

**PREVALENCE, KNOWLEDGE AND USAGE OF HERBAL DIETARY
SUPPLEMENTS AMONG WORKERS IN AGRICULTURAL RESEARCH
INSTITUTES IN IBADAN, NIGERIA**

BY

OLAIDE RUTH ADERIBIGBE

Ph.D NUTRITION (POTCHEFSTROOM, SOUTH AFRICA)

MATRIC NO: 88473

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DEDICATION

I dedicate this work to my family; my dearest husband, son and daughter. Your unfailing love, support and encouragement has always kept me going.

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ABSTRACTS

Herbal dietary supplements (HDS) are plants or plant extracts, other than food, used for the purpose of providing additional nutritional and health benefits to the body. People looking for quick and easy ways to improve nutrition and health have made these non-food sources of nutrition increasingly popular while neglecting the negative effects that could be associated with the use. An understanding of reasons related to the use of HDS may help in the development of appropriate interventions to address the misuse of these products. This study therefore, aimed at assessing the knowledge and usage of HDS among workers in Agricultural Research Institutes in Ibadan.

This study was conducted using a descriptive cross-sectional study design to select respondents from three agricultural research institutes in Ibadan (i.e. National Horticultural Research Institute-NIHORT, Forestry Research Institute-FRIN and Institute for Agriculture and Research and Training-IAR&T). A two-stage sampling technique involving proportionate and simple random sampling technique was used to select 422 participants from the institutes. A semi-structured self-administered questionnaire was used to elicit information from the study population. Knowledge of appropriate use of HDS was assessed using a 15-point scale; it was categorised as poor (0-5), fair (>5-10) and good (>10) knowledge. Descriptive statistics, Chi-square test and regression analysis were used to analyse the data at $p=0.05$ level of significance.

Age of respondents was 38.1 ± 8.7 years and it ranged from 18 to 57 years. Males accounted for 54.8% of the sample. Majority of respondents (67.1%) had used HDS before but only 46.8% were currently using them. Out of those currently using HDS, 70.8% were occasional users. Moringa, garlic, ginger and aloe vera were the HDS mostly taken with 67.9%, 47.3%, 45.0% and 32.2% of respondents taking them respectively. Fifty eight (71.6%) out of the 81 respondents on prescription drugs used the drugs alongside HDS. The knowledge of appropriate use of HDS for all respondents was 3.4 ± 1.1 points. Respondents with poor, fair and good knowledge of appropriate use of HDS were 69.1%, 27.3% and 3.6% respectively. Out of respondents who had used HDS before, 135 (51.5%) used them to prevent diseases and 81 (30.9%) to treat diseases. The proportion of respondents who used HDS for the first time because they read or heard about the benefits from the media/internet was the largest (27.9%) compared to other reasons. There was significant association between age and use of HDS. More males (60.8%) used HDS

compared to females. Knowledge was significantly associated with use of HDS. Respondents that had good knowledge of use were less likely to have used HDS, (OR: 0.8, 95% CI: 0.8-0.9) and respondents that had doctorate degree were less likely to have used HDS, (OR: 0.3, 95% CI: 1.1-1.6).

The use of herbal dietary supplements was high among workers in agricultural research institutes in Ibadan. Knowledge of appropriate use was poor in the majority in this population and disease prevention was the main reason for usage. Enlightenment programmes that will provide basic nutrition information and also discuss appropriate use of these supplements are needed.

Keywords: Herbal dietary supplements, knowledge of use, reasons for use, agricultural research institutes

Word count: 499

CERTIFICATION

I certify that this study was carried out by Olaide R. Aderibigbe under my supervision at the Department of Health Promotion and Education, Faculty of Public Health College of Medicine, University of Ibadan

Supervisor

Oyediran E. Oyewole

B.Sc, R.D (Nig), M.Sc., MPH, Ph.D. (Ib).

Senior Lecturer

Department of Health Promotion and Education,

Faculty of Public Health, College of Medicine,

University of Ibadan, Ibadan

Table of Contents

Dedication.....	i
Acknowledgements.....	ii
Abstract.....	iii
Certification	v
Table of contents.....	vi
List of tables.....	ix
List of figures.....	x
Abbreviations/acronyms	xi

CHAPTER ONE: INTRODUCTION

1.1 Background	1
1.2 Problem Statement	3
1.3 Justification.....	4
1.4 Research Questions	4
1.5 Broad Objective.....	5
1.6 Specific Objectives.....	5
1.7 Hypotheses	5

CHAPTER TWO: LITERATURE REVIEW

2.0 Historical Overview	6
2.1 Types of dietary supplements.....	7
2.2 Health benefits of vitamin and mineral supplements	8
2.3 Health benefits of Herbal Dietary Supplements.....	8
2.4 Health claims, nutritional support claims and structure/function claims	9
2.4.1 Health Claims.....	9
2.4.2 Nutritional support claims.....	9
2.4.3 Structural/functional claims.....	9
2.5 Difference between supplements, drugs and food additives	10

2.6 Dietary supplement use in different populations.....	11
2.7 Why people take dietary supplements.....	14
2.7.1 Supplementation of diet.....	14
2.7.2 An alternative to conventional medicine	14
2.7.3 Health promotion and disease prevention	15
2.7.4 Boost immune function	15
2.7.5 Improve menopausal symptoms	15
2.8 What are the dangers of some dietary supplements?	16
2.8.1 Interactions with other medications.....	16
2.8.2 Unwanted effects during surgery.....	17
2.8.3 Unwanted effects during pregnancy and lactation	17
2.8.4 Naturally dangerous dietary supplements.....	17
2.8.5 Faulty assumptions	17
2.9. Complementary and alternative medicine.....	18
2.10 Regulation and control of dietary supplements	18
2.10.1 Good Manufacturing Practices.....	20
2.10.2 National Agency for Food and Drug Administration and Control.....	20
2.10.3 Food and Drug Act Cap 150 of 1990.....	21
2.10.4 Classification and labelling.....	21
2.11 Commonly used herbs.....	23
2.12 Conceptual Framework.....	34
2.12.1 Social Learning Theory	34

CHAPTER 3: METHODOLOGY

3.1 Study Design and Scope.....	36
3.2 Description of Study Site	36
3.3 Study Population and Sample Size Determination	38
3.4 Sampling Technique.....	38
3.4.1 Distribution of staff in the research institutes.....	39

3.5 Method and Instrument for Data Collection	40
3.6 Method of Data Collection	40
3.7 Validity and Reliability	41
3.7.1 Validity	41
3.7.2 Reliability	41
3.8 Data Management and Analysis	41
3.9 Ethical Consideration	41
3.10 Limitations to the study	42
 CHAPTER FOUR: RESULTS	
4.1 Socio-demographic information	43
4.2 Use of herbal dietary supplements	45
4.3 Reasons for usage of herbal dietary supplements	50
4.4 Knowledge of use of herbal dietary supplements	55
4.5 Perceived factors associated with the use of herbal dietary supplements	57
4.6 Hypotheses testing	59
4.7 Significant predictors of herbal dietary supplement use	62
 CHAPTER FIVE: DISCUSSION, CONCLUSION AND RECOMMENDATION	
5.1 Socio-demographic profiles	64
5.2 Use of HDS	64
5.3 Reasons for use	66
5.4 Knowledge of HDS	67
5.5 Factors associated with use of HDS	67
5.6 Implication for health promotion and education	68
5.7 Conclusion	68
5.8 Recommendation	69
REFERENCES	71
APPENDIX	81

LIST OF TABLES

Table 2.1: Examples of dietary ingredients defined as dietary supplement by the dietary supplement health education Act of 1994.....	11
Table 2.2: Commonly consumed herbs and evidence of their efficacy and safety.....	33
Table 4.1.1: Socio-demographic information of respondents.....	44
Table 4.2.1: Herbal dietary supplements reported among users.....	48
Table 4.3.1; Reasons for usage of herbal dietary supplements.....	51
Table 4.3.2: Types of disease conditions respondents ever used herbal dietary supplements to manage or treat.....	52
Table 4.3.3: Reasons why some respondents were not using herbal dietary supplements.....	54
Table 4.5.1: Perceived factors associated with herbal dietary supplement use.....	58
Table 4.6.1: Chi-square test of the association between age and use of herbal dietary supplements.....	59
Table 4.6.2: Chi-square test of the association between sex and use of herbal dietary supplements.....	60
Table 4.6.3: Chi-square test of the association between knowledge and use of herbal dietary supplements.....	61
Table 4.7.1: Summary of regression analysis showing variables/factors useful in predicting use of herbal dietary supplements.....	63

LIST OF FIGURES

Figure 2.1: Dietary supplement label format.....	22
Figure 2.2: Echinacea.....	23
Figure 2.3: Ginseng.....	24
Figure 2.4: Ginko.....	25
Figure 2.5: Garlic.....	26
Figure 2.6: Peppermint.....	27
Figure 2.7: Ginger.....	28
Figure 2.8: Soy.....	29
Figure 2.9: Chamomile.....	30
Figure 2.10: Kava.....	31
Figure 2.11: Moringa.....	32
Figure 2.12: Social Learning Theory.....	35
Figure 4.2.1: Use of herbal dietary supplements among respondents.....	46
Figure 4.2.2: Frequency of use of herbal dietary supplements among current users.....	47
Figure 4.2.3: Use of herbal dietary supplements among those on prescription drugs.....	49
Figure 4.3.1: The most appropriate reasons why respondents ever started to use herbal dietary supplements.....	53
Figure 4.4.1: Proportion of respondents with different levels of knowledge of herbal dietary supplements use.....	56

ABBREVIATIONS/ACRONYMS

ARCN	Agricultural Research Council of Nigeria
ART	Anti-Retroviral Treatment
CAM	Complementary and Alternative Medicine
CRIN	Cocoa Research Institute
DSHEA	Dietary Supplement Health Education Act
DV	Daily Values
EGCG	Epigallocatechin Gallate
FDA	Food and Drug Administration
FRIN	Forestry Research Institute
GMPs	Good Manufacturing Practices
HDS	Herbal Dietary Supplements
HIV	Human Immunodeficiency Virus
HND	Higher National Diploma
IAR&T	Institute for Agricultural Research and Training
KPMCP	Kaiser Permanente Medical Care Program
LASUTH	Lagos State University Teaching Hospital
LDL	Low Density Lipoprotein
NAFDAC	National Agency for Food and Drug Administration and control
NFVRDC	National Fruit and Vegetable Research and Development Centre
NHANES	National Health and Nutrition Examination Survey
NHIS	National Health Interview Survey

NIH	National Institute of Health
NIHORT	National Horticultural Research Institute
NLEA	Nutrition Labeling and Education Act
NVM	Non Vitamin and Mineral
OND	Ordinary National Diploma
OTC	Over The Counter
RUS	Ready to Use Supplementary Foods
SON	Standard Organisation of Nigeria
SRI	Serotonin Reuptake Inhibitor
UCH	University College Hospital
UI	University of Ibadan
US	United States
VITAL	Vitamin And Lifestyle Study
VM	Vitamin and Mineral
WHO	World Health Organisation

CHAPTER ONE

INTRODUCTION

1.1 Background

Diet and nutrition play important roles in the maintenance of health and prevention of disease (Block, Jensen and Norkus, 2007). The omnivorous diet of humans can provide the diverse blend of nutrients needed for growth, maintenance, and overall health. For some people, however, food alone may not supply adequate amounts of required nutrients. Nutritional needs change with aging, pregnancy, and lactation and may be altered by acute and chronic diseases or other medical conditions (Camire and Kantor, 1999). Dietary supplements represent an important source of essential nutrients since they often contain 100% or more of the daily value of one or more nutrients (Ervin, Wright and Reed-Gillette, 2004; Radimer, Bindewald, Hughes and Ervin, 2004).

The Dietary Supplement Health and Education Act (DSHEA) defines dietary supplements as a product (other than tobacco) intended to supplement the diet that bears or contains one or more of the following dietary ingredients: a vitamin, mineral, amino acid, herb or other botanical; or a dietary substance for use to supplement the diet by increasing the total dietary intake; or a concentrate, metabolite, constituent, extract, or combination of any ingredient described above; and intended for ingestion in the form of a capsule, powder, softgel, or gelcap, and not represented as a conventional food or as a sole item of a meal or the diet (The Commission on Dietary Supplement Labels, 1997). Herbal dietary supplements (HDS) are a type of dietary supplement that contains herbs plant or part of a plant used for its flavor, scent, or potential therapeutic properties. They include flowers, leaves, bark, fruit, seeds, stems, and roots; either singly or in mixtures (EDinformatics, 2013).

Because of the nutritional and health benefits of dietary supplements and the busy lifestyles of most Nigerians, dietary supplement has become one of the fastest growth categories in consumer health. Dietary supplements appeal to a large number of consumers willing to pay for alleged benefits that are too good to be true (DSHEA, 1994). The increasing use of medicinal herbs and

dietary supplements in recent years is evidence of a public interest in having alternatives to conventional medicine. However, little is known about either the evidence base to support appropriate indications or the safety of these supplements for use. Punch Newspaper of March 3, 2013 wrote on the increasing use of dietary supplements by Nigerians and the need to slow down. Herbal dietary supplements can act in the same way as drugs. Therefore, they can cause medical problems if not used correctly or if taken in large amounts. In some cases, people have experienced negative effects even though they followed the instructions on a supplement label.

In the United States, herbal and other dietary supplements are regulated by the U.S. Food and Drug Administration (FDA, 1997a) as foods. This means that they do not have to meet the same standards as drugs and over-the-counter medications for proof of safety, effectiveness, and what the FDA calls Good Manufacturing Practices. Due to the lack of regulation of the dietary supplement industry in Nigeria, an abundance of supplement products of dubious value, content, and quality are now available. Despite this, little information exists on the prevalence, knowledge and use of HDS among Nigerians.

Recent statistics indicate that Americans are increasingly replacing prescription medications with vitamin and mineral supplements as well as medicinal herbs. In 2005, a secondary analysis of the complementary and alternative medicine (CAM) supplement to the 2002 National Health Interview Survey (Kennedy 2005; Kennedy 2007) estimated that more than 38 million Americans use herbs and dietary supplements. Despite the widespread use of these products, primary care physicians are generally unaware of the non-prescribed therapies their patients are taking. Most patients are reluctant to share this information with their healthcare providers, even if they experience adverse events that might be related to use of medicinal herbs or dietary supplements (Barnes, Mills, Abbot, Willoughby and Ernst, 1998).

Likewise in Nigeria, the use of herbs is beginning to take the center stage in the maintenance of health and management of health related problems (Oseneme, Elujoba and Ilori, 2011). The popularity of HDS in Nigeria is readily apparent. Unfortunately, the extent and patterns of use for these supplements have not been ascertained. Commonly cited statistics come from studies

on trends in alternative medicine. There is, therefore, the need to explore the prevalence, knowledge and use of HDSs.

The justification for the beneficial effects of HDS comes from research findings. Agricultural research institutions in Nigeria vary widely on mandate crops but one thing that is common to all is the mandate of developing value added products and analyzing the chemical components of their plants of focus. Thus, workers in agricultural research institutes are expected to have access to information relating to beneficial effects of plants and plant parts which are majorly used in HDS. This study therefore, aims to explore the prevalence, knowledge and reasons for usage of HDS among workers in agricultural research institutes in Ibadan, Oyo State, Nigeria.

1.2 Problem Statement

Dietary supplements have become an important source of nutrition and health among Nigerians. However, little is known about individuals who routinely use these supplements. The increased proportion of people who rely on non-food sources for nutrients and unconventional ways to maintain health raises a public health concern. People's attempt to look for quick and easy ways to improve nutrition and health has made dietary supplements increasingly popular for their potential non-food source of nutrition and positive effects on health. However, excessive and inappropriate use of dietary/herbal supplements has been recognized as a significant public health problem (Ness, Johnson and Nisly, 2003; Nisly, Gryzlak, Zimmerman and Wallace, 2010). People do not know some of the negative side effects of HDS. They take them indiscriminately because of the general believe that they are safe and natural.

In addition, marketers of dietary supplements are getting more aggressive with their marketing strategies. The labels bear all kinds of information about their nutritional and health benefits. The marketers persuade consumers with different claims, some of which have not been scientifically proven.

There have been reports to indicate that people sometimes replace the consumption of nutritious food with consumption of dietary supplements. While dietary supplements are good sources of nutrients, they are however, not meant to replace foods. Many dietary supplements may be safe at certain periods for most people to use (Prentice, 2007), there is growing evidence that some

type of supplements can cause serious adverse effects or have no beneficial effects when used continuously. Negative drug-herb reactions can also result from inappropriate use of these supplements when combined with prescription drugs.

1.3 Justification

More people are taking ownership of their own health, and have thus turned to nonprescription measures for the prevention and treatment of disease. In general, not much acknowledgement has been given to both the worth and widespread use of dietary supplements by the public. It is important to direct some research effort into understanding the patterns and knowledge of users of supplements.

Much of the research performed to date on dietary supplements has been regarding the safety and dangers, and not about the knowledge and practices of HDS use. There have been discussions about whether to regulate HDS as foods or drugs. While research into the safety and efficacy of dietary supplements are necessary, it is important as well to first generate scientific data on the prevalence, knowledge and use of HDSs. Gaining a deep understanding about the current status on issues relating to HDS use among workers in agricultural research institutes may give an insight into the views of the general public. This will help in making appropriate recommendations on the best course of action to help minimize the misuse and maximize benefits of HDS.

There is few data on the use of HDS in Nigeria; this study will assess the prevalence, knowledge and use of HDS among workers in agricultural research institutes in Ibadan. The proposed research will serve as an educational resource on an important and emerging public health issue and could guide the conduct of research and development of interventions necessary for HDS industry and HDS consumers respectively. Furthermore, the outcome of this study will help in formulation of policies to regulate production and marketing of HDS.

1.4 Research Questions

- What proportion of workers in agricultural research institutes in Ibadan is using HDS?

- What are the commonly used HDS among workers in agricultural research institutes in Ibadan?
- Why do workers in agricultural research institutes in Ibadan use HDS?
- What is the level of knowledge of appropriate use of HDS among workers in agricultural research institutes in Ibadan?
- What are the factors associated with the use of HDS among workers in agricultural research institutes in Ibadan?

1.5 Broad Objective

The broad objective of this study was to investigate the prevalence, knowledge and usage of HDS among workers in agricultural research institutes in Ibadan.

1.6 Specific Objectives

The specific objectives were

1. To document the reported use of HDS among workers in agricultural research institutes in Ibadan using HDS.
2. To determine the reasons workers in agricultural research institutes in Ibadan use HDS
3. To assess the level of knowledge of appropriate use of HDS among workers in agricultural research institutes in Ibadan.
4. To identify factors associated with HDS use among workers in agricultural research institutes in Ibadan.

1.7 Hypotheses

The study tested the following null hypotheses:

Ho 1. There is no significant association between age and reported use of HDS among workers in agricultural research institutes in Ibadan.

Ho 2. There is no significant association between sex and reported use of HDS among workers in agricultural research institutes in Ibadan.

Ho 3. There is no significant association between knowledge and use of HDS

CHAPTER TWO

LITERATURE REVIEW

The use of dietary supplements has increased dramatically as our knowledge about the role of nutrients and other bioactive components of food in health has increased. Although much of the information about the diet and health connection that has driven this trend is related to the reduction of chronic disease risk in adults, belief in the prophylactic use of dietary intervention including the use of dietary supplements, has been extended to consumers throughout the life cycle (Balluz, Kieszak, Philen and Mulinare, 2000; Palmer, McKinney, Klein-Schwartz, Tschirgi, Smolinske, Woolf, Sprague, Ko and Everson, 2003). In the past, dietary supplements were confined mainly to health food stores and pharmacies, nowadays dietary supplements are found in supermarkets and are even sold through the internet. Although some supplements such as prenatal vitamin or mineral blends require a prescription, most do not and are readily available over-the-counter.

The Dietary Supplement Health and Education Act (DSHEA, 1994) defines a dietary supplement as a product that:

- supplements the food you eat
- contains one or more dietary ingredient (including vitamins; minerals; herbs or other botanicals; amino acids, and other substances)
- comes in pill, capsule, tablet, or liquid form
- is labeled as a dietary supplement.

2.0 Historical Overview

Multivitamin/mineral formulations were the most common dietary supplements until the 1990s. Publicity surrounding claims made by Nobel-laureate Linus Pauling in the 1970s, that megadoses of at least 10 times the recommended daily allowance of ascorbic acid could prevent or cure the common cold, flu, and cancer (Herbert and Barrett, 1981) may have stimulated public interest in the use of vitamin supplements to enhance health.

Although few of the claims made for supplements in popular books during the 1970s and 1980s were supported by rigorous scientific research, the mainstream scientific community gradually became intrigued by the potential health benefits of dietary supplements. This interest was fueled in part by studies demonstrating that nutrient antioxidants, including vitamins C and E and beta-carotene, have a role in protecting cells from oxidative free radical damage (Gohil, Packer, de Lumen, Brooks and Terblanche, 1986). Furthermore, epidemiological studies suggested that a diet rich in fruits and vegetables and abundant in antioxidants, nutrients, and other substances, reduced the risk of coronary heart disease and certain cancers (Stangeland, Remberg and Lye, 2008).

By the mid 1990s, “antioxidant” became a household word and antioxidant-fortified supplements and foods appeared on the market. Moreover, as some people increasingly became disenchanted with rising health care costs and the perceived impersonal nature of conventional “Western” medicine, there was a dramatic rise in the popularity of various complementary and alternative practices, including herbal medicine, Ayurvedic medicine (an Indian holistic medical system incorporating foods and herbs), acupuncture, and homeopathy (Angell and Kassirer, 1998). During the early 1990s, the U.S. Food and Drug Administration (FDA) attempted to increase regulation of herbal products and other dietary supplements (Gilhooley, 1997), creating concern among both consumers and supplement manufacturers.

2.1 Types of dietary supplements

There are two main types of dietary supplements

- Vitamin and mineral supplements are types of dietary supplements containing micronutrients meant to help a healthy body function smoothly.
- Herbal (or botanical) dietary supplements are supplements that have a medicinal purpose. Herbal supplements generally support a specific area of the body’s health, such as the liver, bones or skin. Herbal supplements are different from homeopathics. Homeopathy uses natural substances derived from botanical, animal, or mineral sources in micro doses to assist the body's natural mechanisms for protecting and healing itself. Herbal supplements are made from parts of whole plants. They are not regulated as medicines by the FDA and thus can make unsubstantiated health claims (FDA, 1997a).

2.2 Health benefits of vitamin and mineral supplements

Vitamins and minerals are micronutrients that serve a specific purpose and benefit the body in a unique way. For example, vitamin A supports vision and bone growth, whereas vitamin E strengthens the immune system and helps repair DNA. Vitamin and mineral deficiency can impair the body's ability to heal and protect itself. Taking vitamins does not make up for an unhealthy diet, and vitamins are an insufficient substitute for nutrients from fresh fruits, vegetables, and whole grains. However, a general multivitamin and mineral supplement can be a good safeguard against periodic vitamin shortfalls in one's diet (National Institute of Health, 2008).

In general, children and adults might benefit from taking one multivitamin per day. A multivitamin helps provide a consistent source of the necessary vitamins and micronutrients. However, the very first consideration is to eat a healthy diet. Even the best supplement is no substitute for good nutrition. Some groups of people, because of distinct nutritional needs, benefit most from taking a vitamin and mineral supplement:

- Women of childbearing age (need extra calcium and iron)
- Pregnant or lactating women
- Children and teenagers with irregular eating habits
- Seniors
- Vegetarians or vegans (may be deficient in key nutrients)
- Dieters or people avoiding certain food groups (may be deficient in key nutrients)
- People with eating disorders or medical conditions (deficiency diseases, absorption problems, lactose intolerance, etc.)
- People who often eat processed and fast food (Huang, Caballero, Chang, Alberg, Semba, Schneyer, 2006)

2.3 Health benefits of Herbal Dietary Supplements

Herbal supplements are different from vitamin and mineral supplements in that they are considered to have medicinal value. Herbs, also known as botanicals, are one of humanity's oldest health care tools, and the basis of many modern medicines. Primitive and ancient

civilizations relied on herbs for healing, as do many contemporary cultures throughout the world. In fact, the World Health Organization has estimated that 80% of the world's population continues to use traditional therapies, a major part of which are derived from plants (WHO, 2003). Okolo and colleagues (Okolo, Olajide, Idowu, Adebisi, Ikokoh, and Orishadipe, 2012) investigated the nutritional composition of the plants commonly used as food supplement in Nigeria – Ginger, Garlic, Millets, Benni seeds, Sorghum, Maize, Crayfish, Moringa oleifera leaves and seeds. Lipids, protein and carbohydrates were confirmed to be present in these food supplements.

The word “supplement” means something added. In this case, you’re “adding” to a basic healthy diet and lifestyle, or to a prescription medication or therapy to treat a medical condition. An herbal supplement or vitamin regimen on its own will not necessarily cure or treat your condition or health problem. It’s also important to remember that not all supplements are beneficial, especially when taken in toxic doses or combined with other medications. Supplement manufacturers are allowed to make claims regarding health, nutritional content, and structure/function, subject only to limited restrictions.

2.4 Health claims, nutritional support claims and structure/function claims

2.4.1 Health claims are specifically defined as statements that characterize the relationship between a food substance and a specific disease or health-related condition, and which are based on significant scientific agreement e.g. calcium and osteoporosis, folate and neural tube birth defects, soluble fiber and coronary heart disease, and sugar alcohols and dental caries. (Commission on Dietary Supplement Labels, 1997).

2.4.2 Nutritional support claims refer to the percentage of daily value of the nutrient the supplement provides. Nutritional support statements or function claims can be distinguished from the more rigorous health claims in that they are not permitted to state or imply a link between a supplement and the treatment, diagnosis, cure or prevention of a disease (Food Standards, 2010).

2.4.3 Structure/function claim is a statement describing how a product may affect the organs or systems of the body. It cannot mention a specific disease. For example: "COQ10 supports

heart function as a component of the electron transport system, and as an antioxidant protects mitochondrial membranes and cholesterol from oxidation” (Camire and Kantor, 1999).

2.5 Difference between supplements, drugs and food additives

A drug is a product used to “diagnose, cure, mitigate, treat, or prevent diseases,” whereas a dietary supplement is meant to supplement the diet by increasing the total dietary intake of a substance. A food additive is any substance that is either intentionally added (direct additive) to food to improve its shelf-life, texture, nutrition, or other aspect of quality or that unintentionally contaminates (indirect additive) food, such as packaging materials or machine residues. Dietary ingredients in supplements are exempt from the food additive regulations applicable to conventional foods (Taylor, 2005).

The pre-market approval process for direct food additives and drugs is lengthy and expensive, requiring that manufacturers rigorously test the product’s safety and effectiveness and requiring that this evidence is reviewed by National Agency for Food and Drug Administration and Control (NAFDAC) before new products are introduced into the marketplace. Efficacy must be proven through adequate and well-controlled investigations, including human trials, demonstrating that the drug will have the effect claimed on its labeling. However, dietary supplement ingredients (examples in Table 1) may be sold without undergoing a formal approval process. Although the supplement manufacturer is not required to provide rigorous scientific evidence of safety or efficacy, the manufacturer should be able to provide information to support any labeling claims (FDA, 1997a).

Table 2.1: Examples of Dietary Ingredients Defined as Dietary Supplements by the Dietary Supplement Health and Education Act of 1994

Category	Example
Vitamins	Vitamins A, D, E, C, B6, B 12, thiamin, riboflavin, niacin, folate, biotin, pantothenic acid
Mineral	Calcium, iron, zinc, magnesium, manganese, selenium, copper, chromium, iodine
Herbs or other botanicals	Garlic, ginkgo, chamomile, dandelion, milk thistle, capsicum, valerian, yohimbe, guarana
Amino acid	Lysine, tryptophan, cysteine, isoleucine, methionine, valine
A dietary supplement used to supplement the diet by increasing the total dietary intake	Fish oil, blue-green algae, bee pollen, bone meal, melatonin
Concentrates, metabolites, constitutes or combinations of any ingredients above	Allicin (from garlic), ginkgo ginsenosides, bilberry extract, chamomile tea

Camire and Kantor, 1999

2.6 Dietary supplement use in different populations

With the expansion of the dietary supplements market came an increased number of products with several claims. As a result, several recent research studies have looked at trends related to the consumption of dietary supplements. Two nationally representative surveys have examined dietary supplement use in the United States. These are the National Health and Nutrition Examination Survey (NHANES) and the National Health Interview Survey (NHIS).

Radimer and associates conducted a cross-section survey on the data from NHANES III related to dietary supplements to uncover possible trends (Radimer, Subar and Thompson, 2000). In this study, supplements were classified into vitamin and mineral (VM) supplements and non-vitamin and non-mineral (NVM) supplements. Only 3.6% of the population studied reported taking any NVM) supplements. When looking at the total amount of NVM supplements reported, garlic and

lecithin were reported the most often. Reported rates of herbal and dietary supplement (Millen, Dodd and Subar, 2004) use tended to be higher in the those older than 35 years; individuals of “other” race/ethnicity; individuals that had a higher alcohol intake; people who were obese; and those that had more healthful lifestyle habits (i.e. former smokers, higher fruit and vegetable consumers, and exercisers). (Knudtson, Klein and Lee, 2007)

National Health Interview survey is a national survey that is conducted annually with the goal of gathering health information on the non-institutionalized, civilian household population in the United States (Millen, Dodd, and Subar, 2004). In the 1987 survey, respondents were queried on the number of pills taken per day and pill dosage while the 2000 survey inquired about the frequency of use of NVM supplements in addition to the VM supplement. The participants who reported taking a NVM supplement were asked to indicate which supplements they used from a list generated by the researchers. (Gunther, Patterson, Kristal and Stratton, 2004). 23% of the population reported taking VM supplement in 1987 but this proportion increased by 10% in year 2000.

Generally women (38.7%), had the highest frequencies of use. It was found that VM supplement use significantly increased as education increased ($p < 0.01$) from less than 9th grade up to some college. It also increased significantly ($p < 0.01$) as individuals’ income increased from below the poverty level to at or above the poverty level. When herbal/botanical and NVM supplements were examined, it was found that 14.5% of US adults reported taking a NVM supplement in the last year, while 6.0% reported using one daily. The NVM supplements taken daily by more than 15% of users were: other herbal/botanical supplements, Echinacea, Ginkgo biloba, garlic pills, ginseng and St John’s wort. Garlic was found to be a popular herbal supplement in both surveys (Knudtson et al, 2007 and Gunther et al, 2004).

The Vitamins and Lifestyle (VITAL) study was a longitudinal cohort of 77,500 50-76-year-old adults from western Washington State. The study examined intake of 20 herbals/specialty supplements and 16 VM supplements (Schaffer, Gordon, Jensen and Avins, 2003). Results found that 1/3 of the cohort reported current use of at least 1 of the 20 herbal/specialty supplements listed. Women were more likely to take supplements overall. The five most

commonly used supplements by women were glucosamine, chondroitin, *Ginkgo biloba*, fish oils, and garlic pills. Men took glucosamine, chondroitin, saw palmetto, garlic pills, and *Ginkgo biloba* most frequently.

A 2003 study analyzing NVM supplement characteristics of a health maintenance organization in California found that use of herbal supplements was much greater than use of non-herbal supplements (29.3% versus 10.4%, respectively). Survey was a general health survey of Kaiser Permanente Medical Care Program of Northern California (KPMCP). Participants were at least 20 years of age. The herbal supplements most commonly used were Echinacea and *Ginkgo biloba*. Glucosamine was the most frequently reported non-herbal supplement by men and women over age 45 years (Harnack, Rydell and Stang, 2001).

A Minneapolis/St Paul, Minnesota-based study which focused on the use of herbal supplements only found a much higher reported rate of use at 61.2% in the past 12 months of the study. The survey was designed to assess prevalence of use of any herbal products. Rationale for using specific herbs was investigated also. Ginseng, Echinacea, garlic, *Ginkgo biloba*, St John's wort, ginger, ephedra, and goldenseal were reported to be taken by at least 10% of the study population. For five of the herbs the most reported reason for use was to promote general health/well-being (Marinac, Buchinger, Godfrey, Wooten, Sun and Willsie, 2007).

In developing countries, few studies have reported the prevalence of use of HDS. The focus of much research has been on complementary and alternative medicine (CAM). In a cross-sectional study conducted in three local government areas in Enugu State, Nigeria, it was reported that 84.7% of the adult population have used CAM while 15.3% have not used any form of CAM. The most commonly used CAM product was the biological products, followed by prayer/faith healing. Major reasons for using CAM include their natural state and also for health promotion and maintenance (Onyapat, Okoronkwo and Ogbonnaya, 2011).

Another study conducted among parents of children with epilepsy, asthma or sickle cell anaemia in Lagos State University Teaching Hospital (LASUTH), Ikeja recorded (31%) prevalence of use of CAM among patients (epilepsy -38%, sickle cell anaemia – 36% and asthma –25%). Biological products were the most frequently used CAMs (58%), followed by alternative

medical systems (27%) and mind-body interventions (14%) (Oshikoya, Senbanjo and Njokanma, 2008). Relations, friends and neighbours had a marked influence on 76% of the parents who used CAM for their children. Eighty-five (86%) parents were willing to discuss the use of CAM with their doctors but were not asked. CAM use was associated with adverse reactions in 7.1% of the patients. None of the parents disclosed to doctors that they used CAM for their children. The two main reasons for this were doctors not asking the parents (84.8%) and fear of the child not being treated (15.2%). However, the 84 parents who were not asked about CAM use for their children were willing to discuss such use if asked by the doctors (Oshikoya et al, 2008).

A descriptive cross-sectional study conducted to determine patterns of dietary supplement use and determinants among the elderly (65 years+) in the Keta municipal area, Volta region, Ghana showed that multivitamins were the most commonly used dietary supplements (41.74%) and a total of 242 (41.72%) of the 580 respondents in the study reported using at least one dietary or herbal supplements in the past week (Tamakloe, 2013).

2.7 Why people take dietary supplements

2.7.1 Supplementation of diet

Neuhouser and colleagues (1999) and Kennedy (2005), studied the rationale for use of dietary supplements in the U.S. Their findings revealed that participants took supplements for many different reasons, including difficulties encountered when trying to consume a balanced diet, to feel better, and for preventive purposes.

2.7.2 An alternative to conventional medicine

Use of herbal supplements was found to be an alternative to traditional medical care, used when conventional treatment was not working, or to treat conditions including colds, stomach illness, arthritis, and anxiety (Kennedy, 2005). Ambrose and Samuels found that herbal supplement users had a stronger belief in the safety of herbal supplements over prescription medications compared to nonusers (Ambrose and Samuels, 2004).

2.7.3 Health Promotion and disease prevention

Studies that focused on college students' beliefs about dietary supplements reported that the rationale for use included general health promotion and prevention of depression, (Newberry, Beerman, Duncan, 2001; Ambrose and Samuels, 2004). Other reasons cited were weight loss promotion, energy level elevation, and increased muscle development (Newberry et al, 2001; Perkin, Wilson and Schuster, 2002). A qualitative study among HIV patients in Ethiopia reported that HIV patients use ready to use supplementary foods (RUSF) with the motivation to get well. RUSF was described as a means to fill a nutritional gap, to “rebuild the body,” and protect it from harmful effects of antiretroviral treatment (ART) (Olsen, Tesfaye and Kaestel, 2013).

2.7.4 Boost immune function

Botanical supplements are purchased for many reasons, predominant among them to enhance immune function. A popular marketing statement for numerous dietary supplements and botanical products is that they “boost” the immune system (Swisher, Gordon, Jensen and Avins, 2002). Many of the most popular herbs sold in the United States, including Echinacea, cranberry, ginseng, milk thistle, Astragalus, and the medicinal mushrooms, are taken for their purported immune system effects. Many such products are advertised on the Internet; over 2.3 million hits were produced when the search term “immune herbs” was used. The abundant marketing of these products contributes to faulty public assumptions about herbs and other botanicals.

2.7.5 Improve menopausal symptoms

Another major reason for dietary supplement purchase is to treat menopausal symptoms (Powell, Dibble, Dall’Era and Cohen, 2002; Swisher et al., 2002). In previous decades, estrogen replacement therapy was used for this purpose, but data from studies such as the Women’s Health Initiative uncovered major detrimental effects (Lystinen, Pukkala and Ylikorkala, 2009, Rossouw, Anderson, Prentice, LaCroix, Kooperber, Tefanick, Jackson, Beresford, Howard, Johnson, Wootton, Kimzey, McCullagh, Wesley, Byrd, Singh, Rubbino and Puccino, 2002). In response to the major safety issues raised by large clinical trials of estrogen therapy, many herbal products were marketed for menopausal symptoms.

2.8 What are the dangers of some dietary supplements?

Many supplements contain active ingredients that have strong biological effects in the body. This could make them unsafe in some situations and hurt or complicate health. For example, the following actions could lead to harmful, even life-threatening, consequences (FDA, 1991).

- Combining supplements
- Using supplements with medications (whether prescription or over-the-counter)
- Substituting supplements for prescription medicines
- Taking too much of some supplements.

Some negative effects of dietary supplement are discussed below.

2.8.1 Interactions with other medications

Some dietary supplements may interact with other supplements or prescription and over-the-counter (OTC) medicines. Taking a combination of supplements or using the products with medications (whether prescription or OTC drugs) can cause dangerous interactions which could be life-threatening (Bent, Goldberg, Padula and Avins, 2005).

Some common negative interactions:

- Calcium can interact with heart medicine, certain diuretics, and aluminum and magnesium-containing antacids.
- Magnesium can interact with certain diuretics, some cancer drugs, and magnesium-containing antacids.
- Vitamin K can interact with blood thinners like Coumadin.
- St. John's Wort is known to adversely affect selective serotonin reuptake inhibitor (SSRI) drugs (i.e. anti-depressant drugs), and birth control pills.

The FDA (1999) has issued a healthcare warning that 5 herbal products used to treat diabetes actually contain prescription drugs that can interact with other diabetes therapies. The products to be avoided are:

- Diabetes Hypoglucoase Capsules
- Pearl Hypoglycemic Capsules

- Tongyi Tang Diabetes Angel Pearl Hypoglycemic Capsules
- Tongyi Tang Diabetes Angel Hypoglycemic Capsules
- Zhen Qi Capsules

2.8.2 Unwanted effects during surgery

Before surgical procedures advice is usually given to stop taking certain products 2 to 4 weeks ahead of time to avoid potentially dangerous supplement/drug interactions, such as changes in heart rate, blood pressure, and increased bleeding (Rispler and Sara. 2011).

2.8.3 Unwanted effects during pregnancy and lactation

Herbs to avoid while breastfeeding include aloe, black cohosh, buckthorn, cascada sagrada, kava kava, ma huang, sage, senna and wintergreen. Women who are pregnant or planning a pregnancy should discuss the use of any dietary supplement with their physicians and consider prenatal vitamins (with folic acid) instead (Pastore, 2000)

2.8.4 Naturally dangerous dietary supplements

Just because a product is on the market does not mean it is definitely safe. There are some known toxic herbs that are still available to the consumer, such as: aristolochia (linked to kidney failure and cancer in the U.S., China, Europe, and Japan); yohimbe (a sexual stimulant linked to heart and respiratory problems); bitter orange (has effects similar to those of the banned stimulant ephedra); and chaparral (linked to liver damage). (Flanagan, 2001).

2.8.5 Faulty assumptions

Two widespread faulty assumptions are that “natural” equals safe, and that long-term use connotes effectiveness. Unfortunately, neither of these assumptions is correct. Because a product comes from a plant does not mean that it is safe or beneficial. Similarly, the fact that botanical products or herbs remain in use for many years and even for millennia does not mean that they are effective. Most of the herbs and botanicals used in traditional cultures have not been subjected to rigorous scientific studies to evaluate their efficacy (Cassileth, Heitzer and Wesa, 2009).

2.9 Complementary and alternative medicine

The term complementary and alternative medicines generally refers to practices that are not integral parts of conventional or orthodox medicine, and are consequently not taught as part of the archetypal medical education curriculum (Hughes, Jacobs and Berman, 2005). The National Institute of Health (NIH) classifies CAM into five major categories:

- *alternative medical systems* (e.g. traditional oriental medicine, acupuncture, Ayurveda, naturopathy, homeopathy, Native American healing, Tibetan medicine),
- *mind-body interventions* (meditation, hypnosis, dance, art and music therapy, spiritual healing, and prayer),
- *biologic – based therapies* (herbal medicine and dietary supplements, special diets, and orthomolecular medicine),
- *manipulative and body-based methods* (chiropractic, massage, the Feldenkrais method, other "body work" systems, and aspects of osteopathic medicine such as craniosacral work),
- *energy therapies* (reiki, therapeutic touch, and other methods of affecting the "bioelectric field" of the body) (Hughes, Jacobs and Berman 2005).

Use of CAM is becoming more popular in the recent times especially due to the increasing cost, distrust and limitations of modern western medical care (WHO. 2003). In a study (Amira and Okubadejo, 2007) examining the use of CAM among hypertensive patients in Lagos University Teaching Hospital, 88% of them use CAM; herbal products were the most commonly used CAM. Furthermore, in a cross-sectional descriptive survey (Abodunrin, Omojasola and Rojuginbakan, 2011) conducted among adults in the Ilorin city of Nigeria the total prevalence of CAM use was 67.7% while the prevalence of the use of both indigenous and foreign alternative therapy use was 44.8% and 30.4% respectively.

2.10 Regulation and control of dietary supplements

Herbal supplements are considered foods, not drugs, by the Food and Drug Administration (FDA 1994) and, therefore, are not subject to the same testing, manufacturing, and labeling standards and regulations as drugs. Food safety is a serious issue globally, with legislative and administrative organs of government playing regulatory and surveillance roles. The Food and

Drug Administration (FDA) regulates safety of foods and dietary supplements in the United States. In Nigeria the Federal Ministries of Health, the National Agency for Food and Drugs Administration and Control (NAFDAC) and the Standard Organisation of Nigeria (SON) play similar roles.

Herbal remedies and dietary supplements are not classified as drugs by the US Food and Drug Administration (FDA). Therefore, although the 1994 Dietary Supplement Health and Education Act allows manufacturers to make claims intended to influence public opinion regarding the benefits of these products (DSHEA, 1994.), herbs and supplements are exempt from the rigorous federal regulations and testing required for products classified as prescription drugs.

Dietary supplements are not approved by the government for safety and effectiveness before they are marketed. If the dietary supplement contains a new ingredient, that ingredient will be reviewed by FDA (not approved) prior to marketing but only for safety, not effectiveness. The manufacturers and distributors of dietary supplements are responsible for making sure their products are safe before they go to market. Manufacturers are required to produce dietary supplements in a quality manner and ensure that they do not contain contaminants or impurities, and are accurately labeled. FDA/NAFDAC can take dietary supplements off the market if they are found to be unsafe or if the claims on the products are false and misleading.

Only recently has the FDA developed good manufacturing process guidelines for herbal products and dietary supplements. On November 4, 2004, the FDA released a strategy for dietary supplements that would focus on monitoring and evaluating product and ingredient safety, ensuring product quality, and monitoring and evaluating product labeling (Office of Nutritional Products, Labeling and Dietary Supplements., 2007 and FDA announces major initiatives for dietary supplements (press release, 2004). The focus of these measures is to protect consumers against dietary supplements that are unsafe, as well as those making unauthorized, false, or misleading claims. However, no policy has been adopted to date (FDA, 2006).

2.10.1 Good Manufacturing Practices (GMPs)

In the US, the FDA regulates dietary supplements via DSHEA. As required by DSHEA, FDA recently established dietary supplement good manufacturing practices (GMPs) to provide the baseline for quality standards among supplement manufacturers. GMPs, implemented in 2007 for rollout to all manufacturers by 2010, have the force of law. They are designed to ensure manufacturers follow procedures to keep products safe, effective, and free of harm. GMPs include requirements around the process of product supply, preparation, testing, and storage. GMPs also regulate the packaging and labeling of products.

2.10.2 National Agency for Food and Drug administration and control Decree No . 15 of 1993.

This is the decree establishing the National Agency for Food and Drug Administration and Control (NAFDAC). The Agency performs the following functions:

- (a) Regulate and control the importation, exportation, manufacture, advertisement, distribution, sale, and use of food, drugs, cosmetics, medical devices, bottled water and chemicals
- (b) Conduct appropriate tests and ensure compliance with standard specifications designated and approved by the council for the effective control of the quality of food, drugs, etc., as well as their raw materials and production, including processes in factories and other establishments.
- (c) Undertake appropriate investigations into the production premises and raw materials for food, drugs, etc. and establish relevant quality assurance systems, including certification of the production sites and regulated products.
- (d) Undertake inspection of food, drugs etc.
- (e) Compile standard specifications and regulations and guidelines for the production, importation, exportation, sale and distribution of food, drugs, etc.
- (f) Undertake registration of food, drugs etc. (g) Establish and maintain relevant laboratory or other institutions in strategic areas of Nigeria as may be necessary for the performance of its functions. The Federal task force on counterfeit and fake drugs established under the provisions

of the counterfeit and fake drugs (miscellaneous provisions) Act operates within NAFDAC. (Erhun, Babalola, Erhun, 2001).

2.10.3 Food and Drugs Act Cap 150 of 1990

This Act prohibits the sale of certain foods, drugs cosmetics and devices as treatment for certain diseases. The Act prohibits the importation, exportation, distribution and sale of specified drugs. It also prohibits practices such as misleading packaging, labeling, and advertising, as well as manufacturing food and drugs in unsanitary conditions. It conveys the power to appoint inspecting officers and food and drug analysts.

2.10.4 Classification and Labeling

Dietary supplements are classified as food products, but DSHEA stipulates that such products must be labeled as “dietary supplements” and be sold in the form of pills, capsules, tablets, gelcaps, liquids, powders, or other forms, and not be represented for use as conventional foods. Supplements also cannot be marketed as the only item in a meal or diet. Dietary supplement labeling may include claims about the supplement’s effect on the structure or function of the human body. However, the law requires that claims related to structure or function have substantiation and be truthful and not misleading.

As of March 1999, dietary supplement packages must bear a “Supplement Facts” panel, similar to the “Nutrition Facts” panel mandated for food labels by the Nutrition Labeling and Education Act (NLEA) of 1990. The purpose of this labeling is to provide information about nutrients and other dietary ingredients. Figure 1 shows a typical “supplement facts” panel (Kurtzweil, 1998). The label must list all dietary ingredients and the daily values (DV) of the amounts contained in a serving. If no DV has been established for a dietary ingredient, this must be indicated.

If a blend of ingredients is proprietary, the total quantity of ingredients per serving must be stated rather than the amount of each individual ingredient in the blend. If an ingredient is an herbal product, the part of the plant (such as the root or leaf) from which the ingredient is derived must be identified. The common name of the botanical as listed in Herbs of Commerce (American Herbal Products Association, Silver Spring, Md.) may be used; if a botanical is not listed in the book, the Latin binomial name (e.g., *Echinacea augustifolia* DC) must be used. The following

information also must appear on the label: statement of identity, which identifies the contents of the product; net quantity of contents; ingredient list (in descending order by weight); and the name and address of the manufacturer, packer, or distributor (FDA, 1997b).

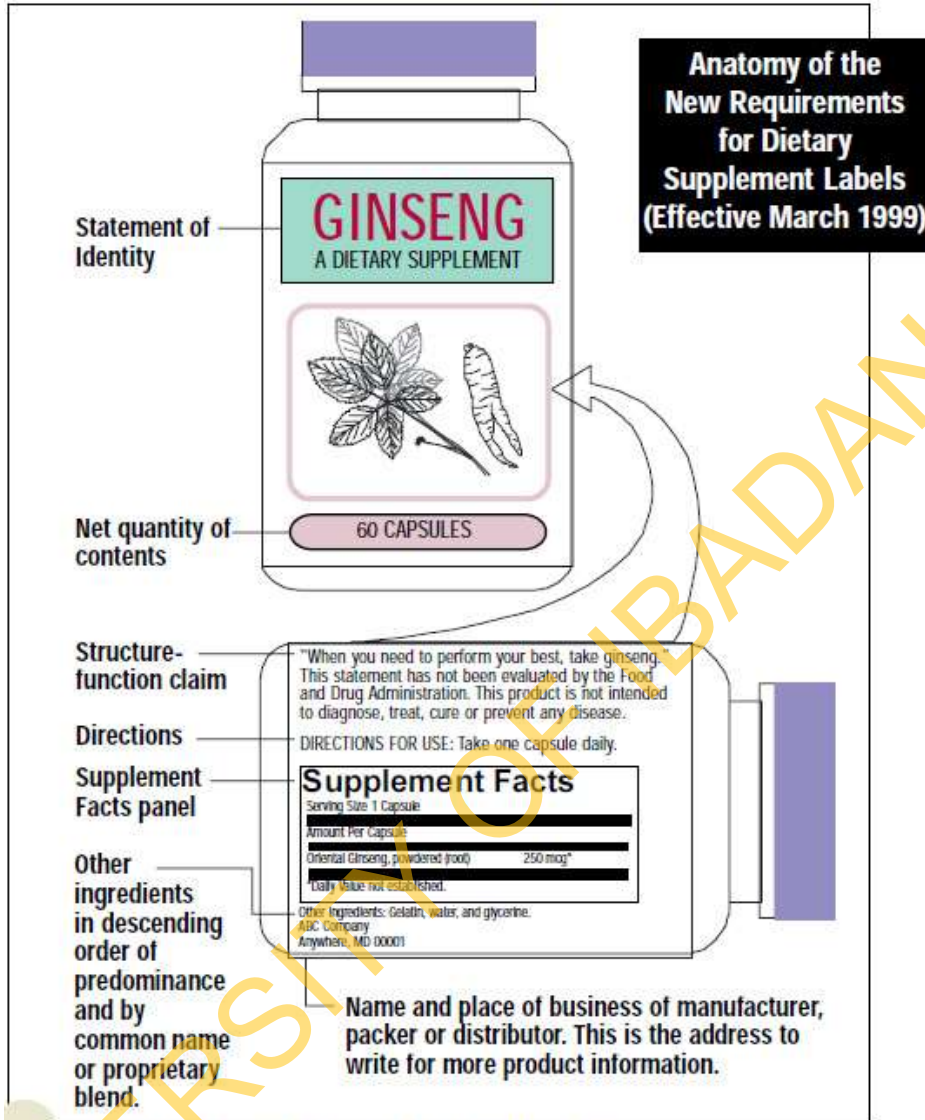


Fig.1—Dietary Supplement Label Format From Kurtzweil (1998)

2.11 Commonly used herbs



Figure 2.2 Echinacea (Jawad, Schoop, Suter, Klein and Eccles , 2012)

Echinacea is most commonly used for treatment of the common cold. A recent systematic review identified 16 randomized, placebo-controlled trials of Echinacea; 9 were positive and 7 were negative. The authors concluded that although there is some evidence of a possible benefit from *Echinacea purpurea* for treatment of the common cold, the results are not consistent (Linde, Barret and Woelkart, 2006). A subsequent large, high-quality randomized controlled trial found no benefit of *Chinacea angustifolia* for the treatment of experimentally induced rhinovirus infection (Turner, Bauer and Woelkart, 2005). However, some authorities believe that a different species (*Echinacea purpurea*) or a higher dose of the species studied, would have been more likely to find an effect (Blumenthal and Farnsworth, 2005). The herb is believed to be safe, with prior studies showing rates of side effects similar in *Echinacea* and placebo groups (Linde et al, 2006).



Figure 2.3 Ginseng (NIH National Library of Medicine's MedlinePlus, 2014)

Ginseng is primarily used to improve energy and physical or cognitive performance (Rotblatt and Ziment, 2002); it is found in many drinks and tonics. A systematic review identified 16 randomized, placebo-controlled trials of ginseng for physical performance, psychomotor performance, cognitive function, immunomodulation, diabetes mellitus, and herpes simplex type-II infections, and found no compelling evidence for efficacy for any indication (Vogler, Pittler and Ernst, 1999). Ginseng is believed to be safe, although there are some case reports of excessive arousal and hyperactivity (Vogler et al, 1999).



Figure 2.4 Ginko (Pittler and Ernst, 2002)

Ginkgo extracts are among the best characterized herbal products, and are generally standardized to 24% flavonoids and 6% terpenoids. Although reviews of prior trials have found inconsistent results, ginkgo is likely effective for dementia, providing a small benefit of approximately 3% in the Alzheimer's Disease Assessment Scale-Cognitive subtest (Oken, Storzbach and Kaye, 1998). It is interesting to note that ginkgo was not effective for improving cognitive function in elderly patients without dementia (Solomon, Adams and Silver, 2002). In a systematic review of 8 prior trials, ginkgo was found to improve pain-free walking distance in patients with claudication, a small benefit of unclear clinical significance (Pittler and Ernst, 2000). While side effects from ginkgo and placebo are similar in clinical trials (Pittler and Ernst, 2002), a significant concern regarding the use of ginkgo is the reported association with spontaneous bleeding (Bent et al, 2005).



Figure 2.5 Garlic (The world healthiest foods)

Garlic is used for many purported medicinal properties, but the most substantial body of research examines the effect on cholesterol. The most recent systematic review concluded that Garlic lowers cholesterol levels by 4–6% (Stevinson, Pittler and Ernst, 2000), which is a modest effect in comparison to the 17–32% reduction achieved with the use of statin drugs (Koren, 2005). The most common side effects are gastrointestinal problems and garlic breath (Stevinson, Pittler and Ernst, 2000). Two case reports suggest a possible increase in the risk of bleeding with garlic use (Burnham, 1995; Rose, Croissant and Parliament, 1990).



Figure 2.6 Peppermint (University of Maryland Medical center website, 2014)

Peppermint is a common ingredient in herbal products marketed to treat irritable bowel syndrome. Although a review of 8 prior trials suggests a possible benefit, the quality of the studies was too limited to reach definitive conclusions (Pittler and Ernst, 1998). Side effects appear to be infrequent and mild (Pittler and Ernst, 1998).



Figure 2.7 Ginger (Food matters, 2011)

Ginger is commonly used as a treatment for nausea. Only 3 prior randomized controlled trials have examined the efficacy of ginger for prevention of postoperative nausea, and although 2 suggested a benefit, the combined summary of the 3 studies did not find a statistically significant benefit (Ernst and Pittler, 2000). Other indications for ginger, including seasickness, morning sickness, and chemotherapy-induced nausea, offer preliminary although inconclusive evidence suggesting possible efficacy ((Ernst and Pittler, 2000). There are no known side effects (Rotblatt and Ziment, 2002).



Figure 2.8 Soy (Gunnars, 2014)

Soy is a common source of dietary phytoestrogens that has weak estrogenic activity, is commonly used for the treatment of menopausal symptoms (primarily hot flashes) and for lowering cholesterol. A recent systematic review identified nine clinical trials examining the effects of increased dietary soy and 9 additional trials examining the efficacy of soy extracts, and concluded that neither was effective for menopausal symptoms) (Lethaby, Brown and Marjoribanks, 2007). A recent review of 11 trials found that soy was effective for lowering total and low-density lipoprotein (LDL) cholesterol by 4–5% (Taku, Umegaki and Sato, 2007), a small effect comparable to that observed in studies of garlic (Stevinson, Pittler and Ernst, 2000).



Figure 2.9 Chamomile (NIH National Center for complementary and alternative medicine, 2014)

Chamomile has been used for thousands of years for numerous ailments and is commonly used in teas (as a mild sedative) or in herbal products used for sleep disorders, anxiety, or gastrointestinal problems. There are no high-quality scientific studies to support efficacy for any of these indications. The herb is generally believed to be safe, but there are case reports of serious allergic reactions (Ulbricht and Basch, 2005).



Figure 2.10 Kava (WebMD Medical Reference from Healthwise, 2014)

Kava is traditionally used in the islands of the south pacific as a sedative and relaxant. Prior clinical studies suggest a small benefit for the treatment of anxiety (Pittler and Ernst , 2003). Use of this herb has been limited by the reported association to several cases of severe hepatotoxicity (CDCP, 2002).



Figure 2.11 Moringa (Echo News Magazine, 1981)

Moringa leaves are rich in flavonoids, such as catechin polyphenols and especially epigallocatechin gallate (EGCG). It has been suggested that these extremely powerful antioxidants may have therapeutic applications in the treatment of many medical disorders and overall well-being. For usage as a supplement, *Moringa oleifera* is recommended mostly as being a highly nutritious antioxidant. While it is indeed nutritious, supplemental dosages are too low to acquire adequate nutrition from and this claim is not relevant. It is a relatively potent antioxidant, and while it seems to be less potent than other herbs when tested outside of a living system it does appear to be quite potent when tested in living models (Fashey, 2005). The reason for the increased potency in living models is not known. There are also anti-inflammatory effects that, while less studies, seem to be quite effective; one of the bioactives, 4-[(2'-O-acetyl- α -L-rhamnosyloxy)benzyl] isothiocyanate (RBITC), is effective in suppressing macrophage activation in the nanomolar range which is worth some future research. Preliminary human testing suggests some anti-diabetic effects, beneficial effects on pancreatic function and reduction of blood glucose level. The following table summarizes the facts given above (Holst, 2000).

Table 2.2: Commonly consumed herbs and evidence of their efficacy and safety

Herb	Common use	Scientific evidence	Safety
Echinacea	Upper respiratory tract infection	Inconclusive	Side effects similar to placebo
Ginseng	Physical and cognitive performance	Inconclusive	Limited data, hyperactivity and restlessness in case reports
Ginkgo bilobba	Dementia Cludication	Likely effective Likely effective	Side effects similar to placebo. Reports of bleeding
Garlic	Hypercholesterolemia	Likely effective	Mild gastrointestinal side effects and garlic odour , case report of bleeding
St John's wort	Depression	Likely effective for mild-moderate depression	Numerous reports of drug interactions
Peppermint	Upset stomach/irritable bowel syndrome	Inconclusive	Limited data, but side effects appear to be mild
Ginger	Nausea	Inconclusive	No known side effects
Soy	Menopausal symptoms	Not effective	Concerns regarding long term estrogenic effects
Chamomile	Insomnia/gastrointestinal problems	No high quality data	Rare allergic reactions
Kava kava	Anxiety	Likely effective	Case reports of severe hepatotoxicity

Bent, 2008

2.12 Conceptual Framework

A conceptual framework is the presentation of the proposed causal linkages of a problem among a set of concepts believed to be related to the specific health problem. It is developed with the aim of providing a guide to health education research and practice. It is not meant to incorporate all the factors of interest but rather to show only a small part of the causal web selected to explain the relationships among any variables of interest of the study valued for predictability, integration of information or analogy as the case may be. For this research, the conceptual model that will be adopted is the Social Learning Theory.

2.12.1 Social Learning Theory

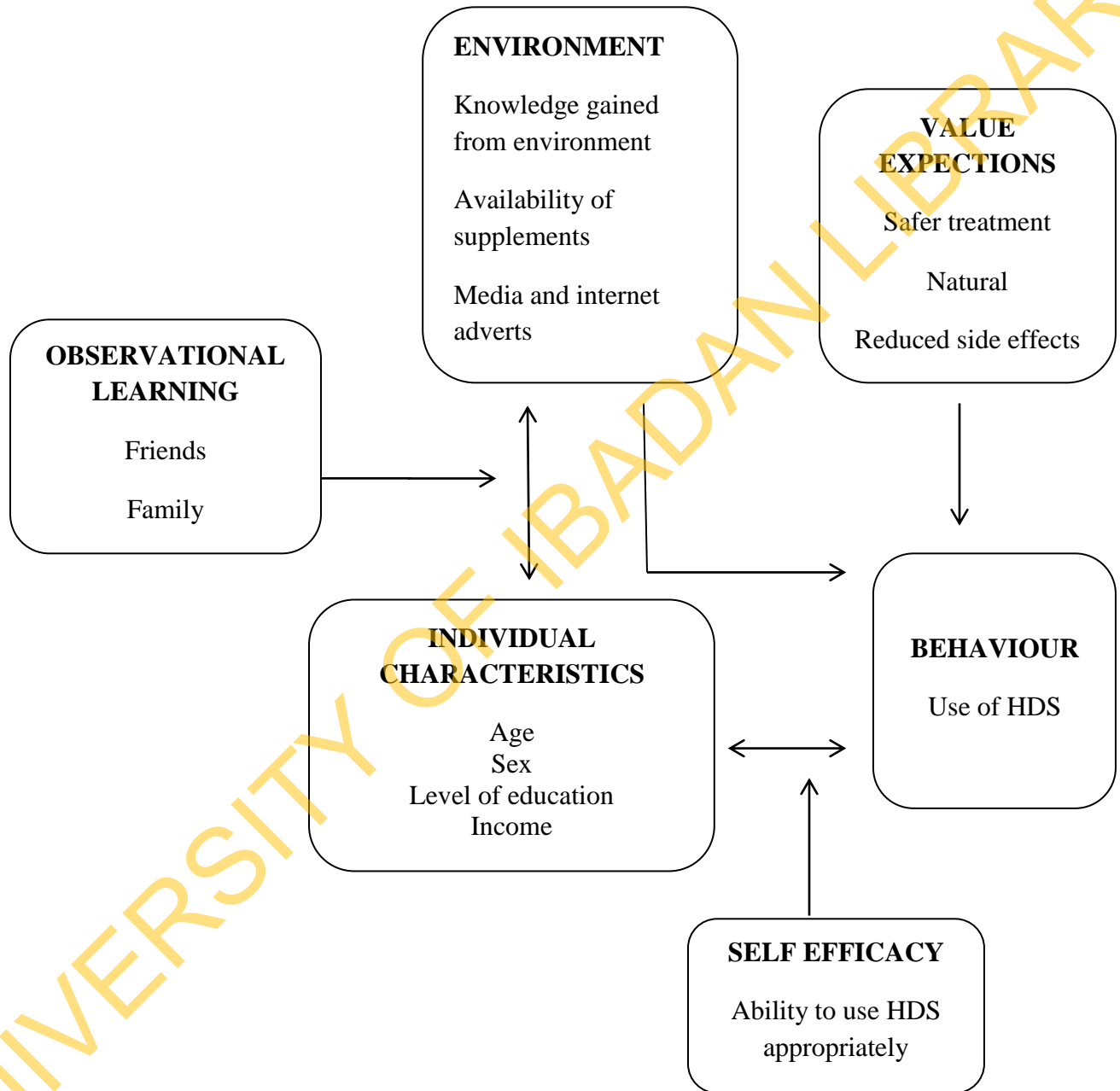
This study was guided by social learning theory by Albert Bandura (1986). According to this theory, behavior is determined by the influence of environmental factors (such as availability of HDS, advertisement and knowledge gained from environment), the socio-demographic characteristics of the person (age, sex, income, level of education) and how much the person learns through observation of events around him or her. This means that individuals determine their own behavior while being influenced by the environmental factors and their own behavior outcomes. The social learning theory perspective emphasizes social cognition and not simply coping.

Banduras social cognitive learning theory tends to focus more on cognitive expectancy, vicarious learning and self regulations as explanatory mechanism of HDS use. In this case, people who use HDS do so because they expect a natural and safer outcome compared to the one derived from conventional medicine. Bandura (1986) contends that behavior is largely regulated by cognitive factors such as knowledge of an issue and the pattern within the environment. Social cognitive theory emphasizes the role of observational learning with regard to the presence and influence of models.

In the context of this study, the researcher argues that people who use HDS have most likely learnt the behavior from the environment. This learning process must have been influenced by their personal characteristics. This study therefore seeks to explore this influence of selected

socio-demographic characteristics and knowledge gained from the environment on the use of HDS.

SOCIAL LEARNING THEORY



Source: Adapted from Bandura, 1986

CHAPTER 3

METHODOLOGY

3.1 Study Design and Scope

This was a cross-sectional survey limited in scope to the determination of prevalence, knowledge, and use of HDS among workers in Agricultural Research Institutes in Ibadan, Nigeria.

3.2 Description of Study Sites

Research institutes in Nigeria were established and are funded by the Federal Government. Each research institute has its mandate crops. The main aim is to conduct research, develop technologies and knowledge adaptable and applicable to local Nigerian situations. Research institutes in Nigeria are classified into five, namely: science and technology, agriculture, education, socio-economic and culture and medical research institutes. There are 16 agricultural research institutes in Nigeria out of which only four are located in Ibadan. Three of these institutes were used for this study; these were Forestry Research Institute, National Horticultural Research Institute and Institute for Agricultural Research and Training. The fourth research institute (Cocoa Research Institute, Idi-Ayunre, Ijebu Road) was used for pre-test.

The National Horticultural Research Institute (NIHORT), Ibadan started as the National Fruit and Vegetable Research and Development Centre (NFVRDC) with the assistance of UNDP/FAO Project NIR/72/007. By the Federal Government Agricultural Research Institutes Establishment Decree Order No. 35 of June 1975, the Centre metamorphosed into the National Horticultural Research Institute (NIHORT) along with other Agricultural Research Institutes. The Institute is under the coordination of the Agricultural Research Council of Nigeria (ARCN).

National Horticultural Research Institute is the only Horticultural Research Institute in Nigeria and West African with a mandate to carry out research on fruits, vegetables, spices and ornamental plants. These four categories of plants are made of more than one hundred different plants species. The institute has the mandate to conduct research into genetic improvement,

production, processing, storage, utilization and marketing of tropical fruits, vegetables, spices and ornamentals plants of both nutritional and economic importance.

The Forestry Research Institute of Nigeria (FRIN) was established as Federal Department of Forest research in 1954 to conduct research into all aspects of forestry and forest products utilization and for the training of technical and sub technical personnel for the forestry services in the country. The mandate has since been extended to include research in wildlife, watershed management and agroforestry. It has six large specialised research departments – each having various specialised sections, three support units, 10 outstations spread across all ecological zones of the country, four service departments and four ND/HND awarding Colleges. The various departments include: Department Of Forest Conservation And Protection, Department Of Forest Products Development And Utilization Department, Department Of Forest Economics And Extension, Information And Documentation Department, Department Of Planning, Research, Statistics And Biometrics, The Pension Unit and The Legal Service Unit.

The Institute of Agricultural Research and Training (IAR&T) is a Nigerian agricultural research institute with headquarters at Ibadan. Its history dates back to 1956 when the then Western regional government under the Ministry of Agriculture and the federal government decided to share the research facilities of Moor Plantation, Ibadan. When the regional government established a University at Ife, the institute became part of the university and was fully integrated in 1973. In 1975, the institute was given a national mandate and was later funded by the Federal Ministry of Science and Technology and then the Federal Ministry of Agriculture. The agency like a few other research institutes has undergone various supervisory changes. The institute conducts research on various cereals and legumes such as maize, jute, kenaf and sisal hemp, soil and also on fertilizer use and farming systems. It has sub stations at Ilora, Ile-Ife, Balla-Ilorin, Ikenne, and Orin-Ekiti.

Agricultural research institutions in Nigeria vary widely on mandate crops but one thing that is common to all is the mandate of developing value added products and analyzing the chemical components of their plants of focus. Thus, workers in agricultural research institutes are expected to have access to information relating to beneficial effects of plants and plant parts which are

majorly used in HDS, they are role models to the general public on issues related to use of plants as nutrient and health materials.

3.3 Study Population and Sample Size Determination

The study population consisted of male and female workers in agricultural research institutes. Temporary, contract staff and pregnant women were excluded from the study. The sample size (n) was determined by using Lwanga and Lemeshow (1991) sample size formula:

$$n = \frac{Z^2 p(1-p)}{d^2}$$

Where n=minimum sample size required

Z= confidence limit of survey at 95% (1.96)

P= Proportion of users of herbs taken at 50% (No known prevalence in literature)

d=absolute deviation from true value (degree of accuracy) = 5%

$$n = \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2} = 253.6, \text{ approximate} = 384$$

A non-response rate of 10% of 384 = $384 \times 0.1 = 38.4 = 38$

was added to sample size calculated to make sample size 422 in order to address any possible case of incomplete response.

3.4 Sampling Technique

The total number of workers in each research institute's headquarter situated in Ibadan was obtained from the record office. A proportionate sampling technique was used to select 422 workers which spread across research, technical and other support staff. Respondents were randomly selected from each of the three agricultural research institutes in Ibadan.

3.4.1 Distribution of staff in the Research Institutes

S/No	Research Institutes	Research staff (n)	Technical staff (n)	Support staff (n)	Total (N)
1	NIHORT	98	180	185	463
2	FRIN	223	490	337	1050
3	IAR&T	154	510	436	1100
	TOTAL	475	1180	958	2613

Proportionate calculation for sample size determination

NIHORT: $\frac{98 \times 422}{2613} = 15.8 = 16$ research staff

$\frac{180 \times 422}{2613} = 29.1 = 29$ technical staff

$\frac{185 \times 422}{2613} = 29.9 = 30$ support staff

FRIN: $\frac{223 \times 422}{2613} = 36.0 = 36$ research staff

$\frac{490 \times 422}{2613} = 79.1 = 79$ technical staff

$\frac{337 \times 422}{2613} = 54.4 = 54$ support staff

IAR&T: $\frac{154 \times 422}{2613} = 24.8 = 25$ research staff

$\frac{510 \times 422}{2613} = 82.4 = 82$ technical staff

2613

$$\frac{436 \times 422}{2613} = 70.4 = 70 \text{ research staff}$$

2613

Proportion of respondents in the Research Institutes

S/No	Research Institutes	No of Research staff	No of Technical staff	No of support staff	Total number of staff
1	NIHORT	16	29	30	75
2	FRIN	36	79	55	170
3	IAR&T	25	82	70	177
	TOTAL	77	190	155	422

3.5 Method and Instrument for Data Collection

Information gathered from reviewed literature was used to guide the design of a self-administered semi-structured questionnaire that was used in this study. The structured questionnaire consisted of set questions that were closed-ended. The instrument was designed to address the objectives of the study. It was divided into five sections. Section 1 focused on the socio-demographic information about the respondents, section 2 assessed the reported use HDS, section 3 assessed the reasons for usage of HDS, section 4 assessed the knowledge of use of HDS and section 5 explored the factors associated with the use of HDS.

3.6 Method of Data Collection

Two research assistants who were literate, mature and have had previous experiences on data collection were recruited and trained for two days. They helped in administering copies of questionnaire in the Research Institutes. The contents of the training included purpose of the study, interpersonal communication and data collection procedures. Data were collected within two weeks. Questionnaires were self-administered and clarifications were sought from research assistants on any items or questions.

3.7 Validity and Reliability

3.7.1 Validity: Validity of the instrument was ensured through the development of a draft instrument by consulting relevant literatures, subjecting the draft to independent, peer and expert reviews, particularly expert in public health and comments from supervisor was used to further fine-tune the instrument.

3.7.2 Reliability: Reliability refers to the consistency of a measure. A measure is said to have high reliability if it produces consistent results under consistent conditions. The instrument was pre-tested among workers in Cocoa Research Institute, Idi-Ayunre, Ijebu Road, Ibadan using 10% of the sample size calculated. Copies of pre-test questionnaires were coded, entered into a computer and analysed. Reliability was determined using the Cronbach's Alpha coefficient. For this study, the Cronbach's alpha coefficient was 0.77 which was considered to be reliable.

3.8 Data Management and Analysis

The principal investigator checked all copies of administered questionnaire one after the other for purpose of completeness and accuracy. Serial number was assigned to each question for easy identification and for correct data entry and analysis. These questionnaires were then kept in a file for proper safe keeping. A coding guide was developed to facilitate data entry. The information in the filled questionnaires were coded with the aid of the developed coding guide and entered into SPSS version 18 for analysis. Knowledge of use of HDS was assessed using a 15-point scale. A score of 0-5 points was classified as poor knowledge, >5-10 was classified as fair and above 10 points was classified as good knowledge. The data entered into the computer were subjected to descriptive (mean, percentages and frequencies) and inferential (Chi-Square test, logistics regression) statistical analyses; the findings were presented in tables and figures.

3.9 Ethical Consideration

Verbal informed consent was obtained from respondents. Ethical issues like confidentiality, opportunity to decline participation and non-exposure to risk was assured. Only respondents who were able to give informed consent (i.e. were able to demonstrate understanding of the objectives of the study and the implication of their role in it) were recruited into the study. They were informed that participation is voluntary and that data collected would be used mainly for research

purposes. Anonymity and confidentiality of responses were ensured. The respondents were assured of being informed about the results of the study.

3.10 Limitations of the study

Limitations of the current study include the use of set questions, which limited the discussion to certain types of HDS and reason for usage HDS. This study was conducted in three agricultural research institutes in Ibadan, which makes the results of limited generalizability. Future studies should explore different populations such as adolescents, the elderly, pregnant women, children and people with certain health challenges.

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CHAPTER FOUR

RESULTS

4.1 Socio-demographic information

Age of respondents ranged from 18-57 years with a mean age of 38.1 ± 8.7 years. The other socio-demographic information of respondents is displayed in Table 4.1.1 Males accounted for 54.8% of the respondents. Most of the respondents fell into 31-45 years age category (55.3%) followed by those within 18-30 years age category (23.7%) and 21.0% were between 46-60 years. About three quarter of the respondents (72.2%) were married and 19.5% were single. The majority of the respondents were Christians (86.8%) with only 12.7% practicing Islam and 0.5% traditional religion. Respondents who had higher diploma, degree, and masters accounted for 25.8%, 22.8% and 21.5% respectively of the respondents.

Forty two percent of respondents worked in IAR&T, 38.0% work in FRIN with only 20.0% working in NIHORT. Most of the respondents were technical staff (43.0%) followed by the support staff (37.0%) and research staff being the 20.0%. In addition, respondents who have spent 1-2 years, 3-5 years, 6-10 years and above 10 years were 15.4%, 30.4%, 28.8% and 24.6% respectively

Table 4.1.1 Socio-demographic information of respondents (N=392)

Variable	Frequency	Percentage (%)
Sex (n=392)		
Male	215	54.8
Female	177	45.2
Total		100.0
Age (n=329)		
18-30	78	23.7
31-45	182	55.3
46-60	69	21.0
Total		100.0
Marital status (n=390)		
Single	76	19.4
Married	305	78.2
Separated	3	0.8
Divorced	3	0.8
Widow	3	0.8
Total		100.0
Religion (n=385)		
Christianity	334	86.8
Islam	49	12.7
Traditional	2	0.5
Total		100.0
Highest Education (n=391)		
Primary school	1	0.2
Secondary School	39	10.0
Ordinary Diploma	54	13.8
Higher Diploma	101	25.8
Degree	89	22.8
Masters	84	21.5
Doctorate	19	4.9
Others	4	1.0
Total		100.0

4.2. Use of herbal dietary supplements

Figure 4.2.1 below highlights that 263 (67.1%) of respondents had ever used HDS and 129 (32.9%) had never used HDS. Only 123 (46.8%) were currently using HDS while 140 (53.2%) were not currently using HDS.

The frequency of consumption is presented in Figure 4.2.2 More than half of respondents took HDS occasionally (54.5%), 30 (24.8%) took them weekly, 24 (19.8%) daily and only one person (0.8%) did not specify how often he or she took HDS.

As shown in Table 4.2.1, moringa, garlic, ginger and aloe vera were the HDS mostly taken among respondents who have ever used HDS; 67.9%, 47.3%, 45.0% and 32.2% of respondents were taking them respectively. However, there was an increase in the proportion of respondents taking garlic and ginger among current users. Sixty eight percent, 59.5%, 54.5%, 33.1% of current users took moringa, garlic, ginger and aloe vera respectively.

Eighty one (20.7%) respondents were on prescription medication and 58 (71.5%) out of these people combined with HDS (Figure 4.2.3).

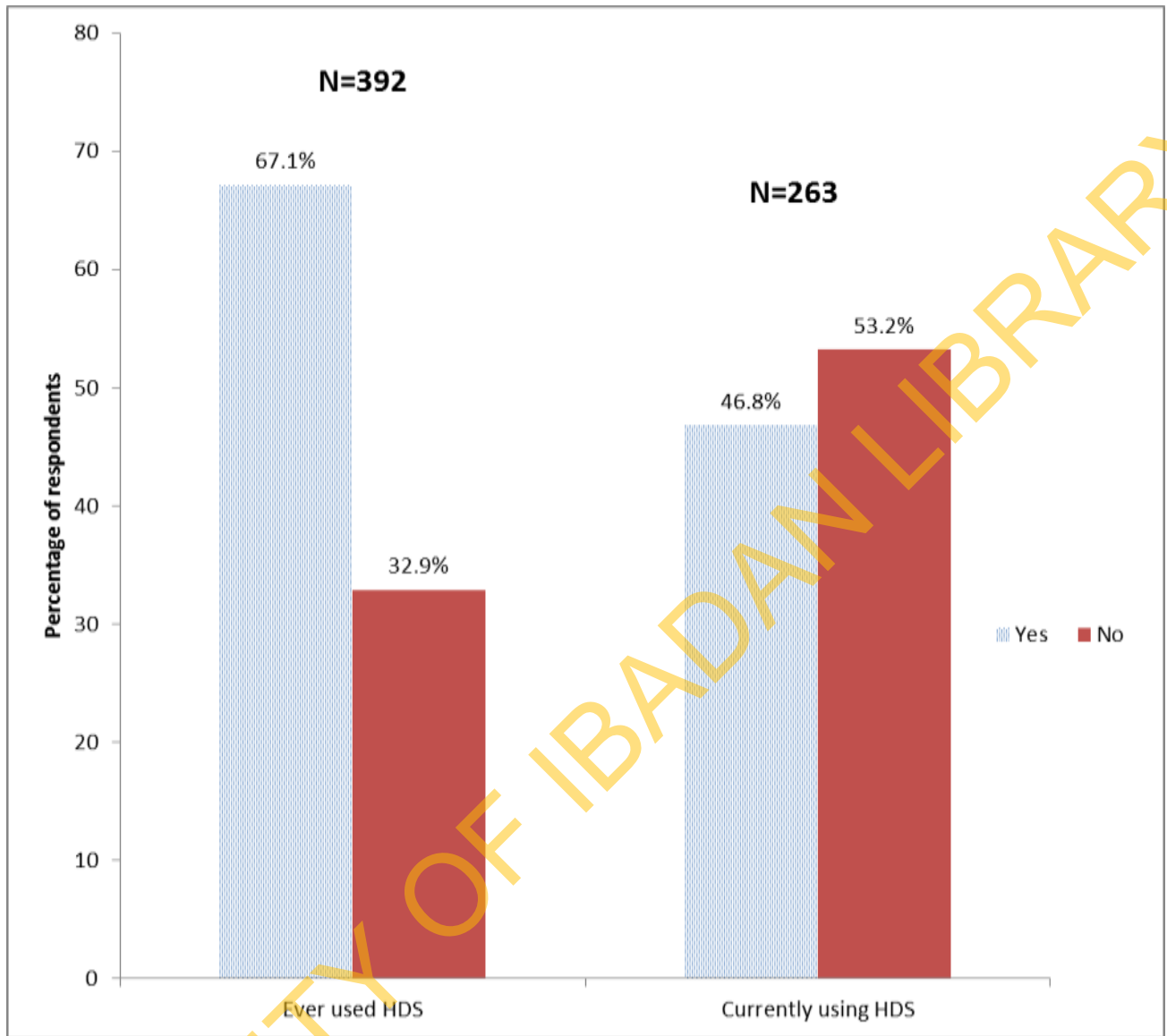


Figure 4.2.1 Use of herbal dietary supplements among respondents

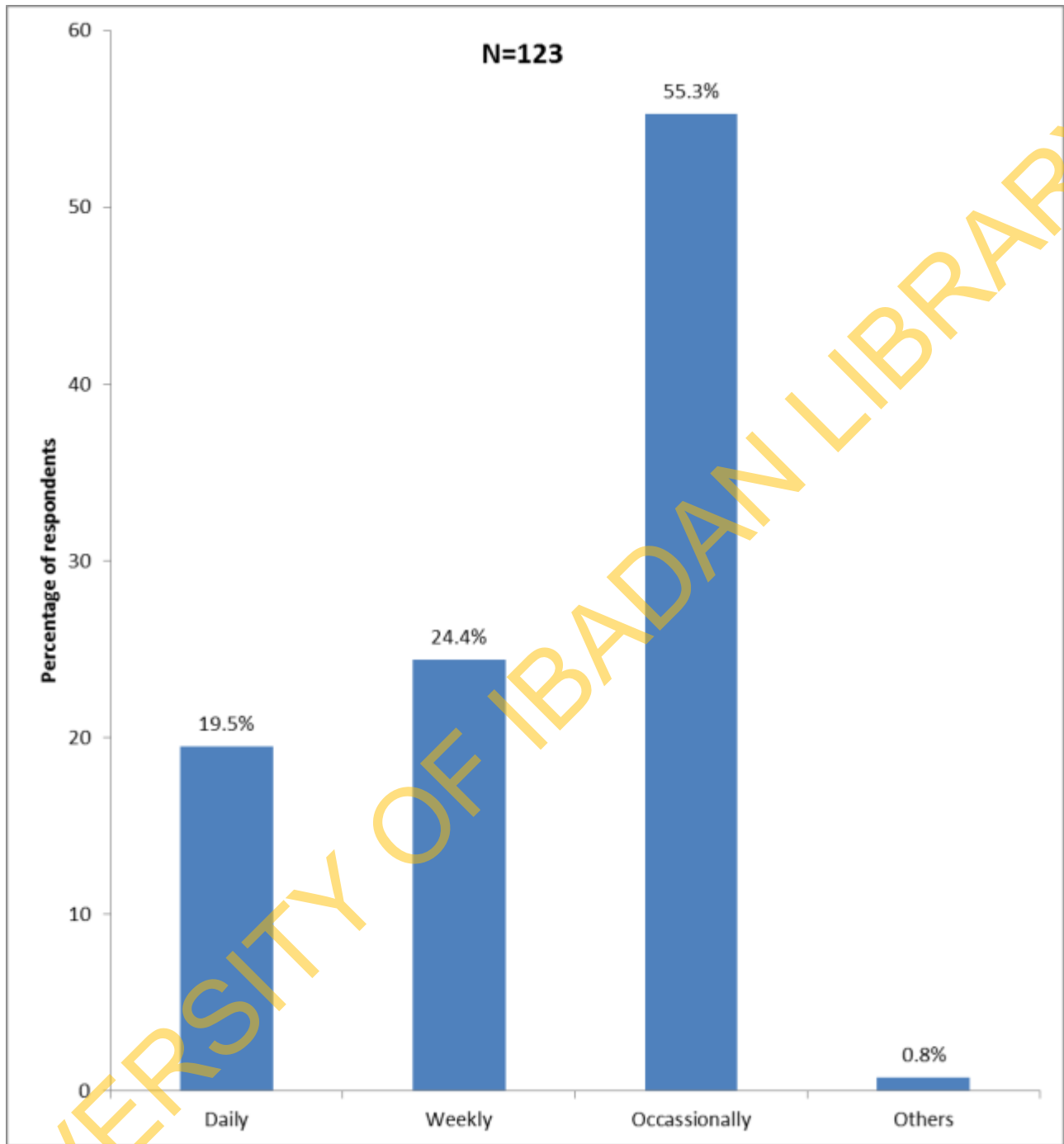


Figure 4.2.2 Frequency of use of herbal dietary supplements among current users

Table 4.2.1 Herbal dietary supplements reported among users (N=262)

**Herbal dietary supplement	Ever used HDS		Currently using HDS	
	N	%	N	%
Ginseng	38	14.5	15	12.4
Echinacea	8	3.1	3	2.5
GinkoBiloba	9	3.4	3	2.5
Green tea	70	26.8	32	26.4
Garlic	124	47.3	72	59.5
Moringa	178	67.9	83	68.6
Aloe vera	87	32.2	40	33.1
Ginger	118	45.0	66	54.5
Others	28	10.7	19	15.7

**** Multiple responses were allowed**

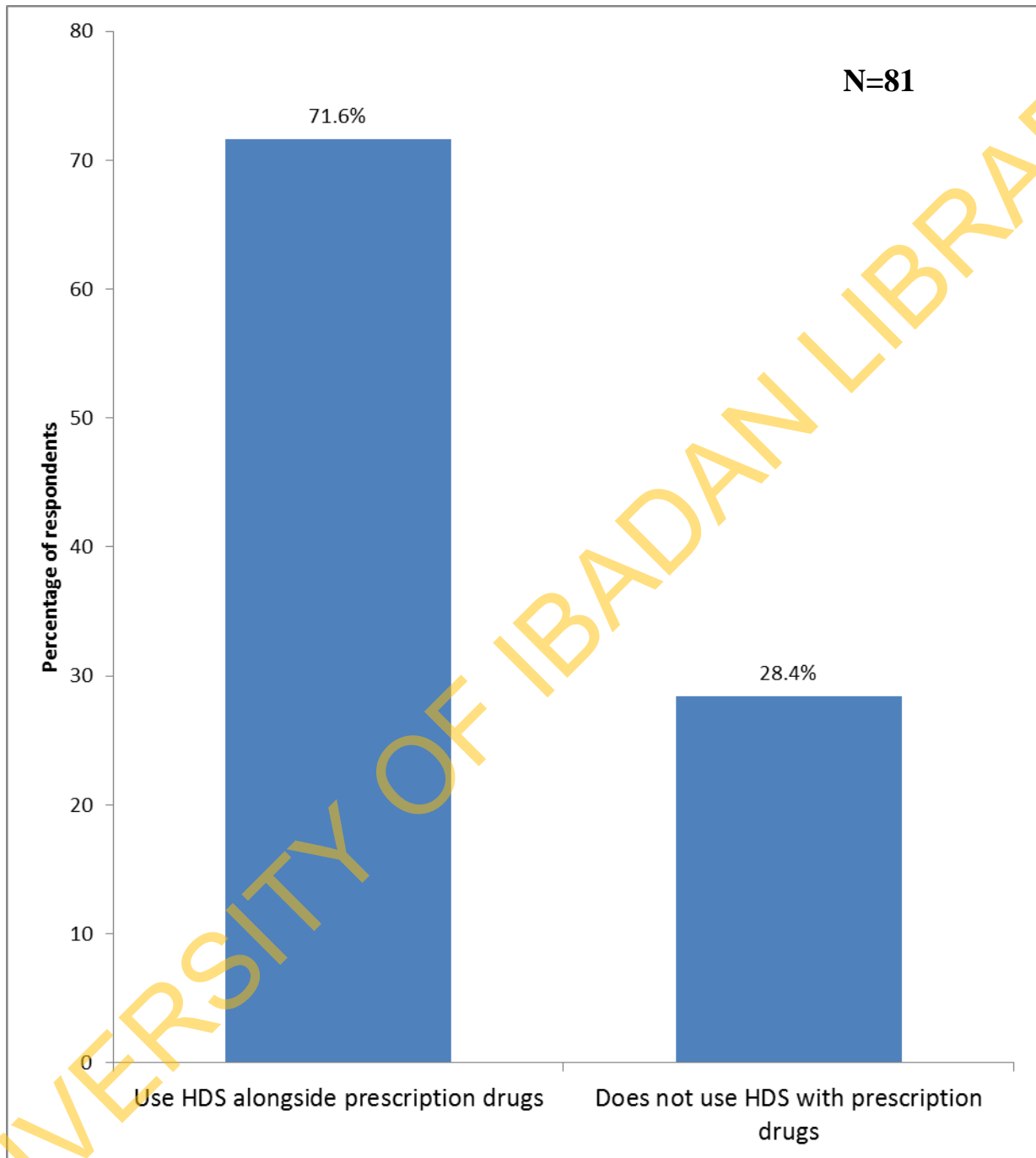


Figure 4.2.3 Use of HDS among those on prescription drugs

4.3. Reasons for usage of herbal dietary supplements

The reasons for using HDS among both who had ever used and those currently using HDS are presented in Table 4.3.1. Many respondents (51.5%) used HDS to prevent diseases, 46.2% used them to improve energy, 36.6% to relieve stress or improve mood, 35.9% for supplementing inadequate diet, 30.9% for treating diseases and 22.9% to enhance sleep. Less than 20.0% each used HDS for weight loss, improving circulation, treating cold, promoting skin or hair health and improving libido while less than 10.0% each used HDS for weight gain and other purposes.

Out of those that used HDS to prevent or treat diseases, 33.2% of them used it to prevent or treat diabetes, 22.1% for hypertension, 16% for skin infection, 10% for malaria fever, 6.9% for oral infection, 3.4% for cancer, 3.2% for typhoid fever, 2.3% for mental health and 17% did not specify the disease conditions they were using HDS for (Table 4.3.2).

The reasons respondents used HDS for the first time are presented in Figure 4.3.1. Seventy three (27.9%) of them used HDS at first because they read or heard about it from the media/internet, 52 (24.2%) were advised by their family or friend to use it, 40 (15.2%) used HDS after a personal research and 30 (11.5%) used it because the information on the package was convincing. The proportion of people who started to use HDS for other reasons was less than 10.0% each.

Table 4.3.1 Reasons for usage of herbal dietary supplements (both ever used and currently using) (N=263)

**Reasons	N	Percentage (%)
To prevent diseases	135	51.5
To improve energy	121	46.2
To relieve stress or improve mood	96	36.6
To supplement inadequate diet	94	35.9
To treat/cure diseases	81	30.9
To enhance sleep	60	22.9
To promote weight loss	50	19.1
To improve circulation	49	18.8
To treat cold	39	14.9
To improve libido	36	13.7
To promote skin or hair health	33	12.6
To improve memory	27	10.3
To promote weight gain	15	5.7
Others	9	3.4

**** Multiple responses were allowed**

Table 4.3.2 Types of disease conditions respondents ever used herbal dietary supplements to manage or treat (N=216)

**Diseases	N	Percentage (%)
Diabetes Mellitus	130	33.2
Hypertension	58	22.1
Skin infection	42	16.0
Malaria	26	10.0
Oral infection	18	6.9
Cancer	9	3.4
Typhoid	8	3.2
Mental illness	6	2.3
Others	47	17.0

****Multiple responses were allowed**

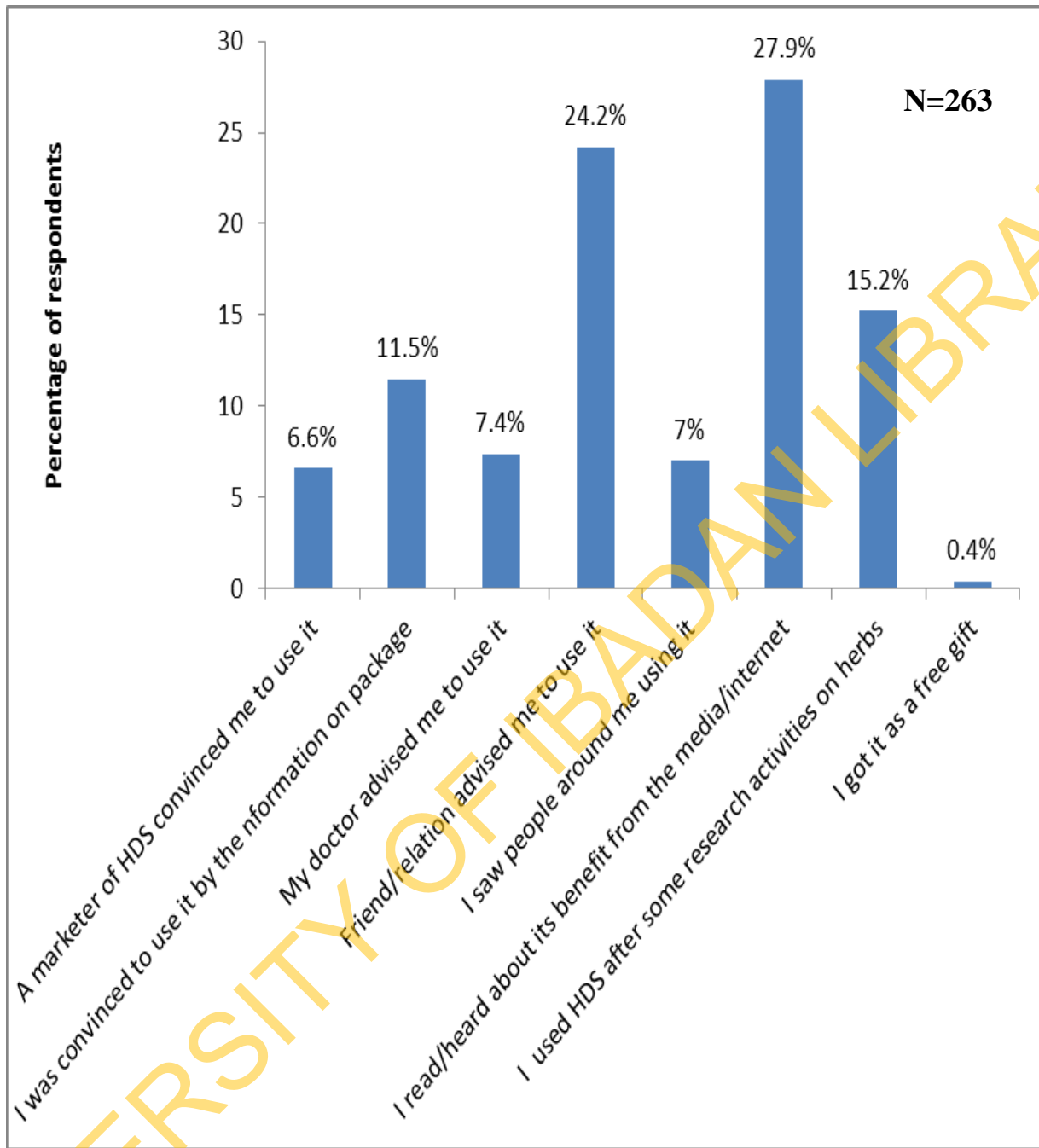


Figure 4.3.1 The most appropriate reasons why respondents ever started to use herbal dietary supplements

Table 4.3.3 below revealed the reasons why some respondents did not use HDS. Among respondents who did not use HDS, those who said they did not need HDS (22.4%) had the highest proportion. This was followed by those who did not like herbal products (15.9%), those who did not believe in it (14.9%), those who had no specific reasons (13.8%), those who were not aware of it (13.7%) and those who were not interested (5.3%). The proportion of people with other reasons was below 5.0% each.

Table 4.3.3 Reasons why some respondents were not using herbal dietary supplements (N=128)

Reasons	Frequency	Percentage (%)
I don't need it, I am okay with my body	21	22.4
I don't like it	15	15.9
I don't believe in it	14	14.9
I am not aware of it	13	13.7
I am not interested in herbal products	5	5.3
Biblically it's not right/because of my faith	4	4.3
I think they have side effects	3	3.3
They are too expensive	2	2.1
HDS are not properly processed	2	2.1
I am allergic to some herbs	1	1.1
HDS do not have dosage	1	1.1
No reason	13	13.8

4.4. Knowledge of appropriate use of herbal dietary supplements

The level of knowledge of respondents on the use of HDS is presented in Figure 4.4.1. Majority of them (69.1%) had poor knowledge, 27.3% had fair knowledge and only a small proportion had good of knowledge (3.6%).

When presented with questions related to use of HDS, only 5.2% could define or describe HDS correctly, 13.6% knew the forms in which HDS are presented and 37.1% knew that HDS are administered orally. Furthermore, 2.9% knew how HDS are controlled or regulated by concerned agencies, 1.3% could differentiate correctly between HDS and prescription drugs, 2.3% were able to differentiate correctly between HDS and other herbs, and 38.6% knew that HDS can have negative effects.

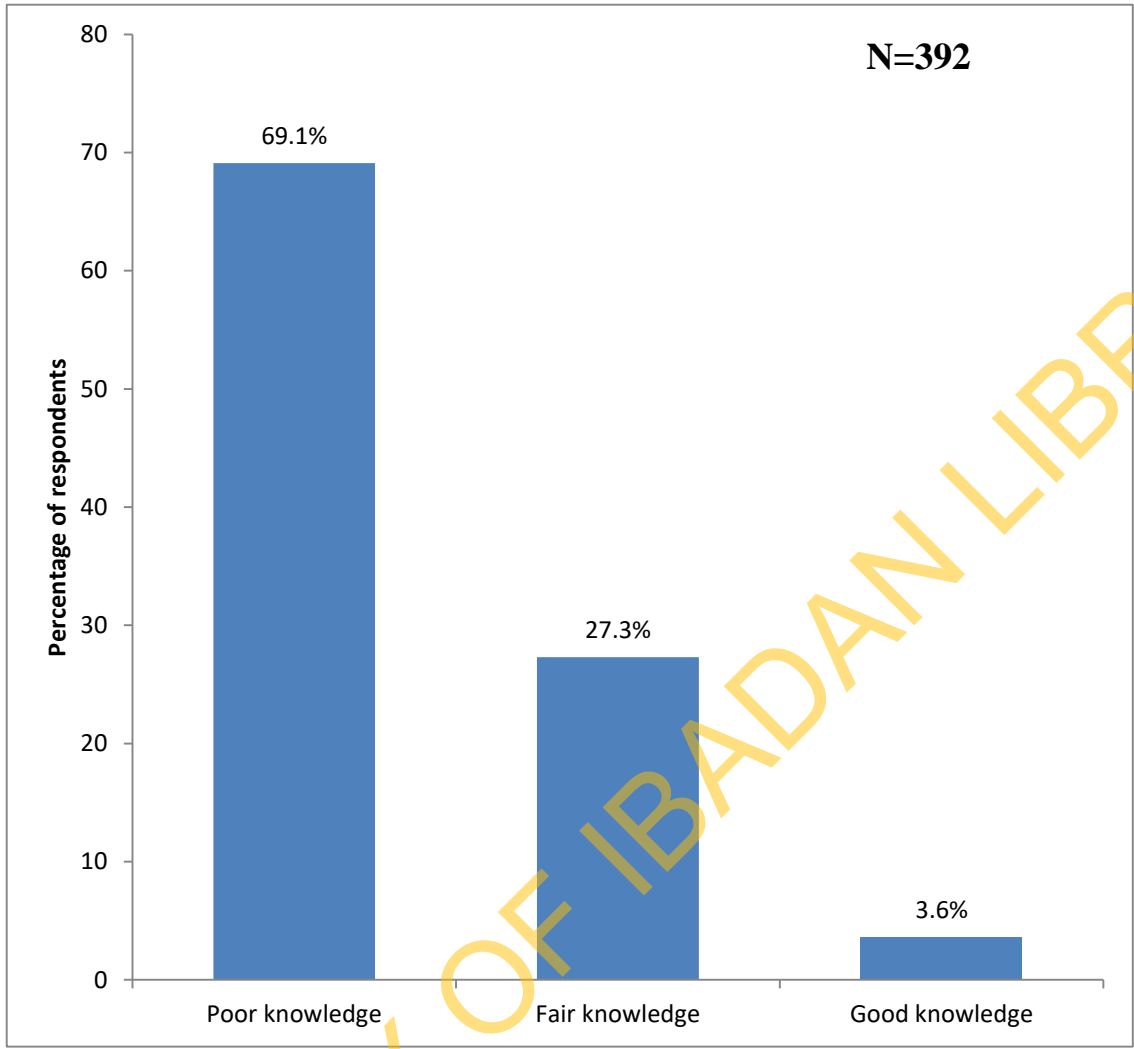


Figure 4.4.1 Proportion of respondents with different levels of knowledge of appropriate use of HDS

4.5 Perceived factors associated with the use of herbal dietary supplements

Table 4.5.1 outlines the responses to the questions on the extent to which respondents agreed that factors influence the use of HDS. Fifty seven percent strongly agreed that the health status of an individual could influence the use of HDS while 37.5% agreed; with only 3.6% and 1.3% disagreeing and strongly disagreeing respectively. Sixteen percent strongly agreed that the type of job an individual does could influence the use of HDS while 38.5% agreed; with 21.9% and 8.2% disagreeing and strongly disagreeing respectively. Sixty six percent strongly agreed that the level of education of an individual could influence the use of HDS while 44.3% agreed; with 25.5% and 9.2% disagreeing and strongly disagreeing respectively. Furthermore, 27.2% strongly agreed that the economic capacity of an individual could influence the use of HDS while 50.8% agreed; with only 16.9 and 5.1% disagreeing and strongly disagreeing respectively. Only 14.9% strongly agreed that the availability of HDS could influence its use while 59.9% agreed; with 21.9% and 3.3% disagreeing and strongly disagreeing respectively. Thirty eight percent strongly agreed that family and friend of an individual could influence the use of HDS while 51.8% agreed; with only 8.0% and 1.6% disagreeing and strongly disagreeing respectively.

Table 4.5.1 PERCEIVED FACTORS ASSOCIATED WITH HERBAL DIETARY SUPPLEMENTS (N=263)

PERCEIVED FACTORS	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
	%	%	%	%
Health status	57.6	37.5	3.6	1.3
Type of job	20.6	49.3	21.9	8.2
Level of education	21.0	44.3	25.5	9.2
Economic capacity	27.2	50.8	16.9	5.1
Availability of HDS	14.9	59.9	21.9	3.3
Family and friends	38.6	51.8	8.0	1.6

4.6 Hypotheses testing

Hypothesis one: There is no significant association between age and reported use of HDS among workers in agricultural research institutes in Ibadan.

Table 4.6.1 below showed that there is a significant association between age and use of HDS, therefore, the null hypothesis is rejected. The alternative hypothesis is true. Use of HDS increased with age, more than half of HDS users belonged to the 31-45 years age brackets.

Table 4.6.1 Chi-square test of the association between age and use of HDS

Use HDS	Age (years)			Total	X ²	df	p-value
	18-30	31-45	46-60				
Yes	43 19.0%	133 58.8%	50 22.1%	226 100.0%	8.756	2	0.013
No	35 34.0%	49 47.6%	19 8.4%	103 100.0%			
Total	78 23.7%	182 55.3%	69 21.0%	329 100.0%			

Hypothesis two: There is no significant association between sex and reported use of HDS among workers in agricultural research institutes in Ibadan.

Table 4.6.2 below showed that there is a significant association between sex and use of HDS, therefore, the null hypothesis is rejected. The alternative hypothesis is true. More males used HDS compared to females.

Table 4.6.2 Chi-square test of the association between sex and use of HDS

Use HDS	Sex		Total	X ²	df	p-value
	Male	Female				
Yes	160 60.8%	103 39.2%	263 100.0%	11.577	1	0.001
No	55 42.6%	74 57.4%	129 100.0%			
Total	215 54.8%	177 45.2%	392 100.0%			

Hypothesis three: There is no significant association between knowledge and use of HDS among workers in agricultural research institutes in Ibadan.

Table 4.6.3 below showed that there is a significant association between knowledge and use of HDS, therefore, the null hypothesis is rejected. The alternative hypothesis is true.

Table 4.6.3 Chi-square test of the association between knowledge and use of HDS

Use HDS	Level of knowledge			Total	X ²	df	P value
	Poor	Fair	Good				
Yes	167 63.5%	85 32.3%	11 4.2%	263 100.0%	11.894	2	0.003
No	104 80.6%	22 17.1%	3 2.3%	129 100.0%			
Total	271 69.1%	107 27.3%	14 3.6%	392 100.0%			

4.7 Significant predictors of herbal dietary supplement use

Table 4.7.1 summarizes the variables and perceived factors that are useful in predicting whether respondents will or will not use herbal dietary supplements. Only level of education, level of knowledge, job type and economic capacity were significant predictors of HDS use. Respondents that had a good knowledge of appropriate use were less likely to have used HDS, (OR: 0.8, 95% CI: 0.8-0.9) and respondents that had a doctorate degree were less likely to have used HDS, (OR: 0.3, 95% CI: 1.1-1.6. Respondents who agreed that type of job (OR: 1.8, 95% CI: 0.1-3.5) and economic status (OR: 2.3, 95% CI: 0.2-4.6) could influence the use of HDS the more likely to use HDS.

Table 4.7.1 Summary of logistic regression analysis showing variables/factors useful in predicting use of herbal dietary supplements (N=390)

Demographic Factors	P-value	Odds ratio	95% Confidence Interval
Age	0.624	1.003	0.991 - 1.015
Sex (Male)	0.077	1.696	0.944 - 3.047
Number of years on the job	0.869	1.024	0.770 - 1.362
Highest level of education (Doctorate)*	0.008	0.346	1.081 - 1.677
Knowledge (Good)*	0.003	0.875	0.801 - 0.956
Perceived factors influencing use of HDS			
The type of job an individual is engaged in can warrant the use of HDS*	0.038	1.894	0.135 - 3.466
The level of education of an individual may determine whether he or she will use HDS	0.675	1.148	0.602 - 2.189
The economic status of individual can influence the use of HDS*	0.016	2.312	0.168 - 4.579
The availability of HDS may determine its use by consumers	0.697	1.137	0.597 - 2.167
Family or friends can influence a person's use of herbal dietary supplements	0.291	1.683	0.641 - 4.420

***Significant predictors**

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

Herbal dietary supplements use has been found to be increasing among the adults in many developed countries (Vitolins Quandt, Case, Bell, Arcury and McDonald, 2000; Radimer et al, 2004) but, there are few studies on HDS use in Nigeria. The data from this study thus provide such information.

5.1 Socio-demographic profiles

Males comprised the larger proportion of respondents in this survey (Table 1). It has generally been observed that more males are represented in academic institutions in Nigeria ((Akinwumi and Ogunsola, 2010); this could explain in part the presence of more males in this survey. Respondents in this study were spread across all age groups including young adults, middle aged people and older adults. However, the 31-45 years age category was the largest category (55.3%). This age category represents the active workforce.

5.2 Use of herbal dietary supplements

The results showed that majority of respondents (67.2%) used HDS. This proportion is quite similar to that of a previous study conducted among individuals 18 years and older residing in the Minneapolis/St Paul, Minn, metropolitan area; the study reported use of HDS among 61.2% of its respondents (Harnack et al, 2001). A possible reason why herbal products are so popular may be due to the placebo effect. The placebo effect relates to a product being effective because the person believes it will be effective (Oklahoma Cooperative Extension Service) Secondly, the increased awareness of the link between diet and health coupled with strategic marketing and aggressive advertisements of these products may have contributed to the increasing use of HDS.

In the present study more men used HDS compared to women. This is contrary to what is reported in other studies (Radimer et al, 2004; Singh and Levine, 2006) which found that more women used HDS compared to men. Part of the explanation given to the observation in previous studies is the fact that women are more concerned about their health. However, many of these studies focused on VM supplements. The focus of the present study is on HDS. More men

consuming HDS than women could be as a result of men ego and their “suck up pain” nature. They may be indulging in the use of HDS in order to avoid hospital visitations or consulting their physician. Moreover, sexual health/performance is an area of health where men are more concerned and would go to any length to get a solution. Men in the pursuit of better sex may use herbs more. In the present study, 13.7% of the respondents which were all men stated specifically that they used HDS to enhance libido, though this option was not included in the list of reasons for usage of HDS. In addition, more men used HDS to improve energy compared to women in this study. In recent times, the potential of natural herbs in addressing erectile dysfunction has been used to attract consumers. Furthermore, these higher percentages of users being males may be due to the higher proportion of males enrolled into the study

Age of respondents associated significantly with the use of HDS. Many of the users (58.8%) were between 31-45 years. Also, in a study aimed to assess dietary supplement use and its association with micronutrient intakes and adequacy among 2,195 US men and women aged 40 to 59 year, supplement use was found to be common among middle-aged Americans (Balluz et al, 2000). Most of the respondents (70.8%) took HDS on occasional basis while only 12.1% took HDS daily. This is consistent with the results of the Vitamins And Lifestyle (VITAL) study, conducted in western Washington States. One third of the respondents in that study reported using HDS in the last one year before the study with only a small proportion of them taking HDS on a daily basis (Schaffer et al, 2003).

Moringa, garlic, ginger and aloe vera were the mostly consumed HDS among respondents. In recent times, moringa has gained popularity in Nigeria. It is claimed to be a magic plant with benefits for skin and hair health, lactation, diabetes, cough and cold, anaemia, inflammation and aging, to mention a few. In addition, garlic has been one of the mostly consumed HDS reported in studies. A longitudinal study examining NVM supplement use of individuals 43 to 86 years of age from Beaver Dam, Wisconsin found that the most commonly used supplements to include garlic (Sebastian, Cleveland, Goldman and Moshfegh, 2007).

Majority of respondents on prescription drugs used their drugs alongside one or more HDS. It is clear that people do not realize that combining dietary supplements with their prescription

medications can result in drug–supplement interactions. A number of drug-herb interactions have been documented in literature (Cupp, 1999; Ernst and Pittler, 2002; Fugh-Berman, 2000). For example, garlic can aggravate reflux in people suffering from gastroesophageal reflux disease (NDDICH, 2003). Ingestion of garlic with cimetidine can increase the risk of bleeding (Gurley, Gardner, Hubbard, Williams, Gentry and Cui, 2002). Similarly, patients have been advised against combining oral diabetic agents with ginseng, as ginseng may reduce blood glucose levels (Sotaniemi, Haapakoski and Rautio, 1995). In a survey of veteran outpatients taking prescription medications, 43% used at least one dietary supplement. Among these patients, 45% had the potential for a drug–dietary supplement interaction (Peng, Glassman, Trilli, Hayes-Hunter and Good 2004).

5.3 Reasons for use

The five most frequent reasons for use of HDS that were found in this study include disease prevention, improve energy, relieve stress, supplement inadequate diet and disease treatment. Similarly, Balluz et al (2000) found that decreasing the susceptibility to health problems such as stress, colds, heart attacks, cancer and increasing their energy were major reasons for using herbal supplement in the US. A variety of hypotheses have been proposed to explain the increased use of herbal remedies in the US. These explanations range from a dissatisfaction with conventional treatments to a desire for more autonomy over decisions involving one’s own health. In support of the latter theory, the most significant predictor identified for use of herbal supplements was an interest in the general health purposes of these substances (Johnson, Wootton, Kimzey, McCullagh, Wesley and Byrd, 2000).

Information obtained from the media and internet encouraged 27.9% of respondents to attempt the use of HDS for the first time. This is followed by those motivated by a family or friend (24.2%). In a survey that was conducted by the American Dietetic Association it was found that 48% of Americans used television and 47% used magazines as their main source for nutrition information (Ryan, Ferme and McManamon, 2000). The media publishes exciting headlines the moment an herb is tentatively shown to be beneficial in some way, it is touted as the next miracle cure. Advertising can be misleading, promising us “totally safe”, “natural”, and “quick and

effective” solutions to many health problems. Offering more formal education and enlightenment is needful to decrease reliance on the media as a convenient source of information.

5.4 Knowledge of HDS

The concept of HDS was ambiguous to the respondents in this study population. Only 5.1% could describe or define HDS correctly. The present study indicates that the term HDS are often mix with other traditional medicine practices. Considering the lack of formal medium of education or enlightenment on claims of HDS and little control of HDS industry, it is not surprising that 69.1% of respondents have a poor knowledge of HDS.

An interesting finding in the present study was that knowledge of HDS use was inversely associated with HDS use. This is in congruent with the study of Massad and colleagues (Massad Shie, Koceja and Ellis, 1995) that reported an inverse relationship between knowledge and use of HDS. Conversely, Nieper (2005) found that knowledge was positively associated with supplement use among athletes. Many of the studies that have found positive association between use of supplements and knowledge have focused on VM supplements. Unlike HDS, VMS are taken through rigorous scientific procedures and their effectiveness has been proven. Herbal dietary supplements are regulated as food and efficacy claims are not confirmed until there are reports of adverse reactions in the population. This could be responsible for the inverse relationship found in the present study as people who know that the efficacy of these products have not been proven scientifically will not likely use them.

5.5 Factors associated with use of HDS

Regression analysis showed that the level of education was inversely associated with use of HDS. It was a significant predictor of use of HDS. People with advanced degrees will be more inclined to modern and conventional medicine; explaining the inverse relationship found in the present study. However, this is different from the report of the National Health Interview Survey (NHIS) conducted in the US. In that study, it was found that VM supplement use significantly increased as education increased ($p < 0.01$) from less than 9th grade up to some college. Vitamin and mineral supplements are recognized and prescribed in modern medicine; it is therefore not

surprising that association between education and use observed for VM supplement users is different from that observed in NVM supplement users.

In addition, the extent to which respondents agreed that the type of job an individual does and the economic status of an individual can determine whether he or she will use HDS increases the odds of HDS use. Many Nigerian nowadays spend more time in offices and other workplace more than in homes in search of greener pasture. This has reduced the amount of time available for gathering/buying and cooking proper food. Resulting into supplement use may be a way of making up for nutrients and other useful agents that could have be obtained from food. This would explain the predictive power economic capacity has over HDS use. As people work and get more economically empowered more of the resources is used to source for nutrients from supplements.

5.6 Implications for health promotion and education

Findings from this study have health promotion and education implication; there is need for multiple interventions to tackle the inappropriate use of HDS.

Raising awareness about the importance of appropriate use of herbs is key to ensuring that consumers use these products in moderation. Nutrition and health messages should be communicated in the best simple ways to stop the misleading concept that herbs are safer and more effective than drugs. Nutrition messages can be provided through television and radio adverts.

Health talks on the dangers associated with the inappropriate use of herbs should be provided in clinics. Workshops and periodic seminars at work places can help equip people engaged in time consuming and tedious jobs with appropriate knowledge and skills related to HDS use.

Health professionals need trainings to do effective communication during their consultations with patients. They have to be able to ask about use of HDS and educate patients appropriately. Policy needs to be developed to regulate the health claims and marketing strategies used for HDS. More stringent regulations are necessary to ensure that manufacturers adhere to good manufacturing practices and safety requirements.

5.7 Conclusion

Investigating the prevalence, knowledge and usage of HDS among workers in agricultural research institutes is relevant as this will help in the development of appropriate interventions to address the misuse of this important non-food source of nutrients. This study revealed that the proportion of workers using HDS was high. General health promotion, prevention and treatment of diseases were reasons found in this study for using HDS. The number of respondents who used HDS because of the information obtained from the media was the highest. Moringa, garlic, ginger and aloe vera were the most commonly used HDS among respondents. Most of the respondents on prescription medication combined it with HDS. Furthermore, the knowledge of appropriate use of HDS was poor. Level of education, knowledge, type of job and economic capacity were as significant associated with the use of HDS.

5.8 Recommendations

1. The use of HDS is high among workers in agricultural research institutes in Ibadan. However, inappropriate use of these products is common among users. It is important to provide educational programmes to guide on the use of HDS. This programme must provide basic nutrition information and also discuss right doses and right timing of use. Alternative messages, , such as consulting a doctor, before using any herbal medicines especially for those on prescription medication will be helpful in curbing inappropriate use of HDS.
2. Educational programs should focus on common misconceptions; the safety and efficacy of HDS. Users need to be made aware of the lack of government regulation on these dietary supplements. It is important to point it out that the safety and efficacy of these products do not have to be proven before the product can be sold.
3. There should also be provision of policies for the regulation of sales, marketing and use of dietary supplements since it was found that a high proportion used HDS because of information they obtained from the media.

4. Moreover, further research is needed. A nation-wide survey with a larger sample size will be useful in providing a better description of supplement use in the country. Differences in supplement use in special populations (such as adolescents, the elderly, pregnant women, children and people with certain health challenges) should also be assessed. Future research should also focus on determining the adequacy of these supplements for which nutrient composition is unknown.

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REFERENCES

- Abodunrin, O.L, Omojasola, T.P. & Rojugbokan, O.O. (2011). Utilization of Alternative Medical Services In An Urban Centre Of North Central Nigeria. *The Nigerian Health Journal*, 11 (2):34-38.
- Akinwumi, F.S. & Ogunsola, A.L. (2010). Women participation in the Nigeria University Teaching Profession. *Reforming Higher Education in Africa*, 259-268
- Ambrose, E. & Samuels, S. (2004). Perception and use of herbals among students and their practitioners in a university setting. *Journal of the American Academy Nurse Practitioner* 16(4):166 - 173.
- Amira, O.C & Okubadejo, N.U. (2007). Frequency of complementary and alternative medicine utilization in hypertensive patients attending an urban tertiary care centre in Nigeria. *BMC Complementary and Alternative Medicine* 7(30): 1-5.
- Angell, M. & Kassirer, J.P. (1998). Alternative medicine—the risks of untested and unregulated remedies (editorial). *New England Journal of Medicine* 339(12): 839- 841.
- Bandura, A. (1986). *Social Foundation of Thought and Action*: Englewood Cliffs, NJ: Prentice-Hall
- Barnes, J., Mills, S.Y., Abbot, N.C, Willoughby, M. & Ernst, E. (1998). Different standards for reporting ADRs to herbal remedies and conventional OTC medicines: face-to-face interviews with 515 users of herbal remedies. *British Journal of Clinical Pharmacology* 45:496-500.
- Bent, S. (2008). Herbal Medicine in the United States: Review of Efficacy, Safety and Regulations. *Journal of General Internal Medicine*. 23(6):854-859.
- Bent, S., Goldberg, H., Padula, A. & Avins, A.L. (2005). Spontaneous bleeding associated with ginkgo biloba: a case report and systematic review of the literature: a case report and systematic review of the literature. *Journal of General Internal Medicine* 20:657–661.
- Block, G., Jensen, C.D., Norkus, E.P., Dalvi, T.B., Wong, L.G., McManus, J.F. & Hudes, M.L. (2007). Usage patterns, health, and nutritional status of long-term multiple dietary supplement users: a cross-sectional study. *Nutrition Journal* 6:30.
- Blumenthal, M. & Farnsworth, N.R. (2005). *Echinacea angustifolia* in rhinovirus infections. *New England Journal of Medicine* 353:1971–1972.

- Balluz, L.S., Kieszak, S.M., Philen, R.M. & Mulinare, J. (2000). Vitamin and mineral supplement use in the United States: results from the third National Health and Nutrition Examination Survey. *Arch. Fam. Med.* 9: 258.
- Burnham, B.E. (1995). Garlic as a possible risk for postoperative bleeding. *Plastic and Reconstructive Surgery* 95:213.
- Camire, M.E & Kantor, M.A. (1999). Dietary Supplements: Nutritional and Legal Considerations. *Food Technology* 53:87-96.
- Cassileth, B.R., Heitzer, M. & Wesa, K. (2009). The public health impact of herbs and nutritional supplements. *Pharmaceutical Biology*, 47(8): 761-767
- Centers for Disease Control and Prevention. (2002). Hepatic toxicity possibly associated with kava-containing products—United States, Germany, and Switzerland, 1999–2002. *MMWR Morb Mortal Wkly Rep.* 51:1065–1067.
- Cupp, M.J. (1999). Herbal remedies: Adverse effects and drug interactions. 1,59(5): 1239-1244.
- Commission on Dietary Supplement Labels: Final Report. 1997. Chapter 1. Available at: <http://www.health.gov/dietsupp/final.pdf>. Retrieved on April 2, 2014
- Dietary Supplement Health and Education Act of 1994, Public Law 103-417, 103rd Congress page. Food and Drug Administration Web site. October 25, 1994. <http://www.fda.gov/opacom/laws/dshea.html>. Retrieved on March 19, 2014.
- Echo News Magazine 1981. www.echonet.org/moringa/ Retrieved on September 23, 2014
- EDinformatics. Health and Fitness Education. http://edinformatics.com/health_fitness/what_are_herbal_supplements.htm. Retrieved on March 26, 2014
- Eisenberg, D.M., Davis, R.B., Ettner, S.L., Appel, S., Wilkey, S., Van Rompay, M., & Kessler, R.C. (1998). Trends in alternative medicine use in the United States, 1990-1997: Results of a follow-up national survey. *Journal of the American Medical Association.* 280(18):1569–1575.
- Ervin, R.B., Wright, J.D. & Reed-Gillette, D. (2004). Prevalence of leading types of dietary supplements used in the Third National Health and Nutrition Examination Survey, 1988–94. In *Advanced data from vital health statistics; no 349* Hyattsville, Maryland: National Center for Health Statistics.

- Erhun, W.O., Babalola, O.O. & Erhun, M.O. (2001). Drug Regulation and Control in Nigeria: The Challenge of Counterfeit Drugs *Journal of Health & Population in Developing Countries*. 4(2):23-34.
- Ernst, E. & Pittler, M.H. (2000). Efficacy of ginger for nausea and vomiting: a systematic review of randomized clinical trials. *British Journal of Anaesthesia* 84:367–371.
- Fajana, S. (2009) “HR Management in Africa: The Social and Economic Framework” *Personalführung*, 7: 80-86
- Fashey, J.W. (2005). *Moringa Oleifera: A review of the Medical Evidence for its Nutritional, Therapeutic and Prophylactic properties. Part I.1:1-5*
- Federal Drug Administration. (1991). Food labeling: Reference daily intakes and daily reference values: Proposed rule. *Fed Regist.* 55:29476-29486
- Federal Drug Administration. (1994). Food labelin: Reference daily intakes Part II. Final rule. *Fed Regist.* 60: 67164-67175.
- Federal Drug Administration. (1997a). Premarket notification for a new dietary ingredient, final rule. *Food and Drug Administration. Fed. Reg.* 62: 49886-49892.
- Federal Drug Administration (1997b). Statement of identity, nutrition labeling and ingredient labeling of dietary supplements, Final rule. *Food and Drug Administration. Fed. Reg.* 62: 49826- 49858.
- Federal Drug Administration. (1999). FDA warns about GBL-related products. *FDA Talk Paper.* T99-21. May 11.
- Federal Drug Administration. (2000). Regulation on statements made for dietary supplements concerning the effect of the product on structure and function of the body. Final rule. *Fed Regist.* 65: 999-1050.
- Flanagan, K. (2001). Perioperative Assessment: Safety Considerations for Patients Taking Herbal Products. *Journal of PeriAnestheisa Nursing.* 16:19-26.
- Food Matters. (2011). Ten healing benefits of ginger. www.foodmatters.tv/articles-1/10-healing-benefits-of-ginger. Retrieved on October 5, 2014
- Food Standards Australia New Zealand. (2010). International Comparison of Regulatory requirements for nutritional content and health claims. Supporting Document 10. P293- Nutrition, Health and related claims.

www.foodstandards.gov.au/code/proposals/document/P293_SD10pdf Retrieved on March 26, 2014

- Fugh-Berman, A. (2000). Herb-drug interactions. *Lancet* 8;355 (1998): 134-138
- Gilhooley, M. (1997). Herbal remedies and dietary supplements: The boundaries of drug claims and freedom of choice. *Florida. Law Review* 49: 665-722.
- Gohil, K., Packer, L., de Lumen, B., Brooks, G.A., & Terblanche, S.E. (1986). Vitamin E deficiency and vitamin C supplements: exercise and mitochondrial oxidation. *Journal of Applied Physiology*. 60:1986–1991
- Gunnars, K. (2014). Is soy bad for you or good? The shocking truth. Authority Nutrition. www.authoritynutrition.com/is-soy-bad-for-you-or-good/ Retrieved on April 4, 2012
- Gunther, S., Patterson, R.E., Kristal, A.R., Stratton, K.L. & White, E. (2004). Demographic and health related correlates of herbal and specialty supplement use. *Journal of American Dietetic Association*. 104:27-34.
- Gurley, B.J., Gardner, S.F., Hubbard, M.A., Williams, D.K., Gentry, W.B., Cui, Y. & Ang, C.U. (2002). Cytochrome P450 phenotypic ratios for predicting herb-drug interactions in humans. *Clinical Pharmacology and Therapeutics*. 72(3):276-287
- Hammerness, P., Basch, E. & Ulbricht, C. (2003). St John's wort: a systematic review of adverse effects and drug interactions for the consultation psychiatrist. *Psychosomatics*. 44:271–82..
- Harnack, L.J., Rydell, S.A. & Stang, J. (2001). Prevalence of use of herbal products by adults in the Minneapolis/St Paul, Minn, Metropolitan Area. *Mayo Clinic Proceedings*. 76:688-694.
- Herbert, V. & Barrett, S. (1981). *Vitamins and "Health" Foods : The Great American Hustle*. Stickley Company, George F.
- Holst, S. (2000). *Moringa: Nature's Medicine* Cabinet Sierra Sunrise Publishing, Sherman Oaks, CA. 128 pp.
- Huang, H.Y., Caballero, B., Chang, S., Alberg, A.J., Semba, R.D. & Schneyer C. (2006). Multivitamin/Mineral Supplements and Prevention of Chronic Disease. Evidence Report/Technology Assessment No. 139. (Prepared by The Johns Hopkins University Evidence-based Practice Center under Contract No. 290-02-0018). AHRQ Publication No. 06-E012. Rockville, MD: Agency for Healthcare Research and Quality.

- Hughes, E.F., Jacobs, B.P. & Berman, B.M. (2005). Complementary and alternative medicine. In Current Medical Diagnosis and Treatment Edited by: Tierney LM, McPhee SJ, Papadakis MA. New York, McGraw-Hill. 1696-1719.
- Jawad, M., Schoop, R., Suter, A., Klein, P. & Eccles, R. (2012). Safety and Efficacy Profile of Echinacea purpurea to Prevent Common Cold Episodes: A Randomized, Double-Blind, Placebo-Controlled Trial. Evidence-Based Complementary and Alternative Medicine. Published online September 16 2012.
- Johnson, E.M., Wootton, K., Kimzey, R., McCullagh, L., Wesley, R., Byrd, D.C., Singh, K.K., Rubbino, D. & Puccino F. (2000) Use of herbal therapies by adults seen in an ambulatory care research setting: An exploratory survey. Journal of Alternative and Complementary Medicine. 6: 429-435.
- Kennedy, J. (2005). Herb and supplement use in the US adult population. Clinical Therapy 27(11):1847-1858.
- Kennedy, J. WSU researcher explores growing use of herbal medicine [Washington State University Web site]. Available at: <http://researchnews.wsu.edu/health/92.html>. Retrieved on April 19, 2014.
- Knudtson, M.D., Klein, R. & Lee, K.E. (2007). A longitudinal study of nonvitamin, nonmineral supplement use: Prevalence, associations, and survival in an aging population. Annals of Epidemiology. 17:933-939.
- Kurtzweil, P. (1998). An FDA guide to dietary supplements. FDA Consumer 32(5): 28-35.
- Lethaby, A.E., Brown, J., Marjoribanks, J., Kronenberg, F., Roberts, H. & Eden, J. (2007). Phytoestrogens for vasomotor menopausal symptoms. Cochrane Database Systematic Review (4):CD001395.
- Linde, K., Barrett, B., Wolkart, K., Bauer, R. & Melchart, D. (2006). Echinacea for preventing and treating the common cold. Cochrane Database Systematic Review. (1):CD000530.
- Linde, K., Mulrow, C.D, Berner, M. & Egger, M. (2005). St John's wort for depression. Cochrane Database Systematic Review (2):CD000448.
- Lwanga, S.K. & Lemesho, S. (1991). Sample size determination in health studies. WHO Library. ISBN 92-4 1544068. World Health Organisation 1991.
- Lyytinen, H., Pukkala, E. & Ylikorkala, O. (2009). Breast cancer risk in postmenopausal women using estradiol-progestogen therapy. Obstetrics and Gynecology. 113:65-73.

- Massad, S.J., Shier, N.W., Koceja, D.M. & Ellis, N.T. (1995). High school athletes and nutritional supplements. A study of knowledge and use. *Int. J. Sport Nutr.*, 21: 232-245.
- Marinac, J.S., Buchinger, C.L., Godfrey, L.A., Wooten, J.M., Sun, C. & Willsie, S.K. (2007). *Herbal Products and Dietary Supplements: A Survey of Use, Attitudes, and Knowledge Among Older Adults*. *Journal of the American Osteopathic Association* 107:13-23.
- Millen, A.E., Dodd, K.W. & Subar, A.F. (2004). Use of vitamin, mineral, nonvitamin, and nonmineral supplements in the United States: The 1987, 1992, and 2000 National Health Interview Survey results. *Journal of the American Dietetic Association*. 104:942-950.
- Ness, J., Johnson, D. & Nisly, N. (2003). "Polyherbacy": Herbal Supplements as a Form of Polypharmacy in Older Adults. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*. 58: 478-478.
- Nutrition Labeling and Education Act. (1990). Guide to nutrition labeling and education act requirement. www.fda.gov/CECI?Inspections/InspectionGuides/ucm074948.
- NDDICH. (2005) National Digestive Diseases Information Clearing House. <http://digestive.nidcd.nih.gov/index.htm>
- NIH Center for Complementary and Alternative Medicine. www.nccam.nih.gov. Retrieved on October 3, 2014
- NIH State-of-the-Science Panel. (2008). National Institutes of Health state-of-the-science conference statement: multivitamin/mineral supplements and chronic disease prevention. *American Journal of Clinical Nutrition*. 85:257-264
- NIH National Library of Medicine's MedlinePlus Ginseng Listing: www.nlm.nih.gov/medlineplus/druginfo/natural/1000.html. Retrieved on September 26, 2014.
- Newberry, H., Beerman, K., Duncan, S., McGuire, M. & Hillers, V. (2001). Use of nonvitamin, nonmineral dietary supplements among college students. *Journal of the American College Health* 50(3): 123-129.
- Neuhouser, M.L., Patterson, R.E. & Levy, L. (1999). Motivations for using vitamin and mineral supplements. *Journal of the American Dietetic Association*. 99(7): 851-854.
- Nieper, A. (2005) Nutritional supplement practices in UK junior national track and field athletes. *British Journal of Sports Medicine* 39, 645-649

- Nisly, N.L., Gryzlak, B.M., Zimmerman, M.B. & Wallace, R.B. (2010). Dietary supplement polypharmacy: an unrecognized public health problem? *Evidence Based Complementary and Alternative Medicine*. 7: 107–113.
- Office of Nutritional, Products, Labelling and Dietary Supplement (2007). www.fda.gov/food/.../LabelingNutrition/ucm053857htm. Retrieved October 10, 2014
- Ogunjobi, T.E. & Fagbami, O.O. (2012). Use of Internet by researchers in agricultural research institute in Ibadan Oyo State. *International Journal of Library and Information Science* 4(4):52-56
- Okolo, S.C., Olajide, O.O., Idowu, D.I., Adebisi, A.B, Ikokoh, P.P, & Orishadipe, A.T. (2012). Comparative Proximate Studies on Some Nigerian Food Supplements. *Annals of Biological Research* 3 (2):773-779.
- Oken, B.S, Storzbach, D.M. & Kaye, J.A. (1998). The efficacy of Ginkgo biloba on cognitive function in Alzheimer disease. *Archives of Neurology* 55:1409–1415.
- Oklahoma Cooperative Extension Service. (n.d.). Herbal remedies. <http://www.fcs.okstate.edu/food/nutrition/issues/concerns/herbal-cont.htm>. Retrieved on July 23, 2014
- Olsen, M.F., Tesfaye, M., Kaestel, P., Friis, H. & Holm, L. (2013). Use, perceptions, and acceptability of a ready-to-use supplementary food among adult HIV patients initiating antiretroviral treatment: a qualitative study in Ethiopia. *Patient Preference and Adherence* 7:481–488.
- Onyapat, J.E., Okoronkwo, I.L. & Ogonnaya, N.P. (2011). Complementary and alternative medicine use among adults in Enugu, Nigeria. *BMC Complementary and Alternative Medicine* . 11:19
- Oseneme, K.P., Elihoba, A.A. & Ilori, M.O. (2011). An overview of Medicine Research and Development in Nigeria. *Research Journal of Medical Sciences* 5 (4): 228-232.
- Oshikoya, K.A., Senbanjo, I.O., Njokanma, O.F. & Soipe, A. (2008). Use of complementary and alternative medicines for children with chronic health conditions in Lagos, Nigeria. *BMC Complementary and Alternative Medicine* 8(66):1-8.
- Palmer, M.E., Haller, C., McKinney, P.E., Klein-Schwartz, W., Tschirgi, A., Smolinske, S.C., Woolf, A., Sprague, B.M., Ko, R. & Everson, G. (2003). Adverse events associated with dietary supplements: an observational study. *The Lancet* 361, 101–106.

- Pastore, L. (2000). Home remedies used during pregnancy. *The Cochrane Library*. 3 :529.
- Perkins, D.D. & Long, D.A. (2002). Neighborhood sense of community and social capital: A multi-level analysis. In A. Fisher, C. Sonn, & B. Bishop (Eds.), *Psychological sense of community: Research, applications, and implications*. 291-318.
- Peng, C.C., Glassman, P.A., Trilli, L.E., Hayes-Hunter, J. & Good, C.B. (2000). Incidence and severity of potential drug-dietary supplement interactions in primary care patients (An exploratory study of 2 outpatient practices). *Arch Intern Med*. 2004;164:630–636.
- Pittler, M.H. & Ernst, E. (2000). Ginkgo biloba extract for the treatment of intermittent claudication: a meta-analysis of randomized trials. *American Journal of Medicine*. 108:276–281.
- Pittler, M.H. & Ernst, E. (1998). Peppermint oil for irritable bowel syndrome: a critical review and metaanalysis. *American Journal of Gastroenterology* 93:1131-1135.
- Pittler, M.H. & Ernst, E. (2003). Kava extract for treating anxiety. *Cochrane Database Systematic Review*. (1):CD003383.
- Prentice, R.L. (2007). Clinical trials and observational studies to assess the chronic disease benefits and risks of multivitamin-multimineral supplements. *American Journal of Clinical Nutrition* 85 (1):308S – 313S.
- Punch Newspaper. (2013). Watch out, supplement can harm. *The Punch-Nigeria*. www.punching.com/health/healthwise/watch-out-supplement-can-harm/
- Radimer, K.L., Subar, A.F. & Thompson, F.E. (2000). Nonvitamin, nonmineral dietary supplements: Issues and findings from NHANES III. *Journal of American Dietetic Association*. 100:447-454.
- Radimer, K., Bindewald, B., Hughes, J., Ervin, B., Swanson, C. & Picciano, M.F. (2004). Dietary supplement use by US adults: Data from the National Health and Nutrition Examination Survey, 1999–2000. *American Journal of Epidemiology* 160: 339-349.
- Rispler, D.T & Sara, J. (2011). The Impact of Complementary and Alternative Treatment Modalities on the Care of Orthopaedic Patients. *Journal of the American Academy of Orthopaedic Surgeons*. 19 (10): 634-643

- Rose, K.D., Croissant, P.D., Parliament, C.F. & Levin, M.B. (1990). Spontaneous spinal epidural hematoma with associated platelet dysfunction from excessive garlic ingestion: a case report. *Neurosurgery* 26:880–882.
- Rossouw, J.E., Anderson, G.L., Prentice, R.L., LaCroix, A.Z., Kooperberg, C., Tefanick, M.L., Jackson, R.D., Beresford, S.A., Howard, B.V., Johnson, K.C., Kotchen, J.M. & Ockene, J. (2002). Risks and benefits of estrogen plus progestin in healthy postmenopausal women: Principal results From the Women’s Health Initiative randomized controlled trial. *The Journal of the American Medical Association* 288:321–333.
- Rotblatt, M. & Ziment, I. (2002). Evidence-based herbal medicine. Philadelphia, PA: Hanley & Belfus; Sales of supplements containing ephedrine alkaloids (Ephedra) prohibited; February 2004: <http://www.fda.gov/oc/initiatives/ephedra/february2004/>. Retrieved on April 7, 2014.
- Schaffer, D.M., Gordon, N.P., Jensen, C.D. & Avins, AL. (2003). Nonvitamin, nonmineral supplement use over a 12-month period by adult members of a large health maintenance organization. *J Am Diet Assoc.* 103:1500-1505.
- Sebastian, R. S., Cleveland, L. E., Goldman, J. D., & Moshfegh, A. J. (2007). Older adults who use vitamin/mineral supplements differ from nonusers in nutrient intake adequacy and dietary attitudes. *Journal of American Dietetic Association*, 107 (8), 1322-1332.
- Singh, S.R. & Levine, M.A.H. (2006). Potential Interactions between Pharmaceuticals and Natural Health Products in Canada: *Journal of Clinical Pharmacology.* 47:1-10
- Stangeland, T., Remberg, S. F. & Lye, K. A. (2008). Total Antioxidant Activity in 35 Ugandan Fruits and Vegetables. *Elsevier*, 113(1): 85-91.
- Stevinson, C., Pittler, M.H. & Ernst, E. (2000). Garlic for treating hypercholesterolemia; a meta-analysis of randomized clinical trials. *Annals of Internal Medicine* 133:420–429.
- Sotaniemi, E.A., Haapakoski, E. & Rautio, A. (1999). Ginseng therapy in non-insulin-dependent diabetic patient. *Diabetes care.* 18(10): 1373-1375.
- Swisher, E.M., Cohn, D.E., Goff, B.A., Parham, J., Herzog, T.J., Rader, J.S. & Mutch, D.G. (2002). Use of complementary and alternative medicine among women with gynecologic cancers. *Gynecologic Oncology* 84:363–367.

- Taku, K., Umegaki, K., Sato, Y., Taki, Y., Endoh, K. & Watanabe, S. (2007). Soy isoflavones lower serum total and LDL cholesterol in humans: a meta-analysis of 11 randomized controlled trials. *American Journal of Clinical Nutrition*. 85:1148–1156.
- Tamakloe, M.S. (2013). Dietary supplement use among the elderly in Keta Municipal Area. A dissertation submitted to the University of Ghana, Legon. July 2013. University of Ghana <http://ugspace.ug.edu.gh/>
- Taylor, L. (2005). Difference and similarities of drugs and medicinal plants. Book: *The healing power of rainforest herbs*, Chapter two. www.rain.tree.com/chapter2.htm#.VDnHGleE71U
- Turner, R.B., Bauer, R., Woelkart, K., Hulsey, T.C. & Gangemi, J.D. (2005). evaluation of *Echinacea angustifolia* in experimental rhinovirus infections. *New England Journal of Medicine* 353:341–348.
- US Dietary Supplement Health and Education Act of 1994. Public Law 103-417. <http://www.fda.gov/opacom/laws/DSHEA.html>. Retrieved on April 2, 2014.
- US Food and Drug Administration. Food Facts. www.fda.gov/food/DietarySupplements/default.htm.
- Ulbricht, C. & Basch, E. (2005). *Natural standard herb and supplement reference: evidence-based clinical reviews*. St. Louis, MO: Elsevier Mosby; 2005.
- University of Maryland Medical Center. www.umm.edu/health/medical/altmed/herb/peppermint. Retrieved on September 6, 2014.
- Vogler, B.K., Pittler, M.H. & Ernst, E. (1999). The efficacy of ginseng. A systematic review of randomised clinical trials. *European Journal of Clinical Pharmacology* 55:567–575.
- Vitolins, M.Z., Quandt, S.A., Case, L.D., Bell, R.A., Arcury, T.A., & McDonald, J. (2000). Vitamin and mineral supplement use by older rural adults. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*. 55:613-617.
- World Health Organisation. (2003). *Traditional Medicine. Fact Sheet No 134*.

APPENDIX

QUESTIONNAIRE

INTRODUCTION

This survey instrument is meant to gather data relating to a study titled **PREVALENCE, KNOWLEDGE AND USE OF HERBAL DIETARY SUPPLEMENTS AMONG WORKERS IN AGRICULTURAL RESEARCH INSTITUTES IN IBADAN, NIGERIA**. It is expected that the outcome of the study will provide the basis for nutrition education for dietary supplements users and sound scientific guidance for policy formulation on the regulation of dietary supplement industry.

Your sincere response is encouraged as participation in this study is voluntary.
Thanks for your cooperation.

Would you want to participate in the study? Yes [] No []

Date.....

SERIAL NUMBER:

SECTION 1: Demographic Information

Instruction: Tick(X) as appropriate

1. Sex: 1. Male 2. Female
2. Age as at last birthday (years):
3. Marital Status
1. Single 2. Married 3. Separated
4. Divorced 5. Others, specify
4. Place of work
1. FRIN 2. NIHORT 3. IAR&T
5. Category of staff
1. Research staff 2. Technical staff 3. Support staff
6. What is your cadre? 1. Senior Staff 2. Junior Staff

7. How many years have you been on this job?
 1. 1-2 years 2. 3-5 years 3. 6-10 years 4. > 10 years
8. What is your religion?
 1. Christianity 2. Islam 3. Traditional 4. Others
9. What is your highest level of education?
 1. Primary school 2. Secondary school 3. Ordinary diploma
 4. Higher Diploma 5. Degree 6. Masters
 7. Doctorate 8. Others, specify

SECTION 2: Use of herbal dietary supplements

Instruction: Tick (x) as appropriate

10. Have you ever used herbal dietary supplement?

1. Yes 2. No

If your answer to question 10 is no please proceed to question 18.

11. Are you currently using any herbal dietary supplement?

1. Yes 2. No

12. How often do you use the supplements?

1. Daily 2. Weekly 3. Occasionally 4. Others, specify

13. How long have you been using herbal dietary supplements?

1. ≤ 3months 2. 4-6months 3. 7-12months 4. Over a year
 5. Many years

14. Please tick any of the following herbal dietary supplements that you are currently using or have used before (Tick all that applies).

1. Ginseng 2. Echinacea 3. Ginko Biloba 4. Green tea
 5. Garlic 6. Moringa 7. Aloe vera 8. Ginger
 9. Others, specify

15. Please tick any of the following brand names of herbal dietary supplements that you are currently using or have used before (Tick all that applies).

1. Mofagrafix 2. Forever living products 3. GNLD products 4. Trevo
 5. Tren-en-en 6. Kediproducts 7. Tasly 8. Tianshi
 9. Others, specify

16. Are you on any prescription drugs? 1. Yes 2. No

17. Do you use your prescription drugs alongside any herbal dietary supplement?

1. Yes 2. No

SECTION 3: Reasons for using herbal dietary supplements

18. If you have not used herbal dietary supplements before please give reasons for not using them.
Give as many reasons as possible.

.....
.....

Respondents who have not used HDS before can proceed to question 23.

Users of supplements should please continue with question 19.

19. Please tick your reasons for using herbal dietary supplement (Tick all that applies).

- | | | |
|--|---|---|
| 1.Improve energy <input type="checkbox"/> | 2.Promote weight loss <input type="checkbox"/> | 3.Gain weight <input type="checkbox"/> |
| 4.Supplements inadequate diet <input type="checkbox"/> | 5.Build muscle <input type="checkbox"/> | 6.Relieve stress/improve mood <input type="checkbox"/> |
| 7.Prevent/Treat colds <input type="checkbox"/> | 8.Improve memory <input type="checkbox"/> | 9.Enhance athletic performance <input type="checkbox"/> |
| 10.Enhance sleep <input type="checkbox"/> | 11.Improve circulation <input type="checkbox"/> | 12.Prevent diseases <input type="checkbox"/> |
| 13.Promote skin/hair health <input type="checkbox"/> | 14.Treat/cure diseases <input type="checkbox"/> | 15.Improve libido <input type="checkbox"/> |
| 16. Others, specify <input type="text"/> | | |

20. If one of your reasons for using herbal dietary supplement is to prevent, treat or cure diseases, choose the disease conditions you are using it for. (Tick all that applies)

- | | | | |
|---|---|--|---|
| 1.Diabetes <input type="checkbox"/> | 2.Hypertension <input type="checkbox"/> | 3.Cancer <input type="checkbox"/> | 4.Oral infection <input type="checkbox"/> |
| 5.Skin infection <input type="checkbox"/> | 6.Mental illnesses <input type="checkbox"/> | 7.Others, specify <input type="text"/> | |

21. Please tick one of the following statements that is most applicable to you.

1. I use herbal dietary supplements so as to complement my diet
2. I use herbal dietary supplements because they are sufficient substitute for food nutrients
3. I use herbal dietary supplements because they are safer than prescription medications
4. I use herbal dietary supplements because they are more effective in treating disease

22. I started to use or ever used herbal dietary supplement because.....

(please tick the most appropriate)

1. The marketer persuaded me to try it
2. The information on the package was convincing
3. My doctor advised me to use it
4. My friends or relation advised me to use it
5. I saw people around me using it
6. I read or heard about the benefits from the media (including internet)
7. I have researched into their benefits personally
8. It was given to me for free

SECTION 4: Knowledge on use of herbal dietary supplements

Instruction: In this section you will be asked certain questions, please answer to the best of your ability. Any information or knowledge shared will be greatly appreciated. Please leave the score column vacant, it is for researcher's use.

Question	Answer/response	score
23. What is herbal dietary supplement?		
24. In what forms are herbal dietary supplements presented? (please list at least three)		
25. In what ways can herbal dietary supplements be administered?		
26. What are herbal dietary supplements screened for by regulatory agencies (e.g. NAFDAC) before they are approved for use?		
27. What is the difference between herbal dietary supplements and prescription drugs?		
28. What is the difference between herbal dietary supplements and other herbs?		
29. Can herbal dietary supplements cause negative effects? (answer yes or no)		

30. Points Scored=

31. Category code=

SECTION 5: Perceived factors associated with herbal dietary supplement use

Instruction: Here are some statements relating to the factors that promote use of herbal dietary supplements. For each statement, indicate whether you strongly Agree [SA], Agree [A], Disagree [D] or strongly Disagree [SD].

<i>S.</i> <i>No</i>	STATEMENT	SA 4	A 3	D 2	SD 1
32.	The health status of an individual can influence the use of HDS.				
33.	The type of job an individual is engaged in can warrant the use of HDS				
34.	The level of education of an individual may determine whether he or she will use HDS				
35.	The economic status of individual can influence the use of HDS				
36.	The availability of HDS may determine its use by consumers				
37.	Family or friends can influence a person's use of herbal dietary supplements				