KNOWLEDGE AND PRACTICE OF NUTRITIONISTS IN MANAGEMENT OF TYPE 2 DIABETES MELLITUS USING HONEY: A CASE STUDY OF SELECTED HOSPITALS IN NAIROBI COUNTY

BARWECHO MERCY JEPKOSGEI B.Sc. (HND)

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DEPARTMENT OF FOOD SCIENCE NUTRITION AND TECHNOLOGY

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DECLARATION

This dissertation is original work and to the best of my knowledge, it has not been presented to any other university for an award.

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MERCY J. BARWECHO **Date**

This dissertation has been submitted for examination with our approval as University supervisors.

_____ _____

Prof. J. K. IMUNGI **Date**
Department of Food Science, Nutrition and Technology

_____ _____

DR C.N. KUNYANGA **Date**
Department of Food Science, Nutrition and Technology

DEDICATION

I feel privileged to dedicate this work to my late mum, G. S. Chelang'a; dad, Z. C. Barwecho; my two sons: F. K. Mutai and V. K. Mutai. I also salute the support and encouragement of my husband Mr. J. K. Ngetich and Dr Z. L. Thaimuta of the Medical School in the University of Nairobi for their support and encouragement which saw me through this degree programme.

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ABBREVIATION AND ACRONYMS

CD's – Communicable Diseases

CKD – Chronic Kidney Disease

CME – Continuous Medical Education

DM – Diabetes Mellitus

FBG – Fasting Blood Glucose

H.E – His Excellency

HbA1c – Glycosylated Haemoglobin

HDL – High Density Lipoprotein

HIV – Human Immune-Deficiency Virus

IGT – Impaired Glucose Tolerance

KAP – Knowledge, Attitude and Practice

KEMRI – Kenya Medical Research Institute

KDHS - Kenya Demographic and Health Survey

KNH – Kenyatta National Hospital

MOPC – Medical Outpatient Clinic

NASCOP – National AIDS and STIs Control Programme

RDI – Recommended Daily Intake

SPSS – Statistical Package for Social Sciences

UON - University of Nairobi

VLDL –Very Low Density Lipoprotein

WHO – World Health Organization

OPERATIONAL DEFINITIONS

The following terms are presented with meaning that pertains to this study.

Adequate refers to satisfactory or acceptable in quantity and quality.

Attitude is expression of feeling or perception

Blood glucose is the main sugar found in the blood and body main source of energy.

Diabetes Educator: an individual who is part of the diabetes management team and enable people with diabetes to manage their diabetes related health to the best of their abilities, to allow them to make choices and take actions based on informed judgment, and to enhance the quality of life of the person with diabetes.

Diabetes mellitus is a metabolic disorder characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both.

Diabetes mellitus Type 2 is a progressive disorder that begins with peripheral insulin resistance and ends with failure of pancreatic β- cells.

Dietician: is a qualified professional who helps promote good health through eating habits.

Healthy eating is eating foods that help maintain or improve general health, provides the body with essential nutrition: fluid, adequate essential amino acids from protein, essential fatty acids, vitamins, minerals, and adequate calories.

Hyperglycemia is a condition in which higher than normal amount of glucose are contained in the blood plasma, and is generally glucose levels higher than 10 mmol/L (180mg/dl).

Impaired Glucose Tolerance: is a pre-diabetic state of hyperglycemia that is associated with insulin resistance.

Interview: a data-collection encounter in which one person (an interviewer) asks questions of another (a respondent) and the interview is conducted face to face.

Key Informant: is a professional who has firsthand knowledge and can give in-depth interviews of a select (nonrandom) group of experts who are most knowledgeable of the organizations and issues.

Lifestyle diseases: Diseases associated by the people's way of life.

Natural honey is honey that is produced by bees, from floral nectars. Colour, flavour, and aroma are depended by the floral origin.

Nutrition knowledge refers to verbalized or demonstrated ability to reproduce from memory facts and principles of nutrition related to honey and diabetes mellitus type 2.

Nutrition Practice refers to what is done by nutritionists or users

Nutritionist: is someone who works with food and nutritional science and works according to nutritional guidelines.

Policy is a deliberate system of principles to guide decisions and achieve rational outcomes. It is a statement of intent and implemented as a procedure or protocol.

Practice is to perform (an activity) or exercise (a skill) repeatedly or regularly in order to acquire, improve or maintain proficiency in it.

Respondent: a person who provides answers to a questionnaire, either verbal or in writing.

Rural: is a geographic area that is located outside cities and towns

Urban: area is a location characterized by high human population density and vast human-built features in comparison to the areas surrounding it which may be cities or towns.

Variables: is a characteristic of a person, object or phenomenon which can take on different values. These may be in the form of numbers (age) or non-numerical characteristics (sex).

ABSTRACT

Diabetes mellitus (DM) is a metabolic disorder that is characterized by chronic hyperglycemia, due to defects in insulin secretion and/or action activity. The prevalence of DM in Kenya is at 3.3% and is reported to be rising. The disease is managed through administration of drugs, healthy eating and exercises. There have been indications that combining anti-diabetic drugs with honey in diabetes mellitus management is more effective than use of drugs alone. However, this has not been authenticated and therefore most Kenyans with type 2 DM cannot benefit because honey is not widely accepted as a prescription item in management of diabetes.

This study therefore was designed to assess the knowledge and practice of the use of honey in diabetic management by the nutritionists. The study was cross-sectional, involving practicing nutritionists in five selected large hospitals within Nairobi County and the heads of the nutrition from the hospitals departments as key informants. Altogether, 57 nutritionists were interviewed from various departments of the hospitals including clinical medical, paediatrics, surgical wards, reproductive health, maternal/family planning clinic and the diabetic clinic. Data was collected from the two groups using a structured questionnaire with section for each group. The study was approved by Kenyatta National Hospital (KNH)/ University of Nairobi (UoN) Ethics and Research Committee.

Results showed that up to 50.9% of the respondents do not have knowledge on the use of honey in the management of type 2 diabetes mellitus (DM), while 42.1% indicated benefits in the use of honey to treat type 2 DM. The gains included lowering glycaemic index (7%), control of blood glucose (19.3%), medicinal value (7%), provision of energy (3.5%), food sweetener (1.8%) and antioxidant (1.8%). However, only 19.3% of the respondents were aware of studies done on the use of honey in type 2 DM management. Majority (80.7%) of the nutritionists were not aware of any studies on the benefits of honey in management of type 2 DM patients.

Nutritionists prescribing honey to type 2 DM patients recommend unprocessed honey (94.1%) compared to the processed honey (5.9%). The common forms of usage of prescribed honey was indicated as spreads (41.2%), sweetener of foods such as tea and porridge (17.6%) as solution in hot water (11.8%) and direct eating (5.9%). The quantity of honey prescribed by nutritionists was found to be a teaspoonful (41.2%), two teaspoonfuls (29.4%), three teaspoonfuls (23.5%) and four teaspoonfuls (5.9%). Nutritionists found not in favour of the use of honey based their arguments on opinions which included honey raising blood glucose (60%), do not know the efficacy (20%), ignorance (17.5%) and patient's aversion (2.5%).

The study concludes that there is limited knowledge among nutritionists on the use of honey in controlling type 2 DM and that there is no guideline nor policy in the country for use of honey in the management of type 2 DM. Prescription of honey for management of Diabetes type 2 is therefore very low.

CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND INFORMATION

Diabetes mellitus is a metabolic disorder that is characterized by chronic hyperglycemia, due to defects in insulin secretion and/or action activity (American Diabetes Association, 2011). Diabetes mellitus (DM) is a major cause of morbidity and mortality worldwide (Roglic and Unwin, 2010). There are approximately 200 million people with diabetes mellitus worldwide (Bahrami, 2009) and the number is predicted to increase to more than 380 million by 2025. This situation is exacerbated by the estimated number of people with impaired glucose tolerance (IGT) – currently at 314 million or 8.2% in the adult population, and expected to increase to 472 million or 9.0% by 2025 (WHO, 2012). Type 2 diabetes constitutes about 85% to 95% of all diabetes in developed countries, and accounts for an even higher percentage in developing countries. The prevalence of DM in Kenya is 3.3% (IDF, 2007). In Kenya, the disease is managed through administration of drugs, healthy eating and exercises. In spite of these efforts, most of DM patients develop diabetic complications. The doctrine of DM management has been maintaining low blood glucose. Elevated blood glucose is infinitely associated also with factors leading to obesity and cardiovascular disease (Tricia, 2011). These factors have been observed to reduce when honey is used in the management of diabetes mellitus (Tricia, 2011).

Honey is primarily composed of fructose (38%), glucose (31%), and other sugars. It however, also contains more than 180 substances, including amino acids, vitamins, minerals, enzymes and phytochemicals, some of which probably have antidiabetic function (Al-Jabri, 2005; Perez, 2002). The composition of honey varies according to its floral source and origin (Lusby, 2002). A study by Erejuwa (2001) indicated combining anti-diabetic drugs with honey in diabetes mellitus management has beneficial effects. Erejuwa observed that

administration of honey increase serum levels of insulin, while it reduced serum concentrations of glucose and fructosamine in diabetic rats (Erejuwa, 2011). It has been established that antiglycemic agent: glibenclamide and metformin when administered in combination with honey resulted in much lower glycemic levels (Erejuwa, 2011). This combination also resulted to lower biochemical parameters such as serum fructosamine, bilirubin, triglycerides, creatinine and very low-density lipoprotein (VLDL) cholesterol in the diabetic rats (Erejuwa, 2011). The effects were not observed when either of the antidiabetic agents was applied alone (Erejuwa, 2011).

Furthermore, the antidiabetic drugs in combination with honey also enhanced antioxidant (flavonoids, phenolic acids, amino acids, proteins, and some enzymes) defenses, reduced oxidative damage in pancreas and the kidney of diabetic rats (Erejuwa, 2011). In brief, though data are still limited to facilitate concrete conclusions, these studies indicate that honey could be used as an adjunct to diabetes therapy to achieve better glycemic control, improve metabolic derangements and mitigate oxidative stress-linked diabetic complications (Erejuwa, 2011).

Use of honey in management of DM has not been adopted in Kenya although few people use it as alternative to sugar. The development of modern beekeeping in Kenya has progressively become a very important component of the livestock sub-sector, particularly in the arid and semi-arid areas where other forms of agriculture cannot be sustained effectively (Farouk, 2012). The demand for honey is high and Kenyan honey producers have been challenged to increase their capacity. Honey has a high market value especially in the export market. Health-conscious consumers are more aware of honey therapeutic properties, used to make a variety of foods and also used as food preservative (Farouk, 2012). According to Farouk (2007) study in northern Kenya found that honey production is expanding in Kenya, though data on production processing, trends and marketing is fragmented (Farouk, 2007). Annual

production is estimated at 700 metric tons (Farouk, 2007). The arid and semi-arid lands yield only crudely processed honey for urban market. Introduction of better technology hives can significantly improve the yields and quality of bee products (Farouk, 2007). Local marketing systems should be strengthened through organization of traders and bee-keepers. To enhance the market competitiveness, honey requires improved processing and quality assurances (Farouk, 2007).

1.2 PROBLEM STATEMENT

The prevalence of DM in Kenya is 3.3%. Its prevalence rate in the rural area is 2.2% and is as high as 12.2% in urban setting. Impaired glucose tolerance is equally high at 13.2% in the urban and 8.6% in the rural population. These problems are on the increase. Management of DM both clinically and conservatively has become a burden to the patient and family both socially and economically.

Diabetes mellitus requires long-term follow up, with uninterrupted access to medication and specialist care. The high cost and low availability of insulin and oral hypoglycemic agents in Kenya with inadequate patient follow up contribute to poor management. Although the Kenyan government subsidizes insulin to reduce price for patients, supplies frequently run out, and most occasionally takes time to restock.

Diabetes is managed through healthy eating and medications either by using insulin or oral hypoglycaemic agents. Some diabetic patients do not receive proper healthy regimen to manage the blood glucose.

It has been observed that there is enthusiasm on the use of natural products including honey in the management of type 2 diabetes There is evidence on benefits of honey in management of type 2 DM although no studies has been done by nutritionists practising use of honey in management of type 2 DM. There is limited information about the use of honey in the

management of type 2 diabetic in Kenya. Debate among nutritionists and health care givers is abounding and opinions differ greatly among health care givers. With the debate on use of honey in persistence, confusion reigns in the nutrition clinics on the way forward. The debate is occasioned by inadequate knowledge, negative attitude or simply the desire to maintain status quo of routine counselling on diet balancing.

1.3 JUSTIFICATION

Owing to the burden of type 2 diabetic at the family level and nationally, there is rise of anxiety particularly in the face of development of complications, while still under management. With some literature indicating the gains drawn through use of natural honey in the blood sugar control, it is important to establish the knowledge gap among nutritionists. To bring the health workers and nutritionist to a perspective with regard to the positive effect of honey in the control of type 2 diabetes mellitus management. There is need to fill the knowledge gap and change the attitudes. This study was conducted for the purpose of improving the conservative management of type 2 diabetic patients.

Knowledge of nutritionists about diabetes, attitude towards the condition and management with respect to the condition (practice), affect compliance and play an important part in diabetes management. This study therefore was conducted to assess the level of nutritionist's awareness on management of DM type 2 using honey, how this knowledge influence their attitude and practice in prevention and control of the disease. The findings are helpful in identifying population knowledge gap and their behavior towards DM management using honey. They form basis for developing guidelines for prevention programmes in the country. Further, these findings contribute to the basis for the Government to develop policy on the use honey to control type 2 diabetes mellitus. The results will be disseminated through this

report and further be published in refereed journals, posters and pamphlets for sensitization in the study sites and health centres in the Nairobi County.

1.4 STUDY OBJECTIVES

1.4.1 General Objective

The general objective of the study was to assess the knowledge and practice by the nutritionists in the use of honey in managing type 2 diabetes mellitus.

1.4.2 Specific Objectives

The specific objectives of this study were to:

1. Establish the socio - demographic characteristics of the nutritionists.
2. Assess the Knowledge of nutritionists on benefits of honey in management of type 2 DM.
3. Assess the practice of nutritionists in prescribing honey for management of type 2 diabetes mellitus.

CHAPTER TWO: LITERATURE REVIEW

2.1 THE PRESENT STATUS OF DIABETES MELLITUS: GLOBAL PERSPECTIVE

Diabetes is one of the commonest non-communicable diseases of the 21st century. In 2007 the global burden of diabetes was estimated to be 246 million people. The international diabetes federation (IDF) estimates that this figure is likely to rise to 380 million by the year 2025 (IDF Atlas, 2007). In its 2009 Diabetes Atlas publication, the International Diabetes Federation, the global burden of diabetes in 2010 was estimated at 285 million and projected to increase to 438 million by the year 2030, if no interventions are put in place (IDF Atlas, 2009). This rise in diabetes is associated with demographic and social changes such as globalization, urbanization, aging population and adoption of unhealthy lifestyles such as consumption of unhealthy diets and physical inactivity.

According to World Health Report 2002 it is estimated globally that 7.1 million deaths could be attributed to high blood pressure out of which 4.4 million deaths to high cholesterol and 2.6 million deaths to excessive body weight. Excessive body weight is a growing problem in almost every country, even the poorest. It is increasing so rapidly that in middle-income countries the disease burden associated with having a body mass index greater than 25 is now equal to or greater than the disease burden resulting from under-nutrition (WHO, 2002). Excessive body weight is known to be an independent risk factor for development of type 2 diabetes mellitus.

In Africa, Approximately 7.1 million were said to be suffering from diabetes at the end of 2000, a figure that was expected to rise to 18.6 million by 2030 (Wild, 2004). In Kenya, the prevalence of diabetes is estimated to be 3.3% (IDF, 2007). This figure is based on regional projections and is likely to be an underestimation as over 60% of people diagnosed to have diabetes in Kenya usually present to the health care facility with seemingly unrelated complaints. Therefore two thirds of people with diabetes do not know they have the disease

(IDF, 2007). Studies done in Nairobi have shown that 53% of all hospital admissions were attributed to non-communicable diseases with Diabetes contributing about 27.3% of the total (Chege, 2010).

There are three main types of diabetes mellitus: Type 1 DM results from the body's failure to produce insulin, and currently requires the person to inject insulin or wear an insulin pump. This form was previously referred to as insulin-dependent diabetes mellitus (IDDM) or juvenile diabetes (KDHS, 2003). Type 2 DM results from insulin resistance, a condition in which cells fail to use insulin properly, sometimes combined with an absolute insulin deficiency. This form was previously referred to as non insulin-dependent diabetes mellitus (NIDDM) or "adult-onset diabetes (KDHS, 2003). The third main form, gestational diabetes, occurs when pregnant women without a previous diagnosis of diabetes develop a high blood glucose level. It may precede development of type 2 DM (KDHS, 2003).

Diabetes imposes a large economic impact on the national healthcare system. Healthcare expenditures on diabetes will account for 11.6% of all the total healthcare expenditures in the world in 2010 (Zhang, 2011). The size of this burden depends on their economic status and social insurance policies of the countries in which they live. Individuals with diabetes and their families in developing countries pay a large share of the expenditure because of the poorer organised systems of medical care insurance and/or lack of governmental provision of medical services (Zhang, 2011). Diabetes leads to loss in productivity and economic growth and this result of loss of earnings due to lost work days, restricted activity days, lower productivity at work, mortality and permanent disability caused by diabetes (Zhang, 2011). The monetary value associated with disability and loss of life as a result of the disease itself and its related complications, including heart, kidney, eye and foot disease (Zhang, 2011).

2.2 PREVALENCE OF DIABETES MELLITUS IN KENYA

In Kenya, diabetes mellitus prevalence has been on increase and is currently classified among the leading non-communicable diseases of public concern (WHO, 2010). The World Health Organization (WHO) estimates that the prevalence of diabetes in Kenya at 3.3% and predicts a rise to 4.5% by 2025. However, two-thirds of diabetics may be undiagnosed (WHO, 2010). In some rural parts of the country such as Nyeri in central Kenya and Kilifi County, the prevalence is as high as 11.6% and above 20% among the richer families in the major urban centers (Chege, 2010).

2.3 MANAGEMENT OF DIABETES MELLITUS

Managing weight and having a healthy-balanced diet are important. Type 2 diabetes patients who report significant reduction of weight or maintain weight loss trend are allowed to cease medication. Very obese patients whose diabetes is not well managed with diet and medicine may consider weight loss (bariatric) surgery (Zhang, 2011).

Regular physical activity is important for diabetic patient's lowers blood sugar level without medicine, burns extra calories and fat to help manage weight, and improves blood flow and blood pressure. It increases energy level and improves their ability to handle stress. Type 2 diabetes patients take special steps before, during, and after physical activity or exercise (American Diabetes Association, 2013).

Medication is prescribed when the diet and exercise do not reduce blood sugar to within reference limits or near-reference levels. The drugs help lower blood sugar levels in different ways; the doctor may have diabetic take more than one drug (American Diabetes Association, 2011).

2.4 USE OF HONEY IN THE MANAGEMENT OF TYPE 2 DM

Honey is carbohydrate-rich syrup produced by bees, from floral nectars. Predominantly honey comprises of monosaccharides and oligosaccharides and contains at least 181 constituents (Bogdanov, 2008). Honey also contains other bioactive constituents such as phenolic compounds, flavonoids, organic acids, carotenoid-derived compounds, nitric oxide (NO) metabolites, ascorbic acid, maillard reaction products, aromatic compounds, trace elements, vitamins, amino acids and proteins (Wang, 2011). A number of enzymes such as glucose oxidase, phosphatase, catalase, and peroxidise have also been found in honey (Bogdanov, 2008).

The beneficial effects of honey in diabetes mellitus has been shown to scavenge reactive oxygen species, improve oxidative stress (imbalance between oxidants and antioxidants in favour of the oxidants, potentially leading to damage) and reduce hyperglycemia (Erejuwa, 2010, Beretta, 2007). Honey supplementation in diabetic rats has been reported to improve renal oxidative stress independent of the dose and its hypoglycemic effect was dose-dependent (Erejuwa, 2010). In addition to its effects on oxidative stress and hyperglycemia, honey supplementation ameliorates several metabolic derangements commonly observed in diabetes. These include reduced levels of hepatic transaminases, triglycerides and glycosylated hemoglobin (HbA1c) as well as increased HDL cholesterol (Busserolles, 2002).

Blood glucose measurements, fructosamine and glycosylated haemoglobin (HbA1c) are commonly employed to assess the glycemic control in diabetes mellitus over a period of two to three weeks and eight to twelve weeks respectively unlike fasting blood glucose (Rohlfing, 2002: Erujuwa, 2011)).

Fructose, the major constituent in honey is believed to contribute to the anti diabetic or hypoglycaemic effect of honey (Erujuwa, 2012). Fructose increases hepatic glucose phosphorylation via activation of glucokinase (Van, 1991); and inhibit glycogenolysis via

suppression of phosphorylation (Youn, 1987). Evidence has also implicated the complimentary and synergistic role of fructose and glucose on key enzymes involved in the metabolism of glucose and glycogen in the liver (Shiota, 2005). Evidence indicates that these monosaccharides produce a synergistic effect in the liver only when present or administered at a low or moderate dose or concentration (Wei, 2004). The detrimental effects do not occur with acute use of fructose, may suggest that the glycemic index is not directly important in evaluating the effects of foods or drinks containing fructose. It is also important to note that fructose is not the same as honey. Honey is quite unique in that it contains more than 181 constituents including free radical scavenging and antioxidants compounds (Bogdanov, 2008). Fructose is just one of the numerous constituents. As evidence has shown, antioxidants do not cause weight gain and hepatic deleterious effects associated with fructose (Razquin, 2009), but they reduce weight gain and ameliorate these abnormalities of lipids (Madero, 2011). The lack of deleterious effects of honey in the liver, in spite of its fructose content, may be due to the health beneficial effects of its numerous bioactive constituents which counter potential deleterious effects of fructose. It may also indicate that the amount of fructose in honey is relatively low compared to the levels in many sugar- or fructose – sweetened beverages (Shambaugh, 1990).

Honey, compared with dextrose, sucrose or other sweeteners, was reported to attenuate post-prandial glycemic response in non-diabetic volunteers (Shambaugh, 1990). In health human subjects, natural honey produced minimal increment (20%) compared to simulated honey and D-glucose which elevated the blood glucose levels to 47% and 52%, respectively after 60 minutes (Ahmed, 2008). The study further showed that after 180 minutes, the reduction in blood glucose levels following D-glucose consumption was 20%, whereas it was twice lower (9.75%) following natural honey consumption (Ahmed, 2008). Another related study also showed that honey supplementation in healthy subjects resulted in lower serum glucose

concentrations and glycemic response compared to feeding on glucose –fructose solution did (Sanz, 2004). In addition, other authors reported serum glucose levels in non-diabetic subjects administered honey (Abdulrhman, 2011).

According to a study by Kowluru, (2007), metabolic derangement in diabetes mellitus is not confined to hyperglycaemia and impaired utilization of glucose by the tissues, but it also sets in motion a train of other metabolic abnormalities which result in advancing complications including abnormalities of microcirculation, atherosclerosis and end organ damage such as nephropathy, retinopathy and neuropathy. Few of these damaging consequences can be minimized with anti-diabetic medication while others continue to progress despite restoration of glycemic control. Several mechanisms have been proposed including the mitochondrial oxidative stress that appears to be the primary determinant for the deleterious effects of hyperglycaemia that result to tissue and organ damage (Brownle, 2005., Giacco, 2010). Additional, oxidative stress has also been shown to reduce glucose uptake, storage and promote insulin resistance (Henriksen, 2010). Hyperglycaemia itself exerts toxic effects on pancreatic β-cells through increased oxidative stress, leading to increased apoptosis and reduced insulin content (Drews, 2010). There is evidence to suggest that honey might provide protection against diabetic complications via its antioxidant and organ protective effects (Drews, 2010).

2.5 COMPOSITION OF HONEY

Honey contains more than 180 identified substances but consists mainly of sugars with the remainder consisting of flavouring materials, minerals, acids, enzymes and pigments (Rostaim Faraji-Haremi, 1976). The total amount of sugars and the relative amounts of the different sugars (sucrose, fructose and glucose) vary with nectars from different Eucalypts,

and ultimately contribute to the different flavours and colours of honey (Rostaim Faraji-Haremi, 1976). The main components of honey are summarized in Tables 1 and 2.

Table 1: components of honey

Major Components				
Vitamins	**Minerals**	**Acids**	**Aromatisans**	**Amino Acids**
Vitamins C	Phosphorus	Malic	Acetone	Alamine
Vitamin B6	Silicon	Citric	Diacetyl	Valine
Vitamin B2	Manganese	Formic	Acetaldehyde	Lysine
Vitamin B	Pottasium	Salic	Formaldehyde	Glutamicacid
Biotin	Calcium	Phosphoric	Isobutyladehyde	Glycine
Folic Acid	Magnesium	Gluconic		Histidine
		Succinic		Arginine
		Acetic		Isoleucine

Others		
Fermenters (enzymes)	**Inhibines**	**Hormones**
Catalase	Hydrogen peroxide	Acetylcholine
Diastase	Penicitin	
Invertase	Arbutine	
Glucoseoxidase	Bactericides	

Source: Crane, 1975

Table 2: Composition of Honey

Components	Percentage
Moisture	15 – 18 (w/w basis)
Fructose	36 - 50
Dextrose (Glucose)	28 - 36
Sucrose	0.8 – 5.0
Maltose	1.7 – 11.8
Nitrogen	0.05 – 0.38
Ash	0.04 – 0.93
pH	3.3 – 5.6
Acid	0.5 (mainly Gluconic acid)
Free Acid	12 – 40 m-equiv./kg
Vitamins	Minimal, less than 10% of Australian RDI
Minerals	Minimal, less than 10% of Australian RDI
Enzymes	Invertase, diastase, glucose oxidase

Source: Winner, 2001

2.6 HONEY PRODUCTION AND UTILIZATION IN KENYA

Bee-keeping in Kenya is practiced in the arid and semi arid areas both by individual small scale farmers and Common Interest Groups (CIGs).According to a report by the Ministry of Livestock (GOK, 2001) bee keeping can be carried out successfully in 80 percent of the country. It is especially suitable in semi-arid areas where other modes of agriculture are not very possible. Bee keeping contributes to incomes as well as food security through provision of honey, beeswax, proppolis, bees' venom and royal jelly for medicine.

The Country's potential for apiculture is estimated at over 100,000 metric tons of honey and 10,000 metric tons of beeswax. However, at the moment only one - fifth of this potential is being exploited (GOK, 2008). Despite this however, and the downward trend in global production of honey, the Kenyan case has however been different. Findings by the Ministry of trade in 2001 indicated that production in Kenya has been steadily growing for instance from 17,259 metric tons in1994, 19,071 in 1996 and 22,803 in 2000 (GOK, 2001). However, in the years 2005 to 2008 there was honey production decline in Kenya. In the year 2005, the

production of honey was at 27,379,481 kg, 2006 was at 18,587,839 kg, 2007 was at 14,653,485 kg, and 2008 was at 12,036,910 kg. In Kenya, over 90% of beekeepers use traditional methods that presumably lead to honey of low quality (Mbae, 1999). Honey is consumed either processed or unprocessed and is produced by three methods (GOK, 2008). There are three types of Beehives used in Kenya for honey production: the **log hive, the box hive and the Kenya top bar hive.** The log hive is made of log which is split into two parts one being larger than the other. The larger pan is made into a trough-shaped structure by removing the inner tissues of the stem using a sharp chisel. Holes are drilled on the sides of the larger pan. The smaller part forms the floor board. The two parts are tied together using wires. Bees attach their combs only on the topside. The lower piece (floor board) can then be removed without damaging the combs and brood. The hive is suspended by means of wires from a tree or a pole (GOK, 2008).

The box hive is made of sown timber cut to a length of one meter. The best size for u-box hive is up to one meter long with the inner area measuring 11x 30 cm. The top side and end board are nailed together while the bottom board is attached by means of wires or supported by four small pieces of timber, which are easily detached. For ventilation and entrance of bees, holes are drilled in the bottom board; two near the ends and one the centre (GOK, 2008).

Kenya Top Bar Hive is a movable frame hive which was designed after the Greek basket hive. The Kenya Top Bar Hive has a series of bars arranged to form the top of the hive. The bees attach their combs to the bars which can be removed for examination. These bars are known as top bars, and hence the name of the hive. They are normally 27 in number but if the bees are to be fed, a feeder box replaces one of the top bars to leave about 26. Again another top bar can be replaced with the queen excluder to restrict the queen from laying eggs on all the top bars, thus ensuring high quality honey which is not mixed with brood. The top bars

contain a strip of beeswax starter along the centre to guide the bees to build their combs straight so that they do not touch each other. Naturally built combs are round in shape with sloping sides and a rounded bottom. The sides of the hive should be sloping at an angle of 110°— 120° almost the same angle as the comb, thus the bees will not attach their combs to the hive walls. This allows inspection of each top-bar separately (GOK, 2008). Honey processing involves the removal of wax and any other foreign materials from honey. Processing methods involves; honey extractors, simple straining method, water bath method, bulk processing, pressing method, honey blending and honey extraction using the centrifuge.

According to the Development plan for 1997-2001, honey production is estimated to have been 79 tons in 1995. Bee keepers earned Kshs 7.2 Million from the sale of honey and this compared favorably with other activities in the livestock-rearing sector. Milk, for example, earned farmers Kshs 6.6 million in the same period. It was expected that earnings could have been higher and lower incomes were blamed on an inadequate marketing infrastructure.

2.7 METABOLISM OF HONEY IN THE HUMAN BODY

Liver is recognized for its pathophysiology and control of glycemia in diabetes mellitus (Klip, 2006). Honey comprises predominantly carbohydrates which can be classified into monosaccharides and oligosaccharides. Consequently, the monosaccharides are classified into tetroses, trioses, hexoses, pentoses and heptoses based on their number of carbon atoms (mainly 3 to 7). Furthermore, monosaccharides in honey, glucose and fructose, are basically hexoses (http://medbio.info). In the liver, the uptake and the metabolism of these monosaccharides from honey (glucose and fructose) are different (Henry, 1991). According to Henry (1991) study, less quantities of glucose than fructose are metabolized in the liver. In addition, available data also indicate that the uptake of glucose into the liver is impaired in the absence or insufficiency of insulin. Furthermore, metabolism of glucose is impaired by

inadequate amounts of insulin (Mayes, 1993). In contrast, level of insulin is impaired or affected by neither the uptake nor metabolism of fructose (Henry, 1991).

With greater amounts of fructose being extensively metabolized in the liver compared to glucose (which undergoes less extensive metabolism), more glucose than fructose pass through the liver un-metabolized (Wright, 2003). The activation of Glucokinase by fructose, more of the un-metabolized glucose might be taken up from the circulation into the liver. This might further contribute to improved gylcemic control. With honey supplementation, fructose from honey could enhance hepatic glucose uptake, glycogen synthesis and storage, resulting to improved glycemic control in diabetes mellitus. Compelling evidence indicates that diabetes mellitus is commonly associated with hepatic dysfunctional or abnormalities such as elevations in serum alkaline phosphatase, aspartate aminotransferase and alanine aminotrasferase (Leeds, 2009). Honey supplementation has been shown to exert a protective effect against streptozotocin- induced, carbon tetrachloride- induced or trichlorf on- induced liver damage (Erejuwa, 2012). In view of the important role played by the liver in mediating glycemic control and the hypoglycemic effect of honey, the hepato-proctective effect of honey might be beneficial in diabetes mellitus. Considering that increased hepatic oxidative damage is documented in diabetes mellitus (Dias, 2005), honey supplementation might protect the liver against oxidative stress and damage (Eraslan, 2010).

CHAPTER THREE: STUDY DESIGN METHODOLOGY

3.1 STUDY DESIGN

Study design was cross-sectional, involving nutritionists in selected hospitals. Key Informants interviews involving nutritionists in charge in the selected hospitals in Nairobi County.

3.2 METHODOLOGY

3.2.1 Study Setting

The study was carried out health facilities both private and public in Nairobi County. The public hospitals included Kenyatta National hospital and Mbagathi district hospital, while Mater, Nairobi and Aga Khan Hospitals represented private hospitals. Nairobi County has 496 health facilities (both private and public): 1 referral hospital, 3 district hospital, 158 dispensaries, 71 health centre's, 144 medical clinic, 14 maternity homes, 4 health profiles, 21 nursing homes and 39 VCT's.

Kenyatta National Hospital in Nairobi is the oldest hospital in Kenya. Founded in 1901 with a bed capacity of 40 as the native civil hospital, it was renamed the King George VI in 1952. At that time the settler community was served by the nearby European Hospital (now Nairobi Hospital). It was renamed Kenyatta National Hospital (after Jomo Kenyatta) following independence from the British. KNH has turned 113 years, and had its Centenary Celebration in 2001. The Hospital was built to fulfil the role of being a National Referral and Teaching Hospital, as well as to provide medical research environment. In 1987 KNH became a State Corporation with a Board of Management and is at the apex of the referral system in the Health Sector in Kenya. It covers an area of 45.7 hectares. Within the KNH complex are College of Health Sciences (University of Nairobi); the Kenya Medical Training College; Kenya Medical Research Institute and National Laboratory Service (Ministry of

Health). KNH has 50 wards, 22out-patient clinics, 24 theatres (16 specialised) and Accident & Emergency Department. Out of the total bed capacity of 1800, 209 beds are for the Private Wing.

There is a Doctors Plaza consisting of 60 suites for various consultant specialities. The hospital offers a wide range of diagnostic services such as Laboratories, Radiology/Imaging and Endoscopy among other specialised services. Sometime, the average bed occupancy rate goes to 300%. In addition, at any given day the Hospital hosts in its wards between 2500 and 3000 patients. On average the Hospital caters for over 80,000 in-patients and over 500,000 out-patients annually. Diabetic clinic also referred as Medical outpatient clinic (MOPC-17) runs from Monday through Friday and caters for patients from all over the country on appointments. The clinic sees more than hundred patients per day both in mini clinic (newly diagnosed) and major clinic (seen after six months).

Mbagathi District Hospital is situated in Kenyatta Golf Course Location, in Dagoretti District of Nairobi County. The hospital was originally known as "Infectious Diseases Hospital" (IDH) under the then "King George VI Hospital," currently Kenyatta National Hospital. It was built in the 1950s to offer health care services, mainly for infectious diseases which required isolation such as Tuberculosis, Measles, Meningitis and Leprosy. In the year 1995, IDH was curved from Kenyatta National Hospital and transformed into an autonomous District Hospital for Nairobi. Mbagathi district hospital has diabetic clinic situated in MOPC which has multi-disciplinary team managing diabetes. They include clinicians, nutritionists, nurses and diabetic foot care specialist.

The Nairobi Hospital diabetes centre was established in 2002 to cater for patients requiring follow up diabetes care. The clinic aims at optimizing health through health information and effective medical management of diabetes. The patients are reviewed by a diabetologist who

carry out a comprehensive medical evaluation to review continuing treatment and establish blood glucose levels. The ophthalmologist see all diabetic patients requiring an annual eye check-up by a specialist to ensure that diabetic eye complication are detected early and appropriate treatment advised. Diabetes education is done by trained diabetes nurses who enlighten and counsel patients on proper self management in diabetes including danger signs, insulin handling, self care, diet and utility of blood monitoring devices. The nurses are available at the clinic, in the wards, and on call during office hours. Podiatry review (foot care) specialist carries out a comprehensive foot evaluation and prescribes appropriate continuing treatment to avoid complications.

Aga Khan University Hospital (AKUH) is a private hospital and was established in 1958. It is a private, not-for-profit institution that provides tertiary and secondary level health care services. There is a one stop diabetic clinic dealing with diagnosis and on-going care for diabetic and endocrine patients. Specialized services for the diabetic patients are offered by: diabetologist, ophthalmologist, pharmacist, diabetes educator and dietician.

Mater Misericordiae University Hospital is located along Dunga road in South B. Mater is known in dealing with heart problems and other medical conditions. The cornerstone of the diabetes service is the diabetes day centre, which is in existence since 1978 and was founded by the late Prof. Ivo Drury. It was one of the first of its kind in Europe. It is staffed by a multi-disciplinary team of health care professionals involved in the management of diabetes. The diabetes day centre runs from Monday through Friday, 8am to 4pm, by appointment only. Services offered include: diabetes education for people with diabetes and their families, both as in- and outpatients, available as individual and group education sessions, berger programme (accu-check education programme intensive insulin programme), dietary education, telephone advice service, daily multidisplinary specialist foot service

(encompassing podiatrist, vascular team, orthopaedic team, endocrinologist and diabetes nurse specialist).

3.3 STUDY POPULATION

The study population included all nutritionists in the health facilities

3.4 SAMPLING FRAME

The sampling frame included all nutritionists working in the selected hospitals (Figure 1) within Nairobi County. The hospitals were purposively selected because they are the only ones with residential nutritionists.

3.5 SAMPLE SIZE DETERMINATION

According to Fisher et al (1998) study, when the population is less than 10,000 individuals, 384 of them are recommended as the desired sample size. The population in this study were 62 nutritionists working in Hospitals within Nairobi County. KNH had 44 nutritionists, Mbagathi district hospital had 10 nutritionists, Nairobi Hospital had 3, Aga khan had 3 and 2 from Mater Hospital. Fisher et al therefore recommend the following formula for samples less than 10,000:

$$nf=n/(1+n/N)$$

Where:

nf= desired sample size when the population is less than 10,000,

n= desired sample when the population is more than 10,000,

N= estimate of the population size.

The sample was therefore:

nf=384/(1+384/62) = 53.38 =54 nutritionists in addition to 5% attrition =57

Therefore 57 Nutritionists who were willing to participate in the study were selected. The total number of nutritionists in KNH were forty four (44) out of which forty (40) were sampled in the study (44/62*57=40). Nine (10/62*57=9.1=9) were sampled from Mbagathi district hospital, three (3/62*57=2.75=3) from Nairobi, three (3/62*57=2.75=3) from Aga khan and two (2/62*57=1.8=2) from Mater hospital.

3.6 SAMPLING PROCEDURE

The study involved nutritionists in practice from both private and public hospitals, hence; purposive sampling was used to select hospitals within Nairobi County and proportionate sampling was used to select nutritionists for the study as shown in Figure 1.

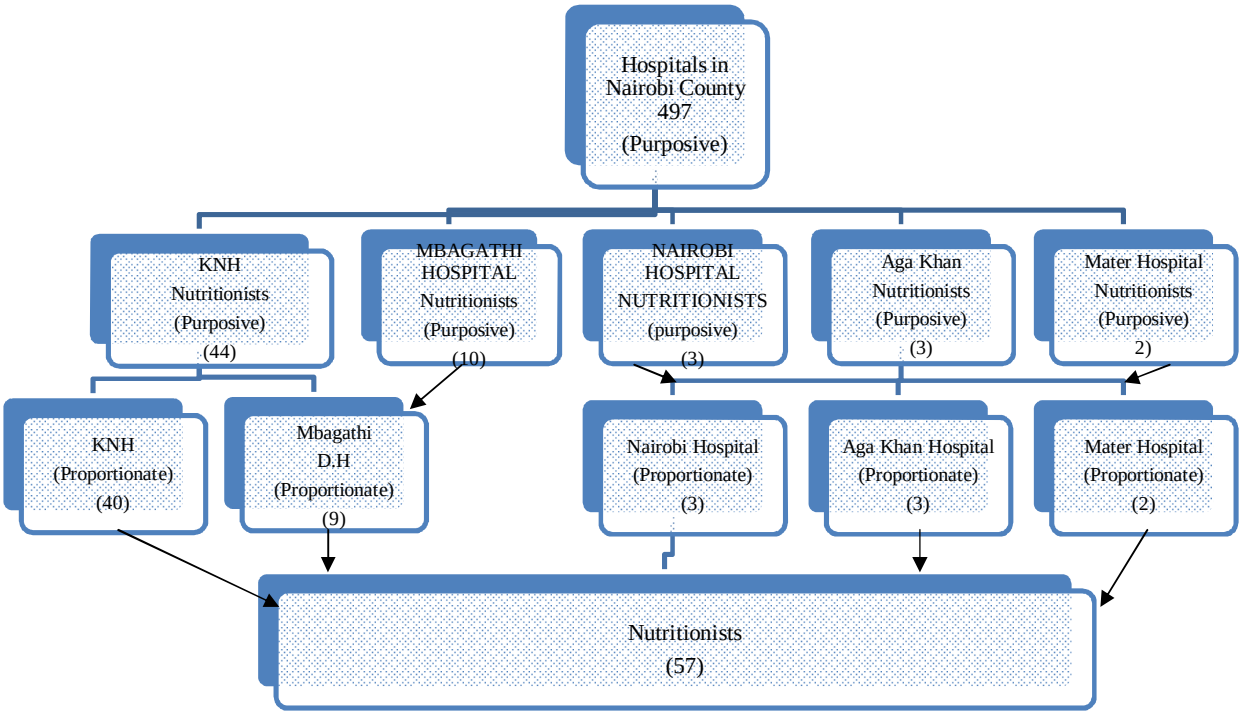

Figure 1: Schematic presentation of sampling procedure on selected hospitals

3.7 STUDY INSTRUMENT

The data was collected using self administered pre-tested questionnaires which were pre-coded to obtain information on knowledge and practice of use of honey for management of diabetic type 2.

3.8 KEY INFORMANT INTERVIEWS

An in-depth interview with key informant was undertaken. The purpose of the key informant interviews was to obtain general qualitative information on the management of type 2 diabetes mellitus using honey. The interviewer sought information on benefits of honey on diabetes management and general practice of nutritionist in management of type 2 diabetes using honey. Key informants included one nutritionist in charge in each hospital selected. In total five key informants were interviewed using a questionnaire (Appendix 3).

3.9 DATA QUALITY CONTROL

Data quality was the researcher's priority. To avoid errors a minimum of 30 minutes was allocated to collect the required information from each nutritionist interviewed. The questionnaires were pre-coded to speed up the data processing. Data quality control measures that were employed throughout the data collection process were carried as follows:-

3.9.1 Reviewing of the Questionnaires

The questionnaires completed each day were cross- checked for any anomalies. The principal investigator examined the questionnaires to check for completeness, accuracy in recording the measurements, consistency of the answers as well as correct filling of the questionnaires. Any errors encountered during the cross checking of the questionnaires were corrected immediately.

3.10 DATA ENTRY, CLEANING AND ANALYSIS

Immediately after data collection the principle investigator developed data entry template. Data entry was carried out using SPSS (21.0). After data entry, cleaning was carried out to ensure that the data had been entered correctly in the computer. Frequencies were run to check for any missing data entry errors, outliers as well as consistency of responses between questions. Required coding and modification of data was done to fit the appropriate statistical method. The statistical package for social sciences (SPSS 21.0) was used for most analysis of this study. Graphs and descriptive information were produced using both SPSS and Ms Excel software. Both descriptive and analytical methods were used in generation of the study results, frequency tables, range, proportions and cross tabulations were used to describe the characteristics of the nutritionists.

3.11 ETHICAL CONSIDERATION

The principal investigator explained the potential study subject the purpose of the study as outlined in the ethical information sheet and the study subjects were recruited after signing consent form (appendix 1).

To gain legal grounds for undertaking the study, the principal investigator presented this protocol to KNH/UoN Ethics and Research Committee requesting permission to carry out the study. The study commenced after the permission was granted by the Ethics and Research Committee (P233/04/2014).

CHAPTER FOUR: RESULTS

This chapter presents results of the study. Results for socio - demographic characteristics, Knowledge and Practices of nutritionists in management of type 2 DM using honey are presented using both descriptive and analytical techniques.

4.1: Socio - Demographic Characteristics

Socio – demographic data collected included: Age, gender, marital status and education level of the nutritionists are shown in 4.1.1 to 4.1.4 below.

4.1.1 Age of the Nutritionists

A total of 57 nutritionists participated in the study. The majority of the nutritionists (49.1%) were aged between 36-45 years. Distribution of the nutritionists by age is shown in Table 3.

Table 3: Distribution of the Nutritionists by Age

Age	Percentage
18 – 25	8.8
26 – 35	22.8
36 – 45	49.1
46 – 55	14.0
>55	5.3
Total	100.0

4.1.2 Sex of the Nutritionists

Of the 57 nutritionists involved in the study, only 26.3% were males while the rest were females. The male to female ratio of the study respondents was 1:2.8. Distribution of the nutritionists by gender is shown in Table 4.

Table 4: Distribution of the Nutritionists by Sex

Gender	Percentage
Male	26.3
Female	73.7
Total	100.0

4.1.3 Marital Status of the Nutritionists

The majority of the nutritionists (66.7%) were married and 24.5% were single. Distribution of the nutritionists by marital status is shown in Table 5.

Table 5: Distribution of the Nutritionists by Marital Status

Marital Status	Percentage
Married	66.7
Single	24.5
Widow/Widower	3.5
Separated	3.5
Divorced	1.8
Total	100.0

4.1.4 Level of Education of the Nutritionists

Majority of the nutritionists (49.1%) had attained bachelor's degree while 31.6% had attained a postgraduate qualification, and 19.3% had diploma level of education. The distribution of the nutritionists by level of education is shown in Table 6.

Table 6: Distribution of the Nutritionists by Level of Education

Education Level	Percentage
Diploma	19.3
Graduate	49.1
Postgraduate (Masters)	31.6
Total	100.0

4.1.5 Years and Type of Hospital of Professional Practice

Most of participants had professional practice of between 11-15 years representing 36.8% and those who had practiced for up to 5 years were at 26.3%. The bulk of nutritionists were from public hospitals at 87.7% and the rest from private hospital at 12.3%. Distribution of nutritionists by years of professional practice and hospital type is shown in Table 7.

Table 7: Distribution of Nutritionists by Years and the Type of Professional Practice

Years of professional practice	**Percentage**
1-5	26.3
6-10	5.3
11-15	36.8
16-20	14.1
>20	17.5
Total	100.0
Hospital Type	
Public	87.7
Private	12.3
Total	100.0

4.1.6: The Clinical Section in the hospital for Practice by Nutritionists

Most of the respondents (38.6%) were found practicing in medical wards while 17.5% were in pediatrics and the rest in different areas as shown in Figure 2.

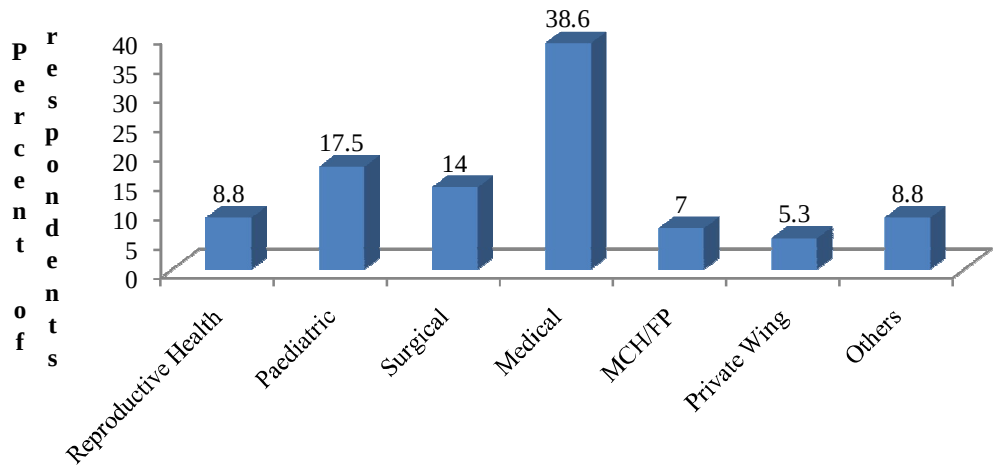

Figure 2: The Clinical Section in the hospital for Practice by Nutritionists

4.2 Knowledge of the Nutritionists on Use of Honey in Management of Type 2 DM

This section contains results of the nutritionist's knowledge on use of honey in the management of type 2 DM.

4.2.1 The Knowledge and Perception of Nutritionists on Benefits of Honey in Management of Type 2 DM

More than half of the respondents (50.9%) do not consider honey to have benefits to type 2 DM and 42.1% considered honey to have benefits to the patients. The results had only 7% who do not know whether honey has benefits or not. Perception of the nutritionists was established after knowledge on honey was established. Distribution of nutritionists on reception on the benefits of honey is shown in Figure 3.

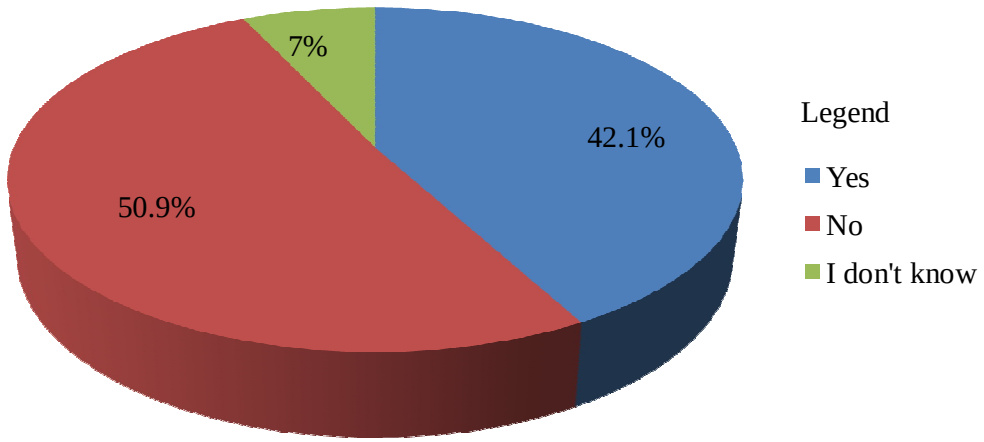

Figure 3: The Perception of Nutritionists on the Benefits of Honey to Type 2 DM

4.2.2: Awareness of Low Glycemic Index of Honey by Nutritionists

Only 26.3% of the nutritionists felt that honey has low glycemic index and control the blood glucose level, and 7% felt that it had some form of medicinal value. These results are shown in figure 4.

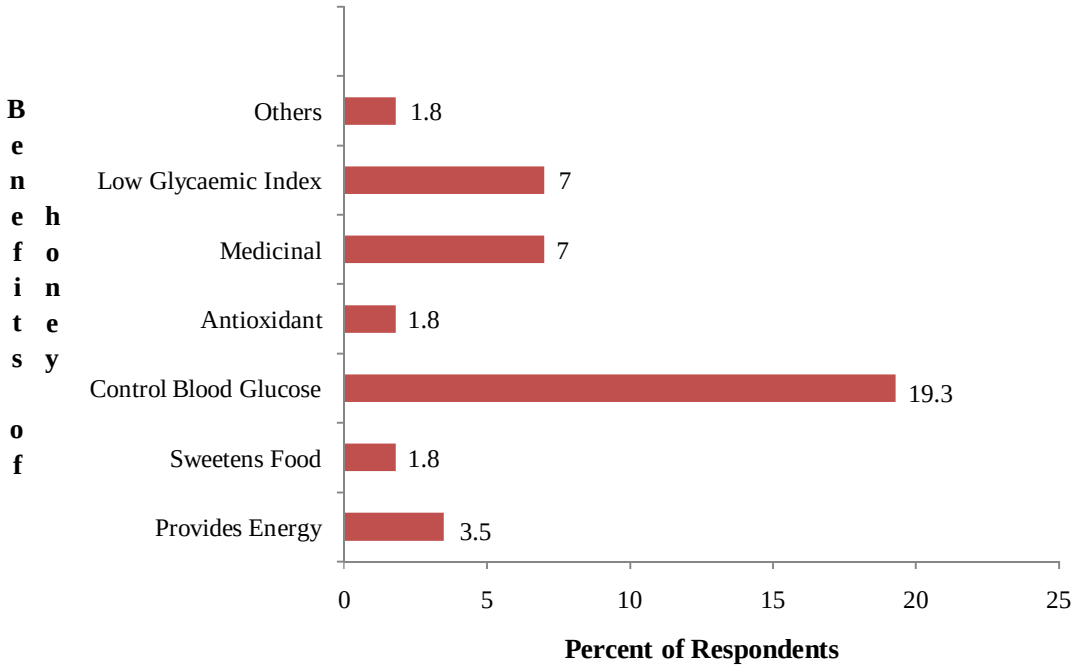

Figure 4: Awareness of Low Glycemic Index of Honey by Nutritionists

4.2.3: Knowledge of studies done on Honey

The majority (80.7%) of the nutritionists did not know of studies done on benefits of honey on type 2 DM. Only 19.3% were aware of such studies.

4.3: Practice of Nutritionists in Management of Type 2 DM using Honey

This section contains results of the nutritionist's practice on use of honey in the management of type 2 DM.

4.3.1: Use of Honey in Management of Type 2 DM

The majority of the nutritionists (70.2%) do not use honey in management of type 2 DM, only 29.8% applied honey in management of this condition.

4.3.2: Type of Honey Recommended and Advice on Use

The common form of honey recommended for use by majority of the nutritionists (94.1%) was unprocessed honey the rest 5.9% recommending processed honey. Most of the nutritionists using honey (41.2%) advised on using it as spreads. Distribution of the nutritionists advising on different ways of using honey is shown in Figure 5.

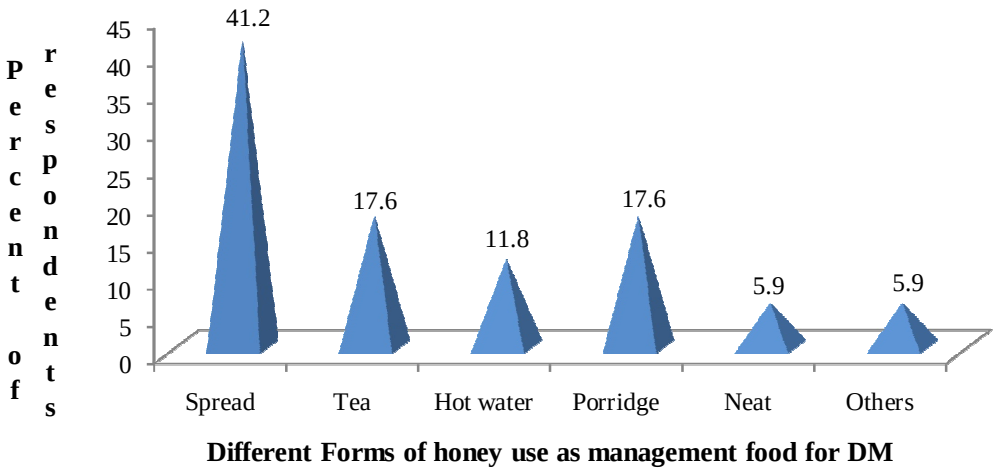

Figure 5: Forms in which honey was used for management of Type 2 DM

4.3.3: Reasons for Using Honey in Management of Type 2 DM

The respondents who recommended use of honey in type 2 DM management advanced reasons of not raising the blood glucose were at 82.3%. Distribution of reasons for using honey in management of type 2 DM is shown in Figure 6.

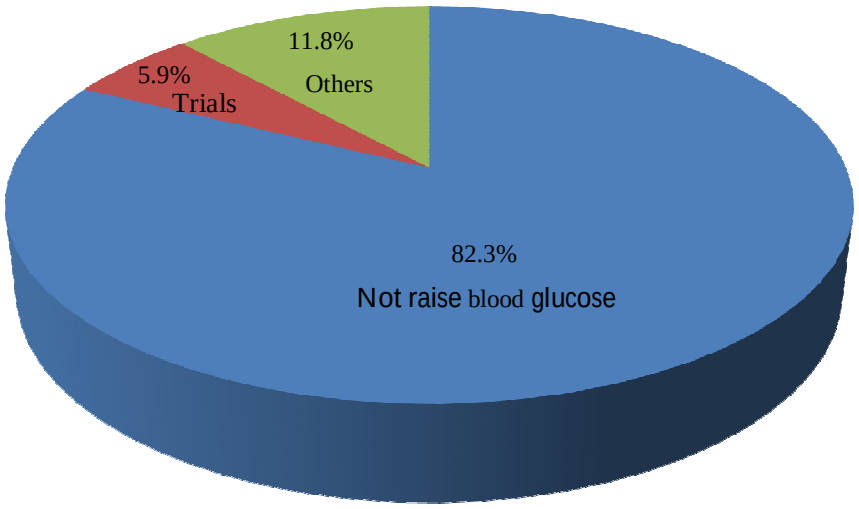

Figure 6: Reasons for using honey in Management of Type 2 DM

4.3.4: Drivers for Use of Honey

Nutritionists (58.8%) who recommended use of honey were motivated by studies published in journals, desire of patients at 35.3% and attendance of seminars at 5.9% as shown in Figure 7.

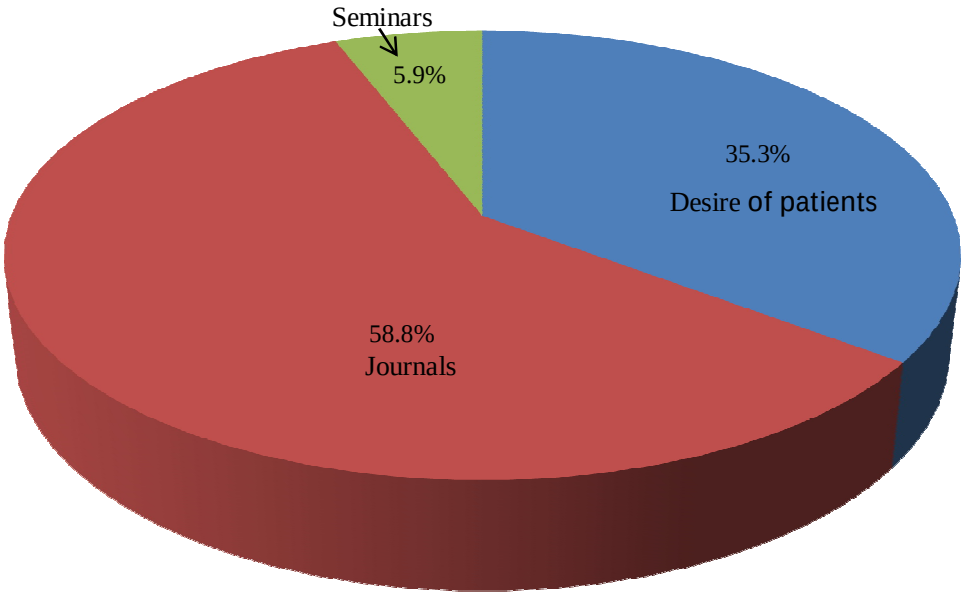

Figure 7: Drivers for Use of Honey

4.3.5: Quantity of Honey Prescribed

The common amount of honey prescribed by nutritionists per day was 1 teaspoon at 41.2% and commonly recommended by participants in the morning. Range of quantities of honey prescribed is shown in Figure 8.

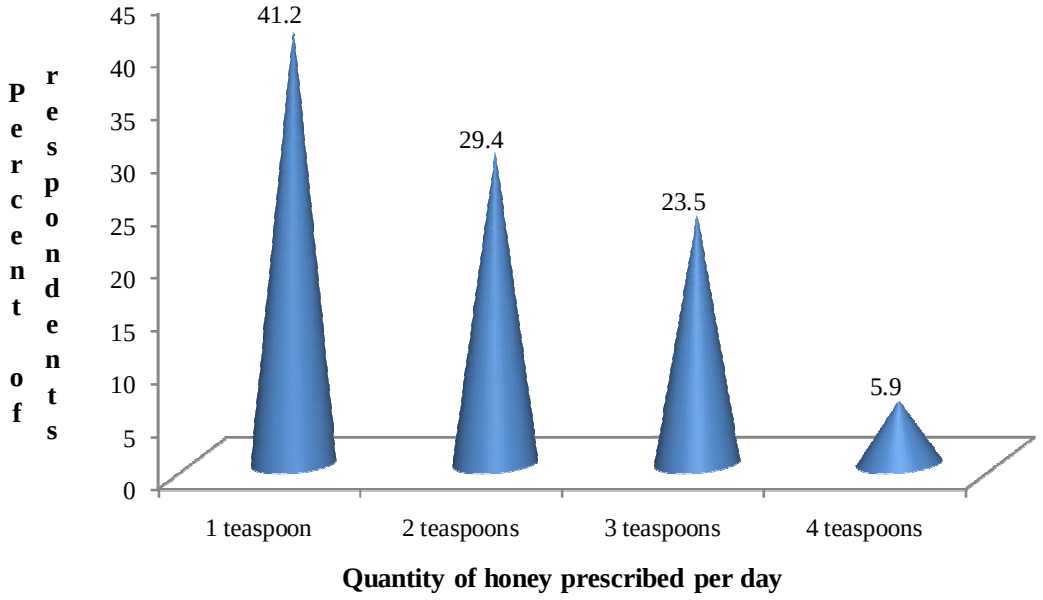

Figure 8: Quantity of honey prescribed per day

4.3.6: Time of Honey Intake and Review Time

Most of the nutritionists (47.4%) recommended morning hours as the time of taking honey and majority of the nutritionists (64.7%) reviewed honey use on the appointment day. Distribution of time of honey use and review time is shown in Table 8.

Table 8: Time of Honey Intake and Review Time

Time of honey use	Percentage	Reviews	Percentage
Morning	47.4	Daily	5.9
Morning and Evening	47.4	Weekly	11.8
Others	5.2	Monthly	17.6
		Appointment	64.7
Total	100		100

4.3.7: Reasons for not recommending Honey for Management of Type 2 DM

The majority of the nutritionists (60%) advanced reasons for not recommending honey in management of type 2 DM for fear of raising the blood glucose. Distribution of reasons for not recommending honey for management of type 2 DM is shown in Figure 9.

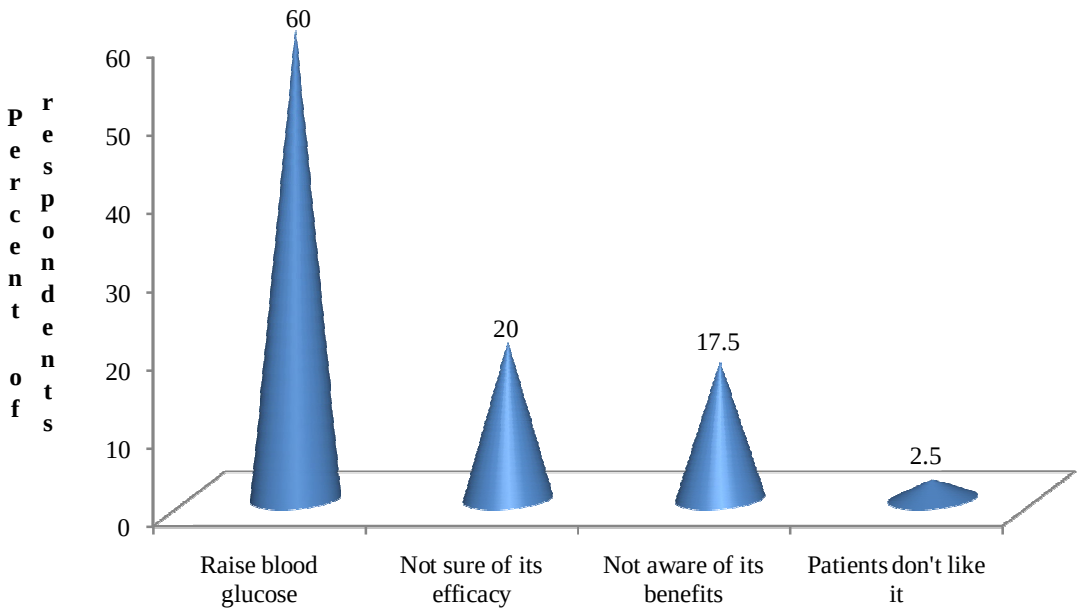

Figure 9: Reasons for not recommending Honey for Management of Type 2 DM

4.3.8: Opinion and Reaction of Nutritionist if found Type 2 DM patients using Honey

On personal opinions of nutritionists, they were asked if they can administer honey in management of type 2 DM and 40.4% gave the opinion that they will administer honey while 45.6% will not use which were comparable. Only 14% were indifferent or no opinion as shown in Figure 10. Most of the study participant would discourage type 2 DM patients from using honey to manage their condition. The approach by nutritionists towards type 2 DM patient using honey include, counsel against use, search literature about honey, check postpradial blood glucose after honey use and educate on dangers of honey use.

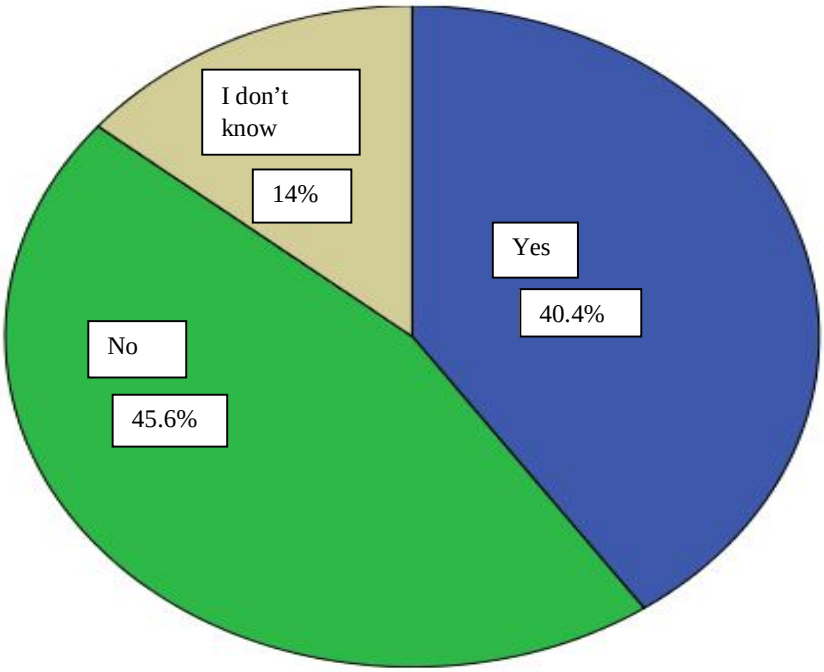

Figure 10: Opinion on Use of Honey in Management of Type 2 DM

CHAPTER FIVE: DISCUSSION

The study was undertaken to assess the knowledge and practice of nutritionists in management of type 2 diabetes mellitus using honey. This study recruited 57 nutritionists conducted among the most professional, experienced and trained nutritionists with coverage to major selected large hospitals across Nairobi County with diversified clinical areas. Therefore, it was representative of knowledge and practice in type 2 DM management within the city. Most of the participants had practised nutrition over 10 years and majority had achieved education level of basic degree. The majority of the participants (38.6%) were drawn from medical department (wards and medical outpatient clinics) where most of type 2 DM patients are commonly attended. Other clinical area of operation of respondents was paediatric, surgical, reproductive health and MCH/FP

It was found in this study that more than half of participants do not consider honey to have benefits on type 2 DM management. However, the few who use honey believe it's beneficial in controlling blood glucose, lowering glycemic index and has medicinal effect. Other benefits of honey that were reported included provision of energy, food sweetening and anti-oxidation. Literature review in this study showed that benefit of honey were lowering serum glucose, biochemical parameters such as bilirubin, creatinine, triglycerides and VLDL is also known to improve metabolic derangement and minimize oxidative stress commonly associated with DM complications (Erejuwa, 2012). More than two thirds of surveyed participants in the study do not find any benefit in use of honey in type 2 DM management (knowledge, practice variance). Generally nutritionists have knowledge that sugar causes hyperglycemia and that is why nutritionists are reluctant to use honey which contains mainly glucose and fructose. Studies done on use of honey by type 2 DM reported lowering blood glucose level (Orejuwa, 2012). Possibility of non sugar components in honey which causes hypoglycaemia exist which are not yet reported.

Studies done on other foods have indicated presence of antidiabetic properties (Kunyanga, 2011; Kunyanga, 2011 a; Kunyanga, 2011 b; Kunyanga, 2012). Some of the foods in these studies included sweet potato, Amaranth, pumpkin, groundnuts, sunflower, pigeon pea and field beans which contain carbohydrates capable of elevating sugar levels in diabetic patients. The anti-oxidant effects of honey (Gheldof, 2002) would thus make it a useful adjunct in the management of diabetes mellitus. The mechanism for the hypoglycemic effect of honey is, however, not well understood. Honey is a mixture of sugars – fructose (38.5%) and glucose (31.0%), maltose, sucrose and other complex carbohydrates. One would thus expect that consumption of honey would raise the blood sugar and that in fact the glycemic index of honey should approach that of glucose. The finding in several studies that honey causes a reduction in blood glucose levels in both normal and diabetic patients is an indication that honey has a mechanism, probably insulin sensitization effect (Al – Waili, 2004). Honey supplementation in diabetic patients showed increased level of insulin concentration (Aronoff, 2004) and reduced insulin resistance (Katsilambros, 1988). Same results from study findings were obtained when streptozotocin (STZ) induced diabetic rats were supplemented with honey where improvement in pancreatic islets was also observed (Erejuwa, 2011).

The maintenance of optimal glycemic control remains the main goal of diabetes management. In spite of this, it is well known that optimal glycemic goal is difficult to achieve as it necessitates the use of multiple anti-diabetic drugs (Turner, 1999). Even then glycemic control deteriorates in these diabetic patients with time (Cook, 2005). Available evidence implicates the role of oxidative stress in the etiology of β-cell dysfunction leading to the inability of pancreatic β-cells to secrete sufficient insulin to satisfactorily recompense for insulin resistance (Drews, 2010). Research findings demonstrating that honey has an adjunct to anti-diabetic drugs, improves glycemic control and metabolic derangements as well as

ameliorates cellular oxidative stress would be of great interest in the management of diabetes mellitus (Drews, 2010).

However, some studies raise a number of interesting questions and debatable issues. These include: are the observed effects of honey exclusive to a particular honey? Could these findings be generalized to other honey samples that originated from other parts of the globe or country? To be able to adequately address these questions, it would be vital to have data from studies that compare the effects of various honey of diverse origin in diabetes mellitus (Fasanmade, 2003). The current literature lacks such studies. Nevertheless, in the absence of such data, the few but limited available data hint that these beneficial effects in ameliorating impaired metabolism are not restricted to specific honey. Studies from several honey samples from other parts of the world have been shown to reduce hyperglycemia and ameliorate metabolic abnormalities in diabetic rats (Fasanmade, 2003), type 1 and type 2 diabetic patients (Al-Waili, 2003). It is noteworthy to state that majority of these studies investigated the acute effects of honey on hyperglycemia and metabolic derangements. This is very important because a number of studies have shown that honey considerably reduced postprandial hyperglycemia but data demonstrating the marked effect of honey on overall glycemia (measured by HbA1c) are limited (Abdulrhman, 2011).

Metabolic studies have been used to compare the glycemic response to sugars consumption in persons with DM with isocaloric (having similar caloric values) consumption of other sources of carbohydrate. A study by Bantle (2000) compared the postprandial glycemic response to various forms of carbohydrate (42g separately of glucose, fructose, sucrose, potato starch, and wheat starch) that composed 25% of total energy within a mixed meal also containing protein and fat. Fructose ingestion led to a lower postprandial glycemic response in those with DM, but the other forms of carbohydrate had nearly identical responses. In a short-term trial, the addition of sucrose did not adversely affect glucose control if accounted for on an

isocaloric basis (Colagiuiri, 2001). The American Diabetes Association (ADA) expert panel analyzed 22 studies addressing this issue and concluded that when ingested in isocaloric quantities, sucrose does not affect glycemic control in DM significantly differently from other carbohydrates (Franz, 2002). The recommendation is that if sucrose is consumed, it should be substituted for other carbohydrates (Franz, 2002).

However, those who recommend use of honey feel that it's useful in unprocessed state. Study by Noori (2004) showed that fresh, unprocessed honey stimulates antibody production and improves and restores the immune system. The common application is through spread or use as food additive. Other applications of honey found in this study included; dissolving in hot water, scooping neat and combining it with lemon tea.

The total amount of starches or carbohydrates in a food is the key consideration and not the amount of sugar (National Honey Board, 2014). Honey is a carbohydrate food as well, just like rice, potatoes, thus 1 tablespoon of honey has approximately 17 grams of carbohydrate and 64 kcals, and taking that into account when counting total daily intake of carbohydrates, diabetics can work it out like any other sweetener or carbohydrates (National Honey Board, 2014). To monitor response to honey, blood sugar levels could be noted before consumption and again two hours later. Also, when purchasing commercial honey for diabetic patients, it should be pure and not adulterated with added glucose, starch, cane sugar, and even malt, which is suspected to be the practice by local small scale processors.

This study established that majority of the practising nutritionists do not know of studies done on honey use in management of type 2 DM. The users of honey were correlated with the benefits of honey which was found to be statistically significant ($p=0.00$). It seems that there was less effort on search of studies on honey in the management of type 2 DM. According to a study by Doyle and Ward (2001), observed that individual behaviour is driven by a

multitude of influencing factors. Immediate influences come from personal knowledge, attitudes and beliefs as well as confidence in one's ability to perform particular health behaviour. Whereas Katzenellenbogenet (2005), asserted in his study findings that there is a weak connection between knowledge, attitudes, beliefs and behaviour but significant relationship between knowledge and practice, attitudes and practice. In support of the findings, Green and Kreuter (1991) explained that health knowledge of some kind is necessary before a conscious personal health action can occur. The desired health action will probably not occur unless a person receives a cue strong enough to trigger the motivation to act on that knowledge.

There is no policy on honey use in management of type 2 DM in the country. This could be attributed to lack of knowledge or reviewed study on use of honey in the management of type 2 DM. The willingness for involvement of drawing policy or guidelines in honey use in type 2 DM was found to be statistically significant ($p=0.003$).

It was found in this study that those who recommend honey use to type 2 DM patients were driven by scientific journals, patient's desire and through seminars. The common dosage was 1 to 2 teaspoon full of honey per day, commonly applied in the morning or morning and evening. It was found that there was no consistent review of patients who were on honey for management of type 2 DM. The review was done dependent of DM clinic appointment date. Most of the clinic reviews their patients after 1 to 3 months period. The review for 1 to 3 months of honey use is not effective measure of efficacy of honey in the management of type 2 DM. This is because the effects of honey on blood glucose levels are instaneous. It therefore follows that even those using honey in management of type 2 DM lose out on its gains through lengthy period of review.

The study found that most of practitioners who do not recommend honey believed it will increase blood glucose, no known benefits and its efficacy. This is not consistent with the

literature reviewed. These reasons deterring the honey use are actually its salient features. Thus, it follows that these reasons advanced for not using honey are driven either on opinions, feelings and attitudes. However, this is consistent with results in this study that most participants do not know of any studies on honey use in type 2 DM management. It was also observed that there were no hospital guidelines on use of honey. This was expected because guidelines are drawn from policies. There are no policies on honey use in type 2 DM management.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

Most practising nutritionists had over 10 years experience. It was therefore clear with years of practise and level of education that nutritionists were familiar with the management of type 2 diabetes.

It was established that the nutritionists had limited knowledge on the use of honey in management of type 2 DM which probably contributed to low recommendation for use of honey in management of type 2 DM.

The study established that there is neither guideline nor policy in management of type 2 diabetes in the ministry of health.

This study established missing gaps in properties of honey which impart benefits in management of type 2 DM. It is not very clear why honey has anti-diabetic properties.

6.2 RECOMMENDATIONS

Further studies to be carried out to establish the anti-diabetic components of honey.

Further studies should be carried to establish Knowledge and Practice of type 2 DM patients on management of type 2 DM using honey.

Further studies to be done to establish the doze, nature and levels of consumption of honey to be effective in type 2 DM management to improve glycemic control.

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APPENDICES

Appendix 1: Informed Consent Form

UNIVERSITY OF NAIROBI

FACULTY OF AGRICULTURE, KABETE CAMPUS

DEPARTMENT OF APPLIED HUMAN NUTRITION

Hello. My name is ***Mercy J. Barwecho***, a postgraduate student at University of Nairobi. I kindly request you to be part of my study and help me fill the questionnaire.The main objective of this study is to establish the Knowledge, Attitudes and Practice of nutritionists in the management of diabetes mellitus type 2 using honey.

The information you will provide will be treated with uttermost confidentiality and will be useful to find out the practice of nutritionist in management of diabetes mellitus type 2 using honey.

The findings of this study will be shared amongst nutritionists who have participated in the study, Government of Kenya through Ministry of Health with recommendations for policy formulation and drafting of session paper to establish guidelines on administration of honey in management of blood glucose in DM type 2 patients. The same findings will be disseminated through reports, conferences, posters and publications in refereed journals.

Respondent agreed to be interviewed: _____ Yes ☐ No ☐

Signature: _____

Date: _____

Appendix 2: Questionnaire

Study Number: _____ Date _____/_____/2014

Section A

Socio - Demographic Characteristics

Q1: Age: 1=18-25 ☐ 2=26 -35 ☐ 3=36 -45 ☐ 4=46 -55 ☐ 6=56 - 60 ☐

Q2: Gender: 1= Male ☐ 2=Female ☐

Q3: Marital Status: 1= Married ☐ 2=single ☐ 3=widow / widower ☐

4= Separated ☐ 5= Divorced ☐

Q4: Education level: 1=Certificate ☐ 2=Diploma ☐ 3=Graduate: ☐

4= Postgraduate (Masters) ☐ 5= PhD ☐

Section B

Practice

Q5: Years of professional practice as Nutritionist: 1=1-5 yrs ☐ 2= 2-6 yrs ☐ 3=11-15 yrs ☐ 4= 16-20 yrs ☐ 5= over 20 yrs ☐

Q6: Hospital you are practicing: 1=Public ☐ 2=Private ☐

Q7: Clinical area of operation: 1=Paediatrics ☐ 2= Surgical ☐ 3= Medical ☐

4=MCH / FP ☐ 5= Private wing / amenity ☐ 6=Reproductive

7=others_____

Section C

Knowledge

Q8: Does honey have benefits to DM patients? 1= Yes ☐ 2=No ☐ 3= I don't know ☐

Q9: If Yes, which of the following are the benefits? 1= Provides energy ☐ 2= sweetens the food / meal ☐ 3= Helps control sudden rise in sugars after meals ☐ 4= Antioxidant compound ☐ 5=Medicinal value ☐ 6=low glycemic index ☐ 7= N / A ☐ 8= others_____

Q10: Are you aware on studies/reviews on honey? 1=Yes ☐ 2=No ☐

Q11: Do you use honey in the management of DM 2 patients? 1=Yes ☐ 2= No ☐

(If your answer is yes, answer Q12 – 18; if no, answer Q19)

Q12: Which honey do you recommend? 1=Natural ☐ 2=Processed ☐

3=Comb honey ☐ 4= N/A ☐

Q13: How do you recommend use of honey or how do you advice on use? 1=Spread ☐

2=in tea ☐ 3=in hot water ☐ 4=in porridge ☐ 5=in food ☐

6=Scooping neat ☐ 7= Other Specify _____ 8= N/A ☐

Q14: What drives you to recommend use of honey DM 2 management? 1=Desire of patients ☐ 2=Drawn from other nutritionists ☐ 3=Learnt through journals ☐

4=Learnt through seminars ☐ 5=Hospital policy ☐ 6= N/A ☐

Q15: Why do you recommend the use of honey? 1=It doesn't raise blood sugar ☐

2=Trials ☐ 3=Availability ☐ 4=Peer pressure ☐

5=Any other reason_____ 6= N/A ☐

Q16: If yes, how much honey do you recommend for use per day? _____teaspoons

Q17: What time do you recommend honey use? 1=Morning ☐ 2=Lunch time ☐

3=Evening ☐ 4=Morning and evening ☐ 5= N/A ☐ 6= Others_____

Q18: How often do you advice change of the quantity? 1=Daily ☐ 2= Weekly ☐ 3= Monthly ☐ 4= N/A ☐ 5= On appointment ☐

Q19: Why don't you use honey in the management of type 2 diabetic patients?

1=It will raise the blood glucose ☐ 2=Not sure of its efficacy ☐ 3=Not aware of its benefits ☐ 4=Most nutritionists don't recommend it ☐ 6=its hospital practice ☐ 7=Patients don't like it ☐ 8= N/A ☐

Q20: Is there policy on management of type 2 diabetes mellitus using honey?

1= Yes ☐ 2= No ☐

Q21: If yes, are you involved in drawing hospital guidelines on patient's management of type diabetes mellitus using honey? 1= Yes ☐ 2= No ☐ 3=N / A ☐

Q22: If yes, at what level are you involved in drawing guidelines?

1=Administrative ☐ 2=Top management ☐ 3=Middle management ☐

4=Diabetic Clinic ☐ 5=Wards ☐ 6=N / A ☐

Q23: If yes, did you include honey in management of diabetes? 1=Yes ☐ 2=No ☐ 3=N / A ☐

Section D

Attitudes

Q24. In your own opinion, do you think you can administer honey in management of type 2 diabetes mellitus? 1=Yes ☐ 2=No ☐

Q25. What would be your reaction if you found your clients (type 2 DM) are using honey or not using?

_____

_____

Q26. What concerns you most if you think of Type 2 DM and honey?

_____

Appendix 3: Guide to Key Informant Interviews

Guidelines to key informant interview on Knowledge and Practice of nutritionists using honey in management of type 2 DM.

Date: _____**Time:**_____

Key informant: _____ **Venue:** _____

Q.1 Do you think honey is beneficial to type 2 diabetes mellitus? 1=Yes ☐ 2=No ☐

Q.2 In your opinion do you think with use of honey on diabetics, the blood glucose will be well controlled? _____

Q.3 In your own opinion, would you recommend usage of honey in management of type 2 DM? 1=Yes ☐ 2=No ☐

Give reasons_____

Q.4 Do nutritionists considers honey of importance as part of DM regimen in management?

1=Yes ☐ 2=No ☐

Q.4 In your opinion what is the practice of nutritionists in management of DM using honey

_____

_____

Q.5 What factors do you think leads to lack of prescribing honey to DM Type 2 patients by nutritionists_____

_____

Q.6 What do you think drives nutritionists not recommending use of honey in DM 2 management? _____

_____

Q.7 Is there policy in use of honey in DM management? 1=Yes ☐ 2=No ☐

Q.8 If NO, do you think is important to have policy in its usage? _____

_____