

**KNOWLEDGE AND USAGE OF DIETARY  
SUPPLEMENTS, AND DIETARY PATTERNS OF  
GYM USERS IN NAIROBI**

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**A DISSERTATION SUBMITTED TO THE DEPARTMENT OF  
FOOD SCIENCE, NUTRITION AND TECHNOLOGY IN  
PARTIAL FULFILMENT OF THE REQUIREMENTS FOR  
THE AWARD OF MASTER OF SCIENCE DEGREE IN  
APPLIED HUMAN NUTRITION, UNIVERSITY OF NAIROBI**

August 2011



## DECLARATION

I, hereby, declare that this dissertation is my original work and has not been presented for a degree in any other university.

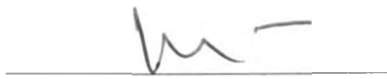


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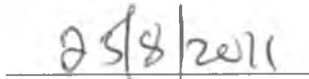


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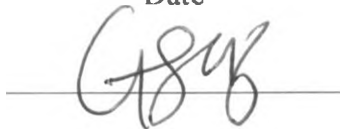
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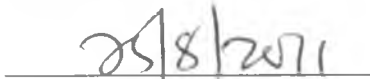
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## DEDICATION

This work is dedicated to my parents, Mr and Mrs C. Wachira who have always inspired me never to start a task and leave it unfinished but to always press on with patience, humility and Gods' guidance.

The dedication is also to my husband Paul and our children Mary, Maureen and Moses, who have always encouraged me and stood by me.

## ACKNOWLEDGEMENTS

This research work has been accomplished through the support and assistance of many people.

I glorify and praise the Lord God Almighty for His mercy and grace which He has instilled upon me throughout the study period.

I am grateful to my supervisors Dr. Alice Mboganie Mwangi and Dr. George N. Chemining'wa for their guidance, invaluable advice, constructive comments from the research proposal development; fieldwork and writing the dissertation.

My sincere appreciation goes to the entire Applied Human Nutrition Programme staff and my former ANP classmates for their assistance throughout the study period.

I am indebted to the data collecting assistants who worked tirelessly to ensure the collection of quality data within the stipulated time. Special thanks go to Mary, Maureen and Moses for their assistance in data entry and to Mwai John for his assistance in data analysis.

I am also indebted to the management of all the gyms that allowed me to use their premises for my research. I am also grateful to the gym users who shared their stories in response to the research questions.

I must also thank the staff of Newmark Pharmaceuticals Limited for standing in for me during the study period and worked tirelessly to ensure everything worked well in my absence.

But finally it is my family to whom I owe this research, for their support, financially, through prayers, encouragement and standing by me throughout the study period. Their love and devotion supported me throughout the study period.

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## **Acronyms and Abbreviations**

<b>BMI</b>	Body Mass Index
<b>BW</b>	Body Weight
<b>CBD</b>	Central Business District
<b>CI</b>	Confidence Interval
<b>DHEA</b>	Dehydroepiandrosterone
<b>DOD</b>	Department Of Defence
<b>DS</b>	Dietary Supplement
<b>DSHEA</b>	Dietary Supplements Health and Education Act
<b>DSs</b>	Dietary Supplements
<b>EC</b>	European Community
<b>EU</b>	European Union
<b>FDA</b>	Food and Drug Administration
<b>FFQ</b>	Food Frequency Questionnaire
<b>GAO</b>	Government Accountability Office- United States
<b>HHS</b>	Health and Human Services
<b>HIV</b>	Human Immunodeficiency Virus
<b>IOC</b>	International Olympic Committee
<b>KEBS:</b>	Kenya Bureau of Standards
<b>KNBS</b>	Kenya National Bureau of Statistics
<b>NHANES:</b>	National Health and Nutrition Education Survey
<b>N1H1</b>	Hemagglutinin1 Neuraminidase1
<b>NIH:</b>	National Institute of Health
<b>OR</b>	Odds Ratio
<b>OTC</b>	Over the Counter

<b>PDE</b>	Provincial Director of Education
<b>PPB:</b>	Pharmacy and Poisons Board
<b>PMS</b>	Post Market Surveillance
<b>RE</b>	Retinol Equivalent
<b>RONs</b>	Reactive Oxygen and Nitrogen Species
<b>SPSS</b>	Statistical Package for Social Sciences
<b>UK</b>	United Kingdom
<b>US</b>	United States

## **Operational Definition of Terms**

### **Botanical**

Botanicals are plants or plant parts used for their medicinal or therapeutic properties. Botanicals are sold either in a crude form (whole dried plants or plant parts as found, for example, in tea bags) or as partially purified or concentrated extracts. These can be liquids or solids in the form of tablets, capsules, soft gels, gel caps, or powders.

### **Daily value**

An estimate of daily need

### **Diet**

The customary amount and kind of food and drink taken by a person from day to day; more narrowly, a diet planned to meet specific requirements of the individual, including or excluding certain foods.

### **Dietary ingredient**

A dietary ingredient includes vitamin, mineral, amino acid, fibres and herb or botanical, as well as other substances that can be used to supplement the diet e.g. enzyme, tissue, metabolite, concentrate, constituent or extract or a combination.

### **Dietary supplements**

Dietary supplements are products in the form of tablets, capsules, powders, bars, and liquids taken by mouth that contain a "dietary ingredient".

## **Ergogenic**

A substance that directly influences the physiological capacity of a particular body system, thereby improving the performance.

## **Gym**

A gym (health/fitness club) is a place which houses exercise equipments for the purpose of, physical and fitness exercise.

## **Gym users**

People who go to the gyms for using the facility for the purpose it's meant for.

## **Multi mineral supplement**

A dietary supplement that contains two or more minerals as the major dietary ingredients.

## **Multi vitamin supplement**

A dietary supplement that contains two or more vitamins as the major dietary ingredients.

## **Single mineral supplement**

A dietary supplement that contains one mineral only as the dietary ingredient

## **Single vitamin supplement**

A dietary supplement that contains only one vitamin as the dietary ingredient



## **Abstract**

Little has been documented about use of dietary supplements in Kenya despite their increase in popularity. Hence a study was conducted to provide information on prevalence of dietary supplements use, knowledge and hence consumption patterns among the gym users in Nairobi.

A descriptive cross sectional survey was carried out among 402 adult gym users from nineteen gyms located in Nairobi in November 2010. Data were collected on the socio-demographic characteristics of the respondents, general knowledge on dietary supplements, prevalence of use of dietary supplements, types of dietary supplements taken, meals intake relative to dietary supplements intake, adverse effects of dietary supplements, source of information on dietary supplements use, sources of dietary supplements, prescription used to source dietary supplements, anthropometric measurements and food frequency using an interviewer administered questionnaire..

The overall prevalence of use of dietary supplements was 43.3%, most popular being body building among the males and single mineral among the females. Prevalence of vitamin/mineral supplements use among the females was 62.7% and that of non vitamin/non mineral use was 78.3% among the males.

The level of knowledge on dietary supplements (OR=2.81, CI=1.73-4.55,  $P<0.001$ ) and knowledge about presence of adverse effects of dietary supplements (OR=1.90, CI=1.34-2.59,  $P<0.001$ ) were significantly related to use of dietary supplements.

The primary source of information on dietary supplements was relatives/peers among the males and physician/hospital for the females. The source of dietary supplements was mainly from the pharmacies/chemists and they were sourced using self prescriptions.

10.9% of the dietary supplement users experienced adverse effects after using the supplements but only 36.8% of them stopped using them. Some of the adverse effects included palpitations, liver problems, temper and mood swings, coloured urine, lethargy and dizziness, stomach problems, nausea, increased appetite and lack of sleep.

The respondents tended to use balanced and healthy diets with more than 75% using fruits and vegetables daily and consuming some foods considered unhealthy moderately.

About only two fifths of the respondents had a body mass index within the normal range ( $18.5\text{kg/m}^2$ - $24.9\text{kg/m}^2$ ) with no difference between the genders. The percent body fat was significantly different between the genders with more males being in the normal range than females ( $\chi^2=55.1$ ,  $P<0.001$ ).

The factors associated with dietary supplements use were alcohol intake, knowledge about dietary supplements and their adverse effects.

In conclusion, the study shows that there was an independent significant association between use of dietary supplements and the following characteristics: alcohol consumption; level of knowledge on dietary supplements; and knowledge about adverse effects of dietary supplements. The gym users have not achieved their goal of being healthy and fit since there was a high proportion of them out of the normal body mass index range although their diet was healthy. There were some adverse effects that were associated with the use of dietary supplements.

# CHAPTER 1

## 1.0 INTRODUCTION

### 1.1 Background

A dietary supplement (DS) is "a product that is intended to augment the diet that bears or contains one or more of the following dietary ingredients: a vitamin, a mineral, an amino acid, a herb or other botanicals, a dietary substance for use by man to supplement the diet by increasing the total dietary intake (e.g., enzymes or tissues from organs or glands), or a concentrate, metabolite, constituent or extract or combinations of these ingredients" (DSHEA, 1994). Diet and nutrition play important roles in the maintenance of health and prevention of disease. Dietary supplements (DSs) represent an important source of essential nutrients since they are widely used and often contain 100% or more of the Daily Value of one or more nutrients. DSs are also of concern because of potential adverse effects if not used professionally. In epidemiological studies, the use of DSs is an exposure of interest because of its potential effect on disease (Ishihara et al, 2003).

#### 1.1.1 Prevalence and adverse effects of dietary supplements

The prevalence of DSs use in the developed nations continues to increase. Prior studies have reported on the prevalence of DSs usage and the characteristics of users in the United States (US) population. In the most recent reporting of nationwide survey data, the National Health and Nutrition Examination Survey (NHANES) 1999–2000, 52% of adults reported taking a DS in the previous 30 days. The popularity and increased use of DSs have led to concerns about their safety and possible health risks. Adverse effects are currently captured largely either through voluntary and/or spontaneous reporting by consumers in US Food and Drug Administration (FDA), Post marketing surveillance programs such as Med Watch or through Poison-Control Centres. A 1998 study of 11 Poison-Control Centres in the US found that

one-third of all adverse effects reportedly attributed to DSs were associated with severe symptoms such as seizures, comas, myocardial infarctions, arrhythmias, coagulation disorders, hepatic disease, anaphylaxis, and death (FDA, 2009).

The prevalence of DSs consumption among the Kenyan population is also on the increase especially in the urban areas. This is evidenced from the increase in stocking of these DSs observed at the commercial outlets including pharmacies, health-shops, supermarkets, cosmetic shops and direct sales (multi-level marketing).

Adverse effects of using DSs can be due to: Presence of contaminants, presence of natural toxins, excessive intake of supplements including mega doses, combination of different brands with similar ingredients and drug-supplement interactions especially since on several occasions the patients generally do not report or under-report use of DSs to their clinicians and pharmacists.

### **1.1.2 Gyms (health/fitness clubs) use**

A gym (health/fitness club) is a place which houses exercise equipments for the purpose of physical and fitness exercise. It has facilities which include main workout area, cardio area/theatre, group exercise classes, sports facilities and personal training. Some gyms generally include health-shops, snack bars, sauna, steam shower, or wellness areas.

People visit the gyms to achieve different goals such as: body building, building muscles- mostly for sports people, toning up, losing of weight and burn fat, keeping healthy and fit, achieving beauty and keeping up with peers.

There is an increasing trend in the number of gyms being established in the urban areas in Kenya. This might be due to an increase in the number of people using the gyms.

Identification of patterns in the use of DSs by the gym users would provide an insight into the utilization of DSs by a more privileged segment of the population. The knowledge acquired about DSs use by gym users would ultimately be used to assess the consumer awareness on DSs use.

## **1.2 Problem Statement**

DSs use in the developed nations is highly prevalent and represents an important source of nutrition. Studies have been done in the US and Western countries like the UK, which show an increase in the prevalence of DSs use in the population.

In Kenya DSs have gained popularity and they are increasingly being sold in pharmacies, health shops, supermarkets, cosmetic shops and direct sales (multi-level marketing). Other sources of DSs are from relatives living abroad and the internet. Most of the sales of these DSs are through self medication (prescription) and this should be of concern due to the probable adverse effects of the supplements.

In addition most of the DSs are imported and some of their contents are not locally verified by the Kenya Bureau of Standards (KEBS, 2009) which has the mandate of controlling dietary supplements. KEBS depends on the manufacturers' claims on the contents of these supplements.

## **1.3 Justification**

The unprofessional use of dietary supplements can have detrimental adverse effects which can be a health risk and some can be life threatening.

The effects that arise from drug-supplement interaction can lead to either decreased efficacy of the drug or potentiate the activity of the drug bringing about an overdose effect. This can lead to worsening the disease condition being treated or even death. If the drug whose efficacy is decreased is an anti-infective drug, this could lead to resistance to this drug and also progression of the disease.

Other effects can arise from overdosing the DSs and lead to disease conditions or even vital organs damage thus interfering with the normal functioning of an individual. This can also lead to loss of life.

Some DSs are contraindicated in certain disease conditions and they can cause life threatening effects when used in such disease conditions. Other DSs contain active ingredients that have strong biological effects and their safety is not always assured in all users. These can also cause life threatening effects to unsuspecting consumers.

All these can translate to decrease in development as resources meant for development is deviated to medical services to cater for the treatment of individuals affected by effects of unprofessional use of DSs. Decrease in productivity of the ones affected and loss of life can also lead to decrease in the development.

This study provides information on DSs use, consumer awareness and DSs consumption pattern which can ultimately be used to implement structural and education interventions.

#### **1.4 Aim**

The aim of this study was to contribute to safeguarding the health of gym dietary supplement users.

## **1.5 Purpose**

The purpose of the study was to provide information on consumer awareness and practices related to DSs use among gym users in Nairobi which can ultimately be used to implement structural and educational interventions.

## **1.6 Objectives**

### **1.6.1 General objective**

To assess the knowledge and usage of dietary supplements, and dietary patterns of gym users in Nairobi.

### **1.6.2 Specific objectives**

1. To determine the prevalence of usage of dietary supplements among gym users in Nairobi.
2. To determine the patterns of utilisation of dietary supplements in relation to meal intake among gym users in Nairobi.
3. To determine the extent of knowledge about dietary supplements among gym users in Nairobi.
4. To determine the factors prompting utilisation of supplements among gym users in Nairobi.
5. To determine the dietary patterns of gym users in Nairobi

6. To determine the nutritional status (Body Mass Index (BMI) and percent body fat) of gym users in Nairobi.
7. To assess the potential adverse effects of usage of the dietary supplements among gym users in Nairobi.

### **1.7 Hypotheses**

1. Knowledge on dietary supplements, gender, age, economic status and education level are the factors associated with usage of dietary supplements among gym users in Nairobi.
2. There are no potential adverse effects of usage of dietary supplements among gym users in Nairobi.

### **1.8 Limitations of the Study**

Under-reporting might have occurred due to the various perceptions the respondents had on the definition of supplements. Some participants considered all items prescribed by a physician as medicines and could not differentiate medicines and DSs. Most of the respondents with a physicians' prescription who could recall using DSs were the ones who already knew about the DSs and wanted advice and from the physician on the DSs.

There were some types of DSs that the respondents considered very confidential and were not reported even after probing. These were the DSs used for improving the sexual drive.



The response of the females was poor with a high proportion of females in the age category 26-35 years not willing to be interviewed. The gym attendance of the females was highest in this age category.

## CHAPTER 2

### 2.0 LITERATURE REVIEW

#### 2.1 Overview of Dietary Supplements

Dietary supplements come in many forms, including tablets, capsules, soft-gels, gel-caps, powders, energy bars, tea bags and liquids (DSHEA, 1994). These products are available in pharmacies, supermarkets, health stores, multi-level sales, as well as on the Internet. They are labeled as DSs and include (DSHEA, 1994):

- Vitamin and mineral products;
- "Botanical" which come in many forms and may include plant materials; algae, macroscopic fungi, or a combination of these materials;
- Amino acid products consisting of amino acids which are known as the building blocks of proteins and play a role in metabolism; and
- Enzyme supplements consisting of enzymes which are complex proteins that speed up biochemical reactions.

People use DSs for a wide assortment of reasons. These include: compensation for meals; medical conditions; eating habits that limit the intake of essential vitamins and nutrients; attainment of beauty; building muscles; improving physical performance; boosting energy; boosting immunity; increasing sexual drive; maintaining a health condition; and getting a good night's sleep (New York Task Force of Life and Law 2005).

Postmenopausal women consider using DSs to counter a sudden drop in estrogen.

DSs are intended to augment the diets of some people, but not to replace the balance of the variety of foods important to a healthy diet. While one needs enough nutrients, too much of some nutrients can be toxic (New York Task Force of Life and Law 2005).

## 2.2 Safety of Dietary Supplements

The consumer turns to dietary supplements often believing them to be more natural, potent or pure than food or pharmaceuticals. Dietary supplements with a broad range of health claims are widely available, and the consumer may think that they have been proven effective. Dietary supplement labels need not list risks or contraindications, and the consumer may assume that supplements are safe. In each case the consumer may be wrong.

DSs may not be risk-free under certain circumstances. Pregnant, nursing women, or people who have a chronic medical condition, such as, diabetes, hypertension or heart diseases, should consult their doctor or pharmacist before purchasing or taking any supplements. While vitamins and minerals are widely used and generally considered safe for children, it is important to check with the doctor or pharmacist before giving any DS to children. If one plans to use a DS in place of drugs or in combination with any drug, it is important to first notify the health care provider. Many DSs contain active ingredients that have strong biological effects and their safety is not always assured in all users. People with certain health conditions who take these products, may be putting themselves at risk (New York Task force of life and law 2005).

The labeling and marketing claims of some DSs are deceptive or questionable and may put the health of consumers at risk. An investigation by Kutz of the Government Accountability Office (GAO) in US found examples of deceptive or questionable marketing and sales practices for DSs popular among the elderly. The most egregious practices included suspect marketing claims that a dietary supplement prevented or cured extremely serious diseases, such as cancer and cardiovascular diseases. Other dietary supplements were claimed to mitigate age-related medical conditions, such as Alzheimer's disease and diverticular disorder (Kutz, 2010).

### **2.3 Dietary Supplements and Drug Interactions**

Some DSs may interact with prescription and over-the-counter medicines (OTC). Taking a combination of DSs or using these products together with medications (whether prescription or OTC drugs) could under certain circumstances produce adverse effects, some of which could be life-threatening. Vitamin E decreases platelet adhesion and at high levels may increase the clotting time. Warfarin (a prescription anticoagulant medicine), aspirin (an OTC drug) and vitamin E (a vitamin supplement) can each thin the blood, and taking any of these products together can increase the potential for internal bleeding (National Institute of Health Drug-Nutrient Interaction Task Force, 2003; Wittkowsky, 2010)

Coumadin (a prescription, anticoagulant medicine) used in medical conditions of increased risks of forming blood clots acts by decreasing the activity of vitamin K: lengthening time it takes for a clot to form. Sudden increase of vitamin K may decrease the effect of coumadin. There are other dietary supplements that affect the clotting of blood for example garlic, St. John's wort, ginger, Ginkgo, wheatgrass and turmeric. The safest policy for individuals on coumadin is to avoid all DSs unless their physician approves (National Institute of Health Drug-Nutrient Interaction Task Force, 2003; Patient and Family Education/NYU Medical Centre, 2002; Heck et al., 2000; Tachjian et al., 2010).

Vitamin A may potentiate the development of intracranial hypertension when taken in combination with tetracycline and minocycline type of antibiotics (Expert Group on Vitamins and Minerals, 2003; Hathcock et al., 1990). The metabolism of retinol and retinoic acid in the human liver may be mediated by cytochrome P450. Drugs such as ketoconazole, which inhibit cytochrome P450, can significantly increase the half life of retinoic acid (Expert Group on Vitamins and Minerals, 2003; Ni et al., 2001). Alcohol may potentiate vitamin A-induced hepatotoxicity. Competitive inhibition of alcohol dehydrogenase may lead to decreased synthesis of retinoic acid, resulting in functional vitamin A deficiency, which has

been postulated to be involved in foetal alcohol syndrome (Expert Group on Vitamins and Minerals, 2003; Ni et al., 2001). Hypervitaminosis A may decrease vitamin C tissue storage and may also have an anti-thyroid effect. Vitamin A may antagonize the action of vitamin K in the blood clotting function (Expert Group on Vitamins and Minerals, 2003; Ni et al., 2001).

Some DSs can have unwanted effects during surgery. It is important for one to let the surgeon know if one is taking DSs so as to avoid the potentially dangerous supplements/drugs interaction—such as changes in the heart rate, blood pressure and increased bleeding- that could adversely affect the outcome of surgery (Eye Care America, 2007).

Co-supplementation of ferrous salts with vitamin C exacerbates oxidative stress in the gastrointestinal tract leading to ulceration in healthy individuals, exacerbation of chronic gastrointestinal inflammatory diseases and can lead to cancer (Fisher and Naughton, 2004). Reactive oxygen and nitrogen species (RONS) have been ascribed an important role in oxidative stress. Redox -active metal ions such as Fe (II) and Cu (I) further activate RONS and thus perpetuate their damaging effects. Ascorbic acid can exert a pro-oxidant effect by its interaction with metal ions via a number of established RONS generating systems which are reviewed here (Fisher and Naughton, 2004)

The cytotoxic agent actinomycin and imidazole antifungal agents interfere with vitamin D activity by inhibiting the conversion of 25-hydroxyvitamin D to 1, 25-dihydroxyvitamin D by the kidney enzyme, 25-hydroxyvitamin D-1-hydroxylase. Lead has also been reported to inhibit vitamin D synthesis. Some anticonvulsant drugs may interfere with hepatic metabolism of vitamin D and so raise requirements (Expert Group on Vitamins and Minerals, 2003).

Further, some herbal dietary supplements may interact in a potentially harmful manner with some prescription drugs. For example, according to NIH, St. John's wort can negatively affect the efficacy of antidepressants, Human Immunodeficiency Virus (HIV) treatments, cancer drugs, and anticoagulants, though this is not always noted on product labels. Many herbal supplements have not been exhaustively tested for hazardous interactions with prescription drugs, other supplements, or foods (Kutz, 2010).

Chamomile may interact with barbiturates and other sedatives intensifying or prolonging the effects of the sedatives. The tannins in chamomile may act as anti nutrients reducing the absorption of iron in iron supplements. Chamomile contains phytochemicals which may have an additive effect on warfarin resulting in increased risk of bleeding (Merck Manuals, 2010).

Echinacea may slow down the metabolism of potentially hepatotoxic drugs metabolised by cytochrome P450 for example ketoconazole, amiodarone and anabolic steroids resulting in an increased risk of hepatotoxicity if taken for more than 8 weeks.

Ephedra increases stimulant effect of other drugs for example epinephrine increasing the risk of irregular or rapid heartbeat and hypertension. It may also intensify the effects of Monoamine Oxidase Inhibitors increasing the risk of side effects (headaches, tremors, irregular or rapid heartbeat, hypertension (Merck Manuals, 2010).

#### **2.4 Specific Vitamin/Mineral Toxicity**

Some DSs cause toxicity on their own without interacting with any other item. This includes some specific minerals and vitamins.

Most cases of acute iron poisoning occurring in children in the world are due to accidental ingestion of iron supplements intended for adults. The acute toxic dose of iron in infants is considered to be approximately 20 mg/kg body weight (bw) associated with gastrointestinal

irritation, whilst systemic effects do not generally occur at doses less than 60 mg/kg bw. The lethal dose in children is approximately 200 – 300 mg/kg bw. Iron poisoning in adults is rare (Expert Group on Vitamins and Minerals, 2003).

Individual case reports suggest that a dose of approximately 100g (approximately 1400mg/kg bw) iron is lethal, although survival may occur with treatment. High doses of iron supplements are frequently associated with gastrointestinal effects, especially constipation, but also with nausea, diarrhea and vomiting. The severity and occurrence of the effect depends upon the formulation of the supplement and the amount of iron released in the stomach.

Severe gastrointestinal damage has been described following iron overdose. Reports of mucosal injury resulting from iron tablet ingestion at therapeutic levels are rare. Very few systematic studies of the potential of therapeutic doses of iron to cause or promote gastric or esophageal ulceration have been conducted. The limited data available suggest that tissue damage due to iron tablets can be demonstrated through histopathology. It is unclear whether therapeutic doses of iron are likely to initiate gastrointestinal damage (Expert Group on Vitamins and Minerals, 2003).

Vitamin supplements that are not balanced correctly can also do more harm than good. For instance, large amounts of folic acid can mask the damaging effects of vitamin B12 deficiency by correcting the megaloblastic anaemia caused by vitamin B12 deficiency without correcting the neurological damage that also occurs. Moreover, preliminary evidence suggests that high serum folate levels might not only mask vitamin B12 deficiency, but could also exacerbate the anaemia (Office of Dietary Supplement, 2010).

Vitamin A can also be toxic, and may even cause birth defects in some instances, depending on the amount taken and type of Vitamin A used in the vitamin supplements. Symptoms of

acute toxicity include abdominal pain, anorexia, vomiting, blurred vision, irritability, headache, and in neonates and infants, bulging of fontanelles. Acute toxicity is associated with doses well in excess of 100,000µg Retinol Equivalent (RE) and 10,000µg RE, in adults and children, respectively. Infants of age less than 6 months have been shown to develop acute symptoms following single dose of 7500-15,000µg RE, whereas a dose of 30,000µg RE appears to be well tolerated in older infants (6 and 9 months of age) (Expert Group on Vitamins and Minerals 2003; Ni et al., 2001). Symptoms of chronic toxicity include dry thickening of the skin, cracking of lips, conjunctivitis, erythematous eruption, alopecia, reduced bone mineral density, bone joint pain, chronic headache, intracranial hypertension and hepatotoxicity. Damage of eyes may be permanent but most of the other symptoms are reversible. Chronic toxicity in adults is generally attributed to supplemental doses of >7500-15000microgramRE/day over weeks, months or years. However there have been cases of toxicity associated with lower doses of approx 1500-3000microgramRE/day. Determination of threshold dose for chronic toxicity may be confounded by pre-existing disease, alcohol abuse, and drug therapy (Expert Group on Vitamins and Minerals, 2003; Perrota et al., 2002).

Epidemiological data have shown that the risk of hip fracture on postmenopausal women may be doubled if dietary retinol intake is 1500µg RE/day compared to an intake of 500µg RE/day (Expert Group on Vitamins and Minerals, 2003; Melhus et al., 1998).

Retinol may represent teratogenic risk particularly within the first trimester of pregnancy. Other groups potentially vulnerable to vitamin A toxicity include the young; older people; those suffering from osteoporosis, chronic renal failure or under-nutrition, haemodialysis patients and individuals with compromised liver function (Expert Group on Vitamins and Minerals, 2003).



Excessive vitamin D intake may lead to hypercalcaemia and hypercalciuria. Vitamin D promotes the absorption of calcium and the resorption of bone resulting in the deposition of calcium in soft tissues, diffuse demineralisation of bones and irreversible renal and cardiovascular toxicity. Patients with sarcoidosis are abnormally sensitive to vitamin D, due to uncontrolled conversion of the vitamin to its active form in the granulomatous tissue.

Although the condition is uncommon, it would be a potential hazard if affected individuals were to take supplementary vitamin D (Expert Group on Vitamins and Minerals, 2003; Adams and Lee, 1997). Choosing the wrong DSs by consumers who are not knowledgeable can be costly since it may be hazardous to ones health.

## **2.5 Dietary Supplements in Sports**

The improvement in understanding human metabolism and exercise physiology made it clear in the last decade that manipulation of nutrients intake had the potential to positively influence sport performance, resulting in an explosion of products that have specific application to exercising individuals (Molinero and Marquez, 2009).

A large number of recreational and elite athletes use DSs in the hope of improving performance. Global supplements use in athletes is estimated to range from 40% to as high as 88% percent with more than thirty thousand supplements available in the US market. These aids can be expensive and potentially harmful, and the advertised ergogenic gains are often based on little or no scientific evidence. Due to the lack of regulation of the DS industry, many of the DSs contain substances that are prohibited in sport or that have been associated to significant morbidity and mortality (Molinero and Marquez, 2009).

Sports supplements are supposed to provide known nutrients requirement to optimize training or competition performance, to contain nutrients in large quantities, in order to treat a

known nutritional deficiency for instance iron supplements or directly enhance performance or maintain/restore health and immune function.

Scientific studies have demonstrated that under specific conditions ergogenic aids can have some positive effects on performance, lean body mass, strength and change in body composition. Furthermore most of the research that has been undertaken has failed to support the claims of the majority nutritional ergogenic aids (Molinero and Marquez, 2009). There is need for appropriate DSs regulation, nutritional educational and scientifically sound guidance for sports people.

### **2.5.1 Risks of nutritional supplementation in sport**

There is evidence that some of the legitimate DSs on sale contain ingredients that are not declared on the label but are prohibited by doping regulation of the International Olympic Committee (IOC) and of the World Anti-doping Agency for example pro-hormones (steroid related compound such as androstenedione, dehydroepiandrosterone (DHEA) and stimulants such as ephedrine or related substances. Athletes consuming such supplement products may jeopardize their sporting status, and their health (Molinero and Marquez, 2009; Maughan et al., 2007). The most important educational messages, however, is to use dietary supplements only if it is deemed of benefits by a nutritional/health expert.

## **2.6 Malpractices**

### **2.6.1 Adulteration with drug substances**

Products that are marketed as dietary supplements but contain active ingredients in Food and Drug Administration (FDA)-approved drugs, analogs of approved drugs, and other

compounds that do not qualify as dietary ingredients, present an emerging and expanding challenge. FDA has found that certain products in the following categories have been illegally represented as dietary supplements: sexual enhancement or erectile dysfunction, weight loss, cholesterol reduction, and body building products. These products have been found to be intended for use as drugs and to contain active prescription pharmaceutical ingredients including Phosphodiesterase (PDE)-5 Inhibitors (for example sildenafil or Viagra), controlled substances for obesity (for example sibutramine or Meridia), lovastatin, and synthetic steroids or steroid-like substances (Joshua and Sharfstein, 2010).

### **2.6.2 Illegal claims**

Dietary supplements with unsubstantiated and illegal claims may encourage consumers to self-treat for a serious disease without the benefit of a medical diagnosis or treatment. In the US, FDA conducts enforcement activities against supplements that make these types of claims. For example, on March 31, 2010, the United States Marshal for the Western District of Wisconsin seized a range of dietary supplements and other products from a firm that was promoting the products for unapproved uses. The firm promoted its bee-derived products to treat, cure or prevent diseases and conditions such as cancer, asthma, arthritis and hypertension.

In response to the Hemagglutinin1 and Neuraminidase1 (H1N1) flu crisis of 2009, FDA launched an initiative to address the numerous fraudulent products that were promoted to treat, prevent, or cure H1N1 flu. The Agency targeted products that were promoted on the Internet and issued Warning Letters to the owners of the websites. Approximately 70 products were supplements. (Joshua and Sharfstein, 2010)

### 2.6.3 Unsafe ingredients

A dietary supplement is adulterated, and subject to enforcement action, “if it bears or contains any poisonous or deleterious substance which may render it injurious to health” or if it presents a “significant or unreasonable” risk to consumers. DSHEA allows the Health and Human Service (HHS) Secretary to ban a dietary supplement if it is found to be an “imminent hazard.”

Under the current regulatory framework, FDA looks for such problems after marketing through reviewing the medical literature and analyzing adverse event reports. Because many products have multiple ingredients, it is challenging to identify causal connections between specific ingredients and adverse effects.

In 2009, FDA became aware of serious problems associated with a supplement product called Hydroxycut. Many of the reports advised of serious liver injuries, including liver damage that required transplants. After discussion with the Agency, the manufacturer voluntarily recalled Hydroxycut and subsequently reformulated the products (Joshua and Sharfstein, 2010)

In 2007 there was a public alert from Pharmacy and Poisons Board (PPB) on a product which was being sold as a Chinese herbal contraceptive. This product was a conventional pharmaceutical product containing very high levels of levonorgesterel and quinesterol. The levels were found to be 40 times above the safe limits. The product had not been registered by PPB, and posed serious medical complications to mothers and children, when breast feeding (PPB, 2007).

## **2.7 Regulation of Dietary Supplements**

### **2.7.1 US market**

FDA regulates dietary supplements under a different set of regulations than those covering "conventional" foods and drug products (prescription and Over-the-Counter). Under the Dietary Supplement Health and Education Act of 1994 (DSHEA), the dietary supplement manufacturer is responsible for ensuring that a dietary supplement is safe before it is marketed. FDA is responsible for taking action against any unsafe dietary supplement product after it reaches the market. Generally, manufacturers do not need to register their products with FDA nor get FDA approval before producing or selling dietary supplements. Manufacturers must make sure that product label information is truthful and not misleading.

FDA's post-marketing responsibilities include monitoring safety, for example voluntary dietary supplement adverse event reporting, and product information, such as labeling, claims, package inserts, and accompanying literature. The Federal Trade Commission regulates dietary supplement advertising.

Domestic and foreign facilities that manufacture/process, pack, or hold food for human or animal consumption in the United States are required to register their facility with the FDA (FDA, 2009)

### **2.7.2 European market**

In the European Union (EU), The Food Supplements Directive 2002/46/European Community (EC) require that supplements be demonstrated to be safe in both quantity and quality, and, only those supplements that have been proven may be sold without prescription. Although to a degree differing from one member state to another there is established view

that food supplements should not be labelled with drug claims but can bear health claims. Under the EU Directive a “positive list” has been created listing the allowable vitamins, minerals and chemical forms (sources) of these vitamins minerals. Derogation in article 4.6 of the Directive allows use of some vitamins and minerals that are not on the “positive list.” (European Commission Health & Consumers Directorate General, 2009)

### **2.7.3 Kenyan market**

Kenya Bureau of Standards (KEBS) is the body in Kenya that has the mandate of regulating DSs. This body depends on the manufacturers’ claims on the quality and quantity of the ingredients. Most of the DSs are therefore not analysed by KEBS. KEBS regulation on dietary supplements is that it shall be accompanied by analysis/test report from the manufacturer (KEBS, 2009). There is also liberal marketing of the DSs.

The Pharmacy and Poisons Board (PPB) is charged with the responsibility of regulating medicines from clinical trial phase through to post-marketing phase. The PPB has no mandate on the control of DSs. The only DSs that fall under the control of PPB are only those with a medical claim and those that have been registered by the PPB. The PPB has registered some dietary supplements in the category of vitamins and minerals especially those marketed by pharmaceutical firms. A product sold as a DS cannot suggest on its label or in labelling that it treats, prevents, or cures a specific disease or condition without specific approval from PPB. Herbal medicines are not regulated in Kenya. Neither a national pharmacopoeia nor national monographs exist or are being developed. No other pharmacopoeias or monographs are used in their place.

No information is provided on manufacturing requirements, but special regulatory requirements for safety assessment of traditional use without demonstrated harmful effects and reference to documented scientific research on similar products apply to herbal

medicines. These have been established by the Kenya Medical Research Institute, but no control mechanism exists to ensure their implementation.

There is no registration system for herbal medicines and they are not included on the essential drug list. A post marketing surveillance system is in development. Herbal medicines in Kenya are sold without restriction (WHO, 2005).

Preparations liable to registration and controlled by the PPB are products claimed to be useful in any of the following purposes:

- Treating or preventing a disease.
- Alleviating symptoms of a disease.
- Diagnosing a disease.
- Ascertaining the existence, degree or extent of a physiological condition.
- Preventing or interfering with the normal operation of a physiological function whether permanently or temporarily and whether by way of terminating, reducing, postponing or accelerating the operation of that function, in human beings and animals. For example: these include substances which can be used as contraceptive or for the purpose of inducing anaesthesia.
- Blood, blood plasma and blood preparations containing cellular elements of blood.

The Department of Pharmacovigilance coordinates all post-marketing surveillance (PMS) activities. The Department of Pharmacovigilance works together with the Pharmaceutical Inspectorate Department, the Drug Registration Department and other departments as necessary.

PMS encompasses the pro-active and reactive collection of information on quality, safety and performance of medicines, medical devices, complementary medicines, DSs, cosmetics, and related products after they have been released into the market (post-registration).

The PPB has the responsibility of carrying out regular audits of the pharmaceutical products, medical devices, cosmetics, DSs, poisons and complementary medicines to ensure compliance with legal, quality and safety requirements (Ministry of Medical Services, 2010).

The adverse effects and safety non-compliance of DSs are therefore supposed to be reported to the Department of Pharmacovigilance for action.

## **2.8 Gaps in Knowledge**

Studies on individual DSs consumption are very few, if any, in Kenya. Some of the DSs contents are not locally verified by the Kenya Bureau of Standards (KEBS) which has the mandate of controlling dietary supplements and depends on the manufacturers' claims. There are no studies on the level of self medication with respect to DSs in Kenya.



# CHAPTER 3

## 3.0 METHODOLOGY

### 3.1 Study Setting and Population

#### 3.1.1 Study area

Nairobi is the capital and the largest city in Kenya. It is situated on an elevation of 1795m above sea-level and occupies 684 square kilometres (260 sq miles). It is adjacent to the eastern edge of the Rift Valley. The Ngong hills located to the west of the city are the prominent geographical features of the Nairobi area. Nairobi River and its tributaries traverse through the Nairobi County. Indigenous Karura Forest lies in the northern part of Nairobi County.



(UNEP, 2010)

Figure 3.1: Divisions of Nairobi County

## **Climate**

At 1,795 metres (5889ft) above the sea level, Nairobi enjoys a moderate climate. It has a Subtropical Highland climate. The altitude makes for some chilly evenings, especially in the June/July season when temperatures can drop to 10 degree Celsius. The sunniest and warmest part of the year is from December and March, when temperatures average mid-twenties during the day with a mean maximum of 24 degrees Celsius (Wikipedia, 2010).

There are two rainy seasons but the rainfall can be moderate. The cloudiest part of the year is just after the first rainy season, when, until September, conditions are usually overcast with drizzle. As Nairobi is situated close to the equator, the difference between the seasons is minimal. The seasons are referred to as wet season and dry season. The timing of the sunrise and sunset varies little throughout the year, due to Nairobi's close proximity to the equator (Wikipedia, 2010).

## **Districts and Suburbs**

Nairobi is divided into eight constituencies; these are Makadara, Kamukunji, Starehe, Langata, Dagoretti, Westlands, Kasarani and Embakasi. There are nine districts namely Makadara, Kamukunji, Starehe, Langata, Dagoretti, Westlands, Kasarani, Embakasi and Njiru which were created in 2007 (PDE, Nairobi, 2007)

Most of the up market suburbs are situated to the west of Nairobi, where most European settlers resided in colonial times. These include Karen, Lavington, Gigiri, Muthaiga, Runda and Highridge. Low and lower middle income estates are located in eastern Nairobi. These include Kariokor, Dandora, Mathare, Kariobangi, Kasarani, Embakasi and Huruma. Many Somali immigrants have also settled in Eastleigh.

## **Society and Culture**

Nairobi is a cosmopolitan and multicultural city. Since its foundation, Nairobi has maintained a strong British presence, and a lasting legacy from colonial rule. This is highlighted by the number of English-named suburbs, including Hurlingham, Parklands and Westlands.

As Nairobi has a diverse and multicultural composition, there are a number of churches, mosques, temples and gurdwaras within the city (Wikipedia, 2010).

## **Population**

Nairobi has experienced one of the largest growth rates of any city in Africa. Since its foundation in 1899, Nairobi has grown to become the largest city in East Africa. The growth rate of Nairobi is currently 4.1%. It is estimated that Nairobi's population will reach 5 million in 2015 (Wikipedia, 2010). The population of Nairobi as per the 2009 census was 3,138,369 (KNBS, 2010).

### **3.1.2 Study population**

The study population consisted of all the adults using gyms in Nairobi aged 18 years and above.

There is a spread of gyms in Nairobi, with at least a gym currently situated in all the divisions of the city. Most of the hotels and clubs have gyms. The club gyms are mostly utilised by the club members. The apartments that are mushrooming in Nairobi especially in the upmarket areas have gyms for the tenants.

Gyms within the Central Business District (CBD) serve mostly the people who work in the town centre. These gyms are mostly utilised early in the morning, during lunch hour and after work. They represent clients from different socio-economic classes.

### 3.2 Study Design

A descriptive cross sectional survey was carried out among the gym users in Nairobi in November 2010.

### 3.3 Sample Size Determination

The sampling frame was the gym users' daily attendance register obtained from instructors of gyms that were randomly selected.

The Fisher et al (1991) formula was used in sample size determination ( $n=Z^2pq/d^2$ )

Where

n=the desired sample size.

Z=standard normal deviation usually set at 1.96 which corresponds to 95% confidence interval.

p=the proportion of gym users who use dietary supplements. A proportion of 50% was used since there was no existing reasonable estimate of gym users on dietary supplements.

q=1-p

d=degree of accuracy desired, usually set at 0.05.

$n = (1.96)^2(0.50)(0.50) / (0.05)^2 = 384$

An attrition rate of 5% was applied resulting in a sample size of 402 gym users (Fisher et al., 1991).

### 3.4 Sampling Procedure

Nairobi city was purposively chosen for being the largest city in Kenya. A list of the gyms in Nairobi was prepared which was used as the sampling frame for the gyms used in the study.

The information about the gyms and their location was obtained from:

- Kenya telephone directory.
- The yellow pages.
- Kenya business directory.
- Internet.
- Health stores.
- Market survey, where the field assistants visited the estates to locate the gyms which were not listed in the directories or internet.

A total of fifty five gyms were located and were used to prepare the sampling frame. A third of the gyms were selected by random sampling from the sampling frame prepared using epi-info software. A total of nineteen gyms were selected for the study.

The sampling frame for the participants was the attendance register which was obtained from the instructors of the selected gyms.

Every third gym user was selected from the sampling frame of each of the nineteen gyms to make the required sample size. If the gym user selected was a Kenyan citizen, aged 18 years and above, and had used the gym for at least three times a week for one month, the interviewer administered questionnaire was filled for the gym user. Study was carried out for six days for each gym. In most gyms the participants who satisfied the inclusion criteria were

the same ones who used the gym after every other day thus having valid respondents for only three days. The clubs with gyms used by the members were the only ones with many users to provide valid respondents for six days.

### **3.5 Data Collection and Management**

#### **3.5.1 Tools**

Tools used in the collection of data were, an interviewer administered semi-structured questionnaire<sup>1</sup> to assess knowledge, usage, identification of dietary supplements and possible adverse effects. A food frequency questionnaire<sup>2</sup> (FFQ) was used to assess the dietary pattern of the respondents. Anthropometric assessment form<sup>3</sup> was used for recording the anthropometric measurements.

A weighing balance, a height board and a tape measure were used to take the anthropometric measurements for the calculation of BMI and percent body fat.

#### **3.5.2 Data collection procedure**

The interviewer who was a trained research assistant conducted a personal interview with the respondent and filled in all the sections of the questionnaire and the FFQ except for the questions that did not apply to the respondent.

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<sup>1</sup> Questionnaire is attached in appendix 1.

<sup>2</sup> FFQ is attached in appendix 1.

<sup>3</sup> Anthropometric assessment form is appendix 1.

The nutritional status of the respondent was conducted by using anthropometric measurements which were recorded on the anthropometric assessment form.

The following measurements were taken for the men:

- Weight in kilograms
- Height in centimetres
- Waist – circumference of the waist was measured in inches at the level of the navel (umbilicus or belly button) parallel to the ground.
- Neck girth - necks' circumference was measured in inches just below the Adams apple with a slight down tilt (front slightly lower than the back).

For the women the following measurements were taken:

- Weight in kilograms
- Height in centimetres
- Hip – measured with the level determined in inches by the greatest circumference over the buttocks and parallel to the floor.
- Waist – measured at the smallest circumference in inches.
- Neck girth- circumference of the neck was measured in inches.

Centimetres in height measurement were converted to metres for use in determining BMI and to compute percentage body fat from the Department of Defence (DOD) tables or equation.

Body fat percent was calculated as follows (Hogdon and Friedel, 1999).

**For men:** % body fat =  $86.010 \times \log_{10}(\text{abdomen} - \text{neck}) - 70.041 \times \log_{10}(\text{height}) + 36.76$

**For women:** % body fat =  $163.205 \times \log_{10}(\text{abdomen} + \text{hip} - \text{neck}) - 97.684 \times \log_{10}(\text{height}) - 78.387$

(Hogdon and Friedel, 1999).

### **Age of respondents**

The age of the respondents were divided into categories. These age categories included 18-25 years, 26-35 years, 36-45 years, 46-55 years and ages of more than 55 years.

### **Education level**

The level of education was classified into those with an education of college level and above and those with lower than college level of education.

### **Economic status**

Economic status was determined by the main means of transport and the type of residential estates of the respondents. The estates were classified according to the classification used by property management companies into upmarket, high income, high upper class, low upper class and low class.

### **Knowledge level on dietary supplements**

The knowledge section consisted of both open ended and close ended questions on knowledge about DSs. The responses to this section on knowledge were given scores. The aggregate score from all the questions on this section was converted to a percentage. The scoring method was from the Centre for Disease Control (CDC) handbook (CDC, 2003). All the scores in the 4<sup>th</sup> quartile (above 75%) implied high level of knowledge (adequate knowledge), 3<sup>rd</sup> quartile (50%-75%) implied medium level of knowledge (moderate



knowledge) and 2<sup>nd</sup> and 1<sup>st</sup> quartile (49% and less) implied low level of knowledge (inadequate knowledge).

### **Knowledge about adverse effects of dietary supplements**

In assessing for the knowledge about DSs having side effects, a question with only three options was given. The options were, DSs have side effects, doesn't have side effects and doesn't know or not sure. The proportion of the participants for each answer was determined.

### **Dietary supplements used**

All the other sections regarding DSs used in the prior 12 months, ingredients of these DSs and all the other sections of the questionnaire were filled up.

In the section of ingredient of the DSs, the respondents gave the brand name of the DSs. Ingredients in these DSs were determined from a market survey and from the internet. Some respondents were aware of the ingredients in the DSs especially if it consisted of one ingredient for example one mineral like iron or one vitamin like vitamin C. For the respondents who didn't know the name and were still using the supplement, they were requested to bring the DSs for verification.

The DSs were classified into various groups depending on the ingredients they contained. All the products that contained ingredients for muscle building, power, strength and endurance were classified as body building DSs. Products with one vitamin were classified as single vitamin DSs and ones with more than one vitamin as multivitamin DSs. DSs with one mineral were classified as single mineral DSs and those with more than one mineral as multi-mineral DSs. Products with a combination of vitamins and minerals were classified as multivitamin/multi-mineral DSs. Products that consisted of any fish oil and omega 3 oils were classified as fish oils DSs. Herbs or any botanicals were classified as herbal DSs. The

products that consisted of a combination of ingredients, they were put in the class in which the major ingredients/recommended use belonged. The glucosamine/chondroitin and anabolic steroids were not classified but taken as they were.

The supplements were further classified into two main groups namely vitamin/mineral DSs and non vitamin/non mineral DSs. Vitamin/mineral DSs were all the products that contained any vitamin or mineral either singly or in combination. Non vitamin/non mineral consisted of products with ingredients that were not vitamin or mineral. For the products with a combination of vitamin, mineral and non vitamin/non mineral the product was put in the class in which the major ingredients/recommended use belonged.

### **Dietary patterns**

The dietary pattern was determined by determining the frequency of using various foods. The frequencies were daily for the foods used everyday for all the days of the week. Foods used at least once a week but not daily were considered to be used weekly. Foods used at least once every two weeks but not every week was considered to be used fortnightly. For the foods consumed at least once in a month and less than every two weeks, was considered to be monthly/rarely. The FFQ was filled and analysed to determine the frequency of using the various foods. The FFQ used was similar to the Student Athletic Nutrition Questionnaire used in Notre Dame University (Whitman, 2009).

### **3.5.3 Ethical and human rights consideration**

A permit for the research was obtained from the Ministry of Education, Science and Technology as this is a requirement by the Government of Kenya.

The study was non invasive and the participants were briefed about the study and agreed to participate voluntarily and the information given was treated as confidential.

### **3.5.4 Recruitment and training of research assistants**

Four research assistants and one supervisor, good in both oral and written Kiswahili and English languages were recruited. The assistants were pharmacy technicians who had knowledge in medicines. The supervisor was a pharmaceutical technologist and had experience in research work. The assistants and supervisor were briefed on the objectives of the study by the researcher and the researcher's expectation from their work. They were trained by the researcher on: principles of ethics including confidentiality, right to privacy and right to decline to be interviewed or answer certain questions; administration of questionnaire; recording of the responses; and research techniques.

One computer literate data entry clerk was employed and trained on data entry.

The training took two days as per the schedule shown in appendix 2.

### **3.5.5 Pre-testing of data collection tools**

The study tools were pre-tested by carrying out five interviews per gym in 3 different gyms.

This provided the assistants with hands on learning experience.

The data obtained was analysed to verify the validity of the questionnaire and adjustments were made before the main data collection.

### **3.5.6 Data quality control**

Data quality control was achieved through:

- Questionnaire pre-testing.
- Thorough training of research assistants who also conducted role plays to ensure an understanding of the questions.
- Daily calibration of equipment (weighing balance).
- Daily debriefing with research assistants and the supervisor.

- Reviewing the questionnaire at the end of each day for completeness of responses entry.
- Informing respondents the objective of the study so as to give reliable information.
- During data entry, cleaning was done to rectify errors by running frequencies and cross tabulations to avoid possible mistakes and obtain quality data.

### **3.5.7 Data analysis**

The computer package Statistical Packages for Social Sciences (SPSS) version 16.0 and EPI INFO were used for the analysis of the data. Descriptive statistics involving measures of central tendency including mean, mode, median, confidence intervals and frequencies were used. Inferential statistical tests including logistic regression multivariate analysis, chi-square and P values were used.

Determination of association between two or more sets of quantitative data was assessed using multivariate analysis. Multivariate analysis was used to assess association between DSs use and the following characteristics: age, gender, education level, level of knowledge about DSs, BMI, percent body fat, smoking and use of alcohol.

## CHAPTER 4

### 4.0 RESULTS

#### 4.1 Demographic Characteristics of the Study Population

The study population comprised 402 gym users of which 70.4% were males and 29.6% were females. The distribution of the study group by selected demographic and socio-economic characteristics is shown in Table 4.1.

The ages of the participants were in the range of 18 to 68 years with a mean  $\pm$ SD of 32.74  $\pm$ 10.8 years and a median of 30 years. The proportion of males in the age categories 18-25 years and 26-35 years was higher than that of the females in same age categories. About three quarters of the males in the study group were in these two age categories while about three fifth of the females were in these two categories. Proportion of females in the age categories 36-45 years and 46-55 years was twice as much as that of males in the same age categories. The age category >55 years had the lowest proportion in both the males and females with a proportion of less than 10%. Proportion of females in this age group was half that of the males. There was a significant difference in age distribution between males and females in the study group ( $\chi^2=13.3$ ,  $P=0.010$ ).

The education level of the study population showed that more than three quarters of males in the study group had college level and above level of education, while the females with this level of education were more than 90%. The difference in education level between the males and females in the study group was statistically significant ( $\chi^2=16.6$ ,  $P<0.001$ ).

The economic status was determined by the means of transport mostly used by the respondents and their types of residential estate. Two thirds of the females used private means of transport while about half of the males used public means of transport. A very small proportion of both males and females walked with the proportion of females in this category

being half that of males. The difference in means of transport between the males and females was significantly different ( $\chi^2=18.5$ ,  $P<0.001$ ).

The proportion of both males and females living in up market and low class estates was low. Twice as many females as males lived in up market and high income estates. The highest proportions for both males and females lived in upper high class estates. In the lower high class estates the proportion of males was twice that of females. About half of the males and females lived in upper high class estates. The difference in estates the study group lived in between the males and females was significant ( $\chi^2=20.2$ ,  $P<0.001$ ). These results indicated that there was a significant difference in economic status between the male and female gym users.

There was no significant difference in marital status between the male and female gym users ( $\chi^2=0.4$ ,  $P=0.546$ ). About half of both the males and females were married while the other half was not married.

The proportion of the males and females in informal employment was the same and was slightly over a third for either gender and for the total study group. About half of the females were self employed while the proportion of males who were students was higher than the females by 10%. The difference in occupation between the male and female gym users was not significant. ( $\chi^2=7.5$ ,  $P=0.610$ ).

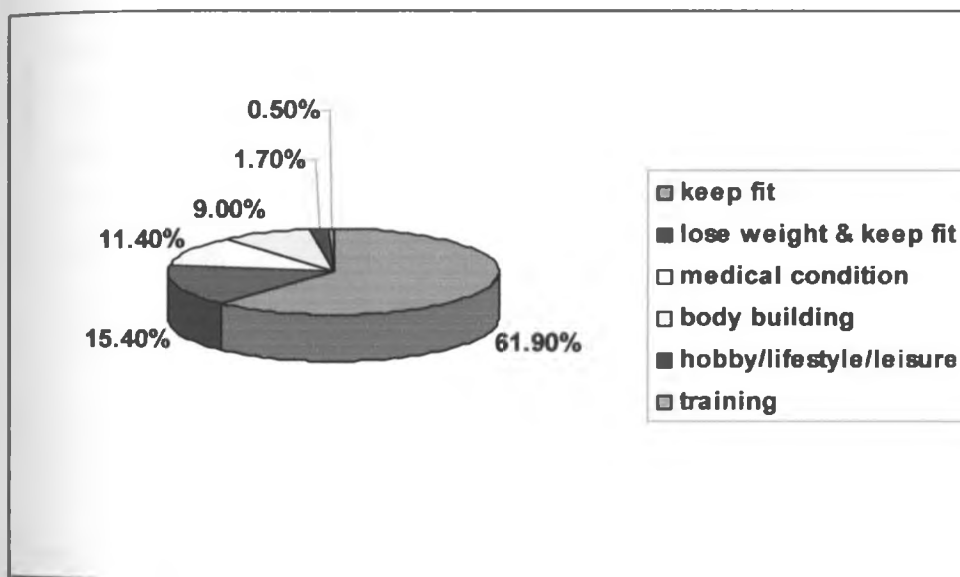
**Table 4.1: Distribution of study respondents by selected demographic and socioeconomic characteristics and sex**

Characteristic	% male n=283	% female n=119	% total N=402
<b>Age category (yrs)</b>			
18-25	32.2	24.4	29.9
26-35	41.7	35.3	39.8
36-45	12.4	22.7	15.4
46-55	8.4	15.1	10.4
>55	5.3	2.5	4.5
<b>Marital status</b>			
Married	46.3	49.6	47.3
Not married	53.7	50.4	52.7
<b>Education level</b>			
College and above	77.0	94.1	82.1
Below college	23.0	5.9	17.9
<b>Means of transport</b>			
Private	43.8	67.2	50.8
Public	47.7	28.6	42.0
Walking	8.5	4.2	7.2
<b>Estate</b>			
Up market	3.2	6.7	4.2
High income	15.6	30.2	19.9
Upper high class	51.9	47.9	50.8
Lower high class	26.5	11.8	22.1
Low class	2.8	3.4	3.0
<b>Occupation</b>			
Student	18.4	8.4	15.4
Formal employment	36.4	36.1	36.3
Self employed	39.6	49.6	42.6
Unemployed	5.6	5.9	5.7

There was no significant difference in gender ( $\chi^2=2.7$ ,  $P=0.098$ ), age ( $\chi^2=3.4$ ,  $P=0.494$ ), marital status ( $\chi^2=1.1$ ,  $P=0.291$ ), education level ( $\chi^2=2.6$ ,  $P=0.106$ ), common means of transport ( $\chi^2=0.03$ ,  $P=0.985$ ), estate of residence ( $\chi^2=14.4$ ,  $P=0.060$ ) and occupation ( $\chi^2=1.7$ ,  $P=0.632$ ) between the users and non users of DSs (see appendix 4).

#### 4.2 Reasons of Participants Using the Gym

The distribution of the study group by reasons of using the gym is shown in figure 4.1.



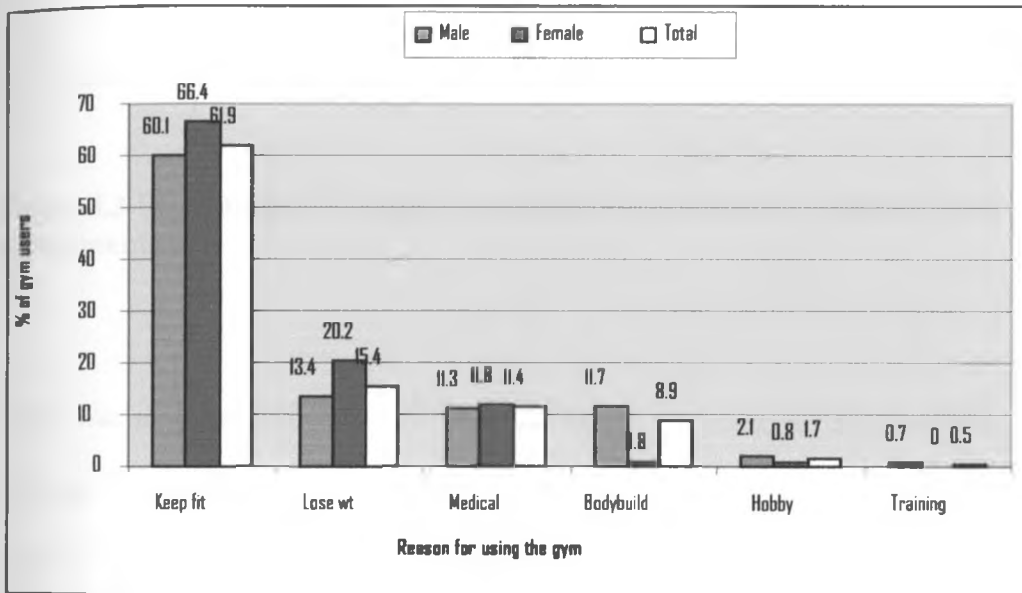
**Figure 4.1** Distribution of study group by reasons of using the gym

The participants used the gym for various reasons including to: keep fit, maintain medical conditions, lose weight and keep fit, for body building, as a hobby/ lifestyle/ leisure and for training. More than two-thirds of the participants used the gym for keeping fit while less than one percent of them used it for training.

The distribution of the study respondents by reasons for using the gym and sex is shown in figure 4.2. There was a significant difference in the reasons for using the gym between the

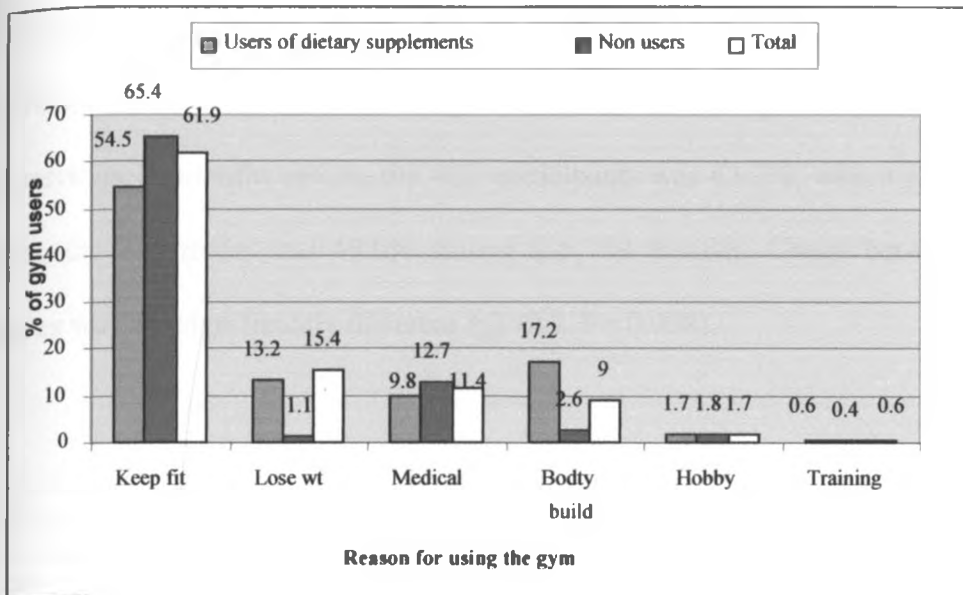


males and females in the study group ( $\chi^2=17.1$ ,  $P=0.004$ ). More than 90% of the females used the gym for fitness and health related issues. The proportion of the females using the gym for body building was negligible. The proportion of males who used the gym for body building was more than ten times the proportion of the females who used the gym for the same reason. More females than males used the gym for the purpose of losing weight.



**Figure 4.2** Distribution of study respondents by reasons for using the gym and sex

The distribution of the study respondents by reasons for using the gym and use of DSs is shown in figure 4.3.



**Figure 4.3 Distribution of study respondents by reasons for using the gym and dietary supplements use**

There was also a significant difference in reasons for using the gym between the DSs users and non users ( $\chi^2=26.3$ ,  $P<0.001$ ). About two-thirds of participants who did not use DSs went to the gym for the purpose of keeping fit and healthy whereas about half of the participants who used DSs went to the gym for this purpose. The proportion of the DSs users who went to the gym for the purpose of body building were more than six times that of the DSs non users who went to the gym for the same purpose.

Reasons for using the gym was significantly different between the married and the unmarried respondents ( $\chi^2=43.1$ ,  $P<0.01$ ). The difference in reasons for using the gym between the respondents who used private means of transport and those using public means was statistically significant ( $\chi^2=54.8$ ,  $P<0.001$ ). The same case applied between the respondents with education level of college level and above and those with lower than college level of education. The respondents in the informal employment and the ones not in the informal employment had no significant difference in reasons for using the gym ( $\chi^2=2.4$ ,  $P=0.78$ ).

### 4.3 Usage of Dietary Supplements

Figure 4.4 shows the prevalence of DSs use of the study group. The prevalence of DSs use in the previous 12 months among the 402 participants was 43.3%, with a prevalence of 40.6% among the 283 males and 49.6% among the 119 females. Usage between the males and females was not significantly different ( $\chi^2=2.7$ ,  $P= 0.098$ ).

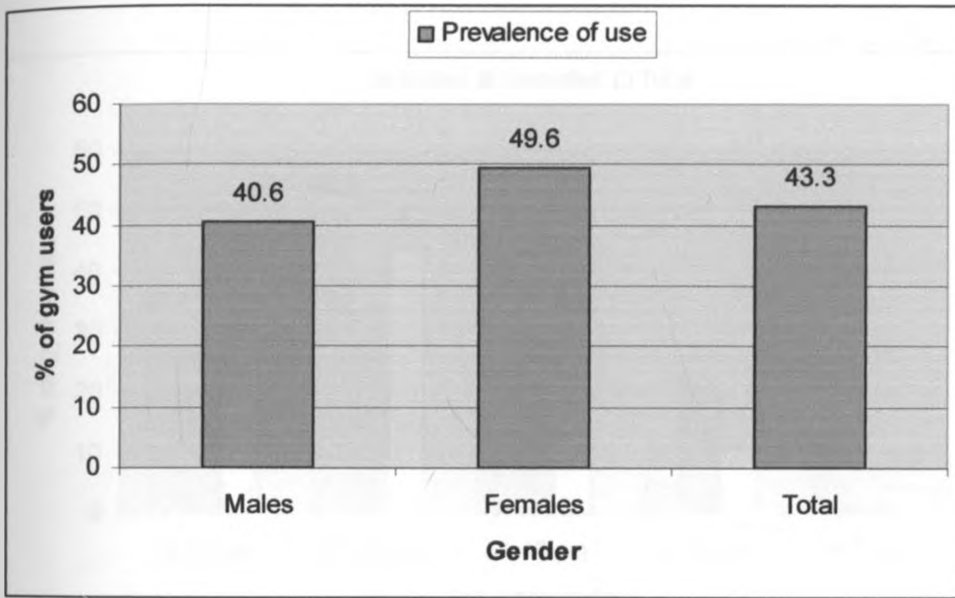
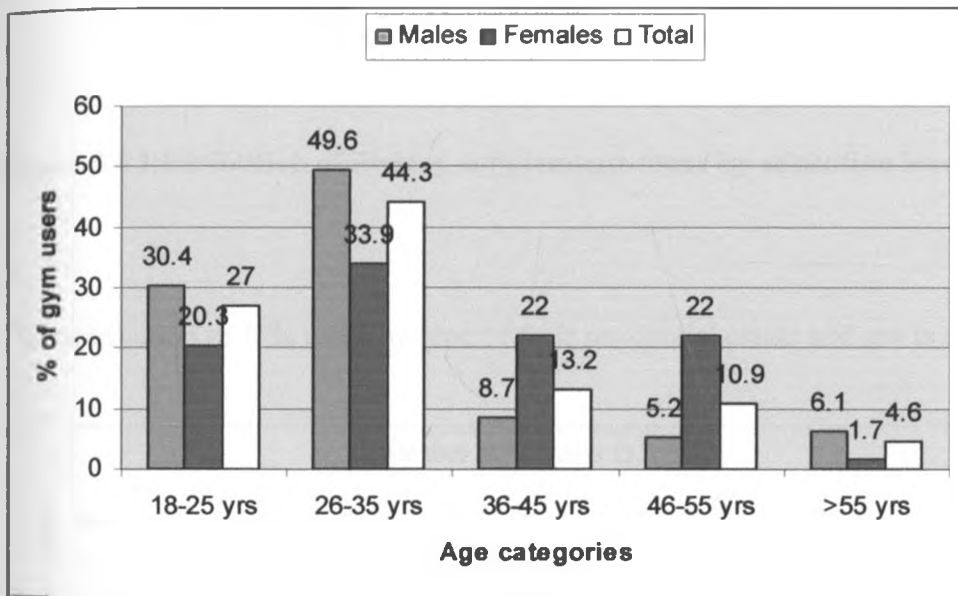


Figure 4.4 Prevalence of dietary supplements use of the study group

#### 4.3.1 Demographic and social economic characteristics of dietary supplements users

The DSs users comprised 174 participants, of which over two thirds were males and about a third, were females. The ages of the DSs users were in the range of 18 to 65 years with a mean  $\pm$ SD of  $33.0 \pm 10.69$  years. Figure 4.5 shows the gender distributions of DSs users by age.

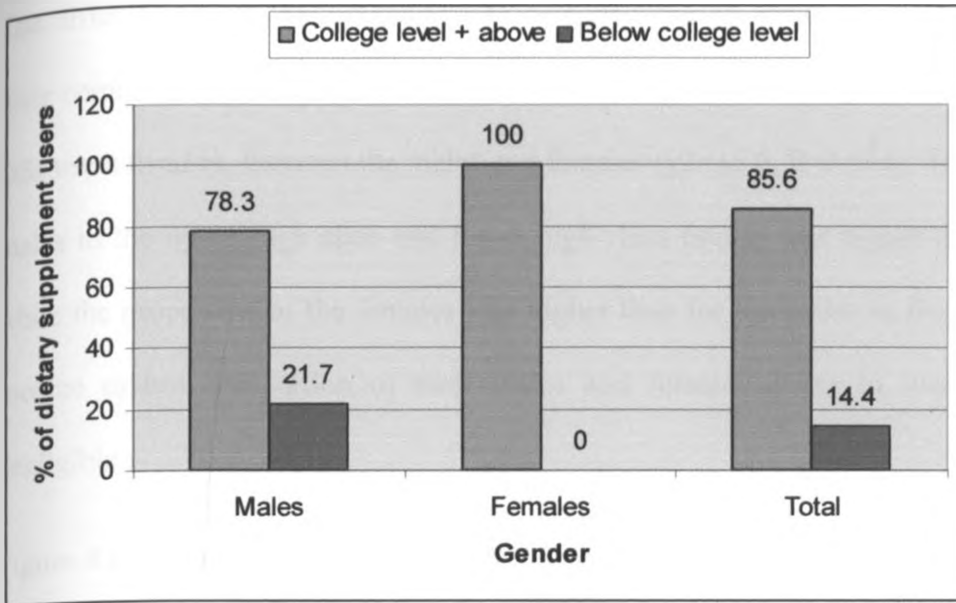
There was a significant difference in age between male and female DSs users ( $\chi^2=20.6$ ,  $p<0.001$ ). The distribution of DSs users by age showed that in the age categories 36-45years and 46-55years the proportion of female DSs users was more than that of their male counterparts while the proportion of female DSs users was lower than that of the males in all the other age categories (see figure 4.5). About half of the male DSs users were in the age category 26-35 years while about a third of the female DSs users were in this age category. More than three quarters of the males were in age categories 18-25years and 26-35 years.



**Figure 4.5 Gender distributions of dietary supplements users by age**

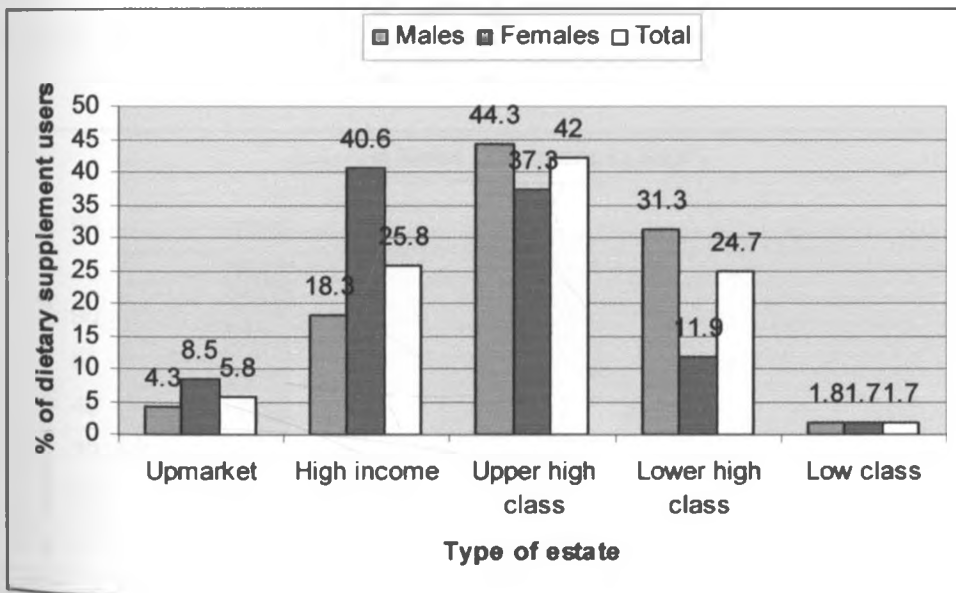
Figure 4.6 shows the distribution of DSs users by education level and sex.

There was a significant difference in the level of education between the male and female DSs users ( $\chi^2=15.0$ ,  $P<0.001$ ). The education level was different between the male and female DSs users with all the females having an education level of college level and above while about three quarters of the males had this level of education.



**Figure 4.6 Distribution of dietary supplements users by education level and sex**

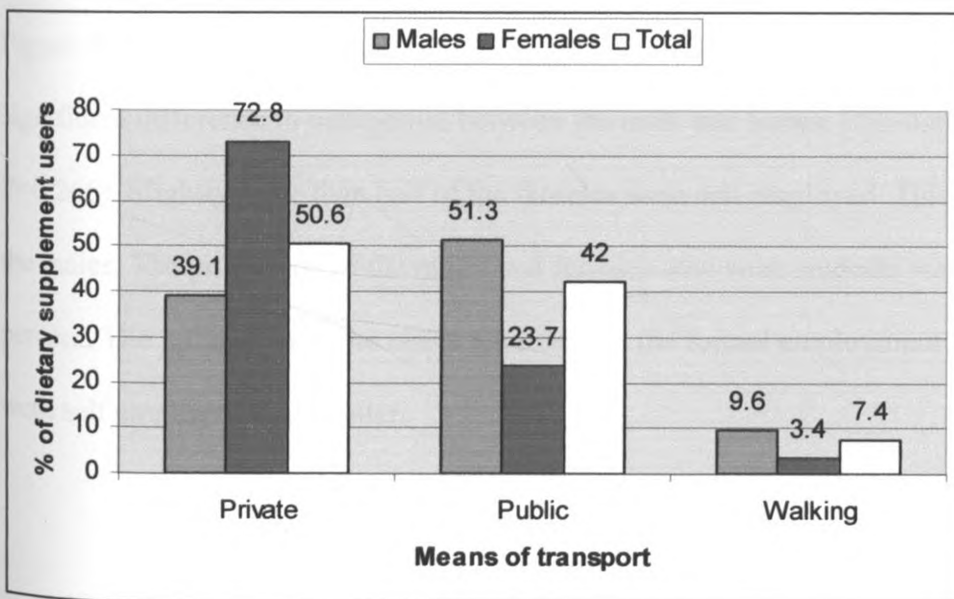
The distribution of DSs users by type of their residential estate and sex is shown in figure 4.7.



**Figure 4.7 Distribution of dietary supplements users by type of their residential estate they live in and sex**

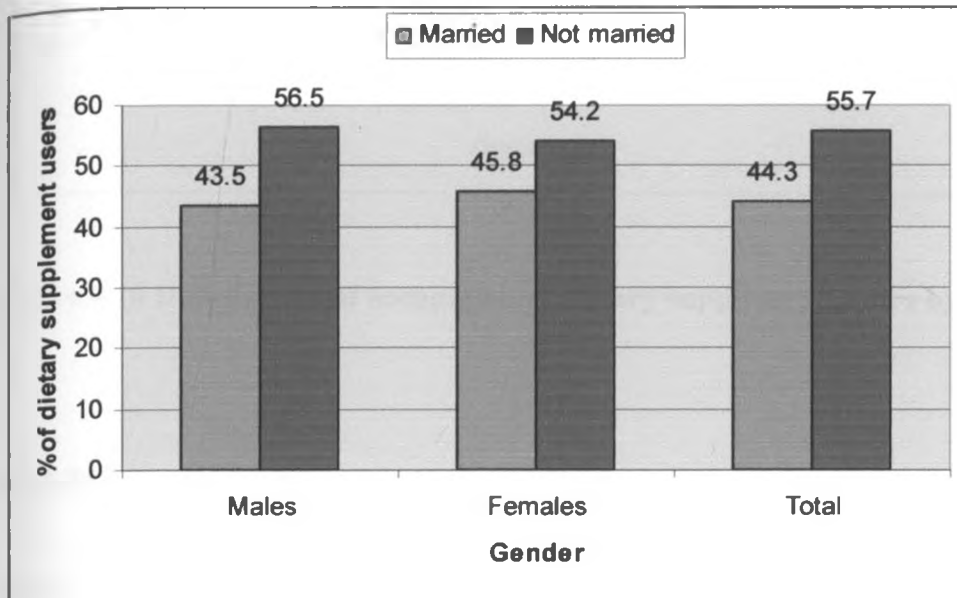
The difference in economic status was demonstrated by estate the gym users lived in and their common means of transport. There was a significant difference in type of estates the DSs users lived in, between the males and females ( $\chi^2=15.6$ ,  $P=0.004$ ). The proportion of the males in the upper high class and lower high class estates was higher than for the females while the proportion of the females was higher than for the males in the upmarket and high income estates. Proportion of both males and females living in low class estates was negligible.

Figure 4.8 shows the distribution of DSs users by common means of transport and sex. The proportion of males that used public means of transport was higher than for the females while the proportion of females using private means of transport was higher. Slightly more than half of the males used public means of transport while about three quarters of the females used private means of transport. Their differences were statistically significant ( $\chi^2=17.8$ ,  $P<0.001$ ). These results indicated that there was a significant difference in economic status between the males and females.



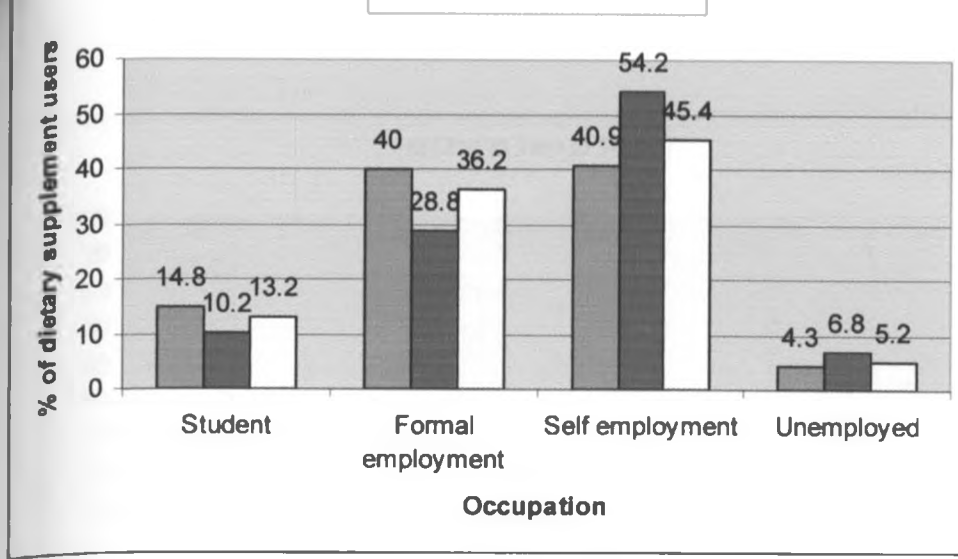
**Figure 4.8** Distribution of dietary supplements users by common means of transport and sex

Figure 4.9 shows the distribution of DSs users by marital status and sex. The marital characteristics of both the male and female DSs users were the same with slightly more than half of both being unmarried ( $\chi^2=0.1$ ,  $P=0.774$ ).



**Figure 4.9 Distribution of dietary supplements users by marital status and sex**

Figure 4.10 shows the distribution of DSs users by occupation and sex. There was no significant difference in occupation between the male and female DSs users ( $\chi^2=4.0$ ,  $P=0.266$ ). Slightly more than half of the females were self employed. This was 40% among the males. The proportion of the males and females who were students was less than 20 percent. The proportion of the males who were in the formal employment and those who were self employed was similar.



**Figure 4.10 Distribution of occupation of dietary supplements users by sex**

### 4.3.2 Types of dietary supplements used by gym users

Figure 4.11 shows the distribution of DSs users by number of types of DSs used and sex. There was a significant difference in the proportion of the number of DSs taken between the males and females ( $\chi^2=23.3$ ,  $P<0.001$ ). There were various types of DSs used by the gym users. The participants reported to have used one to three DSs in the previous 12 months. About a quarter of the females used two or more DSs while only ten percent of the males used two or more types of DSs.





**Figure 4.11** Distribution of dietary supplements users by number of types of dietary supplements used and sex

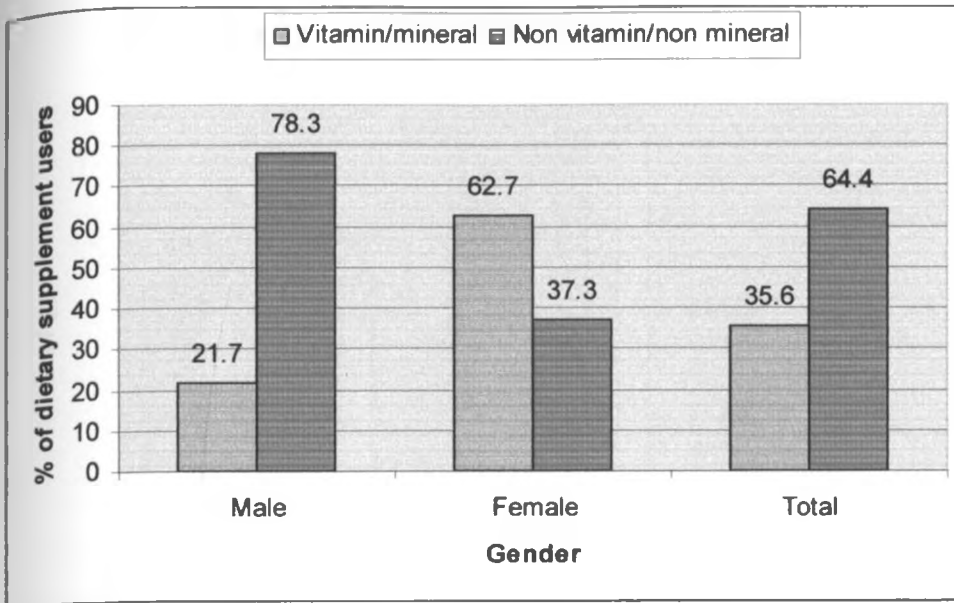
Table 4.2 shows the prevalence of use of the various types of DSs. The types of DSs that were mainly used by the participants included body building , multivitamin and multi mineral , fish oil , single vitamin , single mineral and herbal supplements.

The body building DSs were the most commonly used whereas the anabolic steroids and glucosamine/chondroitin were the least used DSs. For the females, single mineral DSs were the mostly used type of supplements and the minerals mostly used were iron and calcium. Iron was used in ages 18-35 years while calcium was used in ages 36-55 years. Other types of DSs that were highly used among the females were the multivitamin/multi mineral and fish oils with a fifth of the females using each of these types of DSs. The mostly used DSs among the males were the body building DSs with about three fifth of the males using them.

**Table 4.2 Prevalence of use of the various types of dietary supplements**

Supplement group	% male DSs users n=115	% female DSs users n=59	% Total N=174
<b>Vitamin/mineral</b>	<b>21.7</b>	<b>62.7</b>	<b>35.6</b>
Multivitamin/multi mineral	14.8	20.3	16.7
Multivitamin	1.7	3.4	2.3
Multi mineral	0.9	5.1	2.3
Single vitamin	1.7	8.5	4.0
Single mineral	2.6	25.4	10.3
<b>Non vitamin/non multi mineral</b>	<b>78.3</b>	<b>37.3</b>	<b>64.4</b>
Body building	59.2	1.7	39.7
Herbal	4.3	10.2	6.3
Fat burners	1.7	3.4	2.3
Meal replacement	2.6	1.7	2.3
Fish oils	8.7	20.3	12.6
Glucosamine/chondroitin	0.9	0	0.6
Anabolic steroid	0.9	0	0.6
	<b>100</b>	<b>100</b>	<b>100</b>

Figure 4.12 shows distribution of DSs users by vitamin/mineral and non vitamin/non mineral use and sex. There was a significant difference in use of vitamin/mineral and non vitamin/non mineral between the males and females ( $\chi^2=33.4$ ,  $P<0.001$ ).



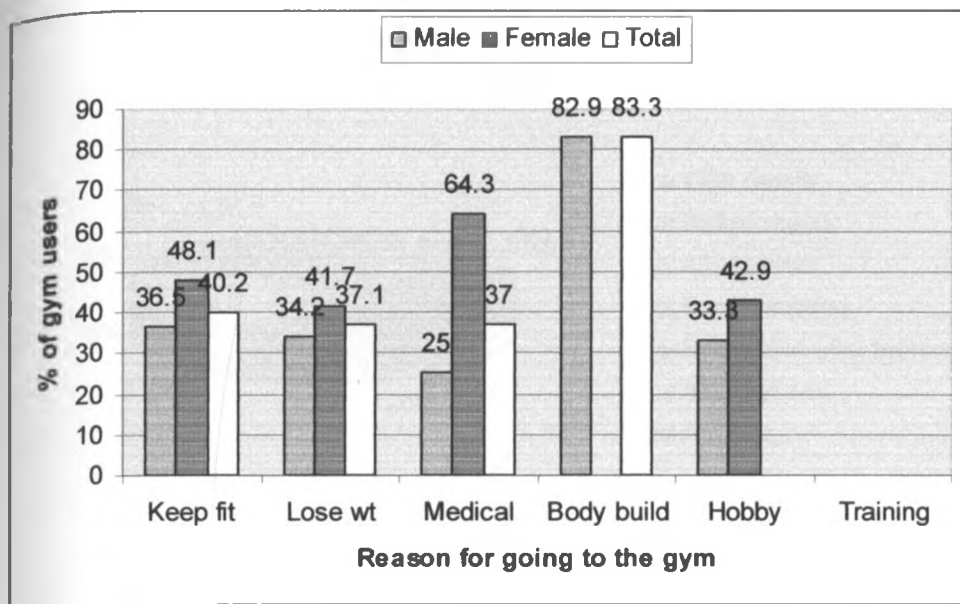
**Figure 4.12 Distribution of dietary supplements users by vitamin/mineral and non vitamin/non mineral use and sex**

There were two main groups of DSs used by the participants namely vitamin/mineral and non vitamin/non mineral. Over three-quarters of the male DSs users used non vitamin/ non mineral DSs while only slightly over a third of the female DSs users used these supplements. Females used vitamin/mineral supplements more than males with almost two thirds of the females using these supplements while only about one-fifth of the males used them.

#### **4.3.3 Prevalence of dietary supplements use and reasons for using the gym**

Figure 4.13 shows the prevalence of DSs use by reasons of using the gym and sex.

About half of the females who used the gym to keep fit also took DSs and among those who used the gym for medical conditions about two thirds used DSs. The use of DSs in these two groups was lower for the males than for the females. More than four fifths of the males who used the gym for body building also used DSs.

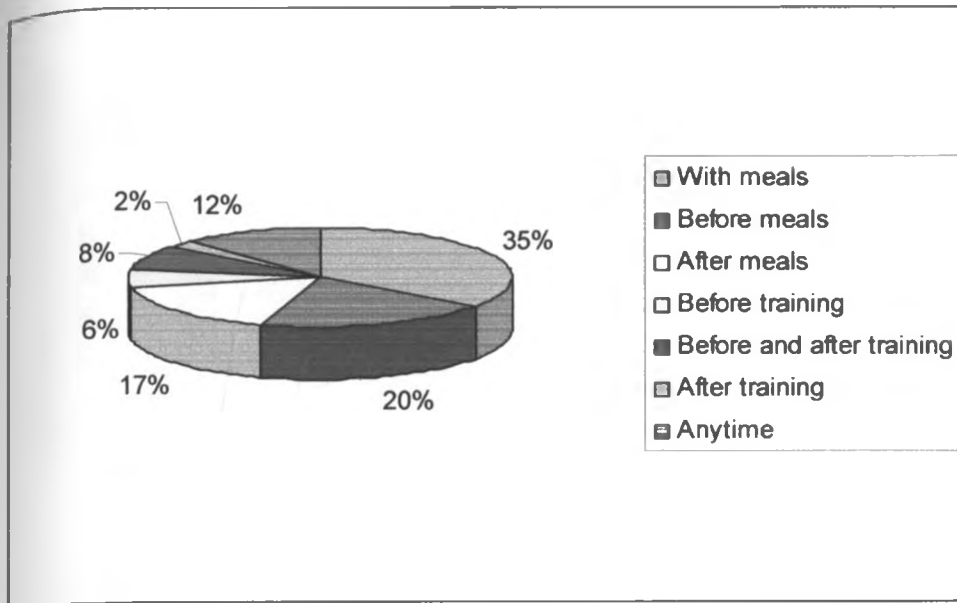


**Figure 4.13 Prevalence of dietary supplements use by reasons of using the gym and sex**

#### 4.3.4 Dietary supplements use in relation to time of meal intake

Figure 4.14 shows distribution of users by time they took dietary supplements relative to meal intake.

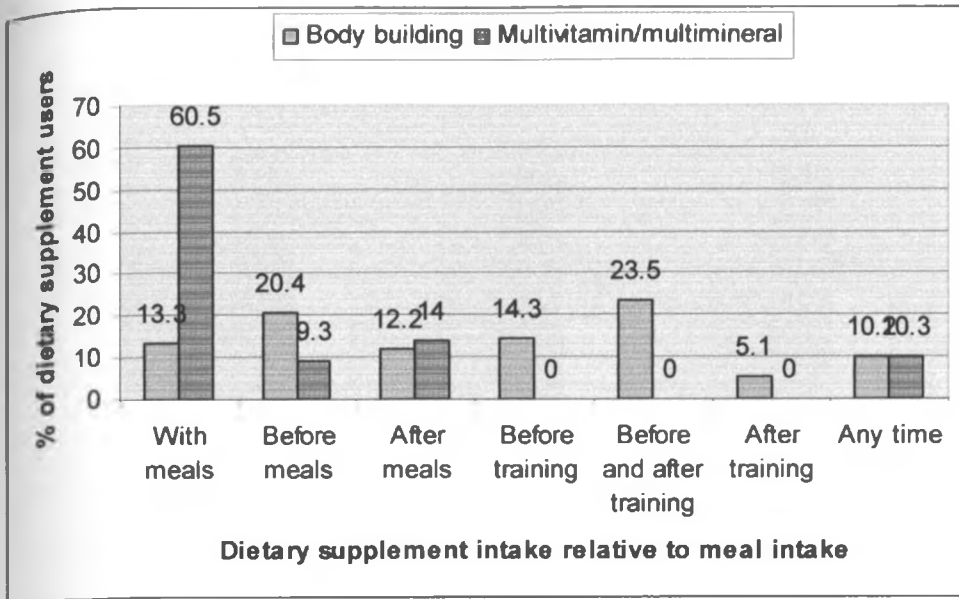
DSs intake in relation to the food intake among the DSs users showed a variation in times of the intake. The most common times of taking DSs was, with meals, before meals, after meals, before training, before and after training, after training, and anytime (figure 4.14). There was a significant difference in the time of DSs intake in relation to food intake ( $\chi^2=85.8, P<0.001$ ). Over a third of the DSs users took them with meals while about a quarter of the users did not consider the intake of supplement relative to food intake.



**Figure 4.14 Distribution of dietary supplements users by time they took the supplements relative to meal intake.**

Figure 4.15 shows the distribution of the study group by time of dietary supplements intake relative to food intake for some chosen types of DSs.

Considering one specific DS intake in relation to food intake there was a variation within the study group. For the multivitamin/multi mineral supplement users, about three fifths of the users took the supplements with food and the remaining two fifths took the supplements either before food, after food or anytime. For the body building supplement users, the proportion of the users who did not consider the time of DSs intake relative to food intake was high. Slightly more than half of the users of body building DSs reported having no relationship between times of supplements intake and that of food intake.



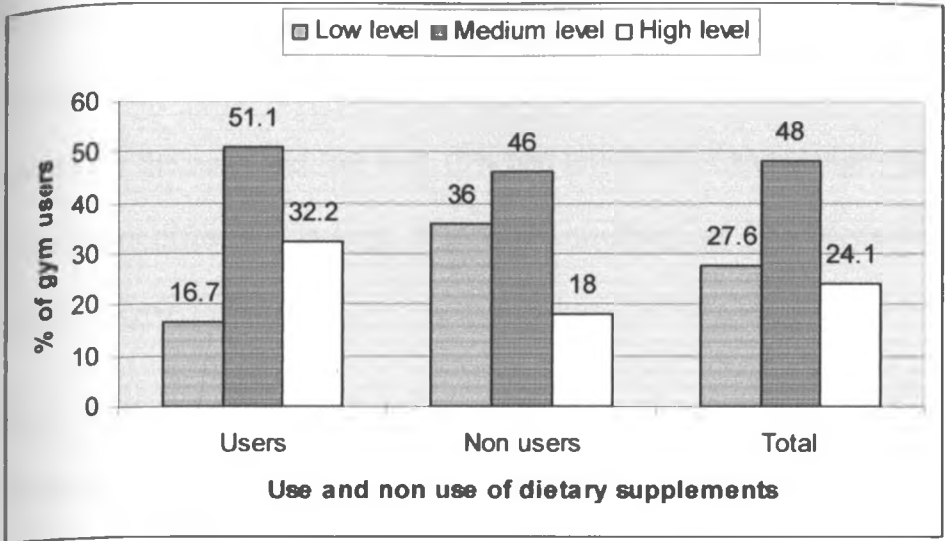
**Figure 4.15 Distribution of the study group by the time of supplements intake relative to food intake for chosen types of dietary supplements**

#### 4.4 Extent of Knowledge on Dietary Supplements

##### 4.4.1 General knowledge on dietary supplements

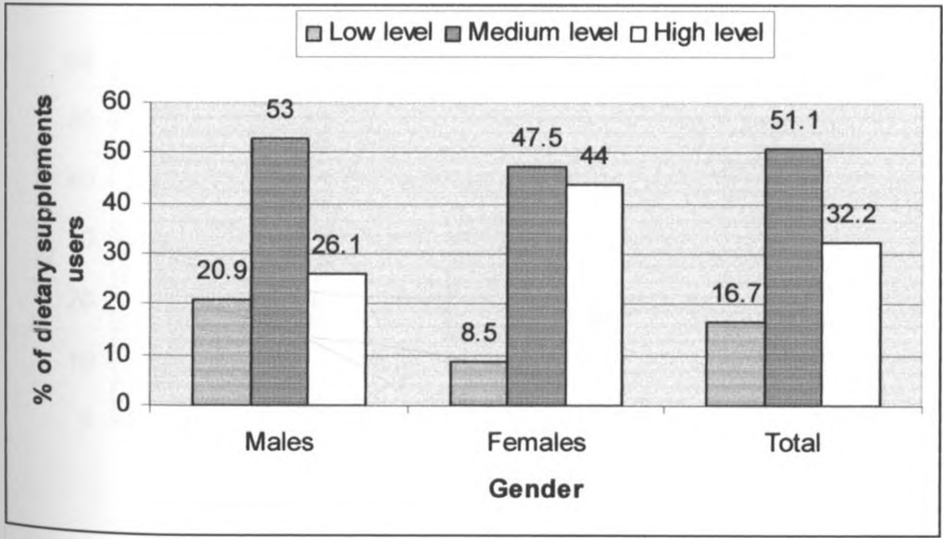
Figure 4.16 shows the distribution of gym users on level of general knowledge on DSs and use of DSs.

The level of general knowledge on DSs in the study group showed that about half of the participants demonstrated medium level of knowledge about DSs and only about a quarter demonstrated either high or low levels of knowledge. The level of knowledge was significantly different between the DSs users and non users ( $\chi^2 = 22.1, P < 0.001$ ). Among the users the proportion of users with medium level of knowledge was slightly more than half while slightly less than a third had high level of knowledge. For the non users slightly less than half of the participants had medium level of knowledge and slightly above a third of the participants had a low level of knowledge about DSs.



**Figure 4.16 Distribution of gym users on level of general knowledge on dietary supplements and use of dietary supplements**

The level of general knowledge on DSs was different between the male and female DSs users. Figure 4.17 shows the distribution on level of general knowledge on DSs of DSs users by sex.



**Figure 4.17 Distribution on level of knowledge on dietary supplements of dietary supplement users by sex**

About half of the males had medium level of knowledge and a quarter of them had high level of knowledge. The proportion of females with medium and high levels of knowledge on DSs was almost the same and less than 10% had low level of knowledge (figure 4.17). There was a significant difference in level of general knowledge on DSs between the male and female DSs users ( $\chi=7.7$ ,  $P=0.021$ ).

Figure 4.18 shows the distribution on level of knowledge on DSs of the gym users by education level. The level of general knowledge on DSs was significantly different between participants with college level of education and above and those with lower than college level of education ( $\chi^2=24.9$ ,  $P<0.001$ ). The participants with lower than college level of education had half of them with low level of knowledge on DSs. The participants with college level of education and above had a proportion of more than 40% with high level of knowledge, about a third with medium level of knowledge and slightly below a quarter with low level of knowledge on DSs.

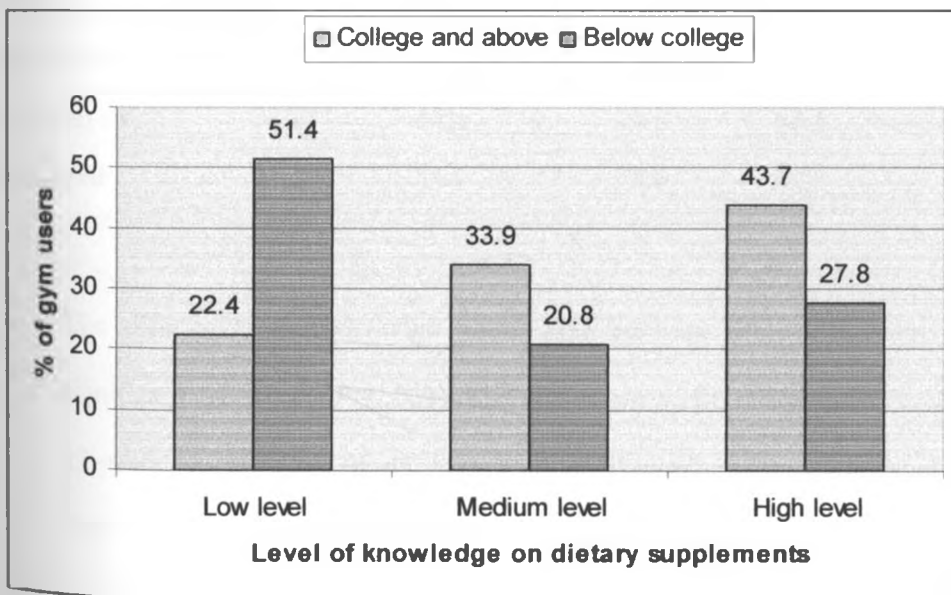


Figure 4.18 Distribution of gym users on level of knowledge on dietary supplements by education level



The distribution of gym users by level of knowledge on DSs and some selected socio-demographic characteristics is shown in table 4.3.

**Table 4.3 Distribution of gym users by level of knowledge on dietary supplements and some selected socio-demographic characteristics.**

Characteristics	Level of knowledge on dietary supplements			Total	Chi square	P value
	Low level	Medium level	High level			
<b>Age</b>					14.81	0.063
18- 25 years	31.7	48.3	20.0	29.9		
26-35 years	20.0	50.6	29.4	39.8		
36-45 years	27.4	50.0	22.6	15.4		
46-55 years	33.3	45.2	21.4	10.4		
>55 years	55.6	27.8	16.7	4.5		
<b>Gender</b>					6.07	0.048
Male	30.4	48.4	21.2	70.4		
Female	17.6	49.5	31.1	29.6		
<b>Occupation</b>					14.4	0.025
Student	32.2	43.5	24.2	15.4		
Formal employment	17.6	56.2	26.0	36.3		
Self employed	31.6	44.4	24.0	42.5		
unemployed	47.8	31.1	13.0	6.7		

The difference in knowledge about DSs between the various age categories was not significant ( $\chi^2=14.81$ ,  $P=0.063$ ). The highest proportion of participants in the age groups 18-25 years, 26-35 years, 36-45 years and 46- 55 years had medium level of knowledge about DSs. Participants in the age category <55 year had the highest proportion in the low level of knowledge about DSs. Participants in the formal employment had the highest proportion in both high level and medium level of knowledge about DSs as compared with all the other

occupations. More than half had medium level and about a quarter with high level of knowledge about DSs. The difference in level of knowledge on DSs between various occupations was significant ( $\chi^2=14.4$ ,  $P=0.025$ ).

#### 4.4.2 Knowledge about side effects of dietary supplements

Figure 4.19 shows the distribution of gym users by knowledge about side effects of DSs and use of DSs. There was a significant difference in knowledge about side effects of DSs between the users and non users of DSs ( $\chi^2=19.4$ ,  $P<0.001$ ). The knowledge the participants had on side effects of DSs demonstrated that more than half of them perceived that DSs did not have side effects and about fifteen percent didn't know or were not sure whether DSs had any side effects. More than half of the DSs users perceived DSs as not having side effects while slightly more than a third perceived DSs as having side effects and less than 10% were not sure or didn't know whether DSs had any side effects. For the non users of DSs about half of them perceived DSs as having no side effects while slightly less than a quarter perceived DSs to have side effects or were not sure/didn't know whether DSs had side effects.

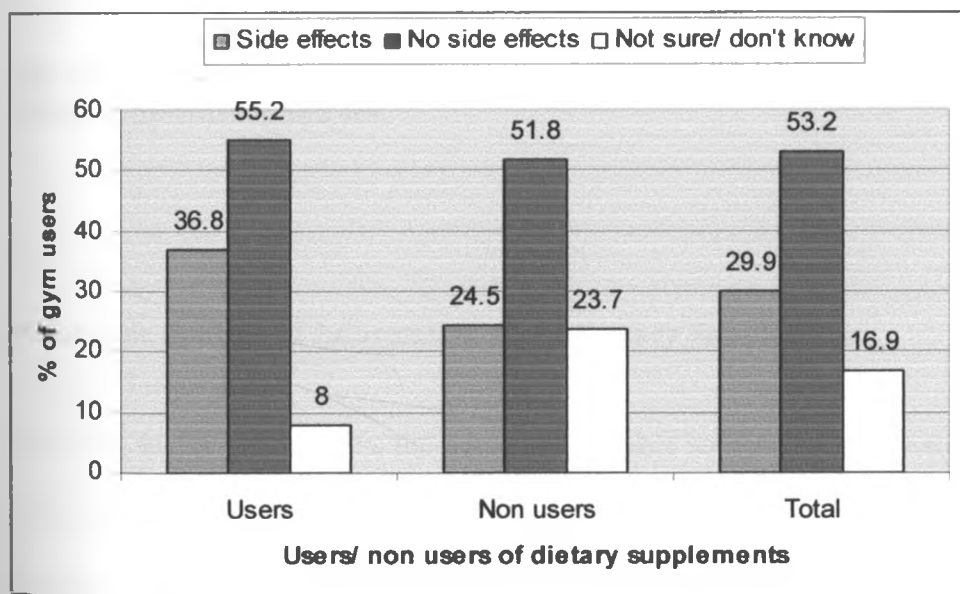


Figure 4.19 Distribution of gym users by knowledge about side effects of dietary supplements and use of dietary supplements

Figure 4.20 shows distribution of dietary supplement users by knowledge about side effects of DSs and sex. There was no significant difference in knowledge about side effects of DSs between male and female DSs users ( $\chi^2=1.9$ ,  $P=0.380$ ). The highest proportion of participants for both the male and female DSs users perceived dietary supplements as having no side effects.

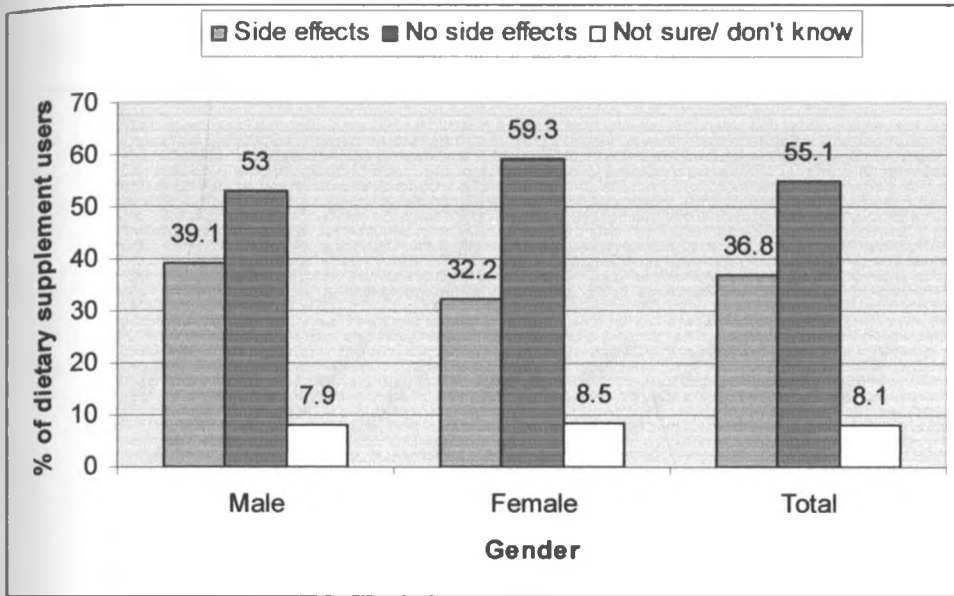


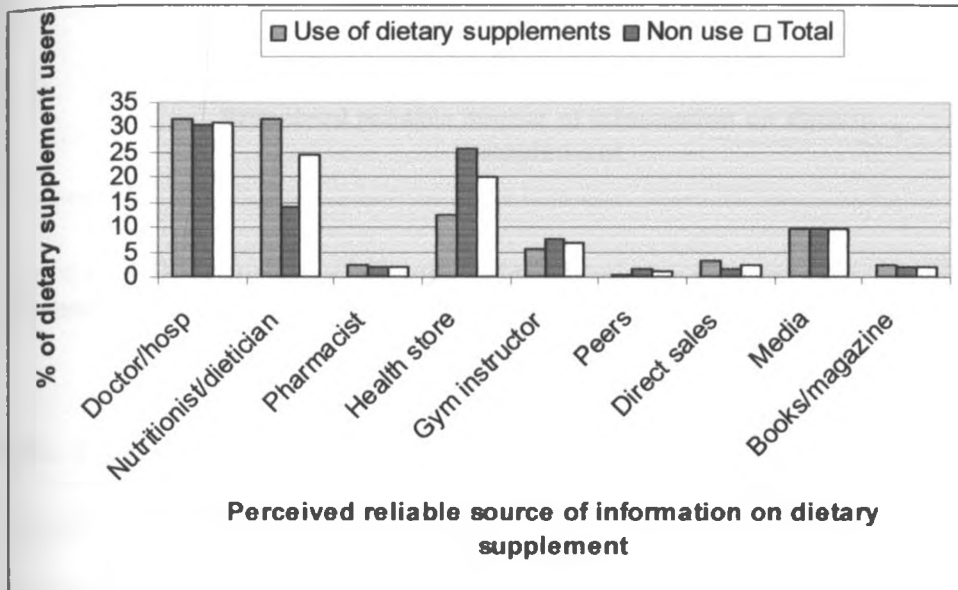
Figure 4.20 Distribution of dietary supplements users by knowledge about side effects of dietary supplements and sex.

#### 4.5 Reliable Sources of Information about Dietary Supplements

According to the participants, the perceived reliable sources of information about DSs were doctors/hospitals, nutritionists/dieticians, health/supplement shops, pharmacists, gym instructors/coaches, the media, books and magazines, sales (direct sales) and peers.

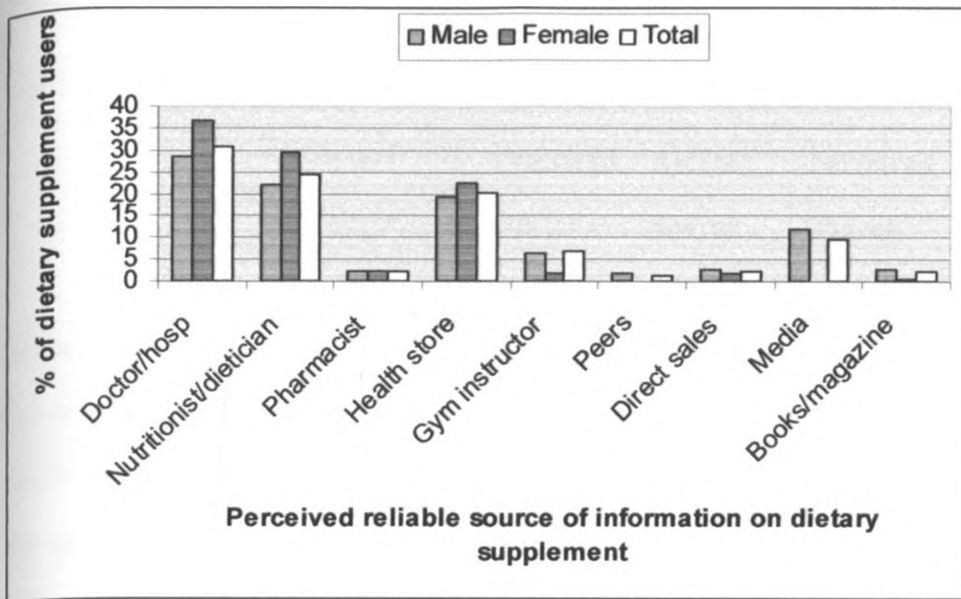
Figure 4.21 shows the distribution of gym users on perceived reliable sources of information on DSs and use of DSs. There was a significant difference on perceived reliable sources of information between the users and non users ( $\chi^2=9.7$ ,  $P=0.002$ ). About a third of the users

and non users perceived doctors/hospitals as one of the reliable sources of information about DSs. The proportion of both users and non users of DSs on doctors/hospitals, pharmacists, books/magazines and media as reliable sources of information was similar. There was a difference between users and non users for all the other sources of information perceived to be reliable.



**Figure 4.21 Distribution of gym users by perceived reliable sources of information on dietary supplements and use of dietary supplements**

Figure 4.22 shows the distribution of DSs users by perceived reliable sources of information and sex. There was a significant difference on perceived reliable sources of information on DSs between male and female DSs users ( $\chi^2=12.4$ ,  $P<0.001$ ). The proportion of female DSs users who perceived doctors/hospitals, nutritionists/dieticians and health shops as reliable sources of information was higher than for the male DSs users. The proportion of males for all the other sources of information perceived as reliable was higher than for the females.



**Figure 4.22 Distribution of dietary supplement users by perceived reliable sources of information on dietary supplements and sex**

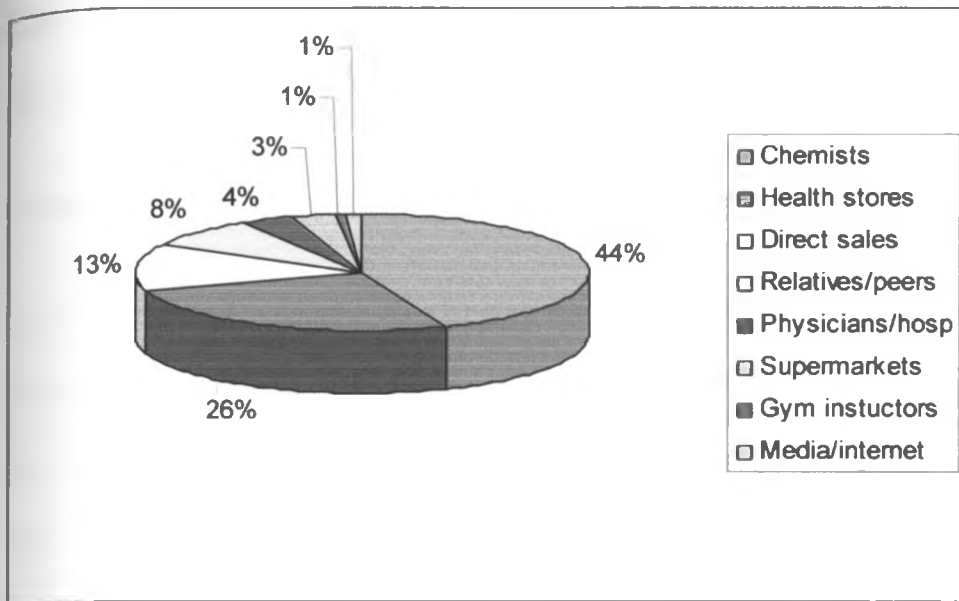
Table 4.4 shows the distribution of DSs users by actual and perceived reliable sources of information on DSs and sex. The sources of information on DSs perceived by the DSs users as reliable were different from the sources the users actually obtained the information about the DSs they were using or had used. For the male DSs users the highest proportion on perceived reliable source of DSs was physicians/hospitals and nutritionists/dieticians but the highest proportion for the actual sources were relative/peers and media/internet. The females were different in that the highest proportion on perceived source of DSs was physicians/hospitals and the highest proportion on actual source was similar although there was a difference in all the other sources. The proportion of females whose source of information on DSs was from relative/peers was high.

**Table 4.4 Distribution of dietary supplements users by actual and perceived reliable sources of information on dietary supplements and sex**

Source of information	Male n=115		Female n=59		Total N=174	
	Actual	Perceived	Actual	Perceived	Actual	Perceived
	Source	Source	Source	Source	Source	Source
	(%)	(%)	(%)	(%)	(%)	(%)
Physician /hospital	14.8	29.6	40.7	35.6	23.6	31.6
Nutritionist /dietician	1.7	27.0	1.7	40.7	1.7	31.6
Health store	3.5	12.2	-	13.6	2.3	12.6
Pharmacist	3.5	2.3	1.7	1.7	2.9	2.3
Media /internet	16.5	12.2	8.5	5.1	13.8	9.8
Books /magazine	12.2	3.5	10.2	-	11.5	2.3
Direct sales	2.6	3.5	8.5	3.4	4.6	3.4
Gym instructor/coach	15.7	8.7	1.7	-	10.9	5.7
Relative /Peers	29.6	0.9	27.1	-	28.7	0.6

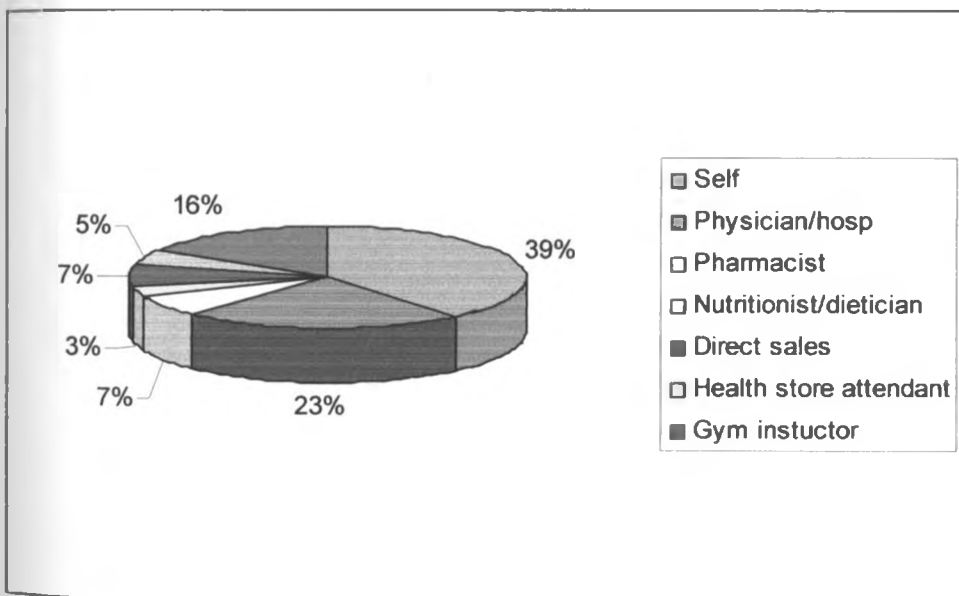
#### 4.6 Sources of Dietary Supplements Used

Figure 4.23 shows the distribution of DSs users by sources of the supplements. The sources included physicians/hospitals, supermarkets, chemists/pharmacies, health stores, direct sales, relatives/peers, gym instructors/coaches and media/internet. The highest proportion of DSs users sourced the supplements from chemists/pharmacies. A quarter of the DSs users sourced the supplements from health stores.



**Figure 4.23 Distribution of dietary supplements users by sources of the supplements**

Figure 4.24 shows the prescription used to source the supplements.



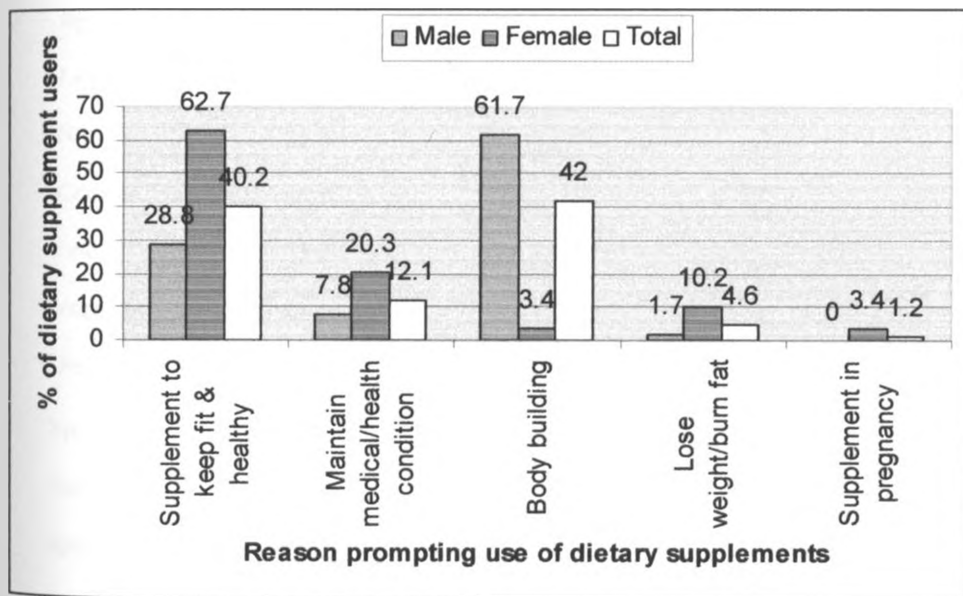
**Figure 4.24 Distribution of dietary users by prescription used to source the supplements**

The DSs users sourced the supplements using various prescriptions which included physicians/hospitals, nutritionists/dieticians, pharmacists/chemists, gym instructors/coaches, health store attendant, self prescription and direct sales. The highest proportion of DSs users

sourced the supplements through self prescription. About a quarter of the users used a physicians' prescription to source while 16% used gym instructors' prescription.

#### 4.7 Reasons Prompting Gym Users to Use Dietary Supplements

Figure 4.25 shows the distribution of gym users by reasons prompting the use of DSs and sex. There was a significant difference in distribution of reasons prompting use of DSs between the male and female users ( $\chi^2=57.8$ ,  $P<0.001$ ). The reasons included, to supplement diet to keep fit and healthy, maintaining health/medical conditions, body building, to lose weight/burn fat and to supplement in pregnancy. About two thirds of the females used DSs to augment the diet to keep physically fit and healthy while about the same proportion of the males used DSs for body building.



**Figure 4.25 Distribution of dietary supplements users by reasons prompting use of dietary supplements and sex**

There were two main categories of reason prompting use of dietary supplements. These were healthy lifestyle and medical conditions. Healthy lifestyle included, keeping fit and healthy, body building and loss of weight, while, medical condition included maintaining already



existing conditions and supplementing in pregnancy. More than three quarters of the dietary supplement users reported to be using dietary supplements to lead a healthy lifestyle.

#### 4.8 Dietary Patterns of the Gym Users

The response on how often the gym users consumed the various food groups is shown in Table 4.5.

**Table 4.5 Dietary patterns of gym users**

Food group	Frequency of Consumption (%)			
	Daily	Weekly	Fortnightly	Monthly/never
Dairy	85.8	8.2	0.2	5.7
Red meat	24.9	60.7	2.5	11.9
Meat products	13.7	36.6	8.7	41.1
Poultry	7.0	69.2	9.0	14.9
Fish	4.2	58.7	13.2	23.9
Eggs	24.9	43.0	7.5	24.9
Legumes	30.3	58.5	3.7	7.5
Nuts	32.8	32.6	6.7	27.8
Cereals	76.1	21.1	1.0	1.7
Fruits	77.9	19.2	0.7	2.2
Vegetables	88.6	10.0	0.5	0.9
Deserts	5.5	30.6	11.9	52.0
Spreads	41.5	16.9	3.2	38.3
Soft drinks	17.2	38.8	6.0	38.1
Sport drinks	1.5	11.7	9.2	77.6
Energy bars	2.2	6.5	5.0	86.3
Alcohol	1.2	37.1	9.2	52.5
Fast foods	6.5	34.3	10.9	48.3
Water	100	0	0	0

The distribution on the consumption of the various food groups by sex is shown in Table 4.6.

**Table 4.6 Dietary pattern of male and female gym users for foods whose frequency of consumption was significantly different between the genders**

Food group	Frequency of consumption (%)							
	Daily		Weekly		Fortnightly		Monthly/never or rarely	
	Male	Female	Male	Female	Male	Female	Male	Female
Dairy	89.0	78.2	4.9	16.0	0	0.8	6.1	5.0
Red meat	30.4	11.8	56.6	70.6	2.8	1.7	10.2	16.0
Meat products	17.7	4.2	36.0	37.8	8.8	8.4	37.5	49.6
Eggs	33.9	3.4	39.2	52.1	6.4	10.1	20.5	34.5
Soft drinks	19.8	10.9	4.2	26.1	5.7	6.7	30.4	56.3
Sport drinks	1.8	0.8	14.8	4.2	12.7	0.8	70.7	94.1
Energy bars	3.2	0	6.0	7.6	6.0	2.5	84.8	89.9
Alcohol	1.8	0	39.9	30.3	8.5	10.9	49.8	58.8
Fast foods	7.4	4.2	38.5	24.4	10.6	11.8	43.5	59.7

Table 4.7 gives the chi-square analysis of frequency of consumption of various food groups based on gender. The proportion of males that consumed dairy products daily was higher than the females. Proportion of females consuming red meat weekly was higher than for the males. For the consumption of red meat in males the highest proportion was weekly and the same case applied for the females. Consumption of alcohol, energy bars, soft drinks and energy

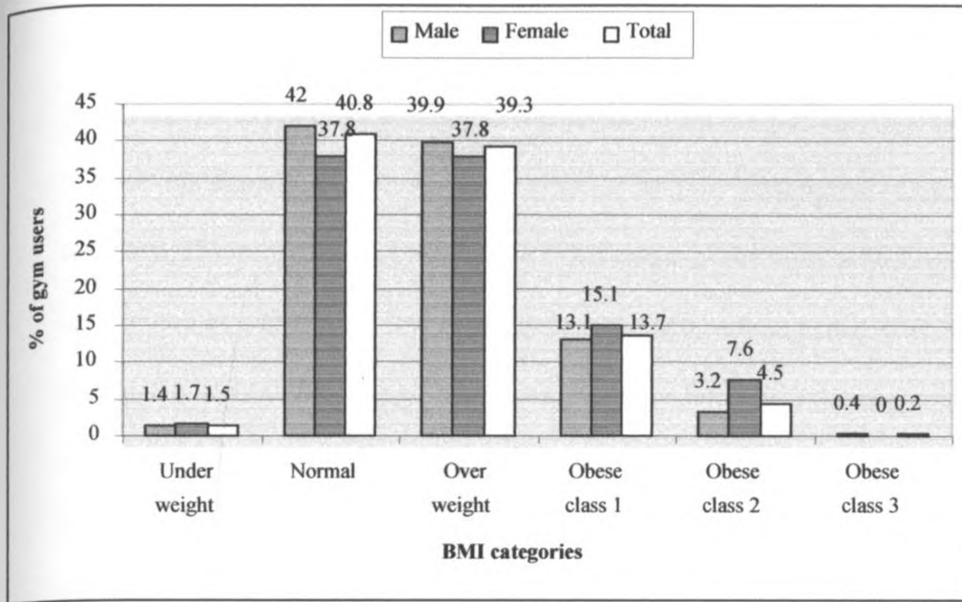
drinks had highest proportion in monthly or never frequencies. Proportion of females consuming these products monthly or never was higher than for the males. There was a significant difference in frequency of consumption of dairy products, red meat, meat products, eggs, soft drinks, sport drinks, energy bars and fast foods between the males and the females. There was no significant difference in consumption of the other food groups between the males and the females.

**Table 4.7 Chi-square analysis of frequency of consumption of various food groups based on gender for foods with a significant difference between the genders**

Food group	Chi-square ( $\chi^2$ )	P value
Dairy	16.7	0.002
Red meat	18.5	0.001
Meat products	15.4	0.004
Eggs	43.0	<0.001
Soft drinks	26.4	<0.001
Sport drinks	31.8	<0.001
Energy bars	13.2	0.010
Alcohol	9.0	0.050
Fast foods	11.2	0.019

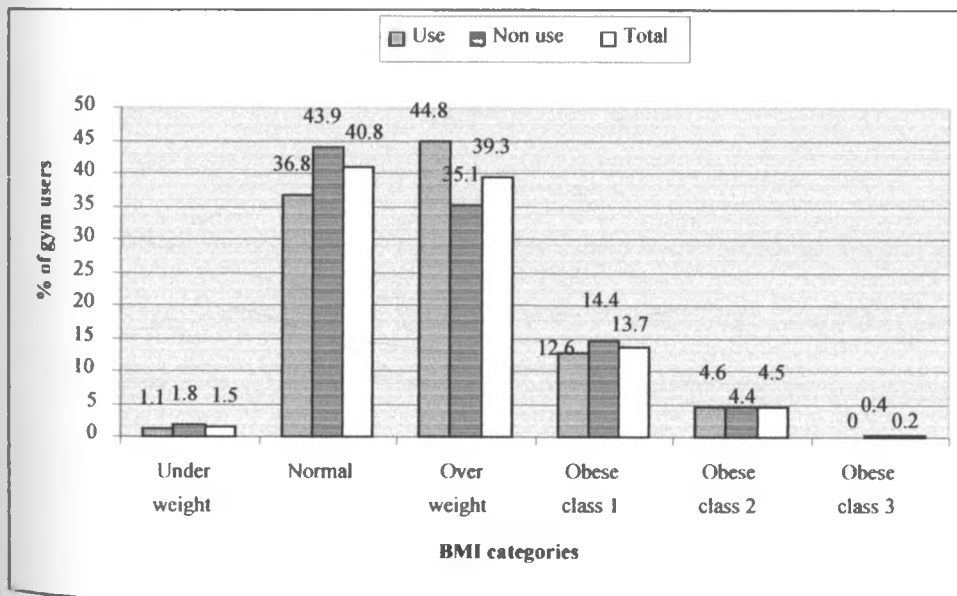
#### 4.9 Nutritional Status of Gym Users

Figure 4.26 shows the distribution of BMI categories by sex. The difference in the BMI between the males and females was not statistically significant ( $\chi^2= 4.8$ ,  $P=0.444$ ). The proportion of the gym users who were within the normal BMI range was almost similar to those in the overweight range. More than three quarters of the gym users were of normal BMI or were overweight. There were some participants who were obese class 2 and 3.



**Figure 4.26 Distribution of gym users by BMI categories and sex**

Figure 4.27 shows the distribution of gym users by BMI category and DSs use. The difference in BMI between the DSs users and non users was not significant ( $\chi^2= 4.8$ ,  $P=0.434$ ). The proportion of DSs users and non users who were in the normal BMI category was more than a third and the same case applied for the overweight BMI category.



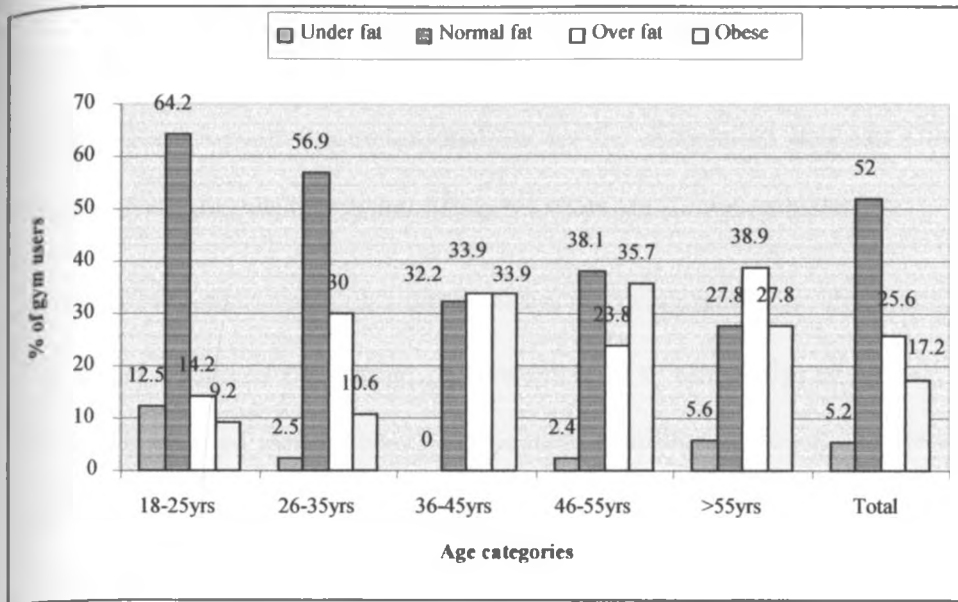
**Figure 4.27 Distribution of gym users by BMI category and use of dietary supplements**

Table 4.8 shows distribution of gym users by BMI and percent body fat and sex. More than half of the male participants had the percent body fat within the healthy fat category. The proportion of overweight and obese was lower using the percent fat content than using BMI for the male participants. About a third of female participants were in the healthy fat category. The proportion of the female participants in the normal and overweight category as determined by percent fat was lower than when determined using BMI. Some of the females within the normal BMI range had a percent body fat within the over fat category and some within the overweight BMI range had a percent body fat within the obese category. The difference in percent body fat between the males and females was significant ( $\chi^2=55.1$ ,  $P<0.001$ ).

**Table 4.8 Distribution of BMI and percent body fat by sex**

Characteristic	Male n=293		Female n=119	
	(%)		(%)	
	BMI	Percent body fat	BMI	Percent body fat
Under (weight/fat)	1.4	6.4	1.7	2.5
Normal (weight/fat)	42.0	61.1	37.8	30.3
Over (weight/fat)	39.9	23.3	37.8	31.1
Obese	16.7	9.2	22.7	36.1

Figure 4.28 shows the distribution of gym users by percent body fat and age categories. There was a significant difference in percent body fat among age categories ( $\chi^2=691$ ,  $P<0.001$ ). The age categories 18-25 years and 26-35 years had the highest proportion in the normal fat range. About a third of the participants in the age categories 36-45 years and 46-55 years were in the obese range.



**Figure 4.28 Distribution of gym users by percent body fat and age categories**

#### 4.10 Potential Adverse Effects of Using Dietary Supplements

Some of the DSs users reported having experienced some adverse effects from the DSs they were using or had used in the last 12 months but continued using them. These included nausea, too much sweating, immense appetite and lack of sleep, increased appetite, temper and mood swings, and feeling of body weakness. Other DSs users experienced adverse effects and stopped using the supplements. These effects included abdominal problems, lethargy and dizziness, palpitations, body weakness, lack of sleep, coloured urine, liver problems, fat accumulation around the waist, water accumulation and black spots. In total 10.9% of the DSs users had experienced adverse effects after using the supplements but only 36.8% of them stopped using the supplements due to these adverse effects.

#### **4.11 Factors Associated with Dietary Supplements Use**

The Odds Ratio (OR) with 95% confidence interval computed using bivariate analysis and multivariate logistic regression analysis for the association between DSs use and selected social demographic, health and lifestyle factors are shown on table 4.9.

Multiple logistic regression analysis of the following factors gender, marital status, BMI, use of alcohol, level of knowledge, percent fat, level of knowledge about side effects of DSs and smoking showed that there was independent significant association between use of DSs and the following characteristics: level of knowledge on DSs; level of knowledge about side effects of DSs and alcohol consumption There was no significant association between the use of DSs and the rest of the characteristics.

**Table 4.9 Analysis of factors associated with dietary supplement use and the strength of the association**

Predictor	Odds Ratio	Confidence Interval	p- value
Gender (male)	0.70	0.45-1.07	0.098
Marital status (married)	0.81	0.54-1.20	0.291
Education level (college level and above)	1.54	0.91-2.63	0.106
BMI (less than 25kg/m <sup>2</sup> )	0.73	0.49-1.09	0.122
Age	1.00	0.98-1.01	0.631
Use alcohol (yes)	<b>2.04</b>	<b>1.35-3.06</b>	<b>&lt;0.001</b>
Level of knowledge (adequate)	<b>2.81</b>	<b>1.73-4.55</b>	<b>&lt;0.001</b>
Chronic diseases (yes)	1.11	0.65-1.89	0.697
Estate (upmarket-upper high class)	0.88	0.56-1.39	0.596
Level of knowledge on side effects of DSs	<b>1.90</b>	<b>1.34-2.59</b>	<b>&lt;0.001</b>
Percent fat (healthy level and less)	0.83	0.56-1.23	0.354
Transport (private)	1.03	0.69-1.53	0.895
Smoke(yes)	0.60	0.26-1.36	0.217

#### 4.12 Summary of the Results

The study respondents consisted of adult gym users whose age was in the range 18-68 years with a mean  $\pm$ SD of 32.74  $\pm$ 10.8 years and a median of 30 years. The difference in most of the selected demographic and socio-economic status between the males and females was statistically significant. There was no significant difference in marital status or occupation between the males and females. There was no significant difference in any of the selected demographic and socio-economic status between the users of DSs and the non users.



The respondents used the gyms for different reasons. About two thirds of the respondents used the gym to keep fit and healthy. The respondents using the gym for body building were mainly the males. There was a significant difference in reasons for using the gym between the DSs users and non users. For the respondents using the gym for losing weight and body building the proportion of the DSs users was more than for non users.

The prevalence of dietary supplements use was 43.3%, with a prevalence of 40.6% among the males and 49.6% among the females and the difference was not significant ( $\chi^2=$ . The most commonly used (39.7%) type of dietary supplements was the body building supplements, mainly used among the males (59.2%). Single mineral supplements were the mainly used among the females (25.4%). Prevalence of vitamin/mineral supplements use among the females was 62.7% and that of non vitamin/non mineral use was 78.3% among the males.

The level of knowledge on dietary supplements was significantly related to use of dietary supplements (OR=2.81, CI=1.73-4.85,  $P<0.001$ ). There was a significant difference on level of knowledge about dietary supplements between the users of DSs and non user ( $\chi^2=22.1$ ,  $P<0.001$ ) and respondents in the formal employment and those in informal employment ( $\chi^2=14.4$ ,  $P=0.025$ ). There was a significant difference in level of knowledge about presence of adverse effects of dietary supplements between the users of dietary supplements and non users ( $\chi^2=19.4$ ,  $P<0.001$ ). There were a high proportion of both users and non users who perceived DSs to have no side effects.

The perceived source of reliable information about dietary supplements was different from the actual source of the information. The primary actual source of information on dietary supplements use among the users was from relatives/peers (28.7%), mainly among the males (29.6%). Physician/hospital was the primary actual source for the females (40.7%).

The source of dietary supplements was mainly from the pharmacies/chemist and they were sourced using self prescriptions.

10.9% of the dietary supplement users had experienced adverse effects after using the supplements but only 36.8% of them stopped using the supplements due to these adverse effects. Some of the adverse effects included palpitations, liver problems, temper and mood swings, coloured urine, lethargy and dizziness, stomach problems, nausea, increased appetite and lack of sleep.

The respondents tended to use balanced diets with more than 75% using fruits and vegetables daily. The frequency of consumption of some food groups was significantly different between the males and females. Consumption of some foods considered unhealthy such as fast foods, soft drinks and alcohol was in moderation.

The nutritional status showed that there were a high proportion of the respondents with a body mass index which was out of the normal range of 18.5kg/m<sup>2</sup>- 25kg/m<sup>2</sup>. The percent body fat was significantly different between the males and females with more than 50% of males and about a third of the females within the healthy fat category.

There was an independent significant association between use of DSs and the following characteristics: level of knowledge on DSs, alcohol consumption and knowledge about adverse effects of DSs.

## CHAPTER 5

### 5.0 DISCUSSION

In this study, usage of DSs and its association with demographic characteristics, lifestyle and nutritional status of gym users in Nairobi was investigated. The knowledge the gym users had on DSs was also investigated.

#### 5.1 Demographic and Socio-economic Characteristics of the Study Group

The participants use the gym for reasons which are different between the age categories and also between the males and females. Without any particular training or dietary strategy, muscle mass peaks at around 18-25 years old in men (Rogol et al, 2000). Males at this age category use the gym for body building so as to gain more muscles, strength and become more attractive to the opposite sex. This leads to the proportion of the males being higher than that of the females in this age category among the study group. In the 26-35 years age category the proportion of the males is higher than for the females although the number of females using the gym is higher than for the males. The female gym users in this age category were very uncooperative and unwilling to respond thus the low number interviewed

The higher proportion of the females in the age categories, 36-45 years and 46-55 years than that of the males can be attributed to females' need to maintain physical appearance after reproductive age, control age related weight gain and control symptoms that come with age such as menopausal symptoms and reduced bone density so as to remain physically fit and in good health. Earlier studies have shown that majority of supplement users tend to be older or college educated females with relatively high incomes (Newberry et al., 2001; US Department of Health and Human Services, 2007).

The participants are highly educated thus having more awareness about healthy lifestyles. Awareness about healthy lifestyles contributes to participants using the gyms in order to become fit and healthy and lead a healthy lifestyle. Gyms being a money making industry, the gym users must pay to use these facilities which they pay daily, monthly, or yearly. The participants are therefore from a high social economic status for them to afford using the gyms.

### **5.2 Reasons for Participants Using the Gym**

The fact that the majority of gym users do so to keep fit and healthy indicates that people have become health conscious and want to live healthy lifestyles. Trainings are being held in health centres, churches and inform of walks to sensitise the general public on lifestyle diseases. Healthcare providers are also sensitising their clients on healthy lifestyles as a way of improving health and preventing diseases. Healthcare providers are also encouraging their clients to maintain/control chronic diseases that come with old age like, diabetes and hypertension by exercising.

### **5.3 Usage of Dietary Supplements**

The prevalence of DSs use of 43.3% among the gym users is lower than the findings of National Health and Nutrition Examination Survey (NHANES) 1999–2000, in which 52% of adults reported taking a DS in the previous 30 days and with those of Weinrich and colleagues (2004) in which 51% of African-American men aged 40-70 years took at least one type of DS (Weinrich et al., 2004). This can be attributed to the difference between the

developed and developing countries. Dietary supplements use is expected to be higher in the developed countries than in developing countries.

The higher proportion of females in the age category 36-55 years than that of males can be attributed to females in this age category being health conscious and requiring to maintain physical appearance after reproductive age, control age related weight gains and control symptoms that come with age such as menopausal symptoms and reduced bone density so as to remain physically fit and in good health. This is in agreement with earlier studies that have shown that majority of supplement users tend to be older or college educated females with relatively high incomes (Newberry et al., 2001; NHANES, 2007).

The higher proportion of male DSs users than that of females in the age category 18-25 years can be attributed to males in this age category using dietary supplement to enhance their body building targets on gaining muscles, endurance, power and strength. Age category 18-25 years corresponds to the category where we have students in high school, preparing to join colleges and some in colleges. Since there are no females in body building then this translates to a difference in education level due to lower proportion of females in age category 18-25 years.

The prevalence of usage of non vitamin/non mineral supplements in males is high contrary to other findings (Sternerg et al., 2003). This can be attributed to having body builders who normally use body building products using the gym. The higher proportion of female DSs users using vitamin/mineral supplements than that of the males can be attributed to females using supplements for purposes that does not apply to men such as use of iron for menstruation, supplement in pregnancy, use of calcium for osteoporosis due to low oestrogen levels and supplementation in menopause. Females also use vitamin/mineral supplements to enhance their beauty. This is consistent with the findings of Romel and colleagues (2009)

who found the prevalence of vitamin/mineral use among African-American adult to be 47% (men) and 70% (women) (Romel et al., 2009). The DSs use by the females is mostly due to health and fitness issues like to stay healthy, maintain a medical condition or augment their diet so as to remain healthy. The single mineral mostly used by the females is calcium, possibly to improve bone density thus reduce osteoporosis which develops with age. Iron is used by the females in the age categories 18-25 years and 26-35 years as a supplement to replace iron lost during menstruation.

A high proportion of the females use the gym for keeping fit and healthy and this demonstrates a healthy lifestyle. The prevalence of DSs use in this group of participants is high and consistent with findings of an earlier study in which participants with a healthier lifestyle were more likely to use DSs (Foote et al., 2003).

There is a variation on time of DSs intake relative to meal intake for a specific supplement between the DSs users. This shows that some users do not consider the instructions on DSs use but take the DSs at a time convenient to them, or there are no instructions for guiding the DSs users. Best time to take vitamin C is with meals in order to avoid irritation due to its acidic nature, but there are some DSs users who take it one hour before meals. This proves the need to educate the consumers on safe use of DSs.

DSs users have various reasons that prompt them to use DSs. The two main reasons include to maintain a healthy lifestyle and to maintain/control health conditions. The DSs users have similar reasons prompting them to use the supplements and to use the gym. This implies that, DSs users are health conscious individuals, whose goal is to have a healthy lifestyle.

## 5.4 Extent of Knowledge Level

The knowledge about DSs among the gym users varies between the users and non users of DSs. The higher knowledge about DSs the users have over the non users can be attributed to the users having some information from some sources about the DSs they use or have used. They might also have done some research on DSs due to having some interests in the supplements. The users have more knowledge about DSs which can be a contributory factor to their usage. Knowledge is associated with usage of DSs, suggesting that education about the supplements can lead to an increase in use of DSs. The significant association of knowledge about DSs and DSs use is consistent with a study by Romel (2009) which showed that participants with a high perceived knowledge on DSs were more likely to use them (Romel et al., 2009).

The association between education level and level of knowledge on DSs leads to an indirect association between education level and use of DSs. The participants with a higher education level are more likely to use DSs.

The high percentage of participants perceiving DSs as having no adverse effects or were not sure or did not know whether DSs had adverse effects leads to the suggestion that DSs consumers need to be thoroughly educated regarding all aspects of DSs.

The actual source of the information about the DSs and the source of DSs themselves, is therefore very crucial, especially information which is evidence and scientific based and sources that have a health professional like, physician, nutritionist, dietician and pharmacist for consultation. Such information and sources will enlighten the users on all aspects of DSs thus lead to safe use of the supplements.

DSs labels need not list risks or contraindications, and the consumer may assume that supplements are safe in which case the consumer may be wrong. The source of the DSs is thus crucial and the users should always be advised on the proper use and any interactions and restrictions of the supplements at the point of source.

There are some participants who continued using the DSs even after experiencing adverse effects of the supplements. This shows the need to educate the general population on possible adverse effects of DSs and what to do in an event they experience the adverse effects.

### **5.5 Reliable Sources of Information about Dietary Supplements**

The majority of the study participants perceives the source of their DSs information to be from qualified health professionals (>60%) but the actual source of the information differs from the perceived source with <45% getting their information from health professionals. The information from professionals is usually scientifically based while anecdotal sources such as family, friends, and the media may not be. Other studies have shown influencing factors of dietary supplement among African Americans identified these anecdotal sources such as friends, neighbours, and relatives as primary influencing factors (Sternberg et al., 2003; Yoon et al., 2004).

### **5.6 Sources of Dietary Supplements**

DSs users source the supplements from various points. A high proportion of DSs users sourcing the supplements from pharmacies/chemists, show that they might be associating chemists with sale of safe and genuine products. The strategic positioning for easy access and



high numbers of chemists might also be leading to majority of the supplement users sourcing the supplements from the pharmacies.

The kind of prescription that the DSs users use to source the supplements is self prescription. Bearing in mind that the highest proportion of actual source of information about the DSs is from relative/peers, then, there is need for the DSs users to get professional advice at the point of source on safe use of the DSs.

### **5.7 Dietary Patterns**

Gym users tend to use balanced diets. The dietary patterns of the participants, portrays a healthy lifestyle of the study group. Typically good and balanced diets provide what mainstream multivitamin/multi mineral DSs contain. It is possible that many of the DSs users are very health conscious that they intend to exceed vitamin/mineral intake recommendations in order to provide better nutrition for their bodies. This **is in consistency** with a study which showed that people with healthier lifestyles are more likely to use dietary supplements (Foote et al., 2003). Other vitamin/mineral supplement users may think diet plays a less important role in meeting their recommended dietary intakes for those vitamins/minerals.

### **5.8 Nutritional Status**

There is a high percentage of the participants whose BMI is out of the normal range. Between 55 and 60% of the participants, have out of the normal range BMI. The difference in nutritional status between the DSs users and non users is not significant and that between the male and female participants is not also significant as categorized using BMI.

The BMI of the male respondents is not a good indicator of nutritional status due to high levels of muscles due to body building. More than 20% of the male participants categorized as obese using BMI have their percent fat content within the normal range. The nutritional status is significantly different between the males and females when categorized using percent body fat.

The nutritional status is also different within age groups. The high proportion of participants with normal fat range in the age groups 18-25 years and 26-35 years can be attributed to a high percentage of body builders in these age categories and at this age the physiological changes that lead to muscle atrophy, increased weight and increased fat levels with age is low. The high proportion of females with a high BMI shows that female participants have not achieved their goal of becoming fit and healthy.

### **5.9 Potential Adverse Effects Dietary Supplements**

Usage of DSs is also associated with adverse effects. Some participants reported experiencing adverse effects while using the dietary supplements which include psychological effects, hepatic problems, and heart problems. This is in agreement with the adverse effects reported in 1998 in US through the poison control centres (FDA, 2000).

### **5.10 Factors Associated with Dietary Supplements use**

Gym users have been characterised as having a positive attitude towards health and therefore might be aware of the unhealthy behaviour of taking alcohol and therefore take DSs to intentionally compensate for this. Knowledge about dietary supplements shows that the

respondents are aware of the advantages and disadvantages of DSs. They are therefore aware of the role of nutrition in good health and this might lead them to taking DSs for good nutrition.

The significant association of knowledge about DSs and DSs use is consistent with a study by Romel (2009) which showed that participants with a high perceived knowledge on DSs were more likely to use them (Romel et al., 2009).

## CHAPTER 6

### 6.0 CONCLUSION AND RECOMENDATIONS

#### 6.1 Conclusion

The study investigated the knowledge gym users had on DSs, then usage of dietary DSs and dietary patterns of the gym users. The first hypothesis “knowledge on dietary supplements, gender, age, economic level and education level are the factors associated with the usage of DSs among gym users in Nairobi is rejected. There is a significant association between use and knowledge of DSs among gym users whereas there is no association between use of DSs and the following factors: gender, age, economic level and education level.

The second hypothesis “there are no potential adverse effects of usage of DSs among gym users in Nairobi” is rejected. The results indicate adverse effects with usage of DSs including too much sweating, immense appetite and lack of sleep, temper and mood swings, abdominal problems, lethargy and dizziness, palpitations, body weakness, lack of sleep, coloured urine, liver problems, fat accumulation around the waist, water accumulation and black spots.

The dietary patterns of gym users are balanced and healthy. This leads to a conclusion that gym users are healthy conscious and lead a healthy lifestyle.

#### 6.2 Recommendations

The results of this study provides information on sources of DSs and since the highest proportion of DSs users obtain the DSs from pharmacies/chemists then these points can be used for educating the DSs users on safe use of DSs. The education should include sensitising the general population on advantages, disadvantages and adverse effects of DSs.

The study also provides information on DSs use, consumer awareness and consumption pattern. This information can be disseminated to the health professionals and other bodies

concerned with safeguarding the health of the general population to raise awareness on need of implementing structural and educational interventions.

Further research is needed to examine the accuracy of information, received by DSs users from other sources apart from health professionals as well as sources of information for particular DSs. The relationship between dietary adequacy and DSs use needs some examination.

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## Appendix1. Questionnaire

Hello. My name is ..... from the University of Nairobi, department of Food Science, Nutrition and Technology, Applied Human Nutrition Programme. I am conducting a survey on the knowledge, usage of dietary supplements and dietary patterns of gym users in Nairobi. All information you give will be confidential. The information will be used to prepare general report but will not include any specific name. There will be no way to identify that you are the one who gave the information. I encourage you to participate in this survey. If it is okay with you, we may proceed with the survey. I agree to participate in the study. Signature.....

### Instructions

The questionnaire has 7 sections. Please fill in all sections except for the questions that may not apply in that respondent. Where codes are given circle the answer.

#### A. Identification

Constituency ..... Location..... Name of Gym .....

Name of interviewer.....Date of interview ...../...../ 2010

Name of respondent.....

#### B. Socio-demographic characteristic

1. Gender 1=M 2=F	2. D.O.B or Age in yrs	3. Mar ital Status	4. Edu cation Level	5. Profession	6. Occupation	7. Time you leave house for work	8. Time you leave work place	9. Main means of transport	10. Estate	11. Whe re you stay

Marital Status  
 1=married  
 2=widowed  
 3=separated  
 4=divorced  
 5=engaged  
 6=single  
 7=others (specify)

Education level  
 1=masters and above  
 2=degree/ diploma  
 3=In university/college  
 4=Finished form four  
 5=dropped in secondary  
 6=finished primary  
 7=dropped in primary

Means of transport  
 1=personal car  
 2=matatus  
 3=personal bike  
 4=walking  
 5=taxis

Where you stay  
 1=own house  
 2=rented house  
 3=stay with parents  
 4=stay with relatives  
 5=others (specify)

**C. General Knowledge on dietary supplements**

12. What are dietary supplements?

.....  
.....  
.....

14. What ingredients do dietary supplements contain?

.....  
.....

15. Where should one get the most reliable advice on use of dietary supplements?

.....

**Fill True = 1 or False = 2 in statements 16 – 23.**

16. Dietary supplements contain vitamins only. ....

17. Dietary supplements should be used to replace meals. ....

18. Dietary supplements have no side effects since they contain nutrients found in food. ...

19. Since protein is a major component of food, consuming protein supplements and without associated adverse outcomes. ....

20. Dietary supplements can be taken together with any medication. ....

21. One doesn't have to inform the physician about using dietary supplements when consulting the physician when one is sick. ....

22. Dietary supplements can be used to prevent nutritional deficiency. ....

23. Dietary supplements can be taken by anyone irrespective of their health status since they contain nutrients found in food. ....

**D. Use of dietary supplements**

24. Which dietary supplement(s) have you taken in the last 12 months? .....
- .....
25. How did you learn about the dietary supplement(s) you are taking? .....
- .....
26. What is the recommended dosage of the dietary supplement according to the literature given on the container? .....
- .....
27. What are the side effects of the dietary supplements you use if any? .....
- .....
- .....
28. What are the dietary supplements you are using recommended for as per literature given on the container?.....
- .....
29. Have you ever been diagnosed with any of these medical conditions?  
1=high blood pressure, 2=diabetes, 3=heart problems, 4=kidney problems, 5=depression, 6=liver problems, 7=others (specify).....
30. How do you manage this medical condition? .....
31. Where did you seek for medical attention? .....
32. Did you inform your doctor that you are using dietary supplements? 1=yes, 2=no
33. Did you inform the pharmacist that you are on dietary supplements when you were refilling your medication? 1=yes, 2=no

**E. Type, contents and usage of dietary supplements**

33. Brand name/ manufacturer	34. No of times in a week you take DS?	35. No of times in a day that you take DS?	36. Dosage of DS?	37. Ingredients	38. History Of product use	39. Duration of product use	40. Reason for use	41. Source	42. type of prescri ption

**34. No of Times in a wk** 1=once

2=2-5 times

3=daily

**35. No of Times in a day**

1=once 2=twice 3=three times

4=others (specify)

**38. History**

1=currently

2=1mth ago

3=2mths ago

4=4mths ago

5=others (specify)

**39. Duration**

1=<1mth

2=1 mth

3=2mths

4=3mths

5=4mths

6=others (specify)

**41. Source**

1=chemist

2=s/ mkt

3=health store

4=cosmetic shop 5=direct sales

6=others (specify)

**Type of prescription**

1=medical practitioner

2=pharmacist

3=nutritionist

4=gym instructor 5=health store attendant

6=self prescription

7=others (specify)

43. Have you ever experienced any undesirable effect while using a DS and continued using it? 1= Yes 2= No

44. Which was the effect? .....  
.....  
.....

45. Have you ever been on a dietary supplement and then you stopped using it? 1=yes, 2=no

46. If yes name the dietary supplement(s).....  
.....

47. If yes to (45) why did you stop using the dietary supplement(s)? .....

.....  
.....  
.....

48. If you stopped usage due to undesirable effects, which were these effects? .....

.....  
.....  
.....

49. Did you report these undesirable effects to anyone? 1) =yes, 2) =no

50. If yes where did you report? .....

**F. Health status and dietary supplement**

51. Have you suffered from any ailment in the last one month? 1=yes, 2=no. If yes go to question no.53

52. When did you last visit a doctor/health facility/chemist for medical attention for being sick? .....  
.....

53. What was the sickness(es)? .....  
.....  
.....

54. Were you prescribed for any medication? 1=yes, 2=no

55. If yes, for how long did you take the medication? .....

56. Were you taking any dietary supplements during this time of ailment? 1=yes, 2=no

57. If yes, did you take the medication together with dietary supplements? 1=yes, 2=no

58. If no, what did you do? .....  
.....

**G. Food intake in relation to dietary supplement**

59. How many meals do you normally take in a day during weekdays? Name them. ....  
.....

60. Do you have a lunch break?            1=yes,            2=no

61. How long is the lunch break?    1) Less than 30 minutes.    2) 31min-1 hour    3) More than 1 hour

62. Do you take snacks in between the meals?    1=yes,            2=no

63. If yes, when do you take the snacks? .....  
.....

64. How many meals do you normally take in a day during weekends? Name them. ....  
.....

65. Do you at times take dietary supplements to compensate for a meal?            1=yes,            2=no

66. If yes to Q 65 above, how often in a week? .....

67. If yes to no.65 above, when does this happen? .....  
.....

68. When do you take the dietary supplement in relation to food intake?

- 1= with meals                      2=one hour before meals                      3=one hour after meals                      4=two hours before meals  
5=two hours after meals                      6=any time                      7=others (specify).....

69. Do you take alcohol?    1=yes.            2=no



70. Do you take the dietary supplements and alcohol at the same time?

1=yes, 2=no

71. Do you smoke? 1=yes, 2=no

**H. Anthropometric Assessment**

72. Height (cm)		73. Body weight (kg)		74. Neck Circumference (cm)		75. Waist Circumference (cm)		76. Hip Circumference (cm)	
1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd

### I. Food Frequency Questionnaire

77. Food Frequency Questionnaire					
Please check the frequency which you consume the following items:					
Food	Daily	Weekly	Fortnightly	Monthly	Never/Rarely
Dairy (milk, cheese, yogurt)					
Red Meat					
Meat products (sausages, ham)					
Poultry					
Fish					
Eggs					
Legumes (Beans, peas)					
Nuts, Peanut Butter,					
Cereal & cereal products (Rice, Bread Pasta)					
Fruit					
Vegetables					
Desserts (Ice cream, Cake, Pie, Candy, etc.)					
Spreads (margarine)					
Soft Drinks					
Sports Drinks					
Energy Bars/Shakes					
Alcohol					
Fast Food					
Water					
Breakfast					
Snacks					
(Eat Out) Restaurant Food					

**Appendix 2: Research assistants training programme**

Day	9.00-11.00	11.30-1.00	2.00-4.00
1	Objective of study Principles of ethics Interviewing techniques	Questionnaire administration	Administration of questionnaire to each other
2	Pre-testing	Pre-testing Data entry	Questionnaire adjustments Analysis of data

**Appendix 3: Selected demographic and socio-economic characteristics of users and non users of dietary supplements**

Characteristics	DSs users n=174 (%)	DSs non users n=228 (%)	Total N=402 (%)	Chi-square	P value
Gender				27	0.098
Male	66.1	73.7	70.4		
Female	33.9	26.3	29.6		
Age				34	0.494
18- 25yrs	27.0	32.0	29.9		
26- 35yrs	44.3	36.4	39.8		
36- 45yrs	13.2	17.1	15.4		
46- 55yrs	10.9	10.1	10.4		
> 55yrs	4.6	4.4	4.5		
Marital status				11	0.291
Married	44.3	49.6	47.3		
Not married	55.7	50.4	52.7		
Education level				26	0.106
Above college	85.6	79.4	82.1		
Below college	14.4	20.6	17.9		
Means of transport				0.03	0.985
Private means	50.5	50.9	50.8		
Public means	42.0	42.1	42.0		
Walking	7.5	7.0	7.2		
Estate				14.4	0.060
Up market	5.7	3.1	4.2		
High income	25.9	15.4	19.9		
Upper high class	42.0	57.5	50.7		
Lower high class	24.7	20.2	2.1		
Low class	1.7	3.9	3.0		
Occupation				1.7	0.632
Stud	13.2	17.1	15.4		
Formal employment	36.2	36.4	36.3		
Self employed	45.4	40.4	42.5		
Unemployed	5.2	6.1	5.7		

Appendix 4: Dietary pattern of male and female gym users

Food group	Frequency of consumption (%)							
	Daily		Weekly		Fortnightly		Monthly/never or rarely	
	Male	Female	Male	Female	Male	Female	Male	Female
Dairy	89.0	78.2	4.9	16.0	0	0.8	6.1	5.0
Red meat	30.4	11.8	56.6	70.6	2.8	1.7	10.2	16.0
Meat products	17.7	4.2	36.0	37.8	8.8	8.4	37.5	49.6
Poultry	8.1	4.2	68.6	70.6	8.5	10.1	14.8	15.1
Fish	4.9	2.5	60.8	53.8	13.1	13.4	21.2	30.2
Eggs	33.9	3.4	39.2	52.1	6.4	10.1	20.5	34.5
Legumes	31.8	26.9	55.1	66.4	3.5	4.2	9.5	2.5
Nuts	33.9	30.3	33.9	29.4	6.7	6.7	25.5	33.6
Cereals	75.6	77.3	20.8	21.8	1.1	0.8	2.5	0
Fruits	74.9	84.9	21.6	13.5	0.7	0.8	2.9	0.8
Vegetables	86.6	93.3	11.3	6.7	0.7	0	1.5	0
Deserts	4.9	6.7	31.4	28.6	11.0	14.3	52.1	50.4
Spreads	44.2	35.2	17.0	16.8	3.2	3.4	35.1	44.6
Soft drinks	19.8	10.9	4.2	26.1	5.7	6.7	30.4	56.3
Sport drinks	1.8	0.8	14.8	4.2	12.7	0.8	70.1	94.1
Energy bars	3.2	0	6.0	7.6	6.0	2.5	84.8	89.9
Alcohol	1.8	0	39.9	30.3	8.5	10.9	49.8	58.8
Fast foods	7.4	4.2	38.5	24.4	10.6	11.8	43.5	59.7
Water	100	0	0	0	0	0	0	0

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Appendix 5: Chi-square analysis of frequency of consumption of various food groups based on gender

Food group	Chi-square ( $\chi^2$ )	P value
Dairy	16.7	0.002
Red meat	18.5	0.001
Meat products	15.4	0.004
Poultry	2.3	0.680
Fish	5.3	0.260
Eggs	43.0	<0.001
Legumes	8.8	0.065
Nuts	2.9	0.563
Cereals	3.1	0.549
Fruits	5.7	0.220
Vegetables	4.7	0.317
Deserts	1.6	0.807
Spreads	3.3	0.507
Soft drinks	26.4	<0.001
Sport drinks	31.8	<0.001
Energy bars	13.2	0.010
Alcohol	9.0	0.050
Fast foods	11.2	0.019