the last few years have witnessed a tremendous growth in the dietary supplements’ market (Euro monitor, 2013). Large multinational companies have engaged or contracted various local marketing and distribution agents who in turn have set up ‘health shops’ at strategic locations in major urban centers as well as using multilevel marketing to augment sales.

An uptake of 43.5% among Kenyan gym users (Wachira, 2011) and 15.5% among Kenya league rugby players (Kimiywe and Simiyu, 2008), has been reported but it is uncertain whether the use of dietary supplements has increased due to self-medication, aggressive marketing by producers, expensive health care or simply owing to inadequate diets. With the market unregulated and too many brands of the same product and unknown ingredients, there is a likelihood of business malpractice as well as consumer abuse of products through overuse (Euro monitor, 2013).

Although many studies have described the prevalence, trends and the dynamics in the use of dietary supplements in various populations (Archer and Boyle, 2008; Pouchieu et al., 2013; Kantor et al., 2016; Alfwaz et al., 2017), they are mostly restricted to profiled groups or to medically challenged subjects who often use dietary supplements alongside drug prescriptions. There is limited information on the factors
and outcomes surrounding their use in the general population. In Kenya, there exist minimal empirical evidence regarding dietary supplements usage among the general adult population and its linkage to dietary practices. This study, therefore intends to fill in a gap in the literature on prevalence of supplements use on a general population.

1.3 Purpose of the Study

The purpose of this study was to determine the prevalence of dietary supplements use and dietary practices among teachers in public secondary school in Kikuyu Sub-County.

1.4 Objectives of the Study

The objectives of this study were to:

1. Establish the demographic and socio-economic characteristics of the teachers in public secondary schools in Kikuyu Sub-County.
2. Determine dietary practices among teachers in public secondary schools in Kikuyu Sub-County.
3. Determine the prevalence of dietary supplements use among teachers in public secondary school in Kikuyu Sub-County.
4. Establish the relationship between demographic and socio-economic characteristics and use of dietary supplements among teachers in public secondary schools in Kikuyu Sub-County.
5. Establish the relationship between dietary practices and use of dietary supplements among teachers in public secondary schools in Kikuyu Sub-County.
1.5 Hypotheses of the Study

$H_{01}$ There is no relationship between demographic and socio-economic characteristics of the teachers and use of dietary supplements among teachers in Kikuyu Sub County.

$H_{02}$ There is no relationship between dietary diversity and use of dietary supplements among teachers in Kikuyu Sub County.

$H_{03}$ There is no relationship between nutrient intake and use of dietary supplements among teachers in Kikuyu Sub County.

1.6 Significance of the Study

The findings of this study may be used by the Ministry of Health to inform policy initiatives regarding use of dietary supplements as an emerging trend in the dietary lifestyle of Kenyans. The findings will also provide evidence that can inform nutrition counseling interventions among specific sub-populations including teachers. The study may also avail information to the individual teachers and the general population so as to make informed choices on dietary practices and dietary supplements usage.

1.7 Limitation of the Study

The study focused only on commercial dietary supplements which included vitamins, minerals and essential oils and not traditional supplements that are not on the commercial market that are used for management and treatment of health conditions.

1.8 Delimitation of the Study

The study included only teachers in Kikuyu Sub-County and hence the results can only be generalized to schools with same attributes.
1.9 Conceptual Framework

The conceptual framework used in this study was modified from Frank et al, (2002) Foote et al., (2003), Randimer et al., (2004) on factors associated with prevalence of dietary supplements use (Figure 1.1).

![Conceptual Framework Diagram]

Figure 1.1 : Conceptual framework on factors associated with dietary supplements use

Demographic and Socio-economic characteristics of an individual as well as the types and sources of dietary information that one receives may influences ones dietary practices with regard to intakes, diversity and consumption patterns, which eventually has a bearing on the diet adequacy of the individual. Holding other factors constant, the adequacy or gaps (perceived or real) in the diet will determine the individual’s
decision regarding the use of dietary supplements. Socio-economic factors as well as demographic characteristics of an individual may also directly influence one’s use of dietary supplements. For instance, the cost implications may be a barrier to use of dietary supplements despite an individual’s own awareness of the shortfall in his diet. The nature and sources of information have a varied influence on different groups: Beauty (complexion) hype about certain supplements may sell well with females and younger audience and motivate their use of the supplements. As well, perceived credibility of an information source may catalyse a potential DS user’s decision to initiate use of dietary supplements.
CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The Kenya Pharmacy and Poisons Board (2012) has defined a dietary supplement as a product, which when taken into the body contains a dietary substance which is intended to add further nutritional value to the diet and shall include naturally occurring substances of animal or plants origin, vitamins, body building substances, minerals or contains any combination of these. It is intended to be taken orally as a pill, a capsule, or in liquids or powder form, and is not represented as a conventional food.

Growing urban population and health consciousness among middle and upper income consumers coupled with aggressive marketing is gradually boosting sales as uptake of vitamins and minerals supplements among consumers looking to improve personal health and build their immunity (Euro monitor international, 2017; Sirico et al., 2018). Increased access to information through both the internet and health institutions as well as the shift towards less active and more stressful lifestyles has led to an increase in product purchases as consumers seek to supplement their poor diets and maintain healthy bodies (Banos, Cebolla, Oliver, Alcaniz, & Botella, 2013; FAO, 2015; Ssewanyana, Abubakar, van Baar, Mwangala, & Newton, 2018).

In recent years, a wide variety of supplements have been available in the Kenyan market and use of these supplements seems to be gaining popularity. Dietary supplements of all types including single ingredients or combinations of vitamins, minerals, botanicals, and probiotics are now easily available behind the counter.
However, few studies are available on the use of these supplements among the general population, and how it relates to their dietary practices.

### 2.2 Prevalence of Dietary Supplements Use

Dietary supplements appear to have attracted much consumer interest with their use increasing dramatically over the past 20 years in both the developed and developing world (Marik & Flemmer, 2012; Kantor et al., 2016; Manson, Brannon, Rosen, & Taylor, 2016). There is increasing appreciation of the role of poor dietary practices as a predisposing factor in chronic health conditions and the implications it has on public expenditure on health (Willet et al., 2006; Harrison, 2010).

Adequate evidence exists that establish the causative link between nutritional deficiencies and poor health particularly in chronic disease conditions and this engendered new impetus in the efforts to ensure adequate nutrient intakes particularly among those that seek to fill the gaps between dietary supply and RNIs (Dickinson, MacKay, & Wong, 2015). In this regard, dietary supplements are now gaining recognition among both healthcare fraternity and the general population as a means of promoting good health as well as being a prophylactic strategy in disease control (McGinnis & Ernest, 2001).

Growing interest and consciousness in personal health and wellbeing among the general population has provided the stimulus for a wide variety of dietary supplements in the market (Anders and Schroeter, 2015). Moreover, as argued by both Willet et al., (2006) and Ferreira et al., (2017), the relatively aging global population is a further stimulus for the adoption of dietary supplements in enhancing the health status of the population in a country. The rising prevalence of the use of
supplements, coupled with the poor or lack of regulation may potentially have adverse outcomes including toxicity and/ or side effects as well as foul play (Intrasook, 2013; Starr, 2016).

Dietary supplements use has been associated with older individuals and those who report having healthier lifestyles (Radimer, Subar & Thompson, 2000). According to a 2014 study by The Council for Responsible Nutrition in USA, 54% of adult supplement users took supplements for overall health benefits, 29% to fill in nutrient gaps in the diet, 25% for bone health, 24% for healthy aging, and 22% for healthy heart. Females, middle aged and who care about lifestyle diseases such as elevated cholesterol levels, malignancies, hypertension, bone disease and obesity are the majority consumers of dietary supplements (Elolemy & AlBedah, 2012). Food and Drug Administration (2015) recommends that one should consult with a healthcare professional before using any dietary supplement to preclude potential hazards associated with use and ensure safety of the users.

Although studies in other countries appear to agree on the rising prevalence in the use of dietary supplements in the general population, such prevalence studies have scarcely been conducted in Kenya and East Africa at Large.

2.3 Factors Influencing Dietary Supplements Use

Various factors influence dietary supplements use. They include demographic factors, socio economic factors, and sources of information as follows;

2.3.1 Demographics and Dietary Supplements Use

Use of supplements has been linked with age in some specific age sets across the population (Kennedy et al, 2013). Supplement usage is reported to increase with age
with more than half of Americans, aged 65 years and above, taking a multivitamin or other dietary supplements regularly as compared to younger adults (Hollenstein, 2007). In a Canadian study on the socio-economic status of dietary supplement users, age was also closely related to supplement use; 40% of children below 8 years were reported to be using dietary supplements (Hassanali, Adolphe & Whiting, 2010). Through adolescence, period there was a drop in prevalence (30%) but as age advanced among adults, utilization was noted to rise steadily among women (60%) and in men (40%) 51 years and above (Hassanali, Adolphe & Whiting, 2010).

Gender has also been found to be a predictor of DS use with women being more likely to use dietary supplements than men (Foote, 2003; Stefan, 2015). Women of child bearing age, especially those who are in a pre-conception period are said to form a large group of dietary supplement users (Aryeetey & Tamakloe, 2015; Sato et al., 2016). Marital status is another factor reported to influence the use of dietary supplements (Najmabadi & Nojourmi, 2010). Married people are reported to be more likely to take dietary supplements than their single counterparts. This could be attributed to better disposable income, and influence from both close relatives and friends (Fattahzadeh et al., 2014).

### 2.3.2 Socio Economic Factors and Dietary Supplements Use

Level of education has been associated with an increased likelihood of supplements use (Foote et al., 2003). Several studies have consistently shown that supplements usage increases among individuals with more years of schooling as compared to the less educated. The pattern of DS usage among US adult population in the NHANES 2007–2008 study found that, supplements use was higher in those with more than a
secondary school education (61%) than those with less (37%) (Kennedy et al, 2013). The knowledge attained through education may make people more receptive to use of supplements (WHO/FAO, 2010). Individual’s profession was also positively correlated with usage of supplements with relatively higher usage amongst individuals working in the health and medical industry (Sirico et al., 2018), further indicating that more information about good diets and personal well-being is significantly linked with a tendency of one taking a supplement. (Frank et al., 2000; Foote et al., 2003).

Intake of dietary supplements has also been correlated to the SES of a household (Gallagher, Black, & Oddy, 2014). In order to maintain a consistent supply of dietary supplements, one needs to have enough money (Foote et al., 2003). Individuals from households that generate more than average income are more likely to use supplements as compared to those from lower income families (Hassanali et al., 2010; Kim et al., 2010). A report from Malaysia has revealed a shifting trend towards health products, better medical services and healthier lifestyle which may indicate some degree of an increase in the level of disposable income (Euro monitor, 2013). These associations have been investigated in many studies in western countries where supplements have been used for a long time. (Dickinson & MacKay, 2014; Anders & Schroeter, 2017).

Although a number of studies abroad have reported an association between the use of dietary supplements and the various demographic and socio-economic characteristics of the subjects, scarcely such research has not been conducted in Sub-Saharan Africa, more so in Kenya. These calls for research that will provide local evidence that can best inform local interventions. This is more so necessary since the interactions of the
various population factors to produce a certain nutrition related outcome appear to be context specific.

2.3.3 Sources of Information for Dietary Supplements

Consumption of a wide variety of nutritious foods is the best way to maintain health and prevent chronic disease. It is among the roles and responsibilities of health practitioners to help educate the public on healthful dietary patterns and on the safe and appropriate selection and use of nutrient supplements to meet their nutrient needs and optimize health (ADA, 2005), but of concern is the availability of resources to consumers that may not be accurate. Among Americans 60 years and older in Kansas city who used dietary supplements, 73% reported TV as the best place to access knowledge on supplements while other sources such as print, radio, acquaintances and displays were least cited sources (Marinac et al., 2007).

Another study by Harnack et al., (2001), on adults 18 years and older in Minneapolis found that family members and printed materials were the major sources of information cited while health care providers were the least popular. In an Independent Urban Health Food Store, 41% of buyers depended on retail staff for DS information, followed by the media, and with the least cited being medical health care professionals (Archer & Boyle, 2008). Finally, from professionals, dietitians cited professional journals (80%), professional organizations clinical guidelines (72%), and in-service conferences (71%) as the most trusted sources of information for dietary supplements (Dickinson et al., 2012).
A study on DS use among gym users in Nairobi found that the perceived reliable sources of information about DS were doctors (31.6%), nutritionists (31.6%), supplement shops (12.6%), pharmacists (2.4%), gym instructors (5.7%), media (9.8%), books (2.3%), direct sales (3.4%) and peers (0.6%) (Wachira, 2011).

Various researches have thus tried to analyze the sources of information on dietary supplements among DS users, however, majority of these studies have been conducted in developed world setting particularly the United States. Few studies exist in the Sub Saharan Africa especially Kenya, that investigate the nature and sources of information on dietary supplements and how it relates to DS use among the general population.

2.4 Dietary Practices for General Adult Population

Dietary practices include nutrient intake, dietary diversity and food consumption patterns.

2.4.1 Nutrient Intake for General Adult Population

Micronutrients, although needed by the body in minimal quantities, are key nutrients in controlling metabolism and boosting immunity (Sight and life, 2011). Inadequate intake of vitamins and minerals lead to deficiency diseases that have been of public health interest world over (Harrison, 2010; Tulchinsky, 2010). Globally, iron, zinc, and vitamin A, are the most common micronutrient deficiencies with folate following closely. The World Health Organization estimates that a quarter of the world population is being anemic, with the highest prevalence rate (44%) of iron deficiency among non-pregnant women being in Africa (Mclean et al., 2008; Balarajan et al., 2011, WHO, 2011). Prevalence of anemia among women of reproductive age (% of
women ages 15-49) in Kenya was 27.20 as of 2016 (WHO, 2017). Likewise, majority (25-35%) of the global cases of maternal vitamin A deficiency are in Africa (WHO, 2009) while 26% of the population in Sub Saharan Africa suffers an inadequate intake of zinc (Wessel & Brown 2012).

Consequences of deficiencies are far-reaching and relate directly or indirectly to increased morbidity and mortality worldwide. Vitamin C plays a protective role as an antioxidant (Hemila & Louhiala, 2007; Ministry of Health, 2017) and it is also crucial in production of connective tissue, assimilation of iron and in hemoglobin formation (Kabir et al., 2010). Calcium is useful in enhancing strength in bones and teeth and aids in uptake of vitamin B₁₂. Fractures and osteoporosis in adults can occur if calcium is insufficiently taken with increased likelihood of palpitations and cramps (Kumssa et al., 2015).

To achieve dietary adequacy of micro nutrients, food based approaches including dietary diversity and variation of consumption patterns to ensure optimal intake of nutrients, are being advocated (Miller & Welch, 2013; FAO, 2014). However, on the contrary, more people seem to adopt nutrition specific approaches toward the management of personal nutrition. Of these, the use of dietary supplements is becoming widespread among the population in developing countries such as Kenya. Unfortunately, few studies exist that have investigated the use of these supplements and its impact on the nutritional practice of the people.

2.4.2 Dietary Diversity for General Adult Population

Dietary diversity has been recognized by nutritionists and other health professionals as a major principle in ensuring high quality diets. It promotes good health by
ensuring sufficient intake of essential micro nutrients (WHO/FAO, 2010). Diverse studies have linked simple dietary diversity to micronutrient intake and since no single food contains all nutrients (FANTA, 2011; Nguyen et al., 2018). Basic nutrient requirements can be met if more food groups are included in the daily diet of an individual (Labadarious et al., 2011; Ngala, 2015).

Different foods across the food groups have varied contents and types of nutrients that the body requires for normal physiological functions, (Vakili et al., 2013). Each nutrient in our diet contributes to the overall nutritional needs of the body and if these needs are not met, an individual suffers the risk of developing adverse health outcomes associated with the deficiency (Torheim et al., 2004; WHO, 2008). Apart from human milk during infancy, no single food can have all and adequate nutrients to consumers (Mirmiran, Azadbakht, Esmailzadeh and Aziz, 2006; WHO, 2011). Quality diets rely on consumption of a variety of foods across the food groups which in return contribute to nutrient adequacy in adults (Daniels, 2009; Ngala, 2015).

As outlined by FAO (2008), dietary diversity is determined by adding the number of foods or food groups that have been eaten over a specified period of time. A low-cost assessment tool, an individual dietary diversity questionnaire which consists of a simple count of foods or food groups an individual has taken over the preceding 24 hours is used (FAO, 2007). The individual dietary diversity score aims to capture nutrient adequacy. The study sought to establish the dietary diversity of the teachers as a representation of the general population because of limited data available in Kenya.

2.4.3 Food Consumption Patterns for General Adult Population
Dietary patterns have changed over time driven by such things as cultural evolution, climate and ecological change, agricultural and industrial revolution as well as socio-economic factors which in turn determine availability of particular foods (Kearney, 2010; Chauvin, Mulangu, & Porto, 2012). It is believed that if people have access to adequate quantities and a variety of foods, they will largely meet their nutritional needs (Anders & Schroeter, 2017). For certain groups of people, however, due to economic constraints, food alone may not be able to meet the minimum requirements for certain micronutrients. Thus, micronutrient adequacy must be taken into account when evaluating the nutritive value of diets alongside energy and protein adequacy. A nutritive diet can be achieved through the intake of multiple combinations of a variety of foods (WHO, 2004).

The average daily caloric intake among the adult population in Kenya is 2155 Kcal of 55% is contributed from main staples; maize, wheat, beans, potatoes, plantains, and rice while other traditional foods such as sorghum, millet, cassava arrowroots and yams are also taken (FAO 2007). While the WHO (2015) recommends at least five servings (400g) of a variety of fruits and vegetables a day and generous portions of legumes, whole grains and nuts, on average, daily consumption of two servings consistently across all age groups has been reported. Minimal intake of free sugars to <10% of total energy intake and reduced amount of total fat intake to less than 30 percent of total energy intake is recommended to help reduce unhealthy weight gain in the adult population (FAO, 2010).

Dependency on available and affordable starchy staples, snacks and beverages has increased vulnerability to malnutrition in Africa (Vorster et al., 2011). Three meals are normally served in a day in a typical Kenyan household (WHO/MoH, 2015).
These include breakfast in the morning, midday meal and supper. In the recent decades, rapid changes in diets and lifestyles that have occurred with industrialization and economic development have not only resulted in monotonous diets but also in the shift of dietary patterns towards the consumption of, particularly, high fat, energy-dense, low in micro nutrients and unrefined carbohydrate diets (Keding, Msuya, Maass, & Krawinkel, 2011). This has brought along with a concomitant rise in the prevalence of the so called lifestyle diseases that have made many people to rethink their personal nutrition and health. As a result, many people have turned to the use of dietary supplements either to boost their nutrition for optimum health or as measure in the management of disease conditions. Unfortunately, there exist limited information on use of the dietary supplements in Kenya and how it relates to the food consumption patterns on a normal/healthy population.

2.5 Summary of Literature Review

Dietary supplements market has been growing at an alarming rate, (Kennedy et al., 2013). Documented literature reveals that demographic and socio-economic factors and sources of information on dietary supplements may influence the use of dietary supplements. Despite the general agreement among health professionals that a balanced diet provides most persons with adequate essential nutrients for good health (WHO/FAO, 2010), the use of vitamins and mineral products to supplement the diet thrive among millions of people (Randimer et al, 2004; NHANES 2003-2006).

Global patterns reveal trends toward increased use of dietary supplements in healthy populations in both developed and developing countries. An uptake of 43.5% among Kenyan gym users (Wachira, 2011) and 15.5% among Kenya league rugby players (Kimiywe and Simiyu, 2008), has been reported. Majority of the studies on
prevalence of dietary supplements use in relation to dietary practices have been conducted in developed countries and on profiled groups or disease related populations.

There is limited literature on the prevalence of dietary supplement use and dietary practices in developing nations particularly in Sub Saharan Africa. This study addressed this gap by determining the of use of dietary supplements in relation to dietary practices of a healthy homogeneous Kenyan population, i.e. teachers in public secondary schools in Kikuyu, Kiambu County.
3.1 Research Design

A cross sectional analytical study design was adopted for this study. Both qualitative and quantitative methods were used in data collection, analysis and presentation. This methodology was chosen as it allows the analysis of factors associated with dietary supplements use, use of dietary supplement and whether dietary practices are related to dietary supplement use among secondary school teachers from data collected at one point in time.

3.2 Research Variables

3.2.1 Dependent Variables

The dependent variables were dietary supplement use, dietary diversity and dietary intake (Vitamin A, B6, D, E, iron, calcium and Zinc). These are micronutrients of public health concern.

3.2.2 Independent Variables

The independent variables for this study were age, gender, marital status, income, level of education and sources of information on dietary supplement use.

3.3 Study Area

The study was undertaken in Kikuyu Sub-County of Kiambu County. The county is adjacent to the northern border of Nairobi County with an area of 2543.42 square kilometers. Being among the wealthiest counties in Kenya, Kiambu is home to different ethnicities that primarily work in civil service or carry out different businesses. According to 2009 Kenya Housing and population census, the county population was at 1,623,282, with Kikuyu Sub-County having a population of
190,208. The area was chosen due to its proximity to city center where many of the
major distributors of the dietary supplement are located and are sold.

3.4 Study Population

The study targeted teachers in public secondary schools as they typically represent the
Kenyan working class in the lower middle income bracket which constitutes the
majority the working population in Kenya. They are also considered as key decision
makers in the local community hence they can influence opinion about use of certain
products in the local context.

3.4.1 Target Population

The target population consisted of 289 teachers in 17 public secondary schools in
Kikuyu Sub-County. Teachers in public schools were targeted because of the relative
homogeneity of the group (in terms of in their working conditions, terms of
employment, average income and level of education) as such; the findings could be
generalized to the other teachers in public secondary in the country.

3.4.2 Inclusion Criteria

Inclusion criteria was all teachers working in public secondary schools in Kikuyu
Sub-County under Teachers Service Commission and had served for at least one year
in the school. One year was deemed adequate duration for one to fully adapt or adjust
his lifestyle according to their new economic/employment status (in terms of
employment or income).

3.4.3 Exclusion Criteria

During the recruitment, potential participants were asked about their pregnancy status
and whether they engaged in the sale of dietary supplements. Pregnant teachers were
excluded because they were assumed to be on IFAS. Teachers who sell supplements were excluded to avoid bias. Besides, those that declined to give consent for participation in the study.

3.5 Sample Size Determination

The sample size was determined by the sample size standard formulae (Fischer et al, 1998):

\[ n = \frac{Z^2 p q}{d^2} \]

Where:

- \( n_0 \) = desired sample size
- \( p \) = percentage picking a choice, expressed as decimal (0.5 used for sample size needed)
- \( z \) = Standard normal deviation which is 1.96 at 95 % level of confidence.
- \( q \) = 1 – \( p \)
- \( d \) = Degree of accuracy desired is 0.05

\( p = \) expected proportion of DS users among teachers in the county = 50% = 0.5;

therefore \( p = 0.5 \) and \( q = 1 – 0.5 \)

Substituting:

\[ n_0 = \frac{(1.96)^2 \times 0.5 \times (1-0.5)}{(0.05)^2} = 384 \text{ respondents} \]

For finite population correction

\[ n = \frac{n_0}{1 + \frac{n_0-1}{N}} \]

\[ n = 384/1 + \frac{(384-1)}{289} \]

\[ = 165 \]
This gave a total of 165. Ten percent non response was factored to get a sample of 182 teachers. Four key informants were selected from each category from those with registered businesses or practicing in Kikuyu Sub-County so that they could give more insight on use of dietary supplements.

3.6 Sampling Techniques

A sampling frame was prepared consisting of the names, with assigned numbers of all the 289 teachers from all the 17 public secondary schools in the Sub County. Simple random sampling was used to select the study participants for the interview (Mugenda & Mugenda, 2003). A computer generated table of random numbers was used to select the participants. Four key informants’ categories were also purposively selected for the study. These included a doctor, a nutritionist, a pharmacist, and a dietary supplement seller. All the key informants must have had registered businesses or practicing in Kikuyu Sub-County.

3.7 Selection and Training of Research Assistants

Two research assistants were recruited from within the study area based on the criteria that they were to have a minimum of a diploma in nutrition or food science, have experience in data collection from other studies and have a good command in English and Swahili. The training covered ethical issues, a brief explanation of the study objectives, the purpose of the study, data collection technique, and a thorough review of the questionnaire which included interviewing skills and field practice on the fourth day for the pre-test.
3.8 Research Instruments

3.8.1 Researcher-administered Questionnaire

A researcher-administered questionnaire (Appendix C) was used to source for data from the participants. The questionnaire was divided into three parts. Section A gathered information on socio-demographic characteristics including age, gender, marital status, level of education and household income. Section B elicited information on the use of dietary supplement including the types of supplements used, duration of usage, frequency of usage, reason for use as well as the nature and sources of information regarding dietary supplements. Section C collected information on dietary practices.

A 24 hour dietary recall questionnaire elicited quantitative data on dietary intakes of specific micro nutrients that is Vitamin A, B6, C, D, E, calcium, iron and zinc through all meals and snacks consumed in a day. The 16 food-group household dietary diversity score (HDDS) questionnaire (FAO, 2010) obtained qualitative data on DDS from the 24-hour recall period. A 7-day food frequency questionnaire gathered information on the number of times selected foods had been eaten in the last 7 days.

3.8.2 Key Informant Interviews (KII) Guides

3.8.2.1 Key Informant Interview Guide for Pharmacists and Dietary Supplements Sellers

One KII guide (Appendix D) was used to elicit information from a pharmacist and a supplement seller in Kikuyu Sub County. The information sought was on the type of supplements sold, their major clients and sources of information on dietary supplements use.
3.8.2.2 Key Informant Interview Guide for Doctors and Nutritionists

A second KII guide (Appendix E) was used to get data from a doctor and a nutritionist on healthy eating, use of dietary supplements, target groups, information on DS use, training on DS and its content, regulation/policies on DS and measures to ensure responsible use of DS.

3.9 Pre-testing of Data Collection Tools

Data collection questionnaires were pre-tested prior to the research. Pre testing of the questionnaires was administered to 17 teachers (10 percent of the sample size) in two secondary schools selected randomly in neighboring Ruiru Sub-County. Pretesting was done to establish accuracy and clarity of questions as well as establish the length of the interview. The pre-testing provided an opportunity for training of research assistants and also allowed for modifications and inclusion of missed items.

3.10 Validity and Reliability of Instruments

3.10.1 Validity

Validity of research tools was ensured through the use of validated questionnaires as per the study objectives and validated by supervisors who are also technical experts. Pre-testing was also done to ensure that the questions were precise, accurate and that they collected the intended data.

3.10.2 Reliability

The test re-test method ascertained the reliability of the research instruments in the study. At pretesting stage, data was collected twice in a span of three days from the sample. The data yielded a correlation coefficient of 0.89 (0.79 – 0.98; 95% CI)
between the two sets of data. For reliability test, a Cronbach’s alpha of 0.7 and above was considered as acceptable (Blaxter et al., 2006).

3.11 Data Collection Techniques

Data was collected within a period of 30 days. Information was collected from each participant in a one-time face to face interview at the school level with a few follow-ups over the weekend to ascertain the household measures used for nutrient intake. The data collection techniques used included the following:

3.11.1 Demographic and Socio-economic Data

Demographic and socio-economic characteristics of the study participants was collected using a semi structured questionnaire through face to face interviews to collect data on age, marital status, level of education, individual personal income, household income and whether an individual involved themselves in other income generating activities (Appendix C).

3.11.2 Dietary Supplements Use

Face to face interviews were conducted on use of dietary supplements (Appendix C). The participants were prompted for duration of use, type of supplements taken, reasons for taking the supplements, source of information for dietary supplements use, point of purchase and nutrition information given during purchase.

3.11.3 Nutrient Intake and Dietary Diversity

Nutrient intake information was collected using 24 hour dietary assessment recall (Appendix C). The 24 hour dietary recall involved asking the participants to enumerate all the foods eaten the day before from the moment they woke up, throughout the day to the time they went to bed at night indicating clearly the time the
food was consumed. To ensure accuracy in the estimation of the portion sizes by the researcher, an assortment of household utensils: spoons, cups, glasses and plates were used to approximate amounts of foods and beverages. Food models and pictures were also used as visual aids. Fruits and vegetables in season were bought, prepared and cooked for use in the estimation of portion sizes during the pretesting period by the trainees and the researcher. To minimize the recall bias and improve on accuracy, a reference period of 24 hours was used.

Using the information collected from the 24-hour recall the DDS for the participants was derived using the 2008 FAO guideline for measuring household and individual dietary diversity (FAO, 2008). In assessing dietary diversity, a scale of fourteen food groups; cereals, vitamin A rich vegetables and tubers, white roots and tubers, dark green leafy vegetables, other vegetables, vitamin A rich fruits, other fruits, flesh meat, organ meat, eggs, fish, pulses/legumes and nuts, milk and milk products, oils and fats was used.

3.11.4 Food Consumption Patterns

Frequency of consumption of certain food items was assessed using a 7-day food frequency questionnaire (Appendix C). Common community dishes/foods were listed down in their sixteen food groups and the respondents asked on how often they had consumed a particular meal/food in the past seven days. Data from the 7-day FFQ were used to describe the food consumption pattern of the participants. FFQ has commonly been used to assess regular consumption patterns of a population. It is usually chosen method because for its cheap, easy to administer requiring minimal efforts from the participants (Subar, 2004), and providing estimates on the number of times a food is consumed by individuals. The adapted FFQ was pre-tested, improved
and finally used in the research. A one on one interview was used where participants were asked the number of times each food item had been consumed in the preceding seven days on all the listed common community food items.

3.11.5 Qualitative Data
Key informant interviews were conducted using the interview schedule (Appendix D & E). The participants were a doctor and a nutritionist and information on circumstances for recommendation, target group mostly advised, probing of patients for dietary supplement use, training on use of dietary supplements and regulation policies was solicited. KII questionnaire was also administered to elicit information from the sellers of DS. The participants were a pharmacist and a dietary supplement seller. Information on level of education, primary source of income, range of supplements sold, duration of sale, major buyers, and sources of information, training and regulation of dietary supplement information was solicited.

3.12 Data Analysis and Presentation
Statistical analysis was conducted using the Statistical Package for Social Sciences (SPSS) version 22 for data analysis. Data collected on demographic, socio economic and use of dietary supplements was analyzed using quantitative methods by use of descriptive statistics such as means, percentages and frequencies. Chi square tests was used to test relationships while odds ratio was used to test associations between demographic and SES characteristics and use of dietary supplements. Data on nutrient intake was analyzed using the Nutri-survey software.
The intakes of key nutrients of interest among the participants were compared to the Recommended Nutrient Intakes (RNIs) to establish the percentage meeting the RNIs. Chi square was used to establish relationship between nutrient intake and dietary supplement use. The DDS of the respondents was computed by awarding a point to each food group eaten over the given period and a total of all points were computed as recommended by FAO (2008). A scale of fourteen food groups was used. An individual dietary diversity score was measured by totaling the number of foods or food groups taken by a participant 24 hours preceding the recall time. Using the fourteen food groups, dietary diversity terciles were established namely; low diversity tercile (≤ 3 food groups); medium diversity tercile (4 to 5 food groups) and high diversity tercile (≥6 food groups) (FAO, 2007; 2010). The participants’ DDS was then assessed based on their position on the scale. Chi square was used to establish relationship between dietary diversity and DS use. Food consumption data from FFQ was analyzed to determine the top food items consumed and regularity of consumption. Statistical significance was set at P<0.05.

For qualitative data, content analysis was conducted for the KIIs. Data was organized into themes such as use of dietary supplements, types prescribed and sold, reasons for prescribing, sources of DS, sources of information and type of nutrition information. Illustrative quotations were also selected.

3.13 Logistical and Ethical Considerations

Approval to carry out research was sought from Graduate School of Kenyatta University (Appendix K). Kenyatta University Ethical Review Committee gave ethical clearance (Appendix J), while National Commission for Science, Technology and Innovation (NACOSTI) (Appendix L) gave a research permit. The researcher also
sought written permission from Sub-County Education Officer (Appendix M) and verbal consent from head teachers of the respective school before engaging the teachers in the schools. The questionnaire was administered to the participants upon voluntary informed consent (Appendix A). The researcher ensured that all information obtained was kept in strict confidence. For privacy, the questionnaires did not bear the names of the participants nor other means of identity linked to individual participants.
CHAPTER FOUR: RESULTS

4.1 Introduction

The use of dietary supplements and dietary practices among teachers was assessed in 17 secondary schools in Kikuyu Sub County. 178 teachers consented and participated in the study, which was 100% of the response rate. The findings are presented as per the study objectives which are: demographic and socio economic characteristics of the teachers, dietary practices of the teachers, and the use of dietary supplements among the teachers. The results on the relationship between demographic and socio economic characteristics, dietary practices and use of dietary supplements among the teachers are also presented.

4.2 Description of the Study Population

4.2.1 Demographic Characteristics of the Participants

Age was counted in terms of completed years with the youngest teacher being 21 years and the oldest at 58. The mean age of the participants was 38 ± 9 years. Of the participants, 27% were aged between 21-30 years, 25% were 31-40 years, 36.5% were 41-50 years while 11.8% were 51-60 years. On gender distribution, 61% of the respondents were females while 39% were males. The gender disparity could be attributed to better quality urban service and living conditions, which attract females. Close proximity to the city of Nairobi for Kikuyu attracts married women whose spouses work and reside in Nairobi and its environs. Majority of the participants were married (65.7%) (Table 4.1).
Table 4.1: Demographic characteristics of the study participants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group (Years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;30</td>
<td>48</td>
<td>27</td>
</tr>
<tr>
<td>31-40</td>
<td>44</td>
<td>24.7</td>
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<tr>
<td>41-50</td>
<td>65</td>
<td>36.5</td>
</tr>
<tr>
<td>51-60</td>
<td>21</td>
<td>11.8</td>
</tr>
<tr>
<td>Mean age 38 ±9.755</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>70</td>
<td>39.3</td>
</tr>
<tr>
<td>Female</td>
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<td>60.7</td>
</tr>
<tr>
<td>Marital status</td>
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</tr>
<tr>
<td>Married</td>
<td>117</td>
<td>65.7</td>
</tr>
<tr>
<td>Single</td>
<td>56</td>
<td>31.5</td>
</tr>
<tr>
<td>Widowed/Divorced</td>
<td>5</td>
<td>2.8</td>
</tr>
</tbody>
</table>

4.2.2 Socio-economic Characteristics of the Participants

4.2.2.1 Level of Education of the Participants

Majority (67%) of the participants had an undergraduate degree while masters degree holders and diploma holders accounting for 19% and 14% of the sample respectively (Figure 4.1).

![Figure 4.1 Level of education of the teachers](image)
4.2.2.2 Level of Income of the Teachers

The participants income from salary was established where 24.2% had a net of less than Ksh 20,000, 41.6% had Ksh 20,001-30,000, 19.1% had Ksh 30,001-40,000, and 6.2% had Ksh 40,001-50,000 with only 9% reported having a net of over Ksh 50,000. On other sources of income, 54.5% of the participants engaged in other income generating activities such as rental income, farming and part time teaching to supplement their income with 24.7% getting ≤ Ksh 10,000, 12.9% earned about Ksh 10,001-20,000, 6.7% had Ksh 20,001-30,000, 2.2% had Ksh 30,001-40,000 and over 7% earned monthly profits of over Ksh 40,000 (Table 4.2).

Table 4.2 : Level of income of the participants per month

<table>
<thead>
<tr>
<th>Income from salary (Kshs)</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤20,000</td>
<td>43</td>
<td>24.2</td>
</tr>
<tr>
<td>20,001-30,000</td>
<td>74</td>
<td>41.6</td>
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<tr>
<td>30,001-40,000</td>
<td>34</td>
<td>19.1</td>
</tr>
<tr>
<td>40,001-50,000</td>
<td>11</td>
<td>6.2</td>
</tr>
<tr>
<td>&gt;50,000</td>
<td>16</td>
<td>9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Income from part time jobs</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤10,000</td>
<td>44</td>
<td>24.7</td>
</tr>
<tr>
<td>10,001-20,000</td>
<td>23</td>
<td>12.9</td>
</tr>
<tr>
<td>20,001-30,000</td>
<td>12</td>
<td>6.7</td>
</tr>
<tr>
<td>30,001-40,000</td>
<td>4</td>
<td>2.2</td>
</tr>
<tr>
<td>40,001-50,000</td>
<td>7</td>
<td>3.9</td>
</tr>
<tr>
<td>≥50,000</td>
<td>7</td>
<td>3.9</td>
</tr>
<tr>
<td>N/A</td>
<td>81</td>
<td>45.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average monthly household income</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 20,000</td>
<td>8</td>
<td>4.5</td>
</tr>
<tr>
<td>20,001-30,000</td>
<td>30</td>
<td>16.9</td>
</tr>
<tr>
<td>30,001-40,000</td>
<td>24</td>
<td>13.5</td>
</tr>
<tr>
<td>40,001-50,000</td>
<td>20</td>
<td>11.2</td>
</tr>
<tr>
<td>&gt;50,000</td>
<td>96</td>
<td>53.9</td>
</tr>
</tbody>
</table>
The average monthly household income covered the net household income from all members contributing to the household expenses. Majority of the participants (53.9%) had a household income of more than Ksh 50,000, with only 4.5% of the participants having a household income of less than Ksh 20,000 (Table 4.2).

4.3 Dietary Practices of the Teachers

Dietary practices of the participants investigated included their dietary diversity, nutrient intakes and frequency of consumption of common foods in the various food groups. The 24-hour dietary recall was used to assess dietary diversity and dietary intakes while the 7-day food frequency questionnaire was used to determine food consumption patterns of the participants. Results are given below;

4.3.1 Individual Dietary Diversity Score Based on 24 hour Recall

Food and Agriculture Organization (FAO, 2008), categorizes dietary diversity score (DDS) as; consumption of less than 3 food groups is classified as poor dietary diversity, 4-5 food groups is classified as moderate dietary diversity and greater or equal to 6 food groups is classified as high dietary diversity. From the possible fourteen food groups, the mean DDS was 7.42 ± 1.21 with scores ranging from 3-11 food groups.

In this study, 84.8% of the participants had a high dietary diversity (≥6 food groups), while 13.5% had moderate dietary diversity with (4-5 food groups). Only 1.7% of the participants were found to have low dietary diversity (≤ 3 food groups) (Figure 4.2)
Nutrient intake from 24 hours dietary recall was analyzed using Nutri-survey. Selected micronutrients included vitamins A, C, B6, D, E, iron, calcium, and zinc. These are micronutrients commonly deficient in many populations in SSA and which play key role in maintenance of good health (Miller & Welch, 2013; WHO, 2007). The total amounts of nutrient intake from all meals and snacks consumed in a day were established. This was compared with the Recommended Nutrient Intakes (RNIs) (Table 4.3).

The study showed that the mean intakes of vitamin A (2300 ± 4432), Vitamin B6 (1.43 ± 0.69), iron (28.39 ± 24.7) and zinc (14.40 ± 5.30) were adequate to meet daily requirements for most of the participants but the mean intakes of vitamin D (6.906 ±
4.59), E (10.12 ±5.697), vitamin C (42.30 ± 27.09) and calcium (703.04 ± 420.87) were inadequate.

Table 4.3: Nutrient intake of selected nutrients among the participants

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Mean intake (SD)</th>
<th>Reference value</th>
<th>% of those meeting RNIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A (µg)</td>
<td>2300 ± 4432.08</td>
<td>600(500)</td>
<td>65.2</td>
</tr>
<tr>
<td>Vitamin B6 (mg)</td>
<td>1.43 ± 0.69</td>
<td>1.3(1.3)</td>
<td>75.3</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>42.30 ± 27.09</td>
<td>45(45)</td>
<td>40.4</td>
</tr>
<tr>
<td>Vitamin D (µg)</td>
<td>6.906 ± 4.59</td>
<td>10 (10)</td>
<td>42.1</td>
</tr>
<tr>
<td>Vitamin E (eq)</td>
<td>10.12 ±5.697</td>
<td>12(12)</td>
<td>19.7</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>703.04 ± 420.87</td>
<td>1000(1000)</td>
<td>43.8</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>28.39 ± 24.7</td>
<td>27.4(58.8)a</td>
<td>61.8</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>14.40 ± 5.30</td>
<td>14(9.8)a</td>
<td>58.4</td>
</tr>
</tbody>
</table>

FAO/WHO 2001; WHO/FAO 2004 aBased on a low bioavailability level of 5%.

4.3.3 Food Consumption Patterns of the Participants

A 7-day food frequency questionnaire elicited information on the food items eaten by the participants within the period of seven days preceding the interview. The results are presented in Tables 4.4 to 4.7

4.3.3.1 Consumption of Cereals, Grains, Roots and Tubers by the Participants

This study established the consumption patterns of commonly consumed carbohydrate foods which included rice, ugali (stiff maize meal porridge), millet, chapatti, bread, githeri (maize and beans), doughnuts, green bananas, arrow roots, sweet potatoes, and Irish potatoes. The results showed that 53.4% of the participants consumed bread daily while 21.9% consumed bread at between 4-6 times in the week preceding the interview. The second most consumed grain was rice with 41% of the participants consuming it between 4-6 times in the week prior to the interview and 28.1% between 2-3 times. With the shortage of the maize flour during the time of study, ugali was not consumed on daily basis by most of the participants but its intake remained relatively high at 4-6 times (34.8%), and 2-3 times at 27.5%. Chapattis were consumed mostly between 2-3 times (29.8%) and 4-6 times (19.1%). Porridge,
doughnuts, arrowroots and sweet potatoes were consumed at 6.2%, 5.8% and 1.7% by the participants on daily basis with majority of the teachers reporting having not consumed them at all in the past week.

*Githeri* was consumed by majority of the participants once (27.0%) and 2-3 times at (30.9%). Green bananas and Irish potatoes were not consumed by 61.8% and 78.7% of the participants respectively despite their availability in the local markets at the time of the study (Table 4.4).

**Table 4.4**: Frequency of consumption of cereals, grains, roots and tubers in a week

<table>
<thead>
<tr>
<th>% of the total N=178</th>
<th>Frequency of consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily</td>
</tr>
<tr>
<td>Rice</td>
<td>19.6</td>
</tr>
<tr>
<td>Ugali</td>
<td>23.0</td>
</tr>
<tr>
<td>Millet</td>
<td>6.2</td>
</tr>
<tr>
<td>Chapatti</td>
<td>0.0</td>
</tr>
<tr>
<td>Bread</td>
<td>53.4</td>
</tr>
<tr>
<td>Githeri</td>
<td>1.1</td>
</tr>
<tr>
<td>Doughnuts</td>
<td>5.8</td>
</tr>
<tr>
<td>Green bananas</td>
<td>1.1</td>
</tr>
<tr>
<td>Arrow roots</td>
<td>1.7</td>
</tr>
<tr>
<td>Sweet potatoes</td>
<td>1.7</td>
</tr>
<tr>
<td>Irish potatoes</td>
<td>2.2</td>
</tr>
</tbody>
</table>

**4.3.3.2 Consumption of Protein Rich Foods by the Participants**

Among the main sources of proteins, beef was the most consumed source of animal protein with 14% reporting daily consumption, 38.2% of the participants reporting a consumption frequency of 2-3 times and 32% at 4-6 times. Only 7.9% of the participants reported not having taken beef. Eggs were consumed at a frequency of once a week, 2-3 times and 4-6 by 14%, 45.5% and 10.7% of the participants respectively. A small percentage of the participants (15.2%, 22.5% and 24.7%
respectively), reported having taken fish, sausages and chicken at least once a week respectively. Organ meats were least consumed with 92.7% not consuming offals and 88.8% having not consumed liver in the week preceding the study (Table 4.5).

Table 4.5: Participants consumption patterns of protein rich foods in a week.

<table>
<thead>
<tr>
<th>Frequency of consumption</th>
<th>Daily</th>
<th>Once</th>
<th>2-3 times</th>
<th>4-6 times</th>
<th>Not consumed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Meats &amp; Eggs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offals</td>
<td>0.0</td>
<td>5.6</td>
<td>1.1</td>
<td>0.6</td>
<td>92.7</td>
</tr>
<tr>
<td>Liver</td>
<td>0.0</td>
<td>7.9</td>
<td>3.3</td>
<td>0.0</td>
<td>88.8</td>
</tr>
<tr>
<td>Beef</td>
<td>14.1</td>
<td>7.9</td>
<td>38.1</td>
<td>32.0</td>
<td>7.9</td>
</tr>
<tr>
<td>Chicken</td>
<td>0.6</td>
<td>24.7</td>
<td>16.8</td>
<td>1.2</td>
<td>56.7</td>
</tr>
<tr>
<td>Sausages</td>
<td>1.5</td>
<td>22.5</td>
<td>6.9</td>
<td>2.2</td>
<td>66.9</td>
</tr>
<tr>
<td>Fish</td>
<td>0.6</td>
<td>15.2</td>
<td>14.0</td>
<td>2.8</td>
<td>67.4</td>
</tr>
<tr>
<td>Eggs</td>
<td>3.9</td>
<td>14.0</td>
<td>45.5</td>
<td>10.8</td>
<td>25.8</td>
</tr>
<tr>
<td><strong>Legumes &amp; nuts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beans</td>
<td>6.2</td>
<td>5.1</td>
<td>36.0</td>
<td>24.0</td>
<td>28.7</td>
</tr>
<tr>
<td>Green grams</td>
<td>0.0</td>
<td>19.6</td>
<td>30.3</td>
<td>2.2</td>
<td>47.9</td>
</tr>
<tr>
<td>Ground nuts</td>
<td>3.8</td>
<td>14.0</td>
<td>12.4</td>
<td>1.1</td>
<td>68.5</td>
</tr>
<tr>
<td>Peas</td>
<td>1.6</td>
<td>18.0</td>
<td>15.7</td>
<td>1.1</td>
<td>63.6</td>
</tr>
<tr>
<td><strong>Milk and milk products</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whole milk</td>
<td>94.4*</td>
<td>0.6</td>
<td>0.0</td>
<td>1.7</td>
<td>3.3</td>
</tr>
<tr>
<td>Fermented</td>
<td>5.6</td>
<td>2.8</td>
<td>8.4</td>
<td>4.5</td>
<td>78.7</td>
</tr>
<tr>
<td>Yoghurt</td>
<td>1.1</td>
<td>11.8</td>
<td>15.2</td>
<td>0.6</td>
<td>71.3</td>
</tr>
</tbody>
</table>

*Most took milk in tea

The commonly consumed pulses and legumes were beans, green grams, ground nuts, and peas. Beans, mostly used in *githeri* or as an accompaniment to rice were consumed by most of the teachers between 2-3 times a week (36%) and at 4-6 times (24.2%). Green grams were consumed between 2-3 times a week by 30.3% of the participants with 19.6% reporting having consumed it once a week. 47.9% reported not having consumed green grams at all. Participants who consumed groundnuts on daily basis were only 3.8 % with only 1.1% consuming 4-6 times a week prior to the week of study. Those who had not consumed peas were at 63.6% (Table 4.5).
On consumption of milk and milk products, the study reveals that 94.4% of the participants took milk on daily basis but most of the milk was in tea or taken as whole to accompany ugali. 5.6% of the participants took fermented milk daily after a meal of ugali while 15.2% took yoghurt 2-3 times a week as a snack (Table 4.5)

4.3.3.3 Consumption Patterns of Vegetables and Fruits by the Participants.

Table 4.6 shows the consumption patterns of vegetables and fruits. The most commonly consumed vegetables were onions and tomatoes by 96.6% and 93.3% on a daily basis respectively. This can be attributed to their use as a seasoning during meals preparation. This was followed by carrots with 52% of the participants having consumed them on a daily basis with 14% and 25% of the participants consuming carrots 2-3 times and 4-6 times in the preceding week respectively. Kales, spinach, cabbage, amaranth, cowpeas and black night shade being moderately consumed with over half of the participants taking between 2-3 and 4-6 times in the week preceding the interview. The moderate consumption could be attributed to prevailing dry weather. The results reveal the consumption patterns of pumpkins and cucumbers was low with only 1.7% of the participants reporting having consumed them only once despite their availability in the local markets
Table 4.6 Participants consumption patterns of vegetables and fruits

<table>
<thead>
<tr>
<th>Vegetables</th>
<th>% of the total N=178</th>
<th>Daily</th>
<th>Once</th>
<th>2-3 times</th>
<th>4-6 times</th>
<th>Not consumed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrots</td>
<td>52.0</td>
<td>1.7</td>
<td>14.0</td>
<td>25.3</td>
<td>7.4</td>
<td></td>
</tr>
<tr>
<td>Pumpkin</td>
<td>5.1</td>
<td>3.4</td>
<td>1.7</td>
<td>2.0</td>
<td>88.8</td>
<td></td>
</tr>
<tr>
<td>Kales</td>
<td>21.9</td>
<td>3.9</td>
<td>28.1</td>
<td>26.4</td>
<td>17.4</td>
<td></td>
</tr>
<tr>
<td>Spinach</td>
<td>28.1</td>
<td>1.7</td>
<td>25.3</td>
<td>27.5</td>
<td>17.4</td>
<td></td>
</tr>
<tr>
<td>Cabbages</td>
<td>17.4</td>
<td>6.7</td>
<td>16.3</td>
<td>37.1</td>
<td>22.5</td>
<td></td>
</tr>
<tr>
<td>Tomatoes</td>
<td>93.3</td>
<td>1.1</td>
<td>1.2</td>
<td>2.2</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>Cucumbers</td>
<td>2.8</td>
<td>1.7</td>
<td>3.4</td>
<td>1.7</td>
<td>90.4</td>
<td></td>
</tr>
<tr>
<td>Onions</td>
<td>96.6</td>
<td>1.1</td>
<td>2.3</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Other African vegetables</td>
<td>11.2</td>
<td>14</td>
<td>34.8</td>
<td>13.6</td>
<td>26.4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fruits</th>
<th>% of the total N=178</th>
<th>Daily</th>
<th>Once</th>
<th>2-3 times</th>
<th>4-6 times</th>
<th>Not consumed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pawpaws</td>
<td>3.4</td>
<td>3.9</td>
<td>8.4</td>
<td>1.1</td>
<td>83.1</td>
<td></td>
</tr>
<tr>
<td>Mangoes</td>
<td>1.7</td>
<td>16.3</td>
<td>14.4</td>
<td>2.3</td>
<td>65.2</td>
<td></td>
</tr>
<tr>
<td>Melons</td>
<td>6.5</td>
<td>17.4</td>
<td>30.3</td>
<td>7.3</td>
<td>38.8</td>
<td></td>
</tr>
<tr>
<td>Passions</td>
<td>0.0</td>
<td>2.8</td>
<td>2.2</td>
<td>3.4</td>
<td>91.6</td>
<td></td>
</tr>
<tr>
<td>Pineapples</td>
<td>0.0</td>
<td>6.2</td>
<td>3.9</td>
<td>0.0</td>
<td>89.9</td>
<td></td>
</tr>
<tr>
<td>Avocado</td>
<td>10.7</td>
<td>12.9</td>
<td>25.3</td>
<td>12.9</td>
<td>38.2</td>
<td></td>
</tr>
<tr>
<td>Apples</td>
<td>3.4</td>
<td>10.1</td>
<td>14.6</td>
<td>4.5</td>
<td>67.4</td>
<td></td>
</tr>
<tr>
<td>Ripe bananas</td>
<td>21.4</td>
<td>9.6</td>
<td>36.0</td>
<td>18.0</td>
<td>15.7</td>
<td></td>
</tr>
<tr>
<td>Oranges</td>
<td>4.5</td>
<td>9.6</td>
<td>25.3</td>
<td>6.7</td>
<td>53.9</td>
<td></td>
</tr>
<tr>
<td>Pears</td>
<td>0.0</td>
<td>4.5</td>
<td>10.7</td>
<td>0.0</td>
<td>84.8</td>
<td></td>
</tr>
</tbody>
</table>

The most popular consumed fruit was ripe bananas with 21.4% of the participants consuming them daily. Most of the participants had taken avocados and melons between 2-3 times and 4-6 times in the preceding week. Mangoes, apples, and oranges were consumed by most of the participants between once and 2-3 times with 65.2%, 67.4%, and 53.9% reporting not having taken respectively. Pawpaws, passion fruits, pineapples and pears were the least taken with most of the participants reporting having not taken in the preceding week with 83.1%, 91.6%, 89.9%, and 84.8% respectively indicating non-consumption in the subject week of study. This was despite pears being in season (Table 4.6)
4.3.3.4 Consumption Patterns of Oils and Fats by the Participants

On use of oils and fats, majority of the participants (96%) reported daily consumptions in the last seven days in cooked foods. It is also worth noting that majority of the participants were using oil (91.5%) on daily basis as opposed to 5.6% who used fats. Margarine was mostly used as a spread on a daily basis by 14.6% of the participants with 55.6% having not consumed it in the last seven days (Table 4.7).

Table 4.7 Participants consumption of oils and fats, beverages, condiments and spices

<table>
<thead>
<tr>
<th></th>
<th>Frequency of consumption</th>
<th>% of the total N=178</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily</td>
<td>Once</td>
</tr>
<tr>
<td><strong>Oils and fats</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oils</td>
<td>91.5*</td>
<td>1.7</td>
</tr>
<tr>
<td>Fats</td>
<td>5.6</td>
<td>1.1</td>
</tr>
<tr>
<td>Margarine</td>
<td>21.3</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Beverages, condiments and spices</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar</td>
<td>71.9*</td>
<td>0.0</td>
</tr>
<tr>
<td>Honey</td>
<td>1.7</td>
<td>2.8</td>
</tr>
<tr>
<td>Cakes</td>
<td>3.3</td>
<td>28.0</td>
</tr>
<tr>
<td>Soda</td>
<td>2.3</td>
<td>18.5</td>
</tr>
<tr>
<td>Tea</td>
<td>87.6</td>
<td>1.7</td>
</tr>
<tr>
<td>Coffee</td>
<td>9.0</td>
<td>6.2</td>
</tr>
<tr>
<td>Other beverages</td>
<td>6.8</td>
<td>7.9</td>
</tr>
</tbody>
</table>

*Most of the oils and fats were used in cooked foods. *Sugar used to sweeten the tea

4.3.3.5 Consumption Patterns of Beverages, Condiments and Spices by the Participants

The most consumed beverage was tea with 87.6% of the participants taking it daily as compared to coffee (9%) and other beverages such as drinking chocolate at 3.4%. Tea is the traditional beverage preferred by most Kenyans especially for breakfast. Sugar mostly used as a sweetener for tea was taken by majority (71.9%) of participants on a daily basis. Only 12.4% of the participants reported ever using honey in the subject week. It was also noted that 21.3% of the participants never took sugar at all. Cakes,
mostly used as a snack were consumed between once and three times in the preceding week by 28% and 16.8% of the participants respectively. Of the carbonated drinks, sodas were the most commonly consumed drinks with 1.7% taking it daily, 18.1% once and 11.8% between 2-3 times. 64% reported having not consumed a soda in the preceding seven days (Table 4.7).

4.4 Prevalence of Dietary Supplements Use

4.4.1 Prevalence of Dietary Supplements Use among Teachers

The prevalence of dietary supplements use among the teachers was 28.7% (n=51) (Figure 4.3), with those taking the supplements reporting having taken them for a period of between one month to twelve years. According to the doctor and nutritionist who were enrolled as key informants, the general increase in DS use could be attributed to increased publicity, people becoming more informed on health issues and the wellbeing of their bodies. The doctor said “Patients rarely ask for information on DS use, I think the general increase in DS use can be attributed to people becoming more aware of their bodies and importance of good health.” (KI1, 2017).

Figure 4.3 : Dietary supplements use among teachers
4.4.2 Types of Dietary Supplements Taken and Frequency of Use

The main types of supplements taken included Omega 3 and 6 which were used by 60.8% of the DS users, followed by calcium supplements (56.9%). 64.7% of the participants reported taking the supplements on daily basis (Table 4.8). On the types of supplements sold, the informant pharmacist said “I mostly sell basic commonly sought after supplements from prescription from doctors but at times, I get clients who buy the supplements over the counter after self-prescription” (KI₃, 2017), while the DS dealer said “I sell all types of DS provided by my marketing companies provided they are fast moving. These include multi vitamins, omegas, and detox tablets like spirulina. My stocks are based on the demand by my clients” (KI₄, 2017).

Table 4.8 : Type of supplement and frequency of use of dietary supplements

<table>
<thead>
<tr>
<th>Type of Supplement</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Omega 3 and 6</td>
<td>31</td>
<td>60.8</td>
</tr>
<tr>
<td>Calcium supplements</td>
<td>29</td>
<td>56.9</td>
</tr>
<tr>
<td>Multivitamins</td>
<td>10</td>
<td>19.6</td>
</tr>
<tr>
<td>Iron tablets</td>
<td>8</td>
<td>15.7</td>
</tr>
<tr>
<td>Spirulina</td>
<td>4</td>
<td>7.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency of intake</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>33</td>
<td>64.7</td>
</tr>
<tr>
<td>Weekly</td>
<td>10</td>
<td>19.6</td>
</tr>
<tr>
<td>Monthly</td>
<td>3</td>
<td>5.6</td>
</tr>
<tr>
<td>Rarely</td>
<td>5</td>
<td>9.8</td>
</tr>
</tbody>
</table>

*Multiple responses allowed

4.4.3 Reasons for Taking Dietary Supplements

The reasons the dietary supplement users gave for taking supplements were varied (Table 4.9). The majority (59.6%), of the participants said they took the supplements on prescription. 29.8% and 25.5%, said they took them to prevent diseases or deficiencies and promote good health respectively, while 2.1% used them to prevent
aging or for cosmetic purposes. According to the doctor and the nutritionist, there are varied reasons as to why clients may use dietary supplements. The doctor said “Normally I recommend DS for patients who have deficiencies of certain vital elements such as iron, folate and in aiming to bridge the gap, with the target group being expectant mothers, the elderly and those with obvious deficiencies. This is after conducting the required clinical tests to establish the deficiencies (KI₁, 2017). The nutritionist on her part said, “Women are our major clients because they come with issues of arthritis, osteoporosis, low iron levels and menopausal issues. I agree that nutrient needs should be met primarily through consuming foods”, but “in certain cases, fortified foods and dietary supplements may be useful in providing one or more nutrients that otherwise might be consumed in less than recommended amounts” (KI₂, 2017).

Table 4.9: Participants reasons for taking dietary supplements

<table>
<thead>
<tr>
<th>Reasons for taking supplements</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>On prescription</td>
<td>28</td>
<td>59.6</td>
</tr>
<tr>
<td>Prevent diseases or Deficiencies</td>
<td>14</td>
<td>29.8</td>
</tr>
<tr>
<td>Promote health</td>
<td>12</td>
<td>25.5</td>
</tr>
<tr>
<td>Beauty or to prevent aging</td>
<td>1</td>
<td>2.1</td>
</tr>
</tbody>
</table>

*Multiple responses allowed

4.4.4 Participants Sources of Dietary Supplements

Most of the participants had multiple sources for the supplements with the majority (60.8%) getting their supplements from pharmacies, non-chemist supplements stockiest (47.1%) and health facilities (43.1%). The least reported source was friends/family by 15.7% of the users (Table 4.10).
Table 4.10: Sources of dietary supplements

<table>
<thead>
<tr>
<th>Sources of supplements</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacies</td>
<td>31</td>
<td>60.8</td>
</tr>
<tr>
<td>Supplement stores</td>
<td>24</td>
<td>47.1</td>
</tr>
<tr>
<td>Health facilities</td>
<td>22</td>
<td>43.1</td>
</tr>
<tr>
<td>Friends and Family</td>
<td>8</td>
<td>15.7</td>
</tr>
</tbody>
</table>

*Multiple responses allowed*

The pharmacist also commented that “As a key person when it comes to research-based medicine, the increase in popularity of supplement is eye opening. People are spending colossal amounts of money (up to Ksh 10,000 or more per month) on an assortment of supplements, most of which are self-prescribed” (K13, 2017).

4.4.5 Sources of Information on Dietary Supplement Use

The main source of information regarding use of dietary supplements were doctors/nurses (66.7%), followed by the internet (62.7%), Corporate marketing agents (47.1%) and nutritionists (23.5%). The least reported sources of information were the mainstream media (9.8%) and the social media by 5.9% of the participants (Figure 4.4).
Figure 4.4: Sources of information on dietary supplements use

Regarding the source of information on dietary supplements, the doctor and nutritionist reported that most patients do not ask for information on dietary supplements. The doctor put some insight that, “patients may be reluctant to discuss or have conversations about DS with their healthcare provider. This could lead to inappropriate dosing and drug-nutrient interactions’’ (KI₁, 2017). The nutritionist said, “Patients rarely ask for information on DS use” (KI₂, 2017), while KI₃ said that, “I sell mostly prescription DS but a few over the counter upon consultation’’ (KI₃, 2017). The KI₄ also added that, “Most of my clients get referral from friends and relatives, doctors, nutritionists while others got it from the internet and social media’’ (KI₄, 2017). Asked whether they were given any nutrition information on the supplements they were using, 72.5% of the supplement users indicated that they had been advised on usage while 27.5% used the supplements without any form of advice.
According to the doctor and nutritionist basic information was given on the supplements they advised their clients to take. The pharmacist and the DS dealer were in agreement that most of the information about the product was in the brochures but “I always advise my clients on importance of healthy eating over and above the use of supplements,” (KI₄, 2017). On the type of advice given, majority of the participants who had been advised reported promotion of health (48.6%), maintenance of bone health (29.7%) to boost immunity (13.5%), with the least cited information being to boost blood levels by 8.1% of the participants (Table 4.11).

All the key informants (KI₁-KI₄) reported that they gave their clients advice on the use of dietary supplements. “I always advise my patients that healthy eating should provide basic nutrients required in the body but I normally recommend DS for patients who are diagnosed with deficiencies of certain vital elements such as iron and folate and in aiming to bridge the gap in the deficient nutrients,” (KI₄, 2017).

Table 4.11: Nutrition information on use of dietary supplements

<table>
<thead>
<tr>
<th>Type of nutrition information given</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promote health</td>
<td>18</td>
<td>48.6</td>
</tr>
<tr>
<td>Maintain bone health</td>
<td>11</td>
<td>29.7</td>
</tr>
<tr>
<td>Boost immunity</td>
<td>5</td>
<td>13.5</td>
</tr>
<tr>
<td>Boost blood levels</td>
<td>3</td>
<td>8.1</td>
</tr>
</tbody>
</table>

*Multiple responses allowed*

On his part the KI₃ said that, ‘As a pharmacist, the most important thing is to improve the wellbeing of my patients through dispensing the correct medication. I sell drugs, vitamins, and supplements, as far as they are being taken for a therapeutic use (KI₃, 2017).

4.5 Relationship between Study Variables
The study established the association between the dependent and the independent variables.

**4.5.1 Relationship between Demographic and Socio-economic Characteristics and the Use of Dietary Supplements**

Chi square test revealed that there was significant relationship between demographic and socio economic characteristics of the participants (age, gender, marital status and average household income) and the use of DS (p < 0.05). (Table 4.12). However, this study did not establish any significant relationship between the participant level of education and DS use (p = 0.150).
Table 4.12: Relationship between demographics and socioeconomic characteristics and prevalence of dietary supplement use

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\chi^2$/Likelihood ratio</th>
<th>df</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence Vs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>16.831</td>
<td>2</td>
<td>0.001*</td>
</tr>
<tr>
<td>Gender</td>
<td>15.191</td>
<td>1</td>
<td>0.000*</td>
</tr>
<tr>
<td>Marital status</td>
<td>10.290</td>
<td>2</td>
<td>0.006*</td>
</tr>
<tr>
<td>Average household income</td>
<td>9.088</td>
<td>4</td>
<td>0.049*</td>
</tr>
<tr>
<td>Level of education</td>
<td>3.793</td>
<td>2</td>
<td>0.150</td>
</tr>
</tbody>
</table>

*significant (P<0.05)

Further, all the above variables were fitted on the logistical regression equation to identify the predictor of supplement use (Adjusted Odds Ratio). The adjusted logistic regression identified age (AOR:3.2; C.I: 1.811-8.956; P value=0.023), gender (AOR: 4.89; C.I: 1.951-12.261; P value=0.001), and income levels (AOR: 2.313; C.I:1.988-4.161;P value=0.028) as the potential predictors of supplement use.

Table 4.13: Demographic and socio-economic predictors of dietary supplement use

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-30</td>
<td>**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31-40</td>
<td>2.313</td>
<td>8.282-0.646</td>
<td>0.198</td>
</tr>
<tr>
<td>41 and above</td>
<td>3.252</td>
<td>8.956-1.181</td>
<td>0.023*</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>**</td>
<td>12.261-1.951</td>
<td>0.001*</td>
</tr>
<tr>
<td>Female</td>
<td>4.891</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single/Widowed</td>
<td>1.988</td>
<td>19.622-0.201</td>
<td>0.556</td>
</tr>
<tr>
<td>Married</td>
<td>1.017</td>
<td>7.975-0.130</td>
<td>0.987</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diploma</td>
<td>**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree</td>
<td>1.054</td>
<td>4.456-0.249</td>
<td>0.943</td>
</tr>
<tr>
<td>Masters</td>
<td>1.115</td>
<td>3.075-0.404</td>
<td>0.834</td>
</tr>
<tr>
<td>Household Income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 20000</td>
<td>**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20001-30,000</td>
<td>1.964</td>
<td>11.194-0.345</td>
<td>0.447</td>
</tr>
<tr>
<td>30,001-40,000</td>
<td>0.901</td>
<td>3.948-0.206</td>
<td>0.891</td>
</tr>
<tr>
<td>40,001-50,000</td>
<td>0.435</td>
<td>1.855-0.102</td>
<td>0.261</td>
</tr>
<tr>
<td>≥50,001</td>
<td>2.313</td>
<td>4.161-1.988</td>
<td>0.028*</td>
</tr>
</tbody>
</table>

*Significant at p<0.05
Reference category: Not using supplements
**. Base category
In regard to age, those above 40 years of age were 3.25 times more likely to use supplements than those who were less than 40 years. On gender, women were 4.89 more likely to use supplements than the men (Table 4.13). With regard to household income, those households earning more than Ksh 50,000 were more likely to use supplements than those earning less than Ksh 20,000 (AOR: 2.3; C.I; 1.988-4.161; P value=0.028) (Table 4.13).

**4.5.2 Relationship between Dietary Diversity and the Use of Dietary Supplements**

Cross tabulations was done to establish whether there was any relationship between supplement use and meeting the minimum dietary diversity. A chi square test established a significant association between dietary diversity score and dietary supplement use ($\chi^2$=6.217, df=2, p=0.045) (Table 4.14)

<table>
<thead>
<tr>
<th>Table 4.14 : Relationship between dietary diversity and dietary supplement use</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDS level</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>Low DD</td>
</tr>
<tr>
<td>Moderate DD</td>
</tr>
<tr>
<td>High DD</td>
</tr>
</tbody>
</table>

Further, dietary diversity and supplement use was associated using binary and multinomial logistic regression as reflected in Table 4.15. Those using the supplements were 3.15 times likely to meet the minimum acceptable dietary diversity (OR:3.15; C.I; 1.548 -4.657; P value <0.001). Furthermore, those using DS were also noted to be 2.05 more times likely to have a high dietary diversity (OR:2.05; C.I; 0.986 -4.474; P value = 0.048) (Table 4.15).
Table 4.15: Association between dietary diversity and supplement use

<table>
<thead>
<tr>
<th>Dietary diversity category</th>
<th>Odds Ratio</th>
<th>Upper bound</th>
<th>Lower bound</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Acceptable Dietary diversity Unmet</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Met</td>
<td>3.15</td>
<td>4.657</td>
<td>1.548</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Dietary diversity category Low diversity Moderate diversity</td>
<td>1.50</td>
<td>2.637</td>
<td>0.610</td>
<td>0.447</td>
</tr>
<tr>
<td>High diversity</td>
<td>2.05</td>
<td>4.474</td>
<td>0.986</td>
<td>0.048</td>
</tr>
</tbody>
</table>

Reference category: Not using supplement
*Base category

4.5.3 Relationship between Participants Nutrient Intake and Dietary Supplement Use

Cross tabulation was done to establish the percentage of both supplement users and non-users who met the RNI of the selected micro nutrients. Majority of both users and non-users met the RNIs for vitamin A (users: 86.3%, non-users: 56.7%), Vitamin B6 (users 86.3% and non-users at 70.9%), iron (users 71%, non-users 58.3%) and zinc (users: 72.5% non-users: 52.8%). On the other hand, only supplement users, respectively had majority fulfilling their RNIs for vitamin C (82.4%) vitamin D (68.6%) and calcium (80.4) while both users and non-users could not meet their RNIs for vitamin E (25% and 17% respectively).
Table 4.16: Relationship between nutrient intake and dietary supplements use

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>RNI Men/ (women)</th>
<th>Users (n=51)</th>
<th>Non-users (n=127)</th>
<th>Total</th>
<th>Chi-Sq. $\chi^2$</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A(µg) 600(500)</td>
<td>Met RNI 44</td>
<td>86.3</td>
<td>72</td>
<td>56.7</td>
<td>65.2</td>
<td>5.27</td>
</tr>
<tr>
<td></td>
<td>Unmet RNI 7</td>
<td>13.7</td>
<td>55</td>
<td>43.3</td>
<td>34.8</td>
<td></td>
</tr>
<tr>
<td>Vitamin C(mg) 45(45)</td>
<td>Met RNI 42</td>
<td>82.4</td>
<td>30</td>
<td>23.6</td>
<td>40.4</td>
<td>5.86</td>
</tr>
<tr>
<td></td>
<td>Unmet RNI 9</td>
<td>17.6</td>
<td>97</td>
<td>76.4</td>
<td>59.6</td>
<td></td>
</tr>
<tr>
<td>Vitamin B6(mg) 1.3(1.3)</td>
<td>Met RNI 44</td>
<td>86.3</td>
<td>90</td>
<td>70.9</td>
<td>75.3</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>Unmet RNI 7</td>
<td>13.7</td>
<td>37</td>
<td>29.1</td>
<td>24.7</td>
<td>7</td>
</tr>
<tr>
<td>Vitamin D(µg) 10(10)</td>
<td>Met RNI 35</td>
<td>68.6</td>
<td>40</td>
<td>31.5</td>
<td>42.1</td>
<td>1.23</td>
</tr>
<tr>
<td></td>
<td>Unmet RNI 16</td>
<td>31.4</td>
<td>87</td>
<td>68.5</td>
<td>57.9</td>
<td></td>
</tr>
<tr>
<td>Vitamin E(eq) 12(12)</td>
<td>Met RNI 13</td>
<td>25</td>
<td>22</td>
<td>17</td>
<td>19.7</td>
<td>1.54</td>
</tr>
<tr>
<td></td>
<td>Unmet RNI 38</td>
<td>75</td>
<td>105</td>
<td>83</td>
<td>80.3</td>
<td></td>
</tr>
<tr>
<td>Calcium (mg) 1000(1000)</td>
<td>Met RNI 41</td>
<td>80.4</td>
<td>37</td>
<td>29.1</td>
<td>43.8</td>
<td>6.04</td>
</tr>
<tr>
<td></td>
<td>Unmet RNI 10</td>
<td>19.6</td>
<td>110</td>
<td>70.8</td>
<td>56.2</td>
<td></td>
</tr>
<tr>
<td>Iron (mg) 28(58)</td>
<td>Met RNI 36</td>
<td>71</td>
<td>74</td>
<td>58.3</td>
<td>61.8</td>
<td>2.77</td>
</tr>
<tr>
<td></td>
<td>Unmet RNI 15</td>
<td>29</td>
<td>53</td>
<td>41.7</td>
<td>38.2</td>
<td></td>
</tr>
<tr>
<td>Zinc (mg) 14(9.8)</td>
<td>Met RNI 37</td>
<td>72.5</td>
<td>67</td>
<td>52.8</td>
<td>58.4</td>
<td>2.12</td>
</tr>
<tr>
<td></td>
<td>Unmet RNI 14</td>
<td>27.5</td>
<td>60</td>
<td>47.2</td>
<td>41.6</td>
<td></td>
</tr>
</tbody>
</table>

*significance (p=0.05)

When the Chi square test was conducted, there was significant association between vitamin A, vitamin C, calcium and iron intake and supplement use (p value<0.05).

There were no significant associations between supplement use and all the other selected nutrients (Table 4.16).

CHAPTER FIVE: DISCUSSION
5.1 Introduction

In this chapter, findings of the study are discussed following the study objectives: dietary practices and use of dietary supplements among participants. Relationships between demographic and socio economic characteristics, dietary diversity, dietary intake and use of dietary supplements among teachers is also discussed. Comparison of this study with other related studies is also reported in the discussion.

5.2 Dietary Practices of Participants

5.2.1 Dietary Diversity among Teachers

Dietary diversity is widely recognized as a key principle in ensuring diets of high quality (WHO/FAO, 2010). It has been shown to enhance nutrient adequacy of both children and adults in developed countries (Habte & Krawinkel, 2016; Kant, 2004) thereby promoting good nutrition and health. Most of the participants in this study had a high dietary diversity with a mean DDS of 7.42±1.4. This is despite the study being conducted during a relatively dry season. The findings of this study correspond with that of Mkemwa (2015) in his study on eating behavior and dietary diversity among adults in Morogoro Urban, Rural and Mvomero districts where the mean DDS was 7.72±1.44 SD. But in a study on south Africans aged 16 years and older from all population groups on diverse diets, a lower DDS of 4.02 was established among the study participants with most commonly consumed food groups being cereals, meat and legumes with moderate consumption of fruits and vegetables (Labadorios et al., 2011). Zhang et al (2017), in their study of diet diversity and nutritional status among Chinese adults also reported a lower mean DDS of 5.2. The high dietary diversity reported in this study could be attributed to fair incomes levels of the participants who were serving government employment with a monthly salary. This had positive
implications on their purchasing power enabling them access to wide variety and options for food.

The most dominant consumed food group in the current study was cereals. The high consumption of rice (94.5%) and ugali (87.5%) in the preceding one week confirms that diets of most Kenyans are majorly composed of starchy staples. These findings reflect those of other studies done in developing countries where starchy staples such as rice, ugali and foufou were reported to be commonly consumed in many communities (Ekesa et al., 2011; Ruel, 2003). Whereas most studies have reported low consumption of animal foods in the developing world, (Daniel et al., 2009), this study found only 7.9% of the teachers had not consumed beef in the preceding week. This could also be attributed to the good purchasing power determined by their better income status. Animal foods are often more expensive and inaccessibly to majority of the population in poor resource settings (Green et al., 2013; Kearney, 2010). There was low consumption of dark green leafy vegetables as well as vitamin C fruits.

5.2.2 Nutrient Intake among Teachers

A large percentage of the world population is affected by micronutrient malnutrition with the common deficiencies being iron, zinc and vitamin A (Torheim et al., 2010). The mean intake of vitamin A, vitamin B6, iron and zinc in this study was relatively high (above the RNIs) with over 60% of the participants being able to fulfill their daily requirements. This could be attributed to high dietary diversity as well as moderate consumption of animal foods. Animal foods particularly meat products are good sources of highly bioavailable iron, zinc and vitamin A. These findings agree with those of a multiethnic cohort study among healthy adults in the United States which found that some participants took more than the UL (Upper Level of Tolerable
Intake) for some nutrients from food alone (Foote et al., 2003). This shows that with good dietary diversity, one can be able to attain most of his daily nutrient requirements. The current study has revealed insufficient uptake of vitamin C, vitamin E, vitamin D and calcium which can be improved through diversified diets.

Low mean intake of vitamin C could be explained by the relatively low consumption of fruits and vegetables reported in the study. Vitamin C serves as a cofactor in the synthesis of collagen needed to support cardiovascular function, maintenance of cartilage, bones, and teeth. It is also important in wound healing. Besides, it has an enhancing effect on the absorption of iron Although vitamin C is essential, humans are unable to synthesize the vitamin and must obtain it from dietary sources (Gallie, 2013). Iron has several vital functions in the body: It serves as a carrier of oxygen to the tissues from the lungs by red blood cell hemoglobin, as a transport medium for electrons within cells, and as an integrated part of important enzyme systems in various tissues (Gupta, 2014). Low mean intake of calcium could be attributed to fact that the dairy consumption by majority of the participants was largely in the form of tea. Vitamin D occurs naturally in very few foods hence the low dietary supply makes it unrealistic that individuals would achieve the recommended intake from the diet (WHO, 2004). Fortunately, the vitamin can easily be synthesized in the human skin in the presence of sunlight. Both calcium and vitamin D are important for general bone health. There is need for an improvement in the vitamin D status either by increasing sun exposure, or increase vitamin D intake or it can also be supplemented.

With the current increase in the cases CVD and cancers in Kenya, it is important for the general population to be aware of importance of vitamin C and vitamin E as antioxidants so as to reduce the prevalence of these lifestyle diseases. The role of
healthcare professionals can also not be ignored in advising their clients on importance of eating diversified diets for provision of basic nutrients needed by the body.

5.2.3 Food Consumption Patterns among Teachers

From the seven-day food frequency data, the study found high consumption of food items from the cereals, roots and tubers group. This indicates that the diet of most teachers is dominantly based on starchy staples. Similarly, in their study among Preschool children in Western Kenya, Ekesa et al., (2008) reported high consumption of cereals, roots and tubers and vegetables. The current findings further corroborates a study done in South Africa on trends in the food intake (Nel and Steyn, 2002), which indicated that starchy foods were the most commonly consumed, with wheat and maize based foods topping the list, contributing between 62 to 71% of total energy intake (Steyn et al., 2006).

Unlike in the past studies where ugali was the most commonly consumed staple in Kenya, current findings reveal that at the time of study, rice was the most consumed staple. This is probably because the study was conducted during a season of maize shortage. A study done by Ngala (2015), on DDS among non-pregnant women of child bearing age in Mbooni, Makueni County, showed that seasonality can affect the consumption patterns of particular food items with DDS varying with availability of particular foods in the market. Tubers and bananas were less consumed despite their availability in the markets. This could be attributed to poor attitude towards certain foods or region-specific dietary heritage biased against certain consumption of certain food items.
The consumption of meat, eggs, milk and beans was moderate. This is expected given that the study population consisted of those serving good/stable employment with constant monthly incomes thus enabling financial access to the otherwise expensive food group for those from poor income setting. A review done by Ofwona (2013), on patterns of food consumption among Kenyan households, similarly reported high consumption of milk, cheese, eggs and meats.

The consumption of meat, fish, and dairy products reported by Labadarios et al., (2011) in a study on South Africans aged 16 years and older appear to be higher than observed in the current study with South Africans eating more white meat than red meat. The frequency of consumption of meats more so red meat has been noted in the findings of this study. Overconsumption of meat and meat products particularly when it replaces other vital components of the diet, such as fruits, vegetables as well as grains, is an a key component of the nutrition transition which has been blamed for lifestyle diseases currently pandemic in many populations across the globe (Kearney, 2010; Nielsen, 2015).

The common green leafy vegetables were only moderately consumed with even lower consumption of fruits. The most consumed vegetables were tomatoes, onions, and carrots with moderate consumption of kales and spinach. This is corroborated by a consumer survey (2015) done in Nairobi, Nakuru and Mombasa where tomatoes as is evidenced by 82% of the survey participants consumed it, onions (69%) followed by sukumawiki (kales) and spinach at 42%. The lower than expected consumption of particularly vegetables could have been occasioned by the prevailing dry weather. This is corroborated by a study done by Peltzer & Phaswana (2012) on fruits and vegetables intake and associated factors in older adults in South Africa where
consumption was considerably lower than current recommended amounts (daily intake of at least five servings; 400 g). Reduced intake of fruits and vegetables is linked to poor health outcomes and increased risk of lifestyles diseases (WHO, 2005).

Majority of the participants had daily consumptions of oils used for frying food as compared to fat which reported a lower percentage. This study agrees with a study by Odhiambo (2015) on perceptions of consumers in Nairobi towards cooking oils where 52.4% used oils for cooking their foods as compared to 27.7% who used fats. This study established high intake of tea as the commonest consumed beverage. This corroborates another study conducted in Kansaala State, Sudan, excessive tea consumption was reported (Fatima et al., 2017) which may also have effects on absorption and utilization of some nutrients.

5.3 Dietary Supplements Use among the Teachers

The use of dietary supplements established by the current study (28.7%) among participants falls below that reported by Kennedy et al., (2013), where almost a half (47.7%) of US adults aged 20-69 were taking at least one DS in the previous month (Kennedy et al., 2013). Besides, O’Brien et al., (2017) reported a prevalence of 43% among Australian adults 19-70 years used at least one dietary supplement in the previous two weeks before the study. The higher prevalence could be attributed to better socio economic environment that prevail in developed countries which imply both better access to information on dietary supplements and purchasing power (FAO, 2015). Currently, there are no studies on use of dietary supplements in Kenya on a general population.
5.3.1 Types of Supplements Used

The main types of supplements taken by the DS users were Omega 3 and 6, calcium supplements, multivitamins, iron tablets, with most of the participants reporting daily supplement intake. This corroborates the findings of Foote et al., (2003), Dickinson et al., (2011) and O’Brien et al.,(2017) who all reported calcium, multi vitamins, fish oils and iron as being the commonly used dietary supplements. The highly unsaturated fatty acid (HUFA) supplements are particularly becoming popular due to their reported enhancement of cardiovascular health a growing health threat assuming public importance in Kenya (Euro monitor, 2017). Calcium supplements are popular with the older people trying to prevent/manage musculoskeletal conditions such as osteoporosis and osteoarthritis (Genga, 2016).

5.3.2 Reasons for Dietary Supplements Use

There are many reasons as to why people take supplements. In this study the main reasons cited included, medical reasons (supplements taken on prescription), to prevent diseases or deficiencies and to promote health. This findings are consistent with those of Dickson & Mackay (2014) and Council for Responsible Nutrition survey (2009, 2011), who both reported that the main reasons cited for the use of DS were maintenance of good health, bone health, and filling nutrient gaps. The study is further corroborated by Pajor et al., (2017) in a study among Dutch people on why they take supplements and Frey & Heur (2017) in their study on motive of use of DS among Germans found that the main reason for DS use was to prevent disease and general health. In this study, the main sources of supplements were pharmacies, health facilities, supplement stores with the least cited source being family/friends. These findings indicate that most DS users taken them on prescription hence the main sources of DS supply were found to be health facilities including pharmacies. This
findings underscore the important role that should be played by healthcare professionals as a credible source of information to their clients.

5.3.3 Source of Information on Dietary Supplements Use among Users
A number of studies show that most of people using dietary supplements or any other therapies do not tell their health care providers (Bennett & Brown, 2000; Blendon, 2001; Foster, 2000). However, in this study, majority of DS users cited health workers as being the main source of information. This could be related to credibility attached to healthcare workers, by most people, as a source where they can obtain trusted health-related information. Aljaloud & Ibrahim (2013) also reported physicians (45.9%), dieticians (28.5%) and internet (20.2%) as being the major sources of information on DS in their study among Saudi professional athletes. This is further corroborated by a cross sectional study in California where doctors were the commonest source of information for those taking supplements for more than half of the participants on both coasts (Rozga et al., 2013).

The internet came second as a main source of information on dietary supplements. Further, a study on Croatian students found prevalence of use of the internet as a source of information on dietary supplements usage at 66.1% rather than health care providers (33.2%). The study further showed that most students (79.6%) did not ask for professional medical help when taking dietary supplement (Pavićić Žeželj, 2018). This underscores the growing importance of the internet as a platform of passing nutritional information in the country and which nutrition IEC interventions need leverage (Banos et al., 2013).
5.4 Relationship between Demographic and Socio-economic Characteristics and the Use of Dietary Supplements among Teachers.

The study established a significant relationship in dietary supplements usage and age, gender, and income levels of the participants. This agrees with the findings of Bailey et al., (2013), Randimer et al., (2004) and Foote et al., (2003), where dietary supplement usage in adults was consistently reported to be higher as one grows older and moves upward the income ladder. Furthermore, within each sub-set, women were more likely than men to take supplements. These could be attributed to women being generally, more conscious of their health than men (Stefan, 2015). The higher uptake of supplemental calcium and vitamin D amongst women could be occasioned by the concern about the growing burden and impact of osteoporosis and hence the need for maintaining bone health and prevent/delay the onset of osteoporosis (Bailey et al., 2013).

Dietary supplements usage in relation to age revealed that older people are more likely to use DS. This is also corroborated by a cross sectional study in California where the oldest persons in the advanced age group (60–75 years) had the highest number of DS users (84.1%) when comparisons were made with 40–59 year and 21–39 year groups and were even more likely to take DS when compared to the youngest age group (adjusted OR: 2.04 (1.12, 3.70); p = 0.02) (Rozga et al., 2013). However, it could also be an indicator that older people tend to have more challenges in achieving adequate nutrient supply to the body (intake, absorption, and metabolism) hence the need for nutritional support through supplements. This could be the true case particularly when majority of the users do so on prescription from qualified health professionals.
Contrary to the findings reported by other studies in which DS use appears to have increased with the rise in the levels of education of the study subjects (NHANES, 2003-2006; Satia-Aboua, 2003), this study did not establish any link in the use of dietary supplements and education levels.

5.5 Relationship between Dietary Diversity and Dietary Supplements Use

The study established significant association between dietary diversity and dietary supplements use with users of dietary supplements having a higher DDS than non-users. This corresponds with the finding of Foote et al. (2003) and Bailey et al., (2011) who found out that DS use was co-related to better dietary patterns. Non-users of dietary supplements were found to have higher prevalence of the consuming high fat, low fiber diets, low fruit diets. This could be due to the concomitant high levels of health and nutrition consciousness among users of dietary supplements implying that DS users would normally be keener on their all-round nutrition and make greater efforts to eat correct.

5.6 Relationship between Nutrient Intake and Dietary Supplements use

The study revealed significant differences in dietary supplements use and the dietary adequacy of the participants. There were significant differences in intakes and the fulfillment of RNIs of vitamin A, vitamin C, calcium and iron between DS users and non-users. This results corroborate those of other studies which have similarly shown that those taking DS were more likely than non-users to consume better diets and also try to improve their total nutrient intake (Blumberg et al., 2017, Dickinson & Mackay, 2014, Foote et al., 2003).
A study conducted among Australian adolescents, on micronutrient intakes from foods and supplements, established that DS users had higher micronutrient intakes (vitamin A, C, zinc and iron) from food sources (Gallagher, et al., 2014). This is further supported by the NHANES 2003-2006 survey among 8860 adults which revealed that DS users had higher consumption of most common nutrients from dietary sources per se, than non-users (Bailey et al., 2011). Furthermore, a study among Africa American and White adults showed that the mean nutrient adequacy ratio scores for vitamins A, C and E, magnesium and copper, based on dietary intakes alone, were significantly higher for DS users than for non-users (Marie Fanelli et al., 2017). As already suggested, this could be credited to the fact that dietary supplement use is also associated with higher overall health consciousness among subjects, which translates into better practices including dietary choices and patterns.

Contrary to the current findings, Murphy et al., (2007) reported that the chances of achieving sufficient nutrient, using food based approaches alone, was similar for both users and non-users of multivitamin supplements, that is, no significant difference. Further studies should be done to establish the contribution of dietary supplements in meeting an individual’s RNI.
CHAPTER SIX : SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Summary of the Findings

Majority (60.1%) of participants in this study were females and in the age category of 41-50 years. Most (65.5%) of the participants were married, had a university degree and came from households with an income of over Ksh 50,000.

Dietary diversity of the participants was high with a mean of 7.42 ± 1.21SD. The majority of the participants had adequate intake of vitamin A, and B6 as well as iron and zinc but had insufficient intake of vitamin C, D, E, and calcium. The participants displayed varied consumption patterns with cereals being the most frequently consumed food group category while vegetables had modest consumption and fruits, low consumption. The consumption of animal foods was found to be moderate.

Almost a third of the participants (28.7%) took dietary supplements with most of the supplements users taking omega 3 and 6 and calcium tablets on prescription or as a prophylactic measure. Asked whether they had any nutrition information on the supplements they were using, most of the supplement users acknowledged having received advice on usage. Most participants said that they found DS important for maintaining bone density and general health. The main sources of information on dietary supplements were indicated to be doctors and the internet.

On associations, gender, age and household income were found to be predictors of dietary supplements use, with women, who were older, and with higher household income more likely to use supplements. Furthermore, dietary supplements usage was significantly associated with dietary diversity with users of dietary supplements tending to have a higher dietary diversity score than non-users. A significant
association was also established between dietary supplement use and the intakes of certain nutrients including vitamin A, C and the minerals; iron and calcium. Those taking supplements were found to be more likely to fulfill their RNIs for these nutrients than non-users. Dietary supplements contribution to nutrient intake was not assessed.

6.2 Conclusions

Based on the study findings and objectives, the participants displayed varied consumption patterns with cereals being the most frequently consumed food group category with low consumption of dark green leafy vegetables and fruits. It was noted that there was inadequate intake of vitamins C, D, E and calcium among the participants.

Almost a third of the teachers consumed dietary supplements on prescription or as a prophylactic measure with omega 3 and 6 and calcium being the most commonly consumed supplements. It was reported that the main source of information on dietary supplements use was health professionals and the internet.

Female teachers, those above 40 years and earning more than Kshs 50,000 were more likely to take supplements. Those taking supplements were also more likely to have a higher dietary diversity. It was further noted that DS users were more likely to meet their fulfillments for their RNIs because they were more conscious about their health. Marital status and education were not co related with DS use.

6.3. Conclusion on the Hypotheses.

The current study has established significant relationship in demographic characteristics (age, gender and household income) and socio economic of the study
participants and dietary supplements use. Subsequently, the first null hypothesis “There is no relationship between demographic characteristics and socio economic characteristics of the respondents and use of dietary supplements” is rejected.

Furthermore, a significant relationship has been established between dietary diversity of the participants and dietary supplements use, with users of DS tending to have a higher dietary diversity than non-users. The second null hypothesis which stated that “there is no relationship between dietary diversity and the use of dietary supplements among the subject population” is therefore rejected.

The findings of the current study have also revealed significant differences among DS users and non-users in the intakes (particularly the fulfillments of RNIs) of vitamins A, C, iron and Calcium. This therefore also leads to the rejection of the third null hypothesis: “there is no relationship between nutrient intake and the use of dietary supplements”

6.4 Recommendations of the Study

The following recommendations are made from this study

6.4.1 Recommendation for Policy

Due to the increased number of people (28.7% prevalence) using dietary supplements among the general population, there is need for a solid foundation of regulatory framework to forestall consumer exploitation and promote their safety as well as prevent abuse of the products by consumers by the Ministry of Health.

6.4.2 Recommendation for Practice

Since most people still rely on doctors and nurses as their primary sources of information on dietary supplements, information relating to dietary supplements
should be incorporated in the relevant guidelines for delivery of healthcare. This may entail a clear system of referrals to department (e.g. nutrition department) which would best placed to offer counseling and advice on dietary supplements as a component of the medical nutrition therapy (MNT).

The internet is increasingly becoming appreciated by most people in the country as a platform for exchange of information including dietary information, it should thus be leveraged by information education and communication (IEC) interventions as it can prove more effective, efficient and cost-effective with certain categories of nutrition and health audience.

**6.4.3 Recommendation for Further Research**

Further research should be conducted in the following areas;

i) The contribution of dietary supplements in achieving dietary adequacy.

ii) More studies should be done on other healthy population sub-groups to build

   the weight of evidence of DS use related factors.
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The CRN Consumer Survey on Dietary Supplements: 2013

The CRN Consumer Survey on Dietary Supplements: 2014


WHO/Global Health Observatory Data Repository/World Health Statistics. 2017 (apps.who.int/gho/data/node.main.1?lang=en)


APPENDICES

Appendix A: Introductory and Informed Consent for Participants

Information for participants:
Dear Sir/Madam,

I am Jane Njambi Gikwa pursuing a Master of Science in Foods, Nutrition and Dietetics at Kenyatta University. I would like to collect data on prevalence dietary supplements use and dietary practices among secondary school teachers in Kikuyu, Kiambu County, Kenya.

Purpose of the research study
The purpose of the study is to determine the prevalence of use of dietary supplements and dietary practices among secondary school teachers in Kikuyu, Kiambu County.

Procedures to be followed
My research assistants and I will ask some questions on demographics and socio economic characteristics, dietary supplements usage and sources of information on dietary supplements will also be sought. A 24 hour dietary recall will be used to determine dietary practices. The interview will take around 45 minutes and your participation is highly valued. Feel free to ask for any clarification if need arises.

Possible risks/Discomfort
The researcher does not foresee any risks associated with the study; however if a question asked makes you uncomfortable, you may decline to answer the questions and you may stop the interview at any time.

Possible benefits
During this study there are no direct benefits to you for participating. However, the findings from the study will contribute to knowledge on use of dietary supplements and factors influencing usage.
Compensation
Participation to the study is voluntary and thus no form of compensation will be offered.

Voluntary participation/withdrawal from the study
Your participation in this study is voluntary. You may decline to take part or you may pull out from the study at any time. Your decision not to take part or pull out from the study will not affect you in any way.

Confidentiality
Any information provided shall be strictly confidential and under no circumstance will I connect your name with data in the cause of collection, analysis or dissemination of the study findings. After the retention period of three years, all the data will be disposed off.

Contact information and questions
1) If you have any questions you may contact:
   Jane Njambi Gikwa
   P.O Box 675-0900
   Kikuyu
   Cell No: 0720 530953.
   Email: njambigikwa@gmail.com

2) If you have any questions, you may contact my research supervisors: Professor Judith Kimiywe on 0722915459 or Doctor Eunice Njogu on 0722862052.
   You may also contact Kenyatta University Research Ethic Committee Secretariat on chairman.kuerc@ku.ac.ke, secretary.kuerc@ku.ac.ke, secretariat.kuerc@ku.ac.ke

If you have any question about the above information please ask
Participant’s statement
I have read and understood the above information and I agree to participate in the study.
Signature ........................................... Date ................................

Investigator’s statement
I certify that, I have explained the purpose and procedure, the potential benefits and possible risks associated with taking part in this study to the above individual.

Interviewer’s name.............................................
Signature............................................................Date..................................
Appendix B: Introductory and Informed Consent for KII

Information for Participants:

Dear Sir/Madam,

My name is Jane Njambi Gikwa from Kenyatta University pursuing a Master of Science in Foods, Nutrition and Dietetics. My study is on prevalence of dietary supplements use and dietary practices among secondary school teachers in Kikuyu, Kiambu County, Kenya.

Purpose of the research study
The purpose of the study is to determine the prevalence of dietary supplements use and dietary practices among secondary school teachers in Kikuyu, Kiambu County.

Procedures to be followed
Key informant interview guide will be used in this study. One will only be ask to give information as requested by the researcher. I guarantee that the information given is confidential and will be used for academic purposes only. The interview will take approximately 15 minutes.

Possible risks/Discomfort
The researcher does not no foresee any risks associated with the study; however if a question asked makes you uncomfortable, you may decline to answer the questions and you may stop the interview at any time.

Possible benefits
During this study there are no direct benefits to you for participating. However, the knowledge gained through this study will help you and we have an insight on prevalence of dietary supplements use and factors influencing prevalence.

Compensation
Participation to the study is voluntary and thus no form of compensation will be offered.
Confidentiality
Any information provided shall be strictly confidential and under no circumstance will I connect your name with data in the cause of collection, analysis or dissemination of the study findings. After the retention period of three years, all the data will be disposed off.

Voluntary participation/withdrawal from the study
Your participation in this study is voluntary. You may decline to take part or you may pull out from the study at any time. Your decision not to take part or pull out from the study will not affect you in any way.

Contact Information and questions
1) If you have any questions you may contact:
   Jane Njambi Gikwa
   P.O Box 675-0900
   Kikuyu
   Cell No: 0720 530953.
   Email: njambigikwa@gmail.com
2) If you have any questions, you may contact my research supervisors: Professor Judith Kimiywe on 0722915459 or Doctor Eunice Njogu on 0722862052. You may also contact Kenyatta University Research Ethic Committee Secretariat on chairman.kuerc@ku.ac.ke, secretary.kuerc@ku.ac.ke, secretariat.kuerc@ku.ac.ke
   If you have any question about the above information please ask.

Participant’s consent
I have read and understood the above information and I agree to participate in the study.

Signature ........................................... Date .............................
Investigator’s statement

I certify that, I the undersigned have explained the purpose and procedure, the potential benefits and possible risks associated with taking part in this study to the above individual.

Interviewer’s name…………………………………………
Signature…………………………………………..Date…………………………..
Appendix C: Questionnaire for Participants

PREVALENCE OF DIETARY SUPPLEMENTS USE AND DIETARY PRACTICES AMONG TEACHERS IN PUBLIC SECONDARY SCHOOLS IN KIKUYU, KIAMBU COUNTY, KENYA

My name is Jane Njambi; I am a graduate student at Kenyatta University doing Masters in food nutrition and dietetics. I am collecting data on prevalence of dietary supplements use and dietary practices. The questionnaire will be administered by way of interview to you. In case of areas you do not understand, please feel free to ask for any clarification. Information given will be treated with utmost confidentiality.

Do you agree to participate in this interview?

Yes ___  No ___

If yes, continue to the next question; if no, stop the interview.

Do you have any question before we start? (Answer questions).

May I start now?

Interview Date: ________________________________
School:_____________________________________
Questionnaire number: _______________________________

SECTION A: SOCIO-DEMOGRAPHIC DATA

Please fill in where appropriate in spaces provided

1. What is your age?.................................................................

2. Gender?  1. Male 2. Female

3. What is your marital status?....................................................


4. What is your highest academic level?-----------------------------

5. What is your estimated net income per month from your salary? 

1. 10,000-20,000
2. 20,000-30,000
3. 30,000-40,000
4. 40,000-50,000
5. 50,000-60,000
6. 60,000-70,000
7. 70,000-80,000
8. 80,000-90,000
9. 90,000-100,000
10. Over 100,000

6. Do you do part time jobs on weekends and school vacation for example

1. Petty trade
2. Part time teaching
3. Farming
4. Rental income
5. None

If yes, approximate the amount earned per month ……………………
(Kshs)

7. What is the average household monthly income (self and spouse or other persons who contribute to family expenses) …………………………………………………………………………………

SECTION B - USE OF DIETARY SUPPLEMENTS

1. Do you take dietary supplements?
   1. Yes
   2. No

   If yes, for how long have you taken the supplements?

2. Which type of dietary supplements do you take?
   ………………………………………………………………………………………

3. How often do you take them?
   1. Daily
   2. Weekly
   3. Monthly
Any other, please specify…………………………

4. Why do you take the dietary supplements?
   1. Medical reasons
   2. Prevent diseases or nutritional deficiencies
   3. Beauty or prevent aging
   4. Maintain muscle mass/ strength
   5. Promote socio economic status
   Any other reason………………………………………………………………

5. From where do you get your dietary supplement(s) from?
   1. Health facilities
   2. Supplements stores
   3. Pharmacies
   4. Friends/Family
   5. Internet
   Other sources: Please indicate…………………………………………

6. Were you given any nutrition information on the supplements you are taking?
   1. Yes
   2. No

   If yes, which one…………………………………………………………

7. What are your sources of information on dietary supplements use?
   1. Media
   2. Doctors/ Nurses
   3. Family/Relatives
   4. Internet
   5. Social media
   6. Magazines/books
   7. Marketers
   8. Nutritionists
   Any other source not listed above……………………………………..
SECTION C: DIETARY PRACTICES

A: 24 HOUR DIETARY RECALL QUESTIONNAIRE FOR DIETARY INTAKE

No. (Code)..................................

Tick day of week that you are recalling.


Friday

6. Saturday □  7. Sunday □

Steps for the interviewer to follow when interviewing each participant.

Step 1: The interviewer can start the interview as follows; “I want you to think back to when you woke up yesterday morning. What time was it? Try and remember what you ate and drank yesterday from the moment that you woke up until you went to sleep again last night. Run through the whole day in your mind and try to remember everything that you ate and drank. The interviewer must then give the subject a little time to do what she was asked to do- during this time the interviewer must be quiet. Then the interviewer can then carry on, —Now I would like you to tell me what you ate and drank yesterday in the morning after you got up! After a subject has mentioned an item, the interviewer should prompt her by saying, —and then?” The interviewer should be careful not to ask for any distinctive information at this point.

The data should be filled in Form 1 (Column 1)

FORM 1

<table>
<thead>
<tr>
<th>STEP 1: Food eaten/Drink drank during</th>
<th>STEP 2: Forgotten Foods (PROMPTED)</th>
</tr>
</thead>
</table>

STEP 1: Food eaten/Drink drank during the day

Step 2: Forgotten Foods (PROMPTED)

**Step 2:** To establish if the participants has forgotten forgot anything, the interviewer may ask the following:

- did you take a drink yesterday?
- did you eat sweets or chocolate yesterday?
- were cakes/cookies eaten yesterday?
- did you have savory snacks like chips/popcorn/salty biscuits yesterday?
- did you have any fruit/ vegetables yesterday?
- was any breads or rolls taken yesterday?

This information should then be entered on Form 1(Column 2)

It is important to establish if what the participant whether what she ate /drank the day before is a usual meal, more than usual or less than usual. The response should be entered at the bottom of Form 1.

**Step 3:** For more details on each item eaten or drunk, ask the following: I am will ask you more about each food or drink that you ate or drank yesterday. Let us start with the first item on the list. At what time did you eat.....? (Item 1 on the list). Enter item 1 on form 2 (column 1). Little time should be spent trying to find out the exact time. Now tell me more about this food item....describe the food and how you made it. If mixed foods are mentioned, request for the list of ingredients. This information should be entered on form 2(column 4). To establish how much of this item the participant
ate/drunk, the interviewer uses the food aids/models to assist the participant to identify amount/size and this is entered on Form 2 (column 5). If the food code or the portion size in grams is not clear or easy to find, enter the food item only. Repeat the process for each of the food item on Form 1.

**Step 4:** The participant may be assisted to think back carefully to ensure no food item is forgotten.

**Form 2:** DATA SHEET FOR INFORMATION COLLECTED IN THE 24 HOUR DIETARY RECALL INTERVIEW.

<table>
<thead>
<tr>
<th>Time/Meal</th>
<th>Name of food</th>
<th>Ingredients</th>
<th>Household measure</th>
<th>Amts in grams</th>
<th>Vol cooked</th>
<th>Vol served</th>
<th>Vol taken</th>
<th>Official amts taken in grams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snack 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snack 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supper</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snack 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**D: DIETARY DIVERSITY QUESTIONNAIRE (24 HOUR DIETARY RECALL)**

Once a participant is through with recall, enter all the foods into their respective food groups based on the data recorded above. If a food group is not mentioned, ask the participant if a food item from the group was eaten.

<table>
<thead>
<tr>
<th>Question number</th>
<th>Food group</th>
<th>Examples</th>
<th>Yes=1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CEREALS</td>
<td>Maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) + insert local foods e.g. ugali, nshima, uji or paste</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>WHITE ROOTS AND TUBERS</td>
<td>white potatoes, white yam, white cassava, green bananas</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>VITAMIN A RICH VEGETABLES AND TUBERS</td>
<td>pumpkin, carrot, or orange fleshe sweet potato</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>DARK GREEN LEAFY VEGETABLES</td>
<td>kales spinach, cabbages, cassava leaves, pumpkin leaves, cowpeas leaves, or indigenous green vegetables</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>OTHER VEGETABLES</td>
<td>tomato, onion, eggplant + other locally available vegetables</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>VITAMIN A RICH FRUITS</td>
<td>ripe mango, pawpaw 100% fruit juice made from these + other locally available vitamin A rich fruits</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>OTHER FRUITS</td>
<td>passion fruit, banana, mkwaju, oranges, Avocado including wild fruits and 100% fruit juice made from these</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>ORGAN MEAT (iron rich)</td>
<td>liver, kidney, heart or other organ meats or blood-based foods</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>FLESH MEATS</td>
<td>beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insect</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>EGGS</td>
<td>Eggs</td>
<td></td>
</tr>
</tbody>
</table>
### C: FOOD FREQUENCY QUESTIONNAIRE

State the frequency of consumption of the selected food items in the last 7 days

<table>
<thead>
<tr>
<th>Food groups</th>
<th>Frequency per week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily</td>
</tr>
</tbody>
</table>

#### 1. Cereal, carbohydrates, starch

- White rice
- Ugali grade ½
- Porridge (Millet/Sorghum)
- Chapatti
- Bread

---

Did you eat anything (meal or snack) OUTSIDE the home yesterday?
<table>
<thead>
<tr>
<th>1. Grains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Githeri</td>
</tr>
<tr>
<td>Maandazi</td>
</tr>
<tr>
<td>Green bananas</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. White roots and tubers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cassava</td>
</tr>
<tr>
<td>Arrowroots</td>
</tr>
<tr>
<td>Yams</td>
</tr>
<tr>
<td>Irish potatoes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Vitamin A rich vegetables and tubers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrots</td>
</tr>
<tr>
<td>Pumpkin</td>
</tr>
<tr>
<td>Sweet potatoes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Dark green leafy vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kale</td>
</tr>
<tr>
<td>Spinach</td>
</tr>
<tr>
<td>Kunde (cow peas)</td>
</tr>
<tr>
<td>Pumpkin leaves</td>
</tr>
<tr>
<td>Other African leafy vegetables</td>
</tr>
<tr>
<td>e.g. saget, managu, terere</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. Other vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cucumber</td>
</tr>
<tr>
<td>Cabbage</td>
</tr>
<tr>
<td>Tomatoes</td>
</tr>
<tr>
<td>Onions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6. Vitamin A rich fruits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pawpaw</td>
</tr>
<tr>
<td>Mangoes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7. Other fruits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melon</td>
</tr>
<tr>
<td>Passion</td>
</tr>
<tr>
<td>Pineapple</td>
</tr>
<tr>
<td>Avocado</td>
</tr>
<tr>
<td>Apples</td>
</tr>
<tr>
<td>Ripe bananas</td>
</tr>
<tr>
<td>Oranges</td>
</tr>
<tr>
<td>Pears</td>
</tr>
<tr>
<td>Others</td>
</tr>
<tr>
<td>Category</td>
</tr>
<tr>
<td>----------------------------------</td>
</tr>
<tr>
<td>8. Organ meats</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>9. Flesh meats</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>10. Eggs</td>
</tr>
<tr>
<td>11. Fish and sea foods</td>
</tr>
<tr>
<td></td>
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<tr>
<td>12. Legumes/ pulses, nuts and seed</td>
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<tr>
<td></td>
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<td></td>
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<tr>
<td>13. Milk and milk products</td>
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<tr>
<td></td>
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<td></td>
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<tr>
<td>14. Oils and fats</td>
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<tr>
<td></td>
</tr>
<tr>
<td>15. Sweets</td>
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<tr>
<td></td>
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<tr>
<td>16. Spices, condiments and beverages</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
</tr>
</tbody>
</table>
Appendix D: Key Informant Interview Guide

PREVALENCE OF DIETARY SUPPLEMENTS USE AND DIETARY PRACTICES AMONG TEACHERS IN PUBLIC SECONDARY SCHOOLS IN KIKUYU, KIAMBU COUNTY, KENYA

The data obtained from you will be confidential and will only be utilized for the purpose of this research.

Pharmacist/Dietary supplement seller
Participant Code ________________________ Position ________________________ Date of Interview ____________________________

1. What is your highest level of education?

2. Your primary source of household income is?

3. Which supplements do you sell?

4. For how long have you sold the dietary supplements?

5. Who are your major buyers of the dietary supplements?

6. In your opinion are dietary supplements cheap or expensive? Give a reason for your answer.)
7. Where do your customers obtain information on dietary supplements before they come to you to buy?

……………………………………………………………………………………
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8. Have you been trained on sale of dietary supplements? If yes, what were some of the contents of the training?

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……………………………………………………………………………………
……………………………………………………………………………………

9. Are you aware of any regulation of dietary supplements?

……………………………………………………………………………………
……………………………………………………………………………………
Appendix E: Key Informant Interview Guide II

PREVALENCE OF DIETARY SUPPLEMENTS USE AND DIETARY PRACTICES AMONG TEACHERS IN PUBLIC SECONDARY SCHOOLS IN KIKUYU, KIAMBU COUNTY, KENYA

The data obtained from you will be confidential and will only be utilized for the purpose of this research.

Doctors/Nutritionists
Participant Code ___________________________ Position ___________________________
Date of Interview ____________________________

1. Do you believe in healthy eating for provision of basic nutrients required by the body?

………………………………………………………………………………………………………………
………………………………………………………………………………………………………………

2. Under what circumstances do you recommend dietary supplements use by an individual?

………………………………………………………………………………………………………………
………………………………………………………………………………………………………………

3. What target groups do you mostly advice to take dietary supplements?

………………………………………………………………………………………………………………
………………………………………………………………………………………………………………

4. Do you normally probe your clients to establish whether they are on any dietary supplement before you recommend one?

………………………………………………………………………………………………………………
………………………………………………………………………………………………………………

………………………………………………………………………………………………………………
5. Do your patients/clients ask for information on dietary supplements use?

6. Are you aware of a general growth in the dietary supplements usage? If yes, why?

7. Have you been trained on use of dietary supplements? If yes, what were some of the contents of the training?

8. Are you aware of any regulation policies on dietary supplements?

9. What measures do you think should be put in place to ensure the general population uses dietary supplements responsibly?
Appendix F: Research Authorization Letter from Kenyatta University Graduate School

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: deang-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57330

Our Ref: H60/ce/24089/2012

DATE: 28th February, 2017

Director General,
National Commission for Science, Technology
& Innovation
P.O. Box 30623-00100,
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR GIKWA JANE NJAMBI – REG. NO. H60/CE/24089/2012

I write to introduce Ms. Gikwa Jane Njambi who is a Postgraduate Student of this University. She is registered for M.Sc degree programme in the Department of Food, Nutrition and Dietetics.

Ms. Gikwa intends to conduct research for an M.Sc Proposal entitled, “Prevalence of Dietary Supplements Use and Dietary Practices among Teachers in Public Secondary Schools in Kiambu, Kiambu County, Kenya”.

Any assistance given will be highly appreciated.

Yours faithfully,

[Signature]

MRS. LUCY N. MRAABU
FOR: DEAN, GRADUATE SCHOOL

13 MAR 2017
Appendix G: Research Approval by Kenyatta University Ethical Review Committee

KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE

Fax: 8711242/8711875
Email: kuerc.chairman@kun.ac.ke
kuerc.secretary@kun.ac.ke
Website: www.kun.ac.ke

Our Ref. KU/ERC/APPROVAL/VOL.I (46) Date: 24th April 2017

Gikwa Jane Njambi
Kenyatta University,
P.O. Box 43844,
Nairobi

Dear Gikwa

APPLICATION NUMBER PKU/650/730 TITLE "Prevalence of Dietary Supplements Use and Dietary Practices among Teachers in Public Secondary Schools in Kikuyu, Kiambu County, Kenya"

1. IDENTIFICATION OF PROTOCOL
The application before the committee is with a research topic application Number PKU/650/730 "Prevalence of Dietary Supplements Use and Dietary Practices among Teachers in Public Secondary Schools in Kikuyu, Kiambu County, Kenya" Received on 30th March 2017 and Approved on 11th April 2017.

2. APPLICANT
Gikwa Jane Njambi

3. SITE
Kiambu County Kenya

4. DECISION
The committee has considered the research protocol in accordance with the Kenyatta University Research Policy (Section 7.2.1.3) and the Kenyatta University Review Committee Guidelines AND APPROVED that the research may proceed for a period of ONE year from 24th April, 2017.

ADVICE/CONDITIONS
i. Progress reports are submitted to the KU-ERC every six months and a full report is submitted at the end of the study.
ii. Serious and unexpected adverse events related to the conduct of the study are reported to this committee immediately they occur.
iii. Notify the Kenyatta University Ethics Committee of any amendments to the protocol.
iv. Submit an electronic copy of the protocol to KUERC.

When replying, kindly quote the application number above.
If you accept the decision reached and advice and conditions given please sign in the space provided below and return to KU-ERC a copy of the letter.

DR. TITUS KAHIGA
CHAIRMAN ETHICS REVIEW COMMITTEE

"26 APR 2017"

"JANE...N.JAMBI...C.KWA..." accept the advice given and will fulfill the conditions therein.

Signature.......................... Dated this day of 26th APRIL, 2017.

cc. DVC: Research Innovation and Outreach
Appendix H: Research Permit from NACOSTI

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Ref No: NACOSTI/P/17/81154/16992 Date: 8th May, 2017

Jane Njambi Gikwa
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on “Prevalence of dietary supplements use and dietary practices among teachers in public secondary schools in Kiambu, Kiambu County, Kenya,” I am pleased to inform you that you have been authorized to undertake research in Kiambu County for the period ending 5th May, 2018.

You are advised to report to the County Commissioner and the County Director of Education, Kiambu County before embarking on the research project.

On completion of the research, you are expected to submit two hard copies and one soft copy in pdf of the research report/thesis to our office.

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

Copy to:
The County Commissioner
Kiambu County.

The County Director of Education
Kiambu County.
Appendix I: Research Authorization from Ministry of Education

MINISTRY OF EDUCATION
State Department of Education

EMAIL: deokikuyu@gmail.com
Telephone 020-8046599
When replying please quote:

Ref: KIK/ED/38(27)
ALL-PRINCIPALS
KIKUYU SUB-COUNTY.


RE: RESEARCH AUTHORIZATION.

As per authority granted through a letter ref: NACOSTI/P/17/81154/16992 dated 8th May, 2017, from the National Commission for Science, Technology and Innovation Jane Njambi Gikwa is hereby authorized to carry out research on “Prevalence of dietary supplements use and dietary practices among teachers in public secondary schools in Kikuyu, Kiambu County” for a period ending 5th May, 2018.

Kindly accord her the necessary assistance.

R. W. KAMAU
FOR: SUB-COUNTY DIRECTOR OF EDUCATION
KIKUYU.

Email: deokikuyu@gmail.com
## Appendix J: Total Number of Schools and Teachers in Kikuyu Sub-county

<table>
<thead>
<tr>
<th>S/N</th>
<th>SCHOOL</th>
<th>TEACHING STAFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MUSA GITAU</td>
<td>14</td>
</tr>
<tr>
<td>2.</td>
<td>KIKUYU DAY</td>
<td>20</td>
</tr>
<tr>
<td>3.</td>
<td>MUHU</td>
<td>09</td>
</tr>
<tr>
<td>4.</td>
<td>MOI GIRLS KAMANGU</td>
<td>24</td>
</tr>
<tr>
<td>5.</td>
<td>KARAI MIXED</td>
<td>12</td>
</tr>
<tr>
<td>6.</td>
<td>GICHURU MEMORIAL</td>
<td>11</td>
</tr>
<tr>
<td>7.</td>
<td>NDERI</td>
<td>06</td>
</tr>
<tr>
<td>8.</td>
<td>FR. KEVIN KELLY</td>
<td>05</td>
</tr>
<tr>
<td>9.</td>
<td>RENGUTI</td>
<td>10</td>
</tr>
<tr>
<td>10.</td>
<td>ALLIANCE HIGH</td>
<td>67</td>
</tr>
<tr>
<td>11.</td>
<td>ALLIANCE GIRLS</td>
<td>63</td>
</tr>
<tr>
<td>12.</td>
<td>KIKUYU BOYS</td>
<td>06</td>
</tr>
<tr>
<td>13.</td>
<td>PCEA MAI-A-IHII</td>
<td>11</td>
</tr>
<tr>
<td>14.</td>
<td>LUSIGETTI</td>
<td>10</td>
</tr>
<tr>
<td>15.</td>
<td>KERWA</td>
<td>11</td>
</tr>
<tr>
<td>16.</td>
<td>MAMA NGINA</td>
<td>04</td>
</tr>
<tr>
<td>17.</td>
<td>NACHU</td>
<td>06</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>289</strong></td>
</tr>
</tbody>
</table>

Source: Kikuyu Sub County Education Office, April, 2017.
Appendix K: Map of Kikuyu Sub-County