



**UNIVERSITY OF NAIROBI**

**Demystifying the Use of Honey in Diabetes Management: A Case of Type II  
Diabetes patients at Kenyatta National Hospital, Nairobi.**

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Submitted to: Board of Postgraduate Studies

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A dissertation submitted in partial fulfilment of the requirements for the award of a Master of Science in Applied Human Nutrition; Department of Food Science, Nutrition and Technology.

## DECLARATION

This dissertation is my original work and has not been presented for a degree in any other university.

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## **DEDICATION**

I wish to dedicate this work to my parents Mr.& Mrs. C. C. Kamau and family, my mentors and life coaches Pastors Kennedy and Merry Luvembe who are always there and ready to support me.

Also I salute Drs. Evans& Naomi Osembo and Dr. and Mrs. Frank Gachemi. Thanks for inspiring me and being a role model to many. Hope this builds to the good work you are doing.

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## **LIST OF ABBREVIATIONS**

CAM:	Complementary and alternative medicine
CI:	Confidence interval
CVD:	Cardiovascular disease
DKA:	Diabetic ketoacidosis
DM:	Diabetes mellitus
DoB:	Date of birth
GI:	Glycaemic Index
HDL-C:	High-density lipoprotein-cholesterol
ICU	Intensive Care Unit
IDDM:	Insulin-dependent diabetes mellitus
IDF:	International Diabetes Federation
KAP:	Knowledge, attitude and practices
KES:	Kenya shilling
Kg:	Kilograms
KMHFL:	Kenya Master Health Facility List
KNBS:	Kenya National Bureau of Statistics
KNH:	Kenyatta National Hospital
LDL-C:	Low-density lipoprotein-cholesterol

mL:	Millilitres
NCD:	Non-Communicable Diseases
NIDDM:	Non-insulin dependent diabetes mellitus
OPD:	Out-Patient Department
OR:	Odds ratio
RBS:	Random blood sugar
SD:	Standard deviation
TH:	Traditional healers
UoN:	University of Nairobi
VLDL-C:	Very low-density lipoprotein-cholesterol

## **OPERATIONAL DEFINITION OF TERMS AND PHRASES**

**Anti-Diabetes Drugs:** oral medication used in treating diabetes mellitus by lowering glucose levels in the blood and relieves symptoms. Other agents include insulin injection. These drugs/agents are administered mainly depending on the nature/type of the condition, age, situation of the person and other factors. The long term goals are the prevention and/or slow disease progression of long term complications of the disease.

**Cautious consumption of honey:** used here in reference to short-term studies that have used 75grams of honey in 250ml of water daily for 15days, showing reduced blood glucose. Similar or lower amounts of honey may be considered.

**C-peptide:** a metabolite (by-product of insulin production in the pancreas) used to gauge insulin production in the body.

**Diabetic:** somebody affected with diabetes, or something suitable for one with diabetes (food or treatment).

**Exudates:** a fluid that oozes out of normal circulation system due to inflammation and is deposited in nearby tissues.

**Glycaemic index:** an indicator of the effect of consumption of a particular type of food on a person's blood sugar level.

**Optimal RBS in diabetes:** targets 4 - 8 mmol/L (two hours postprandial).

**Unprocessed honey:** honey that is natural with no adulterated

## **ABSTRACT**

Diabetes is a metabolic disorder where insulin is either not sufficiently produced or properly utilised. Type II diabetes is more common, with the prevalence rate among adults in Kenya being 3.6%. This is of increasing public health concern due to the social and economic burden of the disease. With dietary management and availability of anti-diabetic drugs being far from satisfactory, an increasing number of diabetic populations globally now resort to complementary and alternative medicines. Honey has been seen to be a valuable agent in the management of type II diabetes and associated complications.

This study sought to explore the potential and extent of use of honey by diabetics, their knowledge and practices on use of honey as part of the diet. The study was a cross-sectional survey carried out at the Kenyatta National Hospital outpatient diabetes clinic. The study respondents were type II diabetics who were studied for their knowledge, perceptions and practices on use of honey. It also had a retrospective component as three consecutive blood sugar readings were obtained to help show association between use of honey and glycaemic control. Health care providers were key informants in the study to corroborate information obtained from the clients and/or their recorded data. Altogether, questionnaires were administered to 126 respondents with all ethical considerations observed.

The distribution of the respondents was 60% females and 40% males with an average age of 57 years. More than 50% of the respondents had completed secondary education and had a source of income, mainly through employment in personal business ventures or formal employment. Slightly more than half of the respondents (52%) lived in rural settings across various counties around Nairobi county. The estimated average monthly income was KES 20,205 while almost half of the total income (49%) would be spent on the household food per month.

Results indicated that only 21.4% of the respondents were using honey as part of their diet. The main reasons for use were mainly to sweeten beverages (40.7%), as an alternative bread spread (33.3%) or because they were advised to use it (18.5%). Respondents who did not use honey either gave reason for it being bad for blood glucose control (47.5%) or they were advised against using it (17.2%). The respondents identified the benefits of honey as improving blood sugar during hypoglycaemia (45%), regulating blood sugar (25%), its role in wound healing (15%) or therapeutic cure for colds and flu (10%).

The main source of information on honey use was identified as word of mouth from friends (59.3%), while the main purchase point for almost half of the respondents was directly from farmers (48.1%) and supermarkets (40%).

Among respondents using honey, 63% used a teaspoon per day. The modes of consumption identified were either as bread spread (51.9%), in boiled water (33.3%), as a sweetener in tea (14.8%) and plain ingestion (14.8%).

Knowledge or perceived benefits of honey in managing diabetes, did not translate to its actual use. There was no significant difference in the mean blood glucose levels between those using honey and those not using honey. However, those using honey were more likely to have normal readings compared to those not using honey. Generally, the longer the respondents consumed honey, the more likely they were to have elevated blood glucose, but with less associated complications of nephropathy, ketoacidosis and diabetic foot.

In conclusion, there was an apparent lack of knowledge on benefits associated with use of honey in diabetes management. Knowledge on the benefits of honey did not translate to its use as part of the diabetics' diet. There were no standard practices of honey consumption among diabetics. There is lack of guidelines or policy in the country in this area.

## **CHAPTER ONE: INTRODUCTION**

### **1.1 BACKGROUND INFORMATION**

Diabetes is a deficiency of insulin production in the pancreas. It is either not sufficiently produced or utilised properly. It is a metabolic disorder of carbohydrates where ingested sugars and starches that cannot be deployed to body cells are eliminated in the urine. The main symptoms of diabetes include: frequent urination, extreme thirst or hunger, weight loss, fatigue, numbness, and infections (Bilous, 2011).

In Type I diabetes, the body does not produce any insulin (insulin-dependent diabetes mellitus, IDDM), while in Type II diabetes one either does not produce enough insulin or their cells resist the insulin (non-insulin dependent diabetes mellitus, NIDDM) (WHO, 2015). There is a tendency for type II diabetics to be overweight, mainly because high insulin levels are not able to channel glucose into the muscles. This glucose is instead converted into fat and cholesterol, leading to not only obesity, but also, heart and eye diseases, and poor circulation of blood in the legs. Normally, Type I diabetes is managed with insulin injections, to assist glucose to reach the body cells and maintenance of optimum blood glucose. However, type II diabetics would generally use glucose-lowering drugs and/or insulin injection. The most common age for type II diabetics is usually around 40 years (Ahmed, 2002).

According to the International Diabetes Federation (IDF), 387 million people have diabetes in the world. More than 22 million people are in the African Region and expected to double by 2035 (IDF, 2014). Many middle- and low-income countries have more people under the age of 60 with diabetes compared to the world average. The prevalence rate of diabetes among 20-79 year old adults in Kenya is 3.6%. While 775,200 were known cases in 2014,



another 582,100 adults were undiagnosed (IDF, 2014). Every year, 7 million people worldwide among them seventy thousand children develop diabetes. More children are developing Type II diabetes than previous years, with 25,000 children living with diabetes in Kenya (Diabetes Kenya, 2015).

These data are creating public health concern due to the economic and social burden caused by the disease. Though there is no known cause for diabetes, a complex interaction of environmental, social, and genetic factors are attributed in its aetiology. Currently, the disease management involves administration of anti-diabetic drugs and/or insulin, observing a healthy diet and increased physical exercise. Conversely, the anti-diabetic drugs currently available are not the best fit for comprehensive management of the disorder. This may partly be due to the multifactorial and heterogeneous aetiologies associated with diabetes. In addition, these drugs are expensive and, mostly out of reach for the common man (Erejuwa, 2014).

Honey as a food is mainly used in cooking, baking, as bread spread, an additive to beverages like tea, a sweetener in some commercial beverages and as sauce flavours. Honey is fermentable; acts as a main ingredient in some alcoholic beverages and as an adjunct in some beers (Wikipedia, 2015). Honey's natural sugars are mainly dehydrated monosaccharides fructose (38%) and glucose (28%), with moisture content of 20%, trace amounts of vitamins Band C, and minerals namely; calcium, iron, zinc, magnesium, phosphorus and potassium. Other compounds include bioflavonoids, antioxidants and mineral elements (Al-Waili & Haq, 2004, and Ediriweera & Premarathna, 2012).

Honey stabilizes blood sugar levels and reduces metabolic stress. It may be logically argued that honey will decrease the occurrence of insulin resistance. When uncorrected, insulin

resistance is reported to be associated with cardiovascular diseases (CVD) and chronic liver diseases (Fessenden, 2009).

The effects that have been observed with honey, when combined with anti-diabetes agents, are not limited to a specific type of honey. Varied samples from different geographical areas have been seen to improve hyperglycaemia and metabolic abnormalities in diabetic rats, type I and type II diabetic patients (Erejuwa, 2014).

The first national diabetes strategy (2010 - 2015) was launched in Kenya in 2010. The strategy was drawn to help step up mainstreaming of diabetes policies and programs; to provide the much needed connectivity in the national public health response to diabetes prevention and care at all levels of the health care system (Mutai, 2010). The Kenya health system provides a range of services for diabetes care and prevention. Cost-sharing in public hospitals covers for only 50% of health costs. There is also limited availability of self-management education. However, specialised services exist for the rural poor, elderly, women, displaced persons, refugees, and infants of mothers with diabetes. A monitoring and surveillance framework for diabetes exists but it is not implemented regularly. This framework captures among others, monitoring of obesity prevalence, diabetes incidence/prevalence, high blood pressure, alcohol and tobacco use, and level of physical inactivity (IDF, 2014).

With increased training of medical personnel on diabetes and its management, the health personnel are able to educate families with a history of diabetes. These families work to reduce modifiable risk factors and undertake screening for them. Regular clinic attendance, self-management and care among diabetics, especially blood glucose monitoring, could help in aggressive management of diabetes. This would help in improving odds to achieving optimal glycaemic control (Jones, 2013).

## **1.2 PROBLEM STATEMENT**

In spite of intense research on Type II diabetes mellitus (DM), it remains an incurable disorder. In addition to complications of the cardiovascular system and other morbidity cases, many patients' quality of life has deteriorated. Individuals using anti-diabetic drugs have expressed dissatisfaction with unmet treatment goals or associated limitations. The high cost of synthetic drugs is also prohibitive to many patients. In addition, following strict diet recommendations may be unattainable, which may have led to diabetics seeking for other options and increasingly going for complementary and alternative medicines (CAM). CAM includes herbs and other natural products like honey, a valuable agent with potential as an anti-diabetic, anti-hypertensive and antioxidant, for the management of Type II DM, hypertension and other diabetic complications. Diabetics have an increased risk of developing hypertension.

Generally, there is lack of awareness on diabetes among the general population in Kenya due to poor public health education and low literacy levels in some areas. Though some people lack health knowledge, they still have indigenous knowledge which enables them adopt good practices in management of diabetes. There is need, therefore, to reinforce such practices in the absence of more conventional practices.

It is possible that there are diabetics using honey, while most people living with the chronic illness would be unaware of the potential of honey; maybe due to lack of comprehensive education from their health advisors. This research, therefore, sought to find out the knowledge available, attitude on and practices around the use of honey as part of diabetes management using a case study of Kenyatta National Hospital (KNH) outpatient diabetes clinic.

### **1.3 JUSTIFICATION**

Anti-diabetes drugs, other topical and systemic agents for dealing with complications associated with diabetes are both expensive and, sometimes, not easily available (Erejuwa, 2014). Poor dietary management has also been associated with poor glycaemic control among patients (Khattab, et al, 2009). Honey is a natural substance collected as nectar from plants by bees. Over the years, there has been a renewed importance placed on the therapeutic uses of honey, both through oral consumption and topical application on diabetic ulcers or wounds. This is mainly because of increased evidence indicative of the positive effects of honey in treating different conditions including diabetes. Honey has been found to be effective in enhancement of antioxidant defences, protection of the pancreas and kidneys against oxidative damage in diabetic, diabetic-hypertensive and hypertensive rats (Erejuwa, 2014).

Previous studies have reported that diabetics were advised against use of honey, sugar and sugar products by health workers, except in cases of hypoglycemia (Wahome, 2012 & Barwacho, 2015). However, pure honey is considered a better option in a diabetic diet than sugar and the common non-nutritive sweeteners due to its lower glycaemic index (Fessenden, 2009 & Tan, 2015). Being three times sweeter than sugar, it needs to be used in much smaller quantities (Ediriweera & Premarathna, 2012), with its intake being taken into consideration in the total daily calorie intake of carbohydrates (Tan, 2015).

With the increased socioeconomic burden of the disease among other chronic infections, it is possible that diabetics with access to honey use it due to some perceived benefits associated to their health. There was, therefore, need to investigate the knowledge, attitude and practices of the use of unprocessed honey which is relatively cheap and readily available to people from diverse backgrounds. It was also likely that it would be more effective to incorporate honey in the management of diabetes (Erejuwa et al, 2011).

## **1.4 GOAL OF STUDY**

The aim of the study was to contribute to knowledge on the management of diabetes in Kenya through assessment of the clients' knowledge, attitude and practices in use of honey.

The study sought to establish if the registered diabetics were using honey to manage the conditions associated with diabetes, alongside using their normal anti-diabetes drugs. It was hoped that the outcome would challenge the health service providers while educating those suffering from the chronic illness on the use of honey as part of the disease management.

## **1.5 STUDY OBJECTIVES**

### **1.5.1 Main objective**

The overall objective of the study was to assess the knowledge, attitude and practices of patients at KNH on their use of honey in combination with anti-diabetes drugs in management of type II DM.

### **1.5.2 Specific objectives**

- I. To establish the demographic and socio-economic characteristics of diabetes patients,
- II. To determine the diabetics' knowledge on use of honey in diabetes management,
- III. To determine the diabetics' attitude towards the use of honey,
- IV. To determine the diabetics' practices on the use of honey.

## **1.6 STUDY HYPOTHESES**

1. There is lack of knowledge on use of honey as an anti-diabetic agent among people living with diabetes in Kenya.
2. Diabetics do not use honey as part of their diet.
3. Diabetics do not use honey as they may consider it counter-intuitive to the disease management.



## **CHAPTER TWO: LITERATURE REVIEW**

### **2.1 HISTORY OF DIABETES**

According to an Egyptian manuscript, one of the first diseases from 1500BCE was diabetes, described as "too great emptying of the urine". Initially, cases were believed to be Type I diabetes. The two types of diabetes were identified as separate conditions in 400-500BCE with type I associated with the youth and type II with obesity. The term "mellitus", Latin for "from honey" was added in late 1600s to separate the condition from diabetes insipidus which was associated with frequent urination (Ahmed, 2002).

The first effective treatment by insulin injection was in 1922, when the first patient was treated successfully. This discovery of Sir Bating was recognized with a Nobel Prize in Medicine in 1923, and he and his colleague made the insulin patent available without charge for worldwide production and distribution (Wikipedia, 2015). He is honored by the World Diabetes Day, on November 14, which is commemorated on his birthday. It serves as a public awareness day, and to remind governments of their commitment to develop and implement national policies on diabetes prevention, treatment and care.

A clearer distinction between type I and II diabetes was made and published in 1936 (Wikipedia, 2015).

### **2.2 MANAGEMENT OF DIABETES**

According to Bilous (2011), coping with diabetes will mean a change in diet to a healthy eating plan rather than a restrictive programme. This applies to anyone with diabetes, but may be enough by itself to control Type II diabetes in some people. However, for type I diabetics, one would need to learn to balance the food intake with the insulin injections to achieve the best possible control of the blood glucose level.

Tablets are of different types and are used mainly for control of Type II diabetes, while insulin is used by every type I diabetic and a minority of type II diabetics.

Others controls are physical activities, minimal use of alcohol and avoiding use of tobacco (Bilous, 2011).

### **2.3 HONEY IN DIABETES MANAGEMENT**

One person dies from diabetes-related causes every 10 seconds, and in the same span of time two people develop diabetes. Diabetes has no cure but research is ongoing. The key prevention and control measures remain to be maintenance of a healthy lifestyle and medication (Diabetes Kenya, 2015). However, due to individual uniqueness, each diabetic should learn how their body reacts or responds to different carbohydrates. The key consideration should be the total amount of starches or carbohydrates in their food, and not necessarily the amount of sugar.

Honey is a carbohydrate, just like potatoes and maize meal. One tablespoon of honey has approximately 17 grams of carbohydrate. Diabetics can work out their honey intake by considering its kilocalories among the total daily intake of carbohydrates, as they do for any other sweetener or carbohydrate (Tan, 2015). During purchase of honey for a diabetic, one needs to ensure it is natural, that is, pure or unrefined honey; not mixed with cane sugar, starch, glucose, or malt, which should be left out in a diet for diabetics (Ediriweera & Premarathna, 2012). Though it may seem counter intuitive to use honey to regulate blood glucose, studies indicate that pure honey is a better option in a diabetic diet than any of the artificial sweeteners like aspartame, saccharin or Splenda, and table sugar (Tan, 2015). In various localities, patients suffering from type II DM use honey in place of sugar. However, honey being three times sweeter than sugar, needs to be used in much smaller quantities as a



sweetener. 5ml of bee's honey (with a pinch of powdered seeds of *Gossypium herbaceum*) has been seen to reduce blood sugar in diabetic patients (Ediriweera & Premarathna, 2012).

Honey has a lower Glycaemic Index (GI) than sugar, that is, it does not raise blood sugar levels as rapidly as table sugar, and needs less insulin for regulation compared to normal white sugar. According to *The Honey Revolution* (Fessenden, 2009), the average one-to-one ratio of fructose-to-glucose in honey enables it to perform this significant role. Fructose aids glucose intake in the liver, thus preventing excess glucose from entering the circulation system. Among all the sugars, this unique ability is only found in natural honey.

With its significantly lower GI, Fessenden (2009) also notes that fructose is often recommended as a sweetener for diabetics. However, its absorption mechanism in the liver is different from that of other sugars. Other factors contributing to the antidiabetic effect of honey may be the number of oligosaccharides present in honey which might also have systemic effects. Mineral elements such as chromium, copper and zinc are also recognized for their role in reduction of elevated blood glucose, maintenance of normal blood glucose tolerance and insulin secretion from the pancreatic cells (Erejuwa et al, 2012). For this reason, a study done over 8-weeks showing beneficial effects of honey on body weight and blood lipids of diabetic patients, recommended its cautious consumption in the long term (Bahrami et al, 2009).

Researchers discovered that diabetic subjects consuming 75 grams of honey in 250 ml of water daily for 15 days experienced decreases in blood glucose, cholesterol, low-density lipoprotein-cholesterol (LDL-C) and triglyceride levels while there was a slightly elevated high-density lipoprotein-cholesterol (HDL-C). This was contrasted with the results of an experiment on healthy subjects ingesting dextrose and sucrose who had an elevation of

insulin and C-peptide. Healthy subjects taking artificial honey had slightly decreased cholesterol and LDL-C but an elevated triglyceride level (Al-Waili, 2004).

Measurement of C-peptide provides a validated quantification of endogenous insulin secretion. This is because C-peptide is co-secreted with insulin as a by-product of the enzymatic cleavage of pro-insulin to insulin. Therefore, serum C-peptide can be used as a true indicator of any change in the insulin level, which is the main determinant of plasma glucose level (Abdulrhman et al, 2009).

Serum insulin was increased with administration of honey, while concentrations of glucose and fructosamine were decreased in diabetic rats. Anti-diabetic drugs, where multiple types maybe needed at a go, act to reduce hyperglycaemia. Still with time, glycaemic control deteriorates in these patients. The combined administration of the drugs and honey proved to lower glycaemic levels. Serum levels of fructosamine, creatinine, bilirubin, triglycerides and very low-density lipoprotein cholesterol (VLDL-C) were quite significantly reduced in diabetic rats. However, the anti-diabetic drugs, unlike honey, did not have any effect on fructosamine concentrations in the serum. Furthermore, the combination was more superior in reducing oxidative stress to the kidneys and pancreas, and providing antioxidant defences for diabetic rats (Erejuwa, 2014).

## **2.4 DIABETES COMPLICATIONS**

### **2.4.1 Cardiovascular diseases**

Cardiovascular diseases (CVD) are the leading cause of mortality for people with diabetes. Diabetics are two to four times more likely to develop cardiovascular diseases than people without diabetes. The increased risk may be due to: hypertension, abnormal blood lipids and

obesity; all risk factors in their own right for cardiovascular disease, but occurring more frequently in people with diabetes (World Heart Federation, 2015).

#### **2.4.2 Retinopathy**

Diabetic retinopathy is a leading cause of adult blindness. Diabetics are six times more prone to develop cataracts and 1.4 times more susceptible to develop glaucoma when compared to the general population (Azeredo & Alla, 2008).

#### **2.4.3 Ketoacidosis**

Diabetic ketoacidosis (DKA) develops under these conditions: absolute insulin deficiency and an absolute increase in contra-insulin hormones. This increases hepatic glucose production, causing decreased peripheral glucose utilization, stimulating release of fatty acids from fat cells and causing production of ketones by the liver (Azeredo & Alla, 2008). DKA accounted for 8% of diabetic admissions at KNH, 30% of the patients died within 48 hours of presentation (Jones, 2013).

#### **2.4.4 Neuropathy and foot care**

Diabetic patients also tend to suffer from lower extremity complications including peripheral neuropathy, arterial disease, vascular problems, and ulcerations that contribute to the occurrence of diabetic foot infections. Diabetic neuropathy may cause pain, sensory loss, weakness, autonomic dysfunction, or present with no symptoms. It has been associated with increased occurrence of risk factors as high blood lipids, hypertension, and physical inactivity (Azeredo & Alla, 2008).

In Kenya, several studies have pointed to foot ulcers prevalence being a major complication presenting at tertiary clinics like KNH. Foot ulcers were attributable to risk factors such as infection, poor self-care, poor glycaemic control, diastolic hypertension, and dyslipidemia

(Azeredo & Alla, 2008). All these factors are modifiable and manageable, thus encourage provision of community mobile podiatry services (Maina et al, 2010).

Unlike typical wounds, diabetic wounds are slower to heal, making treatment with conventional topical medications an uphill process. Diabetic wound infections caused by drug-resistant organisms are now common place, with increased resistance to commonly used antibiotics. This eventually leads to increased treatment costs, morbidity, and mortality (Alam et al, 2014).

As an alternative medicine, honey has been used for wound healing since ancient times. It has recently been considered as an effective choice since it provides comparatively rapid wound healing. Honey is a nontoxic, non-allergenic, non-irritating healing agent with no cytotoxic effects; it is relatively cheap, safe, and effective. With some unique natural features as a wound healer, honey works even more effectively on diabetic wounds than on normal wounds. Honey fights against many microorganisms involved in the wound process due to its antioxidant activity and inflammation control (Alam et al, 2014).

Though some kinds of honey may be 100 times more potent than others, honey has been seen to protect against damage caused by bacteria. Some types stimulate production of special cells for tissue repairs from infections, and act as an anti-inflammatory to reduce pain and inflammation (Alam et al, 2014).

In Greece, a type of honey, Manuka, that was used to make impregnated dressings showed significantly reduced healing time and provided rapid disinfection of neuropathic diabetic foot ulcers in type II diabetic patients when compared to conventional dressings (Alam et al, 2014). Manuka honey was approved in 2010 by the US National Cancer Institute for reduction of inflammation of the oesophagus associated with chemotherapy (Hicks, 2014).

Alam and colleagues did not find any documented toxic effects associated with the topical application of honey on diabetic wounds in comparison with the risk of using other conventional wound healing therapies. They also reported that combination of honey with other compounds could be beneficial for wound healing; it was superior compared to using conventional treatment alone in controlling wound infection, in promoting complete healing process, and in decreasing the rate of minor amputations. They also recommend that honey be evenly applied on the dressing pad rather than directly onto the wound (Alam et al, 2014).

#### **2.4.5 Honey in diabetic complications**

The antioxidant effect in honey has additional benefits in reducing several diabetic complications. Where anti-diabetic drugs may have limited or no benefits in reversing mechanisms of hyperglycemia-induced cellular/tissue damage, the antioxidant effect of honey may complement its anti-diabetic effect. The synergistic and beneficial effects would work through antioxidant defenses in tissues or organs susceptible to oxidative stress-mediated diabetic complications. Oxidative stress is one of the major mechanisms through which glycaemic or metabolic memory induces tissue damage. Honey would, therefore, be seen to have effects: on the kidney, reducing diabetic nephropathy; on the retina, reducing diabetic retinopathy; to the nerves, reduced diabetic neuropathy; and on the heart, reduced diabetic cardiomyopathy. Patients were reported to have these possibilities if the conventional anti-diabetic therapy was used alongside honey as a complementary agent (Erejuwa et al, 2012).

#### **2.5 HONEY ACCEPTANCE**

The International Diabetes Federation (IDF) has produced standardized training modules in different languages for health professionals in diabetes care, education and management (IDF, 2011). Part of the training content is in appreciation of complementary and alternative

medicine (CAM), where it stated that the boundaries within and between CAM and conventional therapies are poorly defined. Also, that the therapies in use are not disputed.

Honey, as a CAM, has attracted attention from patients because it is cost effective and is a wound treatment alternative. Locally available honey got a positive response as the treatment of choice among patients in rural communities. The study reported “patient comfort” levels with honey wound gel applications at 88% and with honey alginate at 93% (Alam et al, 2014).

## **2.6 DIABETES EDUCATION**

According to Azeredo & Alla (2008), the lack of accurate training of service providers in the health sector on diabetes leads to serious complications and accounts for high rates of non-compliance among patients.

In Kenya, the investment on training has been through collaboration with the Ministry of Health and KNH who are providing medical students at the University of Nairobi with hands-on training on how to prevent, treat and care for people with diabetes (WHO, 2014).

Jones (2013) noted that education of families with a history of diabetes would be done by trained health personnel on regular screening and reduction of modifiable risk factors. This can help in aggressive management of diabetes through regular clinic attendance. Patients would be assisted, where possible, to be responsible for their self-management and care, especially their blood glucose monitoring.

A challenge that Azeredo & Alla (2008) noted as a major threat in Sub-Saharan Africa is the health seeking behaviour or health belief system of patients, which leads them to rely on traditional medicine rather than “allopathic medicine”. Traditional healers (TH) who may be

aware of symptoms in their clients (excessive thirst and frequent urination) rarely refer patients to health facilities, maybe due to their limited understanding of diabetes.

Most diabetics needed some psychological counselling to accept “a patient-centred empowerment model that fosters collaboration and builds relationships with patients when providing clinical care” (Azeredo & Alla, 2008). However, though professionals recognize that “there is no ‘best’ education program or approach, programs incorporating behavioural and psychological strategies demonstrated improved outcomes”. Studies show that the more effective programs segregate specific age groups and cultures. Group education generally has improved outcomes (Maina, et al, 2010).

In Kenya, the general public awareness and knowledge about diabetes is low (estimated to be less than one third of the population (Jones, 2013). Most respondents had poor behaviors towards diabetes: 41% showed unwillingness to adopt healthier lifestyles. For diabetes prevention, though increased knowledge would be associated with good practice, 49% with adequate knowledge did not put it into practice. Therefore, there is need to reinforce knowledge for one to see some change in behavior.

Maina (2010) in an earlier study had indicated clear discrepancies at the regional level with regards to diabetes knowledge. The Central region had relatively higher knowledge at 30.8% while the Coastal region recording 23.7% as the lowest level of knowledge. This would be attributed to low literacy levels in some areas, poor public health education on diabetes thus poor exposure to knowledge, or also inaccessible quality health care services. Due to lack of clear guidelines on diabetes education, health promotion efforts towards diabetes by different stakeholders were not well coordinated and messages not standardized.

One's level of education would also have a direct relationship with good knowledge of diabetes. Respondents with a tertiary education (52%) had good knowledge on diabetes.

However, among 37.4% of the people with no knowledge, the reason for good practice was associated with knowledge passed down in the family. Thus, interventions should identify positive peoples' attitudes for reinforcement, despite the knowledge levels on the particular subject. It was also noted that interventions need to consider the differences and uniqueness of different age groups, genders, and regions when designing diabetes education for communities (Maina, 2010).

Speaking to WHO (2014), Dr Nancy Ngugi, Head of the Diabetes Clinic at KNH, noted that community awareness around diabetes was low across Kenya. She pointed out that often, diagnosis would be at medical outreach camps or when patients arrive at the hospital with complications of diabetes like thirst, vision change, fatigue and constant hunger.

## **2.7 METHODOLOGIES CRITIQUE**

There is lack of adequate comparative data for community knowledge, attitude and practices (KAP) on diabetes as most discussions are based on people with diabetes who tend to be better exposed to diabetes education.

The sources of health information have also not been captured in most studies. This information would be useful to identify the most appropriate approach and/or platforms for interventions based on health promotion.

## **2.8 GAPS IN KNOWLEDGE**

Currently, there are no published studies on use of honey in diabetes control and management among diabetes patients in Kenya. In addition, long term successful clinical evidence is required with validated laboratory findings to establish honey as one of the most effective means for glycaemic control and alternative topical medicines for treating diabetic wounds.



## **CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY**

### **3.1 STUDY SETTING**

#### **3.1.1 Study area**

The study was conducted at the outpatient Diabetes Clinic of the KNH in Nairobi, Kenya. The clinic receives an average of 30 clients a day, with referrals from other facilities in the larger Nairobi county and its environs (Machakos, Kiambu, Kajiado, Murang'a). Clients present here with various complications and disease stages. Availability of specialists in the diverse field as key informants made KNH a choice study site.

In Kenya, the public sector provides approximately 50% of the health services, while the remaining health services are provided by the private and faith-based sectors. According to the Kenya Master Health Facility List (KMHFL) there were a total of 9,307 registered facilities in Kenya. Of these, 94 are hosted in academic and other public institutions, there were 4,106 facilities registered under the MoH, 3,551 privately owned, 992 faith-based, 313 NGO-based, 6 under humanitarian agencies, 21 under armed forces, 95 under community and Constituency Development Fund owned, 106 under local authorities and trust funds, and 23 are parastatal and state corporation owned facilities in Kenya (MoH, 2016).

Nairobi as the capital and largest city in Kenya has an estimated 3.363 million persons living in Nairobi. KNH, one of the two national referral hospitals, is situated in Nairobi, Kenya. It has a bed capacity of slightly above 2000 beds in the general and amenity wings, just 21 of these are Intensive Care Unit (ICU) beds (KIDDP, 2014), with over 6000 staff members. It is located on an area of 45.7 hectares. The University of Nairobi Medical School and several government agencies are also located on the hospital grounds (KNH, 2015).

### 3.1.2 Study population

The study population consisted Type II diabetes patients registered at the KNH outpatient Diabetes Clinic and had been attending clinic for at least the previous 6 months.

### 3.2 STUDY DESIGN

A cross-sectional survey was carried out. It involved data collection using semi-structured interviewer-administered questionnaires to diabetics on their knowledge, perceptions and practices on current use of honey.

This was also a partial retrospective study as three consecutive blood sugar readings were obtained from records kept by the respondents to assist in showing association between use of honey and maintenance of glycaemic control.

This study was concentrated only among diabetics presenting at the diabetes outpatient clinic during the month of February 2016.

In addition, we sought for information among the health care providers working at the clinic (nurses, clinical officers and nutritionists) using key informant interviews to corroborate information obtained from the clients and/or their recorded data.

### 3.3 SAMPLE SIZE DETERMINATION

The Fisher's formula (1991) was used to determine the sample size:

$$N = \frac{Z^2 pq}{d^2}$$

N = sample size                      Z = level of confidence set at 95% = 1.96

p = estimate of proportion of diabetics using honey = 10%

q = (1-p) = 90%

d = degree of precision or tolerance margin of error = 0.05

Therefore,  $N = (1.96^2 * 0.1 * 0.9) / 0.05^2$

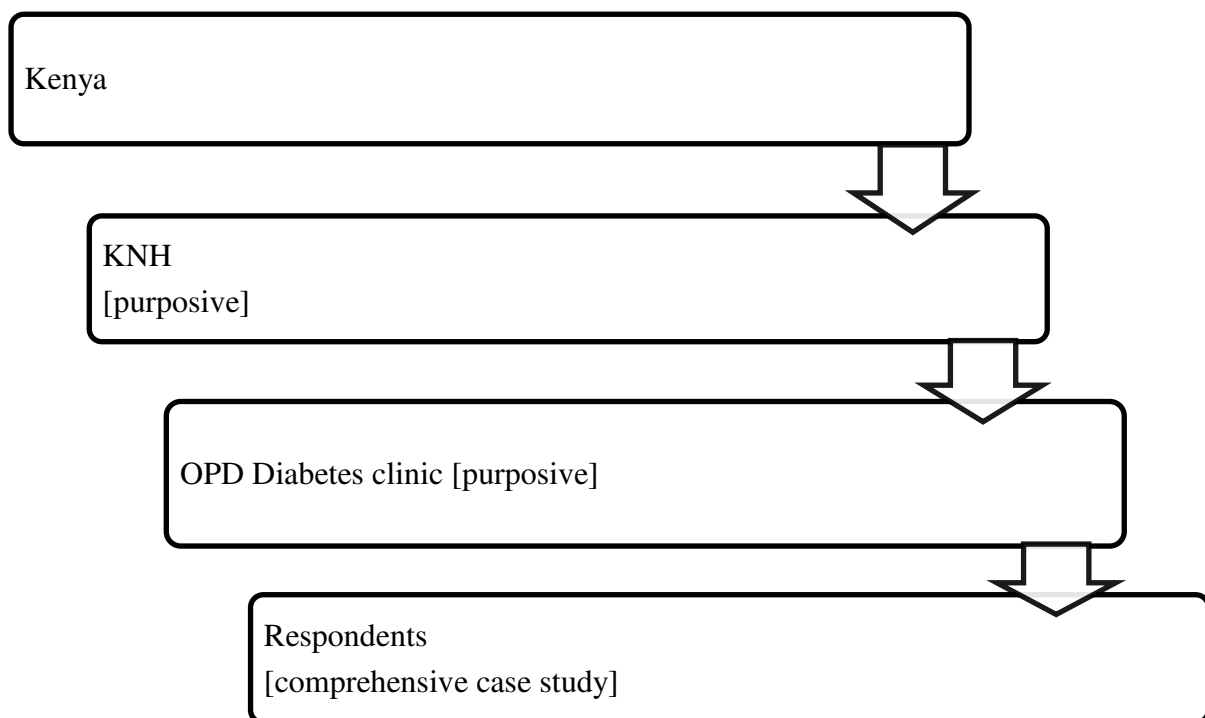
= 139

### 3.3.1 Sampling procedure

KNH was selected purposely as a national referral facility with possibilities of varying cases and specialty consultations. These patients are a subset of all diabetes patients in Kenya and the results of the study would be used to create inference about all patients who fit the prescribed criteria.

The selection of the outpatient clinic was also purposive as this has the highest number of diabetics/respondents at any given time.

This selection criterion is as shown in the diagram below:



*Fig. 1: Sampling procedure schema*

### **3.3.2 Inclusion criteria**

Individual respondents were recruited. These constituted a comprehensive case study of all patients who had 3 months consecutive records of their previous blood sugar readings. Those registered to be seen at the clinic for the day were interviewed while waiting or after the doctor's appointment. They should have:

- Been diagnosed as type II diabetic.
- Been registered at the KNH outpatient diabetes clinic and have attended at least 3 times between the months of June and December 2015.
- Been consistent in use of prescribed drugs.

### **3.3.3 Exclusion criteria**

- To be a diagnosed type I diabetic.
- Not having records of previous consecutive blood sugar readings.

## **3.4 DATA COLLECTION TOOLS AND METHODS**

The study consisted of qualitative and quantitative data, both collected using interviewer-administered questionnaires and key informant guides in a sample survey.

The quantitative data was mainly of socio-economic, demographics, amounts of honey consumed and frequency of use of honey.

The qualitative data was of the human related qualities that influence/affect inclusion of honey in the diabetics' diet. This data was coded for easier entry and analysis.

### **3.4.1 Interviewer-administered questionnaires**

The sampled population was interviewed using semi-structured questionnaires (*see appendix I*) with sections to capture their socio-demographic and economic data, knowledge, attitude and practices around use of honey.

Due to various challenges that some willing respondents were facing, they were assisted in their participation by "treatment buddies" who included spouses, siblings, children, relatives or caretakers.

### **3.4.2 Key informant interviews**

Key informants were also interviewed using a guide (*see appendix II*), administered to professional health service providers; nurses, consultant/clinicians and nutritionists.

## **3.5 DATA MANAGEMENT AND ANALYSIS**

The data was coded and entered onto SPSS v.20 before generating frequencies, proportions and cross tabulations. The data, where necessary, was exported to Ms Excel to facilitate graphical presentations.

### **3.5.1 Descriptive statistics**

To present and complete the data, continuous variables were summarized using mean and standard deviation (SD). Binary and categorical variables were summarized using frequencies and percentages.

### **3.5.2 Inferential statistics**

To determine associations, independent T-test was used appropriately to compare the means between the continuous data groups, where as chi-square along with Odds Ratio (OR) were used to show the likelihood of an independent variable influencing outcomes in honey use

and maintenance of controlled blood sugar levels. Binomial tests were used to show associations for various categorical variables.

Correlation was also used to show relationship between a consistent frequency of honey consumption and the glycaemic levels as observed in the three recorded blood sugar levels. Correlation was also used to show relation between incomes and amount spent on food. Also, to show relation between knowledge on benefits of honey in diabetes management and actual use of honey.

All the statistical tests were at p-value <0.05 (two-tailed) and reported with 95% confidence interval (CI).

### **3.6 ETHICAL CONSIDERATIONS**

Ethical clearance was received from the joint KNH-University of Nairobi (UoN) research committee after submission of the study proposal for approval. Further, authority to conduct the study was obtained from the department of research and programs and the medicine department (*see appendix IV*).

Informed consent was sought from the client/treatment buddy/primary care giver during recruitment of respondents for the study. Respondents to be interviewed were doing so voluntarily. The study process and relevance of the study were explained to respondents by using the standard consent form before interviewing begun.

To ensure confidentiality, the primary investigator and the assistant number-coded all the questionnaires to protect the respondent. No personal identification details were associated with statements included in the report. Some names and contact information were recorded separately with the principal investigator for any form of follow up after the main interview.

### **3.7 DATA QUALITY CONTROL**

Training of the research assistant and pre-testing of the data collection tools was done to enhance thorough data collection.

A review of the questionnaires was done at the end of each interview. The primary investigator went through the day's questionnaires to ensure data was complete, accurate and had no omissions. Supervision during data collection also helped in ensuring a quality job was done.

#### **3.7.1 Recruitment & training of a research assistant**

A research assistant was recruited from the UoN medical school because of the convenient location, familiar surroundings and background knowledge of the subject of investigation. He was picked to work along with the principal researcher; to assist in data collection and also to learn on the job some basic elements of research.

The training and pre-testing were conducted over two days (*see appendix III for guide*). Day I for training on the study objectives, application of informed consent, confidentiality, approach of the respondents and application of the questionnaire by role plays. Day II for pre-testing of the study tools by completing the two sets of questionnaires among 5-10 respondents at the PCEA Kikuyu Hospital outpatient diabetes clinic.

#### **3.7.2 Pilot study**

The informed consent along with the formulated questionnaire and key informant interview guide were pre-tested before the beginning of the study to show:

- Validity: the degree to which questions correctly measured knowledge, attitudes and practices.

- Readability: ease of understanding the questionnaire and questions in terms of sentence length, vocabulary, and writing style.
- Ease of administration: the extent to which questions were linked coherently, to give a sense of unfolding smoothly.
- Respondent burden: degree to which the respondents perceived their participation to be time-consuming, difficult, or emotionally stressful.

Revisions and fine tuning were made where necessary on the tools.



## CHAPTER FOUR: RESULTS

The study was conducted in February 2016. From the expected target of 139 respondents, sampling was done and questionnaires administered to 126 respondents, who represented 91% response rate. Some refusals were due to clients thinking that their personal information would be shared with the care providers, others were not comfortable revealing their socio-economic details, while others left without completing the interview and refusing to cooperate on the phone call follow-up.

### 4.1 SOCIO-DEMOGRAPHIC CHARACTERISTICS

These characteristics included demographic and socio-economic data including: age, gender, level of education, marital status, residency, source of income, average monthly income, and average amount of money spent on food.

#### 4.1.1 Sex of the respondents

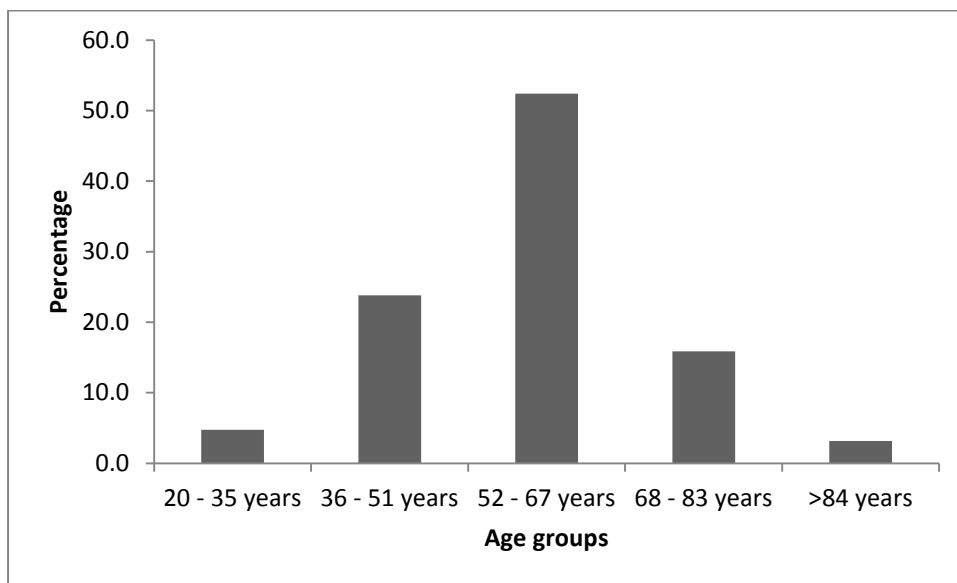
Of the 126 respondents, 50 (39.7%) were male while 76 (60.3%) were female.



*Fig. 2: Sex of respondents*

### 4.1.2 Age

The mean age of the respondents was 57 (SD 13.3) years, with the youngest being 24 years and the oldest 94 years. The figure below shows the mean age of the female respondents being generally higher at 57.62 (SD 13.1) years compared to that of males at 56.06 (SD 13.6) years, though the difference was not statistically significant (Independent t-test  $p=0.522$ , CI: [-6.37 - 3.25]).



*Fig. 3: Age of respondents*

### 4.1.3 Marital status, education, occupation & residency

Majority of the respondents were married (82.5%) while 9.5% were widowed, mainly women.

Results on the level of education among the respondents showed that about a quarter of the respondent had completed secondary school (39.7%), 17.5% completed primary school and 13.5% had completed tertiary education.

With regard to the source of income, majority of the respondents had some form of private business (36.5%), 22.2% were farmers while 19.8% were salaried employees. Quite a few (15.1%) received monetary support from either their family/relatives and/or the government.

Table 1 shows the percentages of different socio-demographic characteristics of the respondents by sex:

*Table 1: Baseline data of study population*

<b>Marital status</b>	<b>All: N=126 (%)</b>	<b>MALE: n=50 (%)</b>	<b>FEMALE: n=76 (%)</b>
<b>Married</b>	104 (82.5)	48 (96.0)	56 (73.7)
<b>Separated</b>	1 (0.8)	0	1 (1.3)
<b>Widowed</b>	12 (9.5)	2 (4.0)	10 (13.2)
<b>Single</b>	9 (7.1)	0	9 (11.8)
<b>Education level</b>			
<b>College/university</b>	17 (13.5)	10 (20.0)	7 (9.2)
<b>Secondary</b>	50 (39.7)	25 (50.0)	25 (32.9)
<b>Primary</b>	22 (17.5)	7 (14.0)	15 (19.7)
<b>Dropped from secondary</b>	18 (14.3)	5 (10.0)	13 (17.1)
<b>Dropped from primary</b>	14 (11.1)	3 (6.0)	11 (14.5)
<b>Did not attend school</b>	5 (4.0)	0	5 (6.6)
<b>Source of income</b>	<b>All: N=126 (%)</b>	<b>MALE: n=50 (%)</b>	<b>FEMALE: n=76 (%)</b>
<b>Salaried employee</b>	25 (19.8)	13 (26.0)	12 (15.8)
<b>Farmer</b>	28 (22.2)	7 (14.0)	21 (27.6)
<b>Self-employment/business</b>	46 (36.5)	20 (40.0)	26 (34.2)
<b>Support from friends/family/govt.</b>	19 (15.1)	7 (14.0)	12 (15.8)
<b>Housewife</b>	3 (2.4)	0	3 (3.9)

<b>Unemployed</b>	5 (4.0)	3 (6.0)	2 (2.6)
<b>Residency</b>			
<b>Urban</b>	61 (48.4)	28 (56.0)	33 (43.4)
<b>Peri-Urban</b>	30 (23.8)	13 (26.0)	17 (22.4)
<b>Rural</b>	35 (27.8)	9 (18.0)	26 (34.2)

Almost half of the respondents (48.4%) lived in urban settings in different counties represented. They reported to have had referrals to the clinic at various points either from lower level hospitals or from the in-patient departments of KNH where they would have been admitted.

Majority of those using honey were likely to be urban dwellers ( $\chi^2=1.633, p=0.442$ ). Table 2 shows the distribution of honey consumption among areas of residence.

*Table 2: Distribution of honey use in areas of residences*

<b>Residence</b>	<b>Use of honey</b>		<b>Total</b>
	<b>Yes</b>	<b>No</b>	
<b>Urban</b>	14	47	61
<b>Peri-urban</b>	4	26	30
<b>Rural</b>	9	26	35
<b>Total</b>	27	99	126

The counties represented in the survey are as shown below:

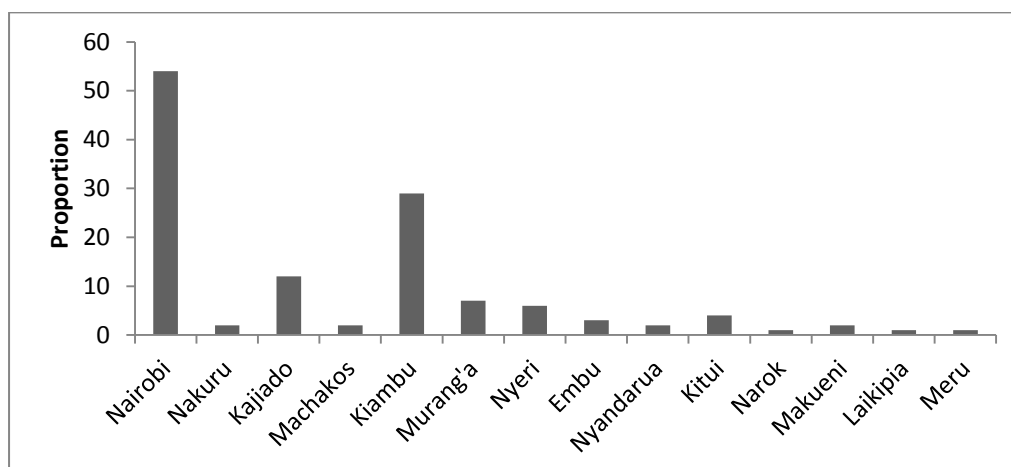


Fig. 4: Distribution of counties of residence of the diabetics

#### 4.1.4 Socio-economic status of the diabetics

To estimate the socio-economic status, respondents were asked about their approximate monthly income. The income range varied widely from KES 2,000 to 100,000; of which 60% (n=105) earned less than KES 20,000 and almost a third (28%) earned between KES 20,000 and 40,000. The average monthly income among all respondents was KES 20,205 (SD 18,310). Table 3 shows the income-groups on income and rough estimation of the expenditure on food:

Table 3: Socio-economic characteristics of the diabetics

Average monthly income	All (N=105)	MALE (n=46)	FEMALE (n=59)
<b>0-9,000</b>	31 (29.5)	13 (28.3)	18 (30.5)
<b>10,000-19,000</b>	29 (27.6)	6 (13.0)	23 (39.0)
<b>20,000-29,000</b>	15 (14.3)	9 (19.6)	6 (10.2)
<b>30,000-39,000</b>	13 (12.4)	7 (15.2)	6 (10.2)
<b>40,000-49,000</b>	6 (5.7)	4 (8.7)	2 (3.4)
<b>50,000-59,000</b>	6 (5.7)	5 (10.9)	1 (1.7)
<b>60,000-69,000</b>	1 (1.0)	0	1 (1.7)
<b>70,000-79,000</b>	3 (2.9)	1 (2.2)	2 (3.4)

<b>90,000-100,000</b>	1 (1.0)	1 (2.2)	0
<b>Mean (SD)</b>	<b>20, 205 (18, 310)</b>		
<b>Money spent on food</b>	<b>All (N=115)</b>	<b>MALE (n=48)</b>	<b>FEMALE (n=67)</b>
<b>500-5,000</b>	51 (44.3)	19 (39.6)	32 (47.8)
<b>6,000-10,000</b>	31 (27.0)	9 (18.8)	22 (32.8)
<b>11,000-15,000</b>	21 (18.3)	12 (25.0)	9 (13.4)
<b>16,000-20,000</b>	9 (7.8)	7 (14.6)	2 (3.0)
<b>21,000-25,000</b>	1 (0.9)	1 (2.1)	0
<b>26,000-30,000</b>	2 (1.7)	0	2 (3.0)
<b>Mean (SD)</b>	<b>8, 800 (6, 433)</b>		

According to the respondents (n=101), almost half of their income (48.9%) was spent on food. On average, the amount of money spent on purchase of food items among respondents was KES 8,800 (SD 6,433). At least 44.3% of respondents used between KES 500 and 5,000 on food and 45.3% used between KES 6,000 and 15,000.

A bivariate correlations analysis showed a positive correlation between the monthly income and the amount spent on food per month ( $r=0.686$ ,  $p=0.000$ ).

#### **4.1.5 Co-morbidities among the Diabetics**

As a background check, the respondents shared on the other co-morbidities that they have suffered in the past year due to diabetes. Majority of the respondents (58%) were on treatment for a cardiac problem, more than half (55.6%) had symptoms associated with neuropathy and close to half (47.6%) reported to be managing hypertension.

Table 4 gives an outline of the co-morbidities:

*Table 4: Diabetes co-morbidities*

Condition within the last 1 year	Respondents: N=126 (%)
Cardiac/heart problem	57.9
Neuropathy	55.6
Hypertension	47.6
Eye complications(retinopathy)	44.4
Ketoacidosis	23.0
Diabetic foot complications	14.3
Kidney complications (nephropathy)	12.7

#### 4.1.6 Dietary habits of the diabetics

Of the respondents interviewed, 91.3% did not have any specific dietary habits, apart from following a balanced diet and using reduced portions of carbohydrates as advised by the health practitioners.

Among those who reported to having a specific dietary habit, 54.5% ate no pork products, 18.2% did not eat cereal-based products, and 27.3% avoided other foods, particularly those causing hyperacidity, e.g. kales, as seen in the following figure:

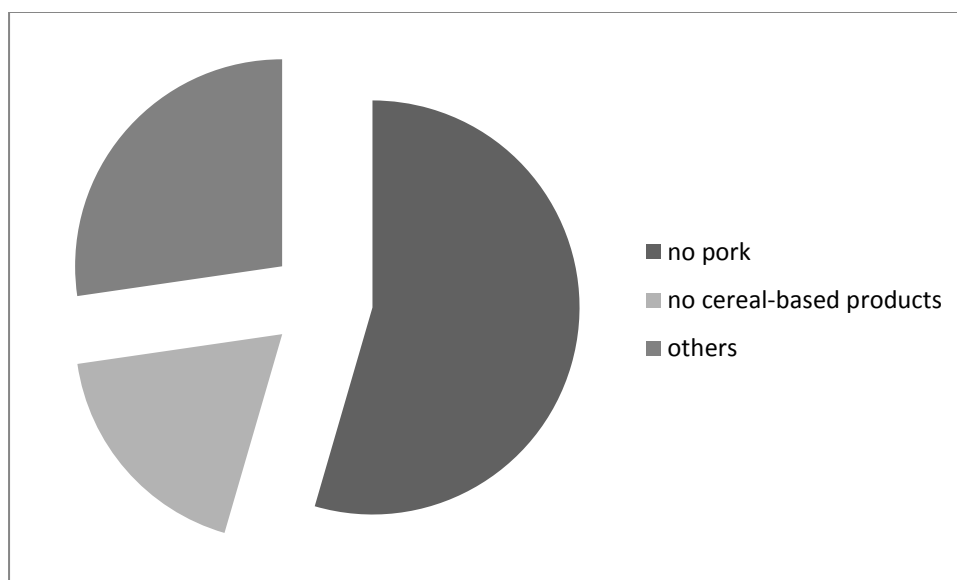


Fig. 5: Specific dietary habits

## 4.2 KNOWLEDGE OF DIABETICS ON USE OF HONEY

Out of the 126 respondents, 21.4% reported to be using honey as part of their diet. Majority of the respondents (78.6%) did not use honey.

### 4.2.1 Honey utilization by respondents

Among the respondents who had been using honey, several reasons cited were mainly that it was a sweetener in their beverages (40.7%), was an alternative bread spread (33.3%) or because they were advised to use it (18.5%).

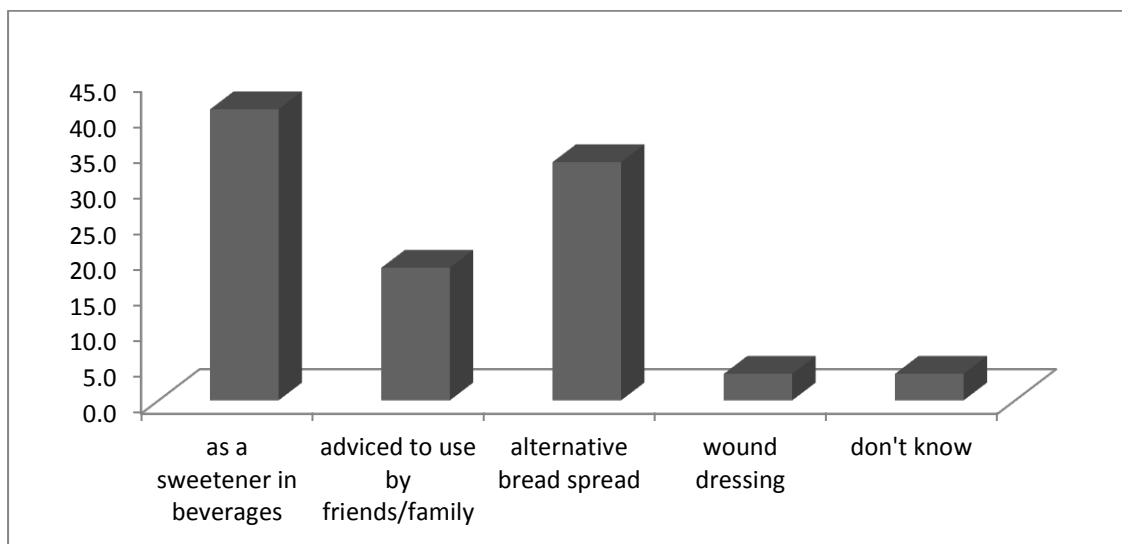


Fig. 6: Reasons for using honey

### 4.2.2 Reasons for not using honey by diabetics

Almost half of the respondents who did not use honey said that it was bad for blood glucose control (47.5%), because they were advised against using it (17.2%) or because honey was too sweet for them (12.1%). A few (5.1%) said it was expensive for them to obtain pure honey.



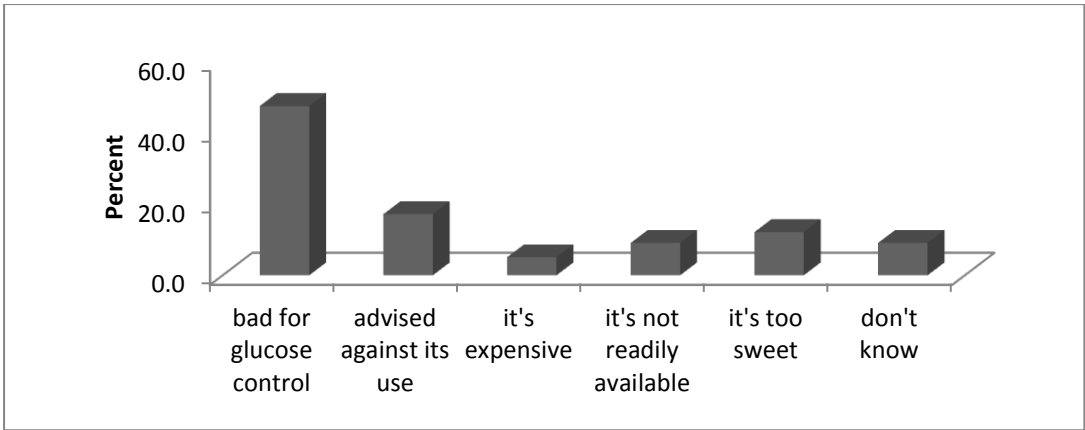


Fig. 7: Reason for not using honey among the diabetics

#### 4.2.3 Knowledge on benefits of use of honey

Among all the respondents in the study, 84.1% did not know of any benefits associated with consumption of honey in managing diabetes.

Those who cited some known benefits said that honey helped them improve blood sugar during hypoglycaemia (45%), that it helped regulate blood sugar (25%), that it helped in wound healing (15%) or worked for colds and flu (10%).

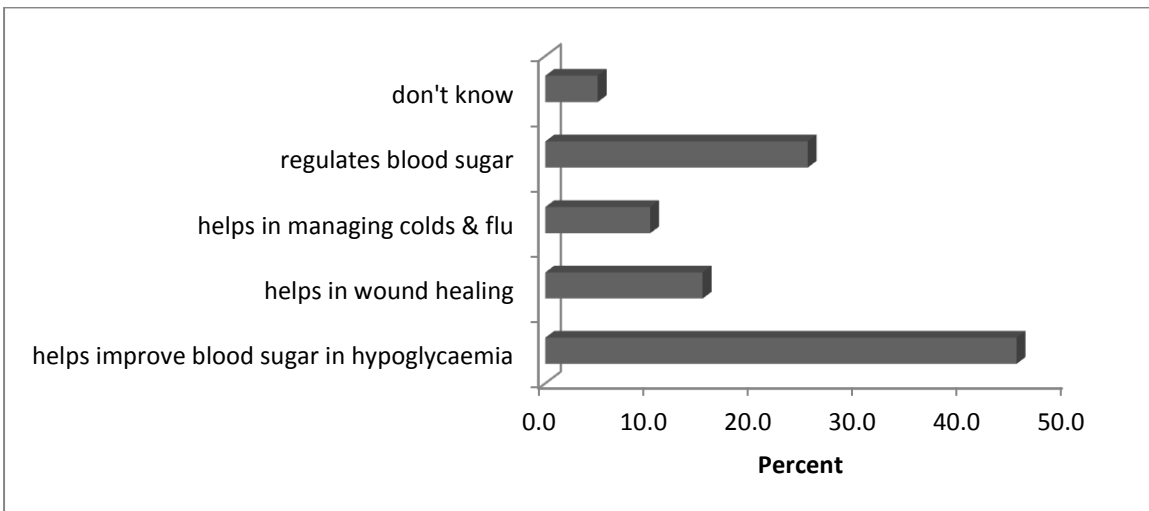


Fig. 8: Benefits of honey to diabetics

#### 4.2.4 Source of knowledge on honey use by the diabetics

Among the respondents who used honey, more than half had their source of information being friends (59.3%). The friends were mainly other diabetics attending the same clinic or other clinics but had used honey and it seemed to be working for them.

Other sources of information included self-research (18.5%), family (14.8%) and traditional/herbal practitioner (7.4%). Health care providers were not cited as a source of information on honey use.

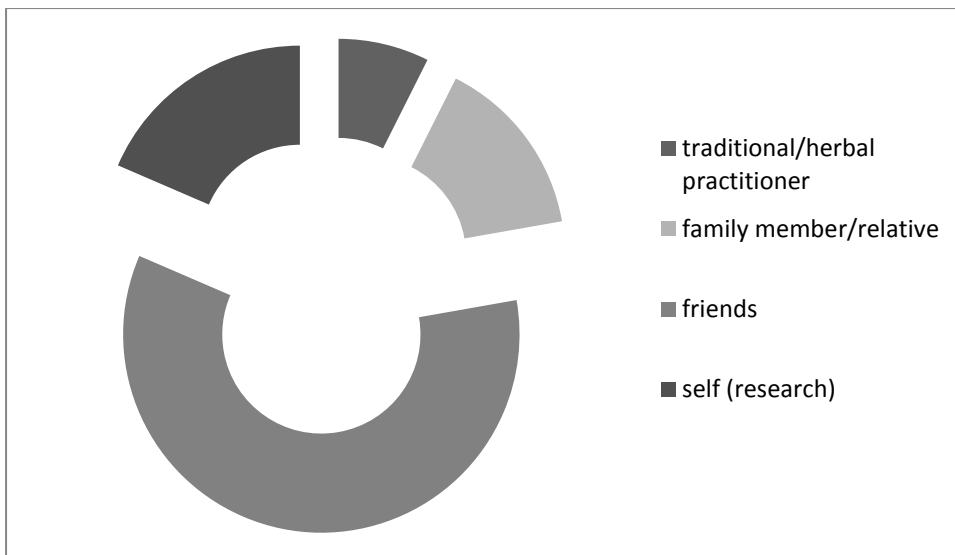


Fig. 9: Source of information on use of honey

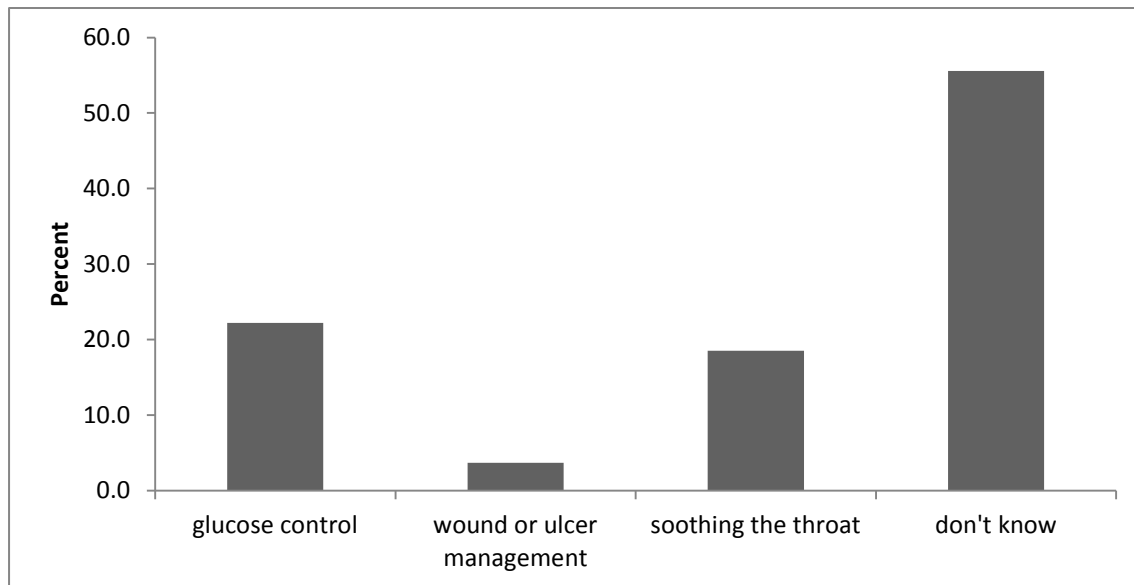
### 4.3 ATTITUDES AMONG THE DIABETICS ON USE OF HONEY

There were varied perceptions on use of honey as part of the diet and how respondents felt it played a role in diabetes management.

#### 4.3.1 Perception on health-related benefits of honey

As indicated in the following figure, among the respondents using honey (n=27), slightly more than half (55.6%) could not relate any health benefits to honey, 22% thought that it

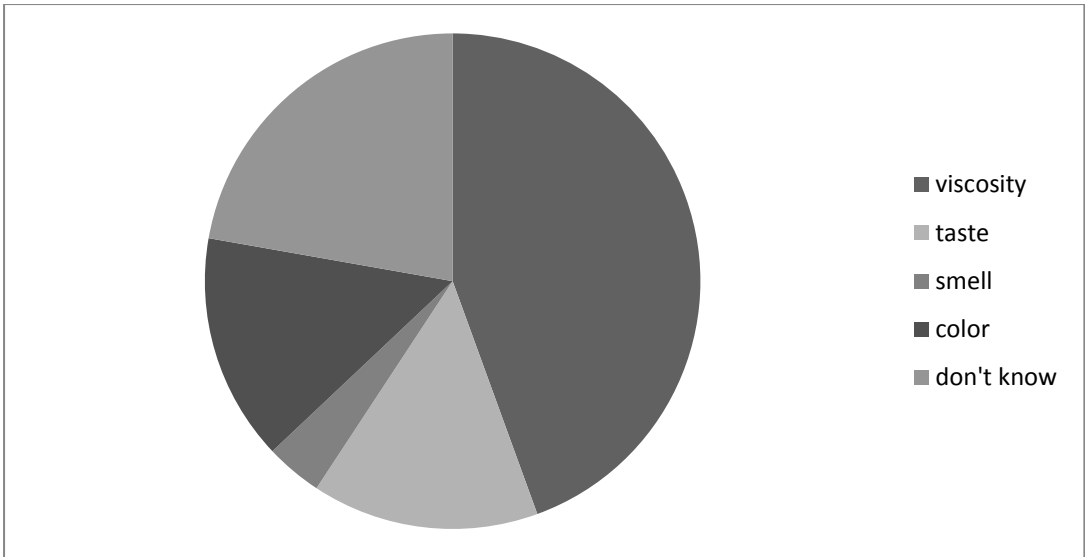
helped in blood glucose control while others thought it was good for soothing a sore throat (18.5%).



*Fig. 10: Perception on health-related benefits of honey*

#### **4.3.2 Indicators of adulteration of honey**

Depending on the initial interaction with honey, respondents (n=27) had different ways of checking for purity &/or adulteration of honey. Most were able to tell by checking the viscosity (44.4%), others by either the taste or colour (14.8%) while 22.2% didn't know how to tell if the honey they obtain was in its pure form.



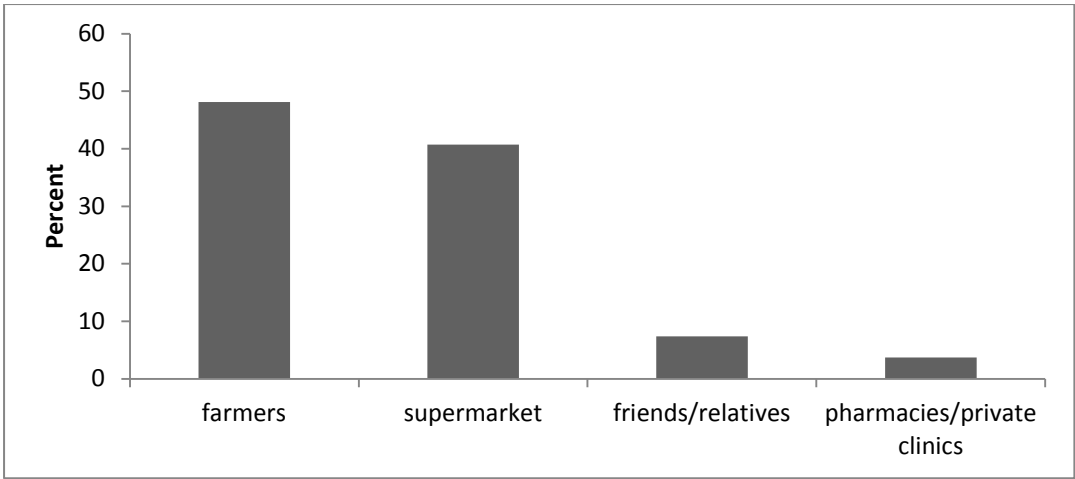
*Fig. 11: Indicators of purity/adulteration of honey*

**4.4 PRACTICES OF DIABETICS ON USE OF HONEY**

To check the practises around the use of honey by diabetics, the study sought to understand the source of honey the respondents’ use, how often they consumed it, how long they had been using honey in their diet, the method of use, and the amount of honey, if any, per intake.

**4.4.1 Source & period of consumption of honey**

The main point of purchase for about 40% of the diabetics (n=27) was supermarkets, while almost half (48.1%) said they get their honey directly from farmers who keep bees or they themselves are beekeepers. The rest purchased from friends/relatives (7.4%) or from pharmacies/private clinics (3.7%).

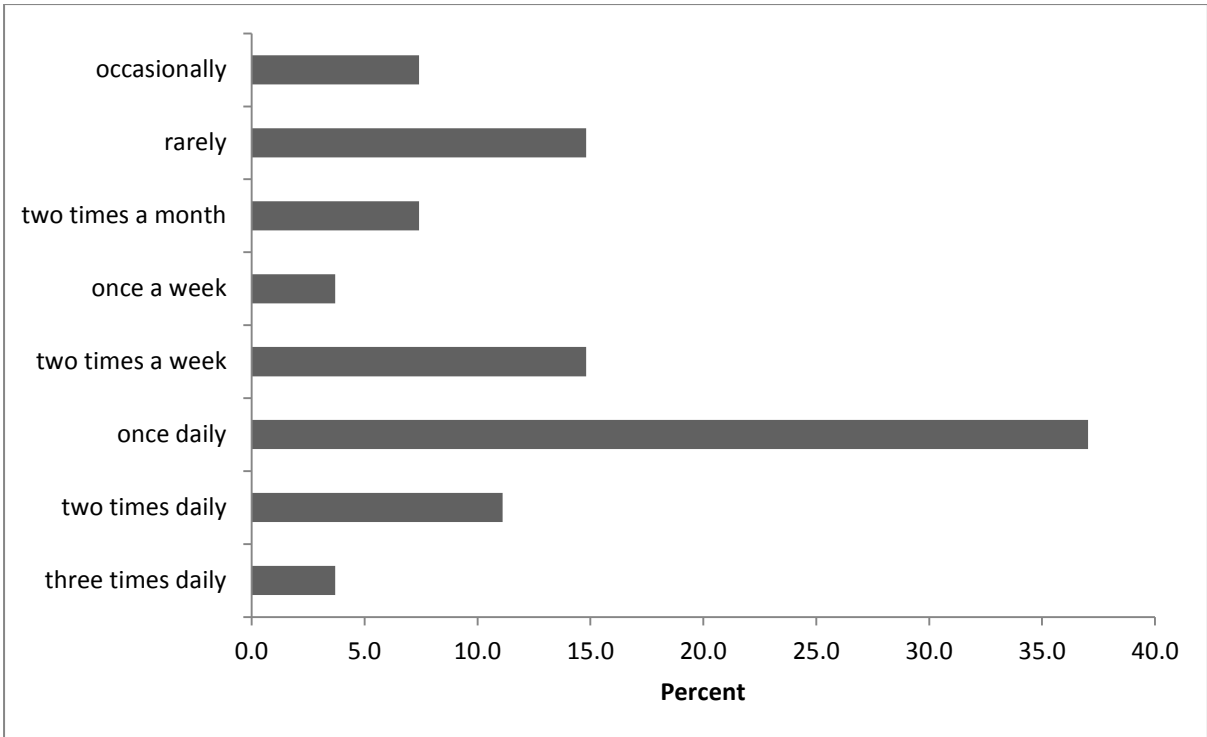


*Fig. 12: Sources of honey*

Majority of the diabetics using honey (63%) had used honey for up to or more than 20 years, since they had been consuming it before being diagnosed with diabetes. Some 22.2% had used honey for 2-10 years, while 11.1% had been using honey for roughly 1 year, and 3.7% for about 15years.

**4.4.2 Frequency and intake levels of honey by diabetics**

Among the diabetics who used honey (n=27), 37% used once a day, 14.8% at least twice a week or occasionally, and a few (11.1%) used honey twice a day. This is illustrated below:



*Fig. 13: Frequency of honey use by diabetics*

More than half of the diabetics using honey alluded to some form of measurement per use (63%), while the remaining 37% did not have a standard measure, were not consistent in measuring or were not sure what measure they used.

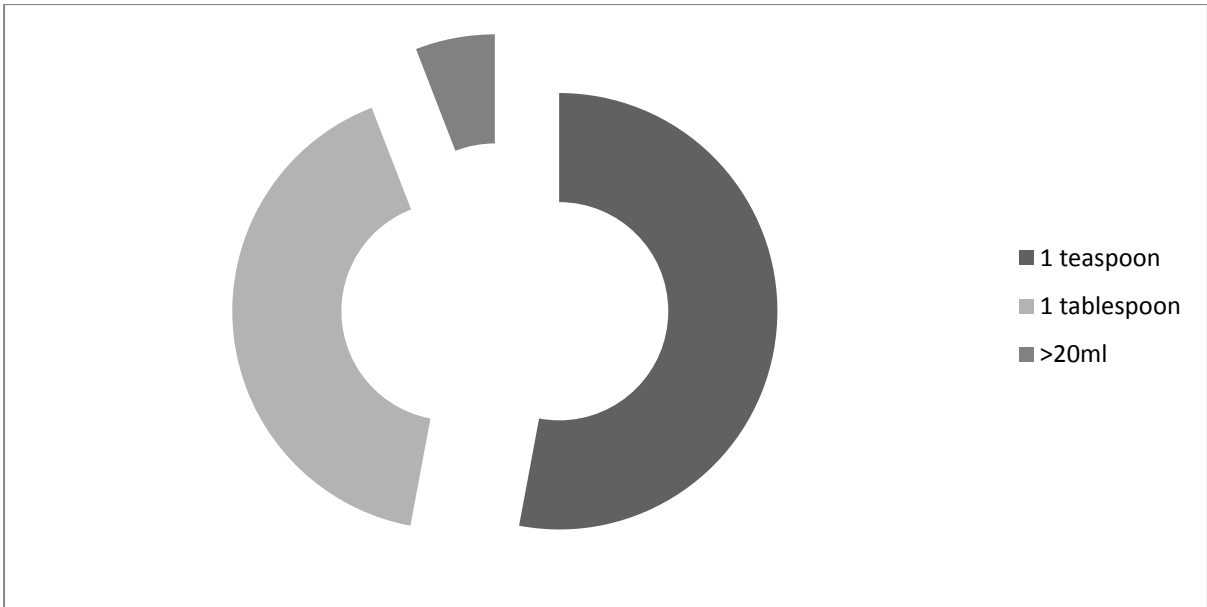


Fig. 14: Intake levels of honey by diabetics

#### 4.4.3 Method of honey use by the diabetics

At least half of the respondents using honey used it on bread (51.9%) and a third (33.3%) ingested it in water. The rest (14.8%) used honey to sweeten tea or ingested it as is.

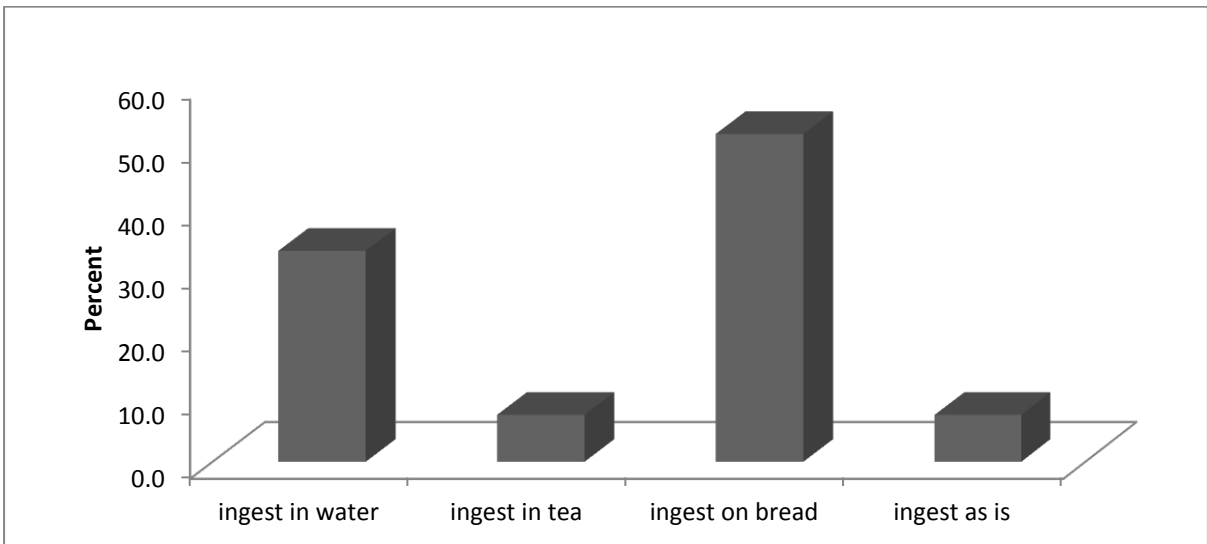


Fig. 15: Methods of use of honey by diabetics

#### 4.5 BLOOD SUGAR LEVELS AMONG SELECTED DIABETICS

Among the respondents interviewed, 114 had at least two out of three consecutive random blood sugar (RBS) records for the months of October to December 2015. The average RBS among the 114 respondents was above normal at 9.48 (SD 3.92) mmol/L.

An Independent T-test for equality of means indicated that there was no significant difference between the average blood sugar readings among respondents using honey compared to those not using honey ( $p=0.785$ ). Table 5 shows this comparison:

*Table 5: Respondents' RBS averages*

	Use of honey	N=114	Mean	Std. Deviation	Test statistics
Blood sugar average	yes	26	9.3769	4.63105	t=-0.274 112df $p=0.785$
	no	88	9.5955	3.21294	

(CI: [-1.80-1.36])

#### 4.6 FACTORS ASSOCIATED WITH HONEY USE AMONG DIABETICS

To compare the use of honey between genders, a Chi-square and odds ratio tests were used. There was no significant difference between gender in use of honey ( $p=0.899$ ), but males were more likely to use honey (OR=1.058). Table 6 indicates the comparison of means:

*Table 6: Comparison in use of honey between males and females*

Use of honey (N=126)	Sex		Test statistic
	male	female	
yes	11	16	$\chi^2=0.016$ , 1df, $p=0.899$
no	39	60	

(OR=1.058; CI:[0.44-2.52])



A Pearson's Correlation indicated that there was a negative relation between knowledge on the benefits of honey in managing diabetes and actual use of honey ( $r = -0.064$ ) but the difference was not statistically significant ( $p = 0.784$ ).

A comparison of means between those using and those not using honey against the recorded RBS, indicated no significant differences between the two groups ( $p = 0.785$ ), though those using honey were more likely to have a normal RBS reading compared to those not using honey (OR=1.545). Table 7 shows the difference in RBS against honey use:

*Table 7: Comparison of RBS against use of honey*

Use of honey (N=113)		RBS categories		Test statistics
		Normal RBS	Elevated RBS	
	yes	11	15	$\chi^2 = 0.908$ , 1df
	no	28	59	$p = 0.785$

(OR=1.545; CI:[0.63-3.80])

Male respondents were less likely to have a normal RBS reading compared to the female counterparts (OR=0.557). This difference, however, is not very significant statistically ( $p = 0.153$ ). Table 8 shows the difference in RBS readings against sex:

*Table 8: Comparison of RBS against sex*

		RBS categories		Test statistic
		Normal RBS	Elevated RBS	
Sex (N=113)	male	13	35	$\chi^2 = 2.038$ , 1df, $p = 0.153$
	female	26	39	

(OR=0.557; CI: [0.25-1.25])

The number of years respondents had taken honey was positively correlated to the average RBS ( $r = 0.254$ ) though with minimal statistical significance ( $p = 0.211$ ). Overall, the longer the respondents consumed honey, the more likely they were to have an elevated RBS, when

compared to those who had taken honey for shorter periods of time. The number of respondents who had used honey for more than four years with an elevated RBS was higher (almost double) that of respondents using honey for the same period but with a RBS within normal range.

Further, at least three times less the number of respondents using honey developed nephropathy, ketoacidosis (DKA) and diabetic foot complications. Generally, the number of respondents not using honey and experiencing any of the diabetes complications was at least two times more than the number of respondents using honey.

## **CHAPTER FIVE: DISCUSSION**

This study was undertaken to assess the knowledge, perceptions and practices around the use of honey by Type II diabetes patients. The study recruited 126 patients attending the KNH outpatient diabetes clinic. It was a comprehensive study among the patients booked for clinic on the particular days over which the survey was being carried out. The possibility of having previous records of the respondents RBS was the main inclusion criteria, though at the end of the interviews some respondents would ask us to follow up for the confirmation, some of whom were not cooperative later.

### **5.1 SOCIO-ECONOMIC AND DEMOGRAPHIC FACTORS AMONG DIABETICS**

The average age of the study population was 57 years, with almost a third of the respondents being past their mid-years (52-67 years). According to the Kenya STEPwise survey for non-communicable diseases risk factors, the age group of respondents with the highest raised fasting blood sugar was of 45 - 59 years. The raised blood sugar was slightly higher in women than in men (MoH, KNBS & WHO, 2015). Almost half of the respondents were urban dwellers spread across various counties neighbouring and including Nairobi county. In Kenya generally, a higher number of people diagnosed with DM and are under medication live in urban settings (54%), compared to rural residence of 28% (MoH, KNBS & WHO, 2015).

At least half of the respondents had a secondary education and higher. In addition, more than half of the participants had a source of income, whether through formal employment or through personal business ventures. The different sources of income for the individuals contributed to the household budget allocation, mainly of food. Drugs for management of the condition and its co-morbidities were also mentioned as a high consumer of the household

budget. It has been noted, however, that only 40% of Kenyans who are aware of their elevated blood sugar are on medication prescribed for by a health worker. Some 5% use herbal therapy/treatment (MoH, KNBS & WHO, 2015).

Study findings show a positive correlation between estimated monthly incomes and money spent on food within the household. The proportion of income used on food was recorded to be almost 50%. These findings are close to those of Kenya National Bureau of Statistics (KNBS) surveys conducted between 2010 and 2015 indicating that the general population uses on average 45% of their income on purchase of food and drinks (Daily Nation, 2016). The slightly higher proportion observed in this study would be due to the fact that diabetics do not necessarily have the liberty of consuming some food types and may need to purchase various fruits and vegetables in larger quantities than usual to manage the condition.

## **5.2 KNOWLEDGE AND PRACTICES IN HONEY USE**

Only a fifth of respondents were using honey as part of their diet. It was also established that it is almost impossible ( $p=0.00$ ) for a diabetic to use honey. The reasons given by up to two-thirds of respondents for not using honey was that they believed it was bad for glucose control or that they had been advised against using it. Majority of the key informants said that they would not recommend to their clients to use honey as they deemed it too sugary thus not good for blood sugar control, unless if used to reverse hypoglycaemia. This is in line with previous research at several hospitals around the city, including KNH (Barwacho, 2015), which indicated that about half of the nutritionists in the study did not consider honey to have any benefits in Type II diabetes management. In addition, only a quarter of the respondents in that particular study felt that honey had a low glycaemic index or that it helped in controlling blood glucose levels. Honey is cited as one of the food sources of free sugar (WHO, 2015).

Some of the highlighted benefits of using honey by the diabetics were improved blood sugar in hypoglycaemia, help in diabetic wound/ulcer management, managing flu and colds. These could be corroborated by the key informants interviewed. Overtime, Abdulrhman (2016) has observed that the use of honey as medicine in larger doses has more therapeutic effects than smaller doses in respiratory and gastrointestinal infections.

The varied responses observed on honey's effect of blood sugar regulation may be due to the fact that different respondents would have different measuring times; 30 minutes, 1 hour or 2 hours postprandial. The timings differed with and among individuals. To examine the response to honey, however, blood glucose levels should be measured before food consumption and two hours postprandial. In Type II diabetes, peak postprandial glucose occurs at 2 hours after a meal, which is an indication of inadequate glucose disposal. This is unlike a peak postprandial glucose of about 1 hour after a meal in people without diabetes (Schrot, 2004).

For diabetic wound/ulcer management, some key informants mentioned that the clinic had moved away from using honey packs to normal saline for dressing, citing relatively equal recovery rates, at a cheaper cost. In a quasi-experimental study which compared wet normal saline and honey gauze dressings, researchers found normal saline was a hyperosmolar physiological dressing and faster in wound preparation, and at a lower cost than honey dressings. The variables highlighted would be associated with the honey available, whose healing characteristics would be influenced upon by bee species, botanical origin and geographical location. Also, different processing and storage conditions of the honey packs. This was in contrast to the regular availability of normal saline as intravenous drips, thus, it was sterile, free of pyrogens and had a standard concentration. The cost of normal saline dressings was also cheaper than the non-sterile commercially available honey. Gamma

sterilization of pure honey packs would increase costs of treatment further (Bashir & Afzal, 2010).

For most respondents using honey, they believed that they were using pure/unadulterated honey. They would use various organoleptic tests to check for taste, viscosity, colour, or smell that they believed was standard for pure honey. Muli and colleagues (2007) had noted that excessive smoking of beehives during harvesting would compromise the aroma and flavour of honey. Honey consumed in most of Africa, Kenya included, was processed using traditional methods. The Codex Alimentarius has proposed standards to check the quality of honey. This includes analysis of moisture, hydroxymethylfurfural, sugar and proline contents, diastase and free acidity (Muli et al, 2007). This study's responses indicated no formal training on this matter, but rather, a taught practice from family or friends or bee keepers. The study respondents, both patients and health providers, agreed on the fact that the commercially available product on retail in supermarkets/pharmacies may not be in its purest form, due to different processing and packaging, and would not be sure of the credibility of the processors. A study to assess the quality of retail honey in Nairobi and its environs through physicochemical analysis concluded that 21% of the samples did not meet the standards set by Kenya Bureau of Standards and the International Honey Commission (Ng'ang'a et al, 2013). From general observation, honey obtained directly from the producer and used without processing would not be readily available to all, especially urban dwellers.

Various respondents had different practices around the use of honey, mostly depending on preferences. Some would mix honey with cinnamon in plain water to help in managing and/or preventing hypertension. Honey dissolved in water is thought to have enhanced antimicrobial properties, water also facilitated swallowing and helped adjust the honey dose (Abdulrhman, 2016).The antioxidant properties of natural honey have been given some

medicinal value towards management of hypertension and diabetes mellitus (Ediriweera & Premarathna, 2012). The respondents would mention that utilization of complementary and alternative foods was not advocated for by the health care providers but instead by their friends, family or conviction after personal research. Nutrition education on these natural substances is not part of the standardized guidelines and protocols for management of diabetes in Kenya, thus they had no reference available on proportions per intake or frequency of intake. Recommendations, however, have been made for the need to restructure health information systems to guarantee reliable, complete, quality, and timely data to facilitate evidence-based practices for decision-making in prevention and control of NCDs. This is mainly because the health sector in Kenya is disease/curative oriented and not focusing so much on wellness and health-seeking behaviour of the population (MoH, KNBS & WHO, 2015).

### **5.3 CORRELATIONS OF HONEY USE TO DIABETES MANAGEMENT**

The study found no significant difference ( $p=0.785$ ) between the average RBS readings of respondents using honey and those not using honey. This could be attributed to lack of verification of the purity of honey consumed, lack of a standard reference for honey consumption periods or amounts, and differing postprandial measures of the blood sugar.

Male respondent were more likely to use honey than women (OR=1.058). This may be associated with the socio-economic status of men whereby the difference in means of the men's monthly incomes was found to be statistically significant compared to that of women in the study ( $p=0.032$ ).

A negative correlation observed between knowledge on the benefits of honey in diabetes and actual use of honey ( $r= -0.064$ ) may be due to the fact that there is not much information or evidence on the effectiveness of controlling blood glucose levels through use of honey

(Anarkooli et al, 2014). Actually, respondents who had been using honey in either food or drink for some time (up to 4 years) were cautiously optimistic of its contribution in maintaining a controlled blood sugar. Those who had used honey for longer had a relatively higher RBS reading compared to those who had used honey for a shorter period. In a continuing study that has been going on for 15 years, Abdulrhman (2016) is using raw unprocessed honey as the sole medication for Type II DM at an empirical dose of 2g/kg/day. He has recorded persistent hyperglycemia and dyslipidemia which, unexpectedly, did not lead to development of any of the macro-vascular complications (that is: coronary heart disease, hypertension or cerebral stroke) in patients who did not have these complications before the trial. He attributes these positive effects to weight reduction or the antioxidant effects of honey, or both. These findings happened without medication or a specific dietary regimen (Abdulrhman, 2016). Previous evidence had shown the potential of honey to protect against diabetic complications through its antioxidant and organ protective effects. Antioxidants are known to reduce insulin resistance and improve insulin levels. The protection extends to the pancreatic  $\beta$  cells, which would effectively mean a slowing down diabetes progression (Kadirvelu & Gurtu, 2013).

A comparison of means between those using and not using honey against the recorded RBS indicated no significant differences between the two groups ( $p=0.785$ ), though those using honey are more likely to have their RBS within the normal range (4.4-<7.8 mmol/L) compared to those not using honey (OR=1.545). Male respondents were less likely to have a normal RBS reading compared to the female counterparts (OR=0.557). This difference, however, was not very significant statistically ( $p=0.153$ ). This could be explained by a general observation that females have better health seeking behaviour than men. The Kenya STEPwise survey found a marked variation in the use of diabetes medication between women (57%) and men (17%) (MoH, KNBS & WHO, 2015). Women have been reported to have



more interest in and do more active seeking of health-related information. They are more attentive, compared to men, to see/relate how their expenditures in everyday products (good or services) affect their health. In addition, women would receive more health information by informal means like through friends, workmates or relatives, compared to men (Stefan, 2013).

Different research has shown women being more likely to search for health information than men (Higgins et al, 2011). The search for information online is more common among more educated and middle income earners, with access to internet at home or work. This would translate to this category of people being more likely to take diabetes self-care proactively (Ayele et al, 2012).

## **CHAPTER SIX: CONCLUSIONS& RECOMMENDATIONS**

### **6.1 CONCLUSIONS**

Majority of the diabetics are in their mid-years, have completed secondary school education and have a source of income.

Majority of their income is used in purchasing food for the household.

There is a general lack of knowledge on benefits associated with use of honey among diabetics, or protocols/guidelines on honey use as part of the diet. This could be the reason why most diabetics do not use honey as part of their diet in managing the condition.

People living with diabetes may have knowledge on the benefits of honey but that does not translate to them using it as part of their diet.

### **6.2 RECOMMENDATIONS**

With increasing access to internet, a lot of curiosity on use of honey in diabetes management would be misguided through varying, sometimes inaccurate information available across the internet. This would call for guidelines or standard protocol formulation and training of health care providers on complementary and alternative medicines for diabetes management, including honey.

Diabetics should be taught on the meaning of various best practices on self-care, like having a standard time of taking blood glucose measurements (2 hours postprandial) and importance of keeping personal records to monitor the condition overtime.

The small number of respondents using honey from which conclusions were drawn may warrant further studies on the topic for stronger evidence-based findings.

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## **APPENDIX I: INTERVIEWER-ADMINISTERED QUESTIONNAIRE**

### **INCLUSION CRITERIA**

First confirm if potential respondent is:

- i. A confirmed type II diabetic
- ii. Has honored TCA dates at least 3 consecutive times in the last 6 months
- iii. Is currently on prescribed anti-diabetes drugs &/or insulin

### **EXCLUSION CRITERIA**

- i. First confirm that potential respondent is not a type I diabetic

## **INFORMED CONSENT (English)**

Good morning/afternoon, Mr/Ms. \_\_\_\_\_. We are students from the University of Nairobi. We are working on a research as part of studies in Applied Human Nutrition. Now, the research is just starting and we are completing a survey among participants to know more about their knowledge, attitudes and practices to do with honey among people living with Type II diabetes.

**Rights as a volunteer:** Your participation is voluntary and highly appreciated. The interview we will take with you will go on for about 15 minutes. Also, you are not obliged to answer any question you do not want to, and you may stop the interview at any time. If you choose not to participate, you will not be denied any service.

**Confidentiality:** All the personal details we obtain will remain strictly confidential and your answers will not be associated with your personal details whether during analysis, reporting or publication. The information obtained will be used only for the purpose of the study.

**Risks & benefits:** The objective of this study is to assess the glycaemic control among diabetics using honey, compared with those not using honey. There will be no invasive tests done, this will just be a question and answer session. This is not to evaluate or criticize you, so please do not feel under pressure to give a specific response and do not feel shy if you do not know the answer to a question. I would like you to answer the questions honestly, telling me about what you know, how you feel, and how you use honey. Feel free to answer questions at your own pace. The information obtained will help provide feedback to your health facility may be used to improve the quality of service and advice in management of diabetes.

**Compensation:** There will be no incentives in form of money or gifts for participation in the study .

Do you agree to participate in this interview? Yes \_\_\_ No \_\_\_ (*If yes, continue to the next question; if no, stop the interview*).

Do you have any question before we start? (*Answer questions*).May I start now?

**For further clarifications/queries, feel free to contact the principal investigator on:**

P. O. Box 1752 - 10100, Nyeri.

Tel: 0721 529 606

Email: chegeress@gmail.com

You can also contact my supervisor:

Dr. C. Kunyanga

P.O Box 29053 – 00625, Kangemi, Nairobi

Tel: 0722 873357 or

Email: ckunyanga@uonbi.ac.ke

You may also contact The Chairman KNH/UoN-ERC through:

P.O.BOX 19676 - 00202, Nairobi

Tel: (+254) 20 2726300 Ext. 44355

Email: uonknh\_erc@uonbi.ac.ke

## **FOMU YA IDHINI KWA KUSHIRIKI KATIKA UTAFITI**

Hujambo, Bwana/Bi \_\_\_\_\_. Sisi ni wanafunzi wa chuo kikuucha Nairobi. Tunafanya uchunguzi ili kutimiza mahitaji ya masomo yanayohusiana na lishe bora. Kwa sasa, tungependa kukamilisha utafitikati ya washiriki kuhusiana na ujuzi/maarifa, mitizamo/tabia na utumizi wa asali kwa wanaoishi na kisukari (ainaya II).

**Haki za mwenye kushiriki:** Tungeshukuru sana kwako kushiriki lakini ni kwa hiari yako. Mahojiano haya yatachukuamuda wa dakika 15 hivi. Pia, hautalazimishwa kujibu swali lolote dhidi ya hiari yako, na unaweza kuwacha mahojiano wakati wowote. Kama utachaguakutoshiriki, hautakatali wahuduma yoyote.

**Usiri:** Maelezo binafsi tutakayopata yatabaki siri; hivi ni kusema kuwa majibu hayatahusishwa na jina lako aitha wakati wauchambuzi, utoaji wa taarifa auuchapishaji. Ujumbe utakaopatikana utatumika tu kwa madhumuniya utafiti.

**Hatari na faida:** Lengo la utafiti huu ni kutathmini udhabiti wa sukari kwenye damu kwa walio na kisukari na wanatumia asali kulinganisha na wasiotumia asali. Hatutafanya vipimo vyoyote vya mwili, nia yetu ni kuuliza maswali na kupata majibu peke yake. Hatufanyi hivi kukukosoa au kukulinganisha na wengine, kwa hivyo usijihisi kushinikizwa kujibu swali kwa namna fulani. Pia usionesoni/haya usipokuwa na jibu kwa swali lolote. Sihitaji ukuwe na jibu maalum; ningependa uweze kujibu maswali kwa uaminifu iwezekanavyo, uniambie unachojua kuhusu, unavyohisi kuhusu unavyotumia asali. Jisikie huru kujibu maswali kwa kasi yako mwenyewe. Ripoti itakayopatikana itasaidia kutoa maoni kwa kituo chako cha afya, na inaweza kutumika kuboresha ubora wa huduma na ushauri katika usimamizi wa kisukari.

**Fidia:** Hakuna marupurupu yoyote, aidha fedha au zawadi, inayotolewa kwenye huu utafiti.

Utakubali kushiriki kwa haya mahojiano? Ndio \_\_\_\_ La \_\_\_\_ (*Kama ndio, endelea na maswali; kama la, maliza mahojiano*).

Una swali lolote kabla tuanze? (*Jibu maswali*).

Twaweza anza sasa?

**Kwa maswali yoyote/ufafanuzi, wasiliana na mpelelezi mkuu kupitia kwa:**

Sanduku la Posta 1752 - 10100, Nyeri.

Simu: 0721 529 606

Baruapepe: chegeress@gmail.com

**Unawezapiakuwasiliananamsimamiziwangu:**

Dk. C. Kunyanga

Sanduku la Posta 29053 – 00625, Kangemi, Nairobi

Simu: 0722 873357

Baruapepe: ckunyanga@uonbi.ac.ke

**Au vilevileMwenyekiti KNH/UON-ERC kupitia:**

Sanduku la Posta 19676 - 00202, Nairobi

Simu: (+254) 20 2726300 Ext. 44355

Baruapepe: uonknh\_erc@uonbi.ac.ke

**A. DEMOGRAPHIC & SOCIO-ECONOMIC CHARACTERISTICS**

1 Sex M=1 F=2	2 Age (years/ DoB)	3 Marital status - codes-	4 Education - codes-	5 Residence: Do you live in an urban or rural area? -codes-	6 (Estate /county)	7 Main source of income -codes-	8 Average monthly household income	9 Proportion of income used on food

Marital Status	Education	Residence	Occupation
1=married 2=separated 3=widowed 4=single 5=divorced 9=N/A	1=college/university 2=completed secondary 3=completed primary 4=Dropped from primary 5=dropped from secondary 5=in primary 6=in secondary 7=adult education 8=Did not attend	1=Urban 2=Peri-urban 3=Rural 9=do not know	1=salaried employee 2=farmer 3=self-employment/business 4=casual laborer 5=student 6=housewife 7 =unemployed 8= other (specify) 9= N/A

**B. DISEASE &FAMILIAL HISTORY**

10. Which year were you diagnosed with Type II diabetes?	_____
11. Have you been diagnosed with any of the following conditions during the past year?	
11.1. heart/cardiac problems 1=yes 2=no 9=don't know If yes for cardiac problems, please specify _____	_____
11.2. kidney problems 1=yes 2=no 9=don't know	_____
11.3. eye problems (retinopathy) 1=yes 2=no 9=don't know	_____
11.4. loss of sensitivity in lower limbs (neuropathy) 1=yes 2=no 9=don't know	_____
11.5. ketoacidosis 1=yes 2=no 9=don't know	_____

11.6. foot wound/ulcers/gangrene 1=yes 2=no 9=don't know	_____ _____
12. What kind of management are you currently receiving? (indicate all mentioned)	_____ _____
13. Has any of your nuclear family members been diagnosed with diabetes? 1=yes 2=no 3= don't know	_____
14. How old were they when they were diagnosed?	_____
15. Which type of diabetes were they diagnosed with? 1=Type I, 2=Type II	_____
16. Has any of your extended family members been diagnosed with diabetes? 1=yes 2=no 3= don't know	_____
17. How old were they when they were diagnosed?	_____
18. Which type of diabetes were they diagnosed with? 1=Type I, 2=Type II	_____

### C. LIFESTYLE CHARACTERISTICS

19. Do you currently smoke cigarettes? 1=yes 2=no	_____
20. If yes in Q.19, how many cigarettes did you smoke in the last 24hrs?	_____ (no. of cigarettes)
21. Do you currently smoke or use any (other) type of tobacco? 1=yes 2=no	_____
22. If yes in Q.21, what other type of tobacco do you currently use or smoke?(record all mentioned) 1=pipe 2=chewing tobacco 3=snuff 4=water pipe/shisha 5=other (specify)	_____

23. Do you drink alcohol? 1=yes 2=no	_____									
24. During the last two weeks, on how many days did you have at least one alcoholic drink?	_____ (no. of days)									
25. Are you involved in exercise that causes an increase in your heart rate for at least 10 minutes continuously?  A) at work? B) during other physical activities?	<table style="width: 100%; border: none;"> <thead> <tr> <th style="width: 60%;"></th> <th style="text-align: center;">Yes</th> <th style="text-align: center;">No</th> </tr> </thead> <tbody> <tr> <td>A) at work.....</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>B) other physical activities.....</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> </tbody> </table>		Yes	No	A) at work.....	1	2	B) other physical activities.....	1	2
	Yes	No								
A) at work.....	1	2								
B) other physical activities.....	1	2								

#### D. KNOWLEDGE & ATTITUDE OF USE OF HONEY IN DIABETES MANAGEMENT

26. Have you used honey before? 1=yes 2=no	_____
27. If yes in Q.26, why do you use honey? 1=as a sweetener in beverages 2=it is cheap 3=advised to use it by _____ 9=don't know	_____ _____
28. If yes, how do you think honey helps you? 1=believe it helps in glucose control 2=it helps in wound/ulcer management 3=to soothe the throat 8=other (specify) 9=don't know	_____
29. If no in Q.26, why do you not use honey? 1=it is bad for glucose control 2=was advised against its use 3=it is expensive 4=it is not readily available 8=other (specify) 9=don't know	_____
30. Do you know anything about use of honey in diabetes? 1=yes 2=no	_____
31. If yes, what do you know about use of honey in diabetes? (indicate all mentioned)	_____ _____ _____ _____



<p>32. Where did you hear/get the knowledge about honey use?</p> <ol style="list-style-type: none"> <li>1. Public Health professional</li> <li>2. Traditional/herbal medicine practitioner</li> <li>3. Family member/relative</li> <li>4. Friend</li> <li>5. Community health worker</li> <li>6. Private clinic/pharmacy</li> <li>7. Shop/kiosk</li> <li>8. Other (specify)</li> <li>9. Don't know</li> </ol>	<p>_____</p>
<p>33. If (s)he uses honey, where do you obtain the honey from?</p> <ol style="list-style-type: none"> <li>1. Supermarket</li> <li>2. Retail shop/kiosk</li> <li>3. Hawkers</li> <li>4. Friend/relative</li> <li>5. Pharmacy/private clinic</li> <li>6. Traditional/herbal medicine practitioner</li> <li>7. Bee keeper/farmer</li> <li>8. Other (specify)</li> <li>9. Don't know</li> </ol>	<p>_____</p>
<p>34. How can you tell if honey is pure/unadulterated? (indicate all mentioned)</p>	<p>_____</p> <p>_____</p>

**E. PRACTICES OF USE OF HONEY IN DIABETES MANAGEMENT**

<p>35. Do you follow a specific dietary habit?</p> <p>1=Yes 2=No</p>	<p>_____</p>
<p>36. If yes in Q.35, Please indicate which dietary habit:</p> <ol style="list-style-type: none"> <li>1. Eggs-only vegetarian</li> <li>2. Milk &amp; eggs-only vegetarian</li> <li>3. Complete vegan</li> <li>4. No pork</li> <li>5. No cereal-based products</li> <li>8. Other (specify)</li> <li>9. Don't know</li> </ol>	<p>_____</p>
<p>37. If yes in Q.26, when did you begin using honey? (indicate year as recalled)</p>	<p>_____</p>
<p>38. If you use honey, how often do you use it?</p> <ol style="list-style-type: none"> <li>1. 3 times daily</li> </ol>	

2. 2 times daily 3. Once daily 4. 3 times a week 5. 2 times a week 6. once a week 7. 2 times a month 8. Other (specify) 9. Don't know	_____
39. Do you have a standard measurement per usage? 1=yes 2=no	_____
40. If yes in Q.41, what amount do you use per intake? 1=1 teaspoon ( <i>approx. 5ml</i> ) 2=1 tablespoon ( <i>approx. 10ml</i> ) 8=other (specify) 9=don't know	_____
41. What is the main way of use of honey?  A) Ingestion 1=in water, 2=in tea, 3=as bread spread 8=other (specify)  B)Skin application (on lesion, ulcer, or wound)  C) Other (specify)	

**F. BLOOD SUGAR RECORDS**

42. Indicate three random/fasting blood sugar readings as recorded during previous clinic visits between times respondent said to have begun using honey (also for those not using honey, use similar time frame for comparison purpose).

Date:	Blood sugar:
Date:	Blood sugar:
Date:	Blood sugar:
<b>Average reading</b>	

**THANK YOU FOR YOUR TIME**

**ASANTE SANA KWA MUDA WAKO**

**APPENDIX II: KEY INFORMANT INTERVIEW GUIDE**

Thank you for accepting to participate in this study as one of my interviewees. Any information you give will be highly appreciated. This interview will take about 20 minutes, and will help give a health provider's view on use of honey in diabetes management.

Your answers are and will be completely confidential; will be coded and recorded without referring to you as an individual.

1. What service do you provide to people living with Type II diabetes?
2. Would you/do you advice diabetics to use honey in their diet?
3. If advice on use of honey is given, what points of emphasis are made?
4. If advice on use of honey is given, do you demonstrate its usage or specify amounts to use? (Describe amounts used and what is demonstrated to client).
5. As a health practitioner, what is your view on use of honey as part of Type II diabetes management?
6. In your opinion, what do you think are (have you experienced any) the merits or demerits in diabetics (who have been) using honey?
7. Lastly, in the Kenya health setting, do you think honey could/should be considered as part of diet for diabetics?

### **APPENDIX III: RESEARCH ASSISTANT TRAINING GUIDE**

To be covered over two days, the main topics included in the training were:

- Study objectives;
  - ✓ Background,
  - ✓ Justification and
  - ✓ Objectives
- Informed consent and confidentiality;
  - ✓ Seeking consent,
  - ✓ To be articulate in the study objectives,
  - ✓ To answer any question related to the study,
  - ✓ To guarantee confidentiality
- Content and use of study questionnaire
  - ✓ Present the overall format of the questionnaire, its content (topics covered) and instructions to follow
  - ✓ Review every question, discuss meaning and reason it was included in the questionnaire
  - ✓ Emphasize importance of exploring questions thoroughly with the respondents and not trying to force answers to match the listed response options
  - ✓ Ensure that questions are asked in the order they appear on the questionnaire
- Approaching the respondent and administering the questionnaire
  - ✓ Basic skills to communicate with respondent, to develop trust and obtain accurate information
- Role-playing for effective interviews
  - ✓ Practice interviewing to familiarize with the questionnaire, observe performance and give feedback to improve technique

The principal researcher and research assistant both pre-test the questionnaire and key informant interview with at least of 5-10 respondents.

### **APPENDIX IV: ETHICS APPROVAL & STUDY CERTIFICATE**

## **APPENDIX V: PLAGIARISM REPORT**