KNOWLEDGE, ATTITUDE AND PREVENTIVE PRACTICE AGAINST RISK FACTORS OF DIABETES MELLITUS 2 AMONGST STUDENTS OF MOUNT KENYA AND GITWE UNIVERSITIES RWANDA.

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DECLARATION AND APPROVAL

Declaration by the Student

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

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Approval by the supervisors

We confirm that the work reported in this thesis was carried out by the candidate under our supervision as the university supervisors.

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DEDICATION

To my lovely wife Ruth, my son Jeremy, my mother and my father.

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Profound appreciation goes to Mount Kenya University fraternity for their endeavor to meet my needs as a student beyond satisfaction.

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ABSTRACT

The incidence of diabetes mellitus 2 among youths has increased. The specific objectives were to assess the level of knowledge regarding risk factor for Diabetes mellitus 2, to identity the attitude towards risk factors of Diabetes mellitus 2, to determine the prevention practice against risk factor of Diabetes mellitus 2, to determine the factors associated with adequate preventive practice to risk factor of Diabetes mellitus 2 prevention amongst students of Mount Kenya and Gitwe Universities Rwanda. Entire populations of 2780 students from Mount Kenya University and 978 from Gitwe University constituted the target population, Using Yamane formula, Sample size was calculated which was 268 and 94 students respectively. A close-ended questionnaire was designed to collect student's data. A total of 384 students filled the questionnaire satisfactorily. Most of the respondents (61.5%) had moderate level of knowledge on risk factors of Diabetes mellitus 2. However, about a quarter (25.3%) had low level of knowledge and those with high level of knowledge on the same were 12.9%.The study revealed that most of the respondents (59.8%) had positive attitude on risk factors of Diabetes mellitus 2 followed by moderate (36.8%) while only 3.4% had low attitude. Most of the students (60.6%) scored adequate practice on risk factors of Diabetes mellitus 2 prevention while the remaining (39.4%) scored in-adequate practice towards risk factors of Diabetes mellitus 2 prevention. Students from Gitwe University were 2.1 times more likely to practice adequately on risk factor of Diabetes mellitus 2 prevention [OR=2.10; 95%CI=1.24 - 3.56; P=0.006] as opposed to those enrolled at Mount Kenya University. Female students were 1.71 times more likely to practice adequately on risk factor of Diabetes mellitus 2 prevention [OR=1.71; 95%CI=1.10 - 2.64; P=0.016] than their male counterparts. Moreover, employed students were significantly more likely to practice adequately on risk factor of Diabetes mellitus 2 prevention [OR=3.01; 95%CI=1.57 - 5.77; P=0.001] than those who were students. Students with high level of knowledge had about 3 times more adopt preventive practice against risk factor of Diabetes mellitus 2 [OR=3.33; 95%CI=1.44 - 7.74; P=0.005] as opposed to those with low level of knowledge. Similarly, students with positive attitude on the risk factors of Diabetes mellitus 2 were 5.5 times [OR=5.55; 95%CI=1.46 - 21.13; P=0.012] and with moderate level of attitude were 4 times [OR=3.98; 95%CI=1.03 - 15.40; P=0.045] more likely to adequately practice on risk factor of Diabetes mellitus 2 prevention compared to those with low attitude. The study recommended that the University should endeavor to inculcate healthy life style behavior through health education clubs, programs and workshops and instill good knowledge and attitude towards diabetes mellitus 2.

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LIST OF ACRONYMS AND ABBREVIATION

ADA	**:**	American Diabetes Association
DKA	**:**	Diabetic keto acidosis
DM1	**:**	Diabetes Mellitus 1
HBM	**:**	Health Belief Model
HHNS	**:**	Hyperosmolar non-ketotic syndrome
WHO	**:**	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Globally, there has been an increase in the number of new cases of diabetes mellitus. Approximately about 425 million people are living with diabetes mellitus according to International Diabetes Federation. The figure is estimated to reach 629 million adult diabetic mellitus patient by the year 2045,a 48% increase(IDF Diabetes Atlas 8th Edition 2017)

Internationally there was a record of 53 million deaths in the year 2010; Forty (40) million of these deaths which represent 75% were caused by non-communicable disease. Diabetes accounted for 0.8 million of the total deaths which is about 2% of the total global deaths globally (WHO, 2014).

Diabetes mellitus 2 is major challenge for health and development in Africa in the 21st century. This disease is for sure a preventable disease but it is currently a killer disease accounting for millions death annually, bankruptcy, and high degree of morbidity. It does not discriminate poor or rich, all are bowed down by it. Currently Africa has an estimated 16 million adults living with Diabetes mellitus 2 , this translate to a regional prevalence of 3.1 %.Global projection indicate that it will experience an exponential increase in incidence of diabetes of about 156% by year 2045(IDF Diabetes Atlas 8th Edition 2017).

Disease pattern is changing from communicable to non-communicable in Rwanda like other low-income countries due to epidemiological shift (Ministry of Health, 2014). Diabetes happens to be among the overriding NCD in Rwanda, other common and non-communicable disease that have high prevalence include cancer, respiratory diseases, injuries caused by road accident and physical disability (Ministry of Health, 2014).

In 2014, World Health Organization non-communicable diseases analysis of Rwanda recorded 78,000 deaths, of this deaths, 28,080 were attributed to non-communicable disease which represent 36% of total deaths (WHO, 2014). The prevalence of diabetes in Rwanda is about 3.06 %(Rwandanon-communicable disease report 2015).

The genesis of diabetes mellitus 2 is associated with environmental factor and genotypic factors. Environmental factor includes poor eating habits, inactiveness, certain physiological conditions in the body, alcohol and tobacco consumption (Finlayson *et al*, 2012).

The basic characteristic of diabetes is total or relative shortage of insulin hormone; it is the only hormone that is involved in glucose metabolism in the body therefore bringing blood glucose concentration down. Reduced secretion of insulin by pancreas cell and diminished sensitivity of body cells to it action begets Diabetes mellitus 2 (American Diabetes Association 2010). Diabetes mellitus 2 will strike in at the age of 40, but some time the onset can come earlier at the age of 20 years. It is occasioned when the body is not able to utilize or produce optimum insulin whose purpose is to get glucose inside the body cells (Bilous, 2010).

1.2 Statement of the Problem

Studies indicate that among youth below 30years including university students, prevalence of diabetes mellitus has been on the rise for the past two decades or so (Mayer-Davis *et al* 2017).The chances of getting diabetes mellitus are elevated with poor lifestyle behaviors and genetic predisposition. According to Sarwar *et al 2010*, prevalence of diabetes mellitus 2 has been on rise, it rose from 4.7% in 1980 to 8.5% in 2014. This comes as a global epidemic and gradually but surely it has become a public health menace. The chances of getting the disease are elevated with poor lifestyle

behaviors and genetic predisposition. Studies indicate that among youth below 30years including university students, prevalence of diabetes mellitus has been on the rise for the past two decades or so (Mayer-Davis *et al* 2017).

According to Vadeboncoeur *et al (2016),* University student in their first year are prone to add weight which can be attributed to change in lifestyle and it affect almost 70% of all the students. To add more salt to the injury, the last two decades have seen the incidence of Diabetes mellitus 2among the adolescent rise tremendously (CDC, 2020).

A study by CDC researchers indicates that Diabetes mellitus 2 accounts for between 8% and 46% of all new incidence of diabetes (CDC, 2020). The actual numbers of youths that are suffering from Diabetes mellitus 2 is little known, because they normally don't manifest clinical symptom that would call for blood test to diagnose the condition (Fagot-Campagna *et al*, 2016).

Inactiveness and poor dietary habits has been associated with increase in prevalence of diabetes mellitus among university students. Dedicated international endeavor to reduce Diabetes mellitus 2 has been hindered by ignorance of those at high risk of becoming the victims of the disease. The ever-elevating prevalence and negative spiraling social cost effects of type 2 diabetes calls for formulation of appropriate interventions.

High occurrence of obesity and overweight notwithstanding, very few investigations has seen the light of day concerning physiological risk for this population (Huang et al., 2007). Even if they are many and rapid diagnostic tool for diabetes, they hardly find applicability in the younger population (Mainous *et al.,* 2016). In the face of overweight and metabolic complication College students remains an understudied population (Huang *et al.,* 2015).

There is scanty information about university students' risk for diabetes mellitus type 2 and students' perceived threat of the disease. The prevalence of Diabetes mellitus 2 is

growing fast in Rwanda and globally and this is exerting immense pressure on the public health facilities and a drawback to development in terms of other social and economic infrastructure (Wang *et al* 2018). Despite this increase, very little research has been done on Rwanda young population at university where habit and lifestyle behavior are acquired and cemented, some of which are key to avoiding or predisposing an individual to diabetes.

In a related study done by Waweru *et al* (2016) to determine the association between BMI and dietary habits, found a 20% overweight occurrence among students of Mount Kenya University. Waweru *et al* (2016) further found out that body mass index was statistically related to dietary habits characterized by too much snacks, fast foods, few vegetable and fruits. Body mass index and poor eating habits being among the risk factor for diabetes mellitus 2 and having been identified among this population precipitated a dire need to carry out this research. Below is a table showing the prevalence of BMI distribution of Mount Kenya University students Waweru *et al* (2016).

Table 1: BMI status among Mount Kenya University Students Study Participants

BMI(kg/m^2)	**Number**	**Propotion (%)**
<18	37	14
18-24.9	161	65
25-29.9	49	20
>30	2	1
Total	249	100

Source: Waweru *et al*, (2016)

1.3 Objective of the Study

1.3.1 General Objective

To determine knowledge, attitude and preventive practice against risk factors of diabetes mellitus 2 amongst students of Mount Kenya and Gitwe Universities Rwanda.

1.3.2 Specific Objectives

The researcher was out to achieve the specific objectives below. Common risk factors for diabetes mellitus 2 are overweight, sedentary lifestyle, poor diet and family history

1. To assess the level of knowledge regarding risk factor for Diabetes mellitus 2amongst students of Mount Kenya and Gitwe Universities Rwanda.
2. To identity the attitude towards risk factors of Diabetes mellitus 2amongst students of Mount Kenya and Gitwe Universities Rwanda.
3. To determine the prevention practice against risk factor of Diabetes mellitus 2 amongst students of Mount Kenya and Gitwe Universities Rwanda.
4. To determine the factors associated with adequate preventive practice against risk factor of Diabetes mellitus 2amongst students of Mount Kenya and Gitwe Universities Rwanda.

1.4 Research Questions

1. What is the level of knowledge regarding risk factor for Diabetes mellitus 2amongst students of Mount Kenya and Gitwe Universities Rwanda?
2. What is the attitude towards risk factors of Diabetes mellitus 2amongst students of Mount Kenya and Gitwe Universities Rwanda?
3. What is the level of prevention practice against risk factor of Diabetes mellitus 2 amongst students of Mount Kenya and Gitwe Universities Rwanda?

4. What are the factors associated with adequate preventive practice against risk factor of Diabetes mellitus 2amongst students of Mount Kenya and Gitwe Universities Rwanda?

1.5 Significance of the Study.

The departments in the government that are entrusted with creating policy will find the finding of this research useful, more so the ministry of health and education as they develop systems that will ensure health education among university and college youths that would help fight type 2 diabetes mellitus. The ministry of finance and that of youth and gender will also borrow from the findings as they allocate funds and draw their annual plans respectively.

The result will come in handy for the policy maker as they formulate health education, health promotion and surveillance programmes that will help in early prevention of incidence of Diabetes mellitus 2, if early detection is done timely treatment and management to prevent death and incapacitation can be achieved.

The Mount Kenya University students, other various university students and the entire young Rwandan community is expected to benefit from reduced risk of Diabetes mellitus 2 following implementation of the recommendations that has been made in this research study. This will also go a long way in keeping them away from getting diabetes mellitus type 2, thus giving them quality and more productive life and also evade them from the financial burden the disease can pose to it victims.

Local, regional and internationally researchers will find this study beneficial as it has beefed-up to the existing documented knowledge, on the relationship between University students Diabetes mellitus 2 risk factors and demographic characteristic. On the same breath it has highlighted not only the level of knowledge of risk factor for

diabetes mellitus 2 among university student but also the actual risk factor that predispose the student to diabetes mellitus 2.

The study has provided the university with the list of risk factor for diabetes mellitus 2 among their student and their corresponding level of knowledge about the risk factors. The university benefits from the recommendation that has been offered which can be implemented to help diminish the Diabetes mellitus 2 risk in the student population. The study forms the basis on which the University can introduce health education courses for all students in order to nurture a culture of better lifestyle. With evidence from the findings, a customized lifestyle educational programs that can enlighten and inculcate to students the need to deliberately choose appropriate lifestyle behaviors can be designed.

1.6 Justification of the study

Prevalence of Diabetes mellitus 2 among youths between the age of 17 to 30 years has increased, an age group where most of university student belong to (Nagheer *et al* 2017).It is for this reason that university student were selected as a study population as most fall in this age group. There is limited studies on students as group in terms of diabetes mellitus (Huang *et al.*, 2015), therefore there is need to conduct more studies to bridge the gap of information. The prevalence of Diabetes mellitus 2 globally has been on the rise and may climax to pandemic level in 2030 and thus becoming a global health challenge of 21st century (Shaw *et al.*, 2010), it is for this reason that studies need to be done about Diabetes mellitus 2 in order to design methods and tools to reduce the incidence of the disease.

1.7 Scope of the Study

In a research done by waweru *et al* 2016, the finding indicated that overweight and obesity among Mount Kenya University students was at 20%, these being among the risk factors for Diabetes mellitus 2 persuaded the researcher to select the university as a study population. Mount Kenya University is located in Kigali which is an urban area in order to be able to compare the results with a rural located study population; Gitwe University was selected.

1.7.1 Content Scope

Data was obtained from students at Mount Kenya University and Gitwe University. It entailed collecting data pertaining to knowledge practices and attitude towards Diabetes mellitus 2 in the student's population.

1.7.2 Geographical

Mount Kenya University, Kigali Campus Rwanda and Gitwe University were the venue of the study. Mount Kenya University is located in Kigali city, Kicukiro district, Kagarama. Gitwe University is located in the southern province of Rwanda in Ruhango district.

1.7.3 Time Scope

This research was carried out from January 2018 through February, March and April up to December 2018. Data was collected from students who were at the respective schools during the study period.

1.8 Definition of Key Terms

Type 2 diabetes mellitus: This is a type of diabetes that is occasioned majorly by body cell becoming increasingly resistance to insulin or inadequate secretion of insulin, it common among those aged 30+ years. It was previously called non-insulin dependent diabetes (America Diabetes Association 2004)

Type 2 diabetes risk factors: This refers to condition that elevates the possibilities of acquiring diabetes mellitus 2. They include: age, eating habits, origin, cultural backgrounds, obesity, lipid metabolic disorder, hypertension genotype and pregnancy. (America Diabetes Association 2008)

University Student: A male or female of any age that is enrolled in a university to pursue a bachelor, master or Phd degree and who is actively registered to study certain unit in a given semester, having fulfilled all the necessary requirements as per university demands.

A risk factor: This refer to a situation either environmental or physiological that increase the chances of one to contract an adverse health condition, example could include but not limited to food, drugs, type of work, level of physical activity and general physiological condition.

CHAPTER TWO

LITERATUREREVIEW

2.0 Introduction

This chapter will see several aspects discussed such as: critical review, empirical review, theoretical framework, conceptual framework. All information from other researcher will be properly referenced.

2.1 Theoretical framework

2.1.1 Health Belief Model (HBM)

The HBM was initially designed in order to steer the United States people to embrace preventive measures for certain disease (Becker 1975). The HBM have found new application in prevention and uptake of the emerging remedies such as breast cancer screening influenza vaccine sexual behaviors, accident prevention and lifestyle behaviors (Griffin, 2012).

The HBM hypothesizes that a person conception if or not they are at risk of acquiring an adverse health condition and their belief on whether or not they will benefit from taking such action to avert the condition determine their willingness to act. HBM is the dominant theory used for studying health behavior (Glanz& Bishop, 2010), the HBM suggest six paradigm that can be used to steer health behavior: risk vulnerability, the extent of negative impact of the risk, challenges to change, confidence to afford change and lastly cue to action (Rosenstock, 1974; Becker, 1974; Champion & Skinner, 2014).

The drive of HBM is to evaluate health behavior of persons through determining people's perception and attitude as regard to certain disease conditions and the undesirable effects of those actions. HBM adopts that, for a successful change in health behavior three element must be present concurrently and they include; an individual

must accept that a certain health condition is critical, a person must perceive that he/she is at risk of that disease and the negative impact of that health condition and a person must be convinced that the benefit of avoiding that condition are worthwhile

HBM is the commonest used theory when handling preventable disease and those that pose no clinical symptoms. Examples of such condition include high blood pressure screening and early cancer detection. HBM has also proved very handy when it comes to reducing risk factors for Diabetes mellitus 2.

This theory is applicable to this study in that it reveals that the students must perceive the risk of contracting diabetes mellitus 2 associated to unhealthy eating habits and lifestyle, if he or she continues with their habits. Also, the students need to be aware of the severity of health conditions associated with obesity and overweight such as diabetes mellitus 2 and hypertension and its consequences such as the increasing death rates arising from unhealthy eating habits. Additionally, the theory implies that for the students to adopt health eating habits they must desire the benefits of their habits such as reduced risk of non-communicable diseases.

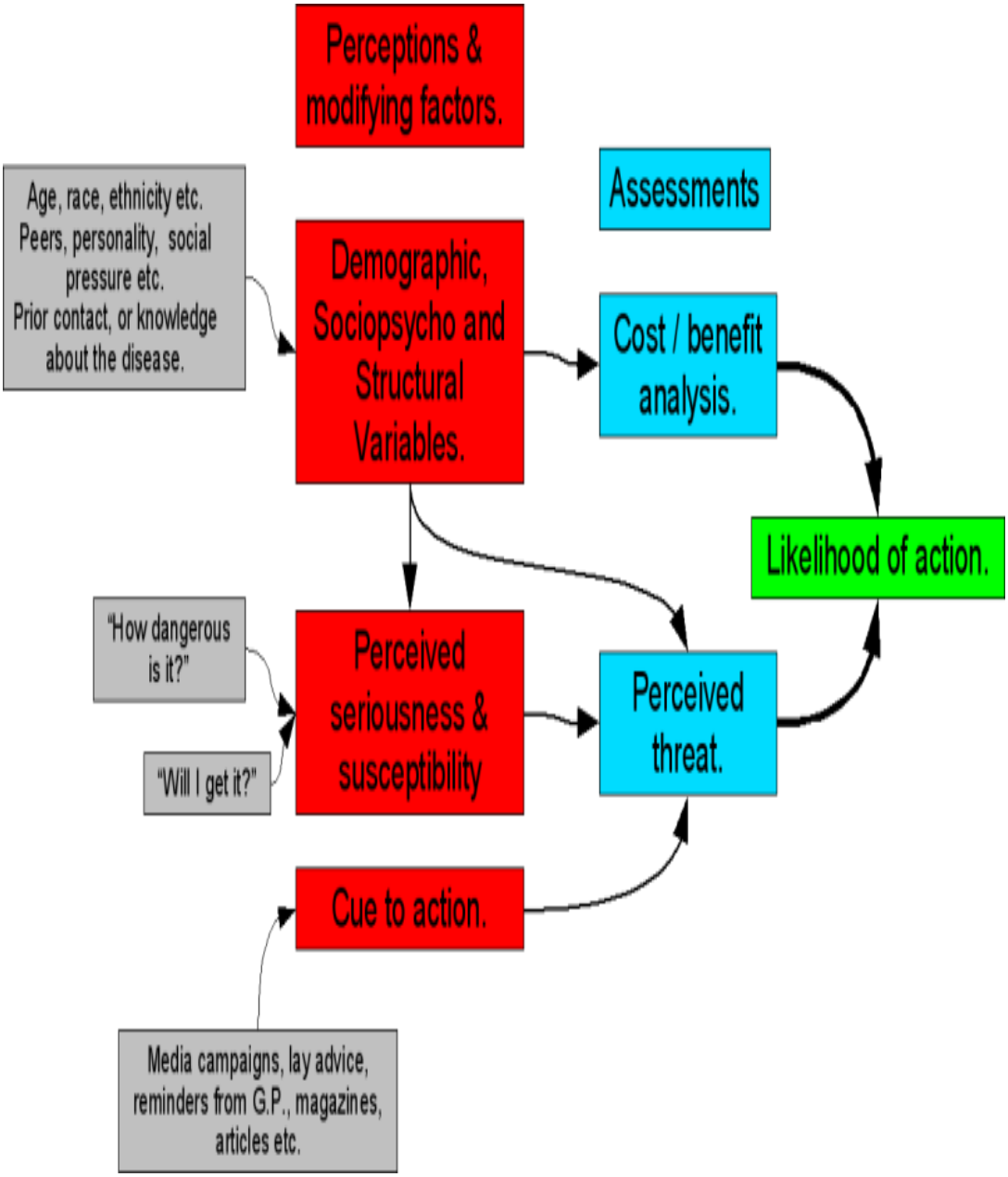

Figure 1: Diagram of Health Belief Model

Source: Becker (2015)

2.2 Conceptual Framework

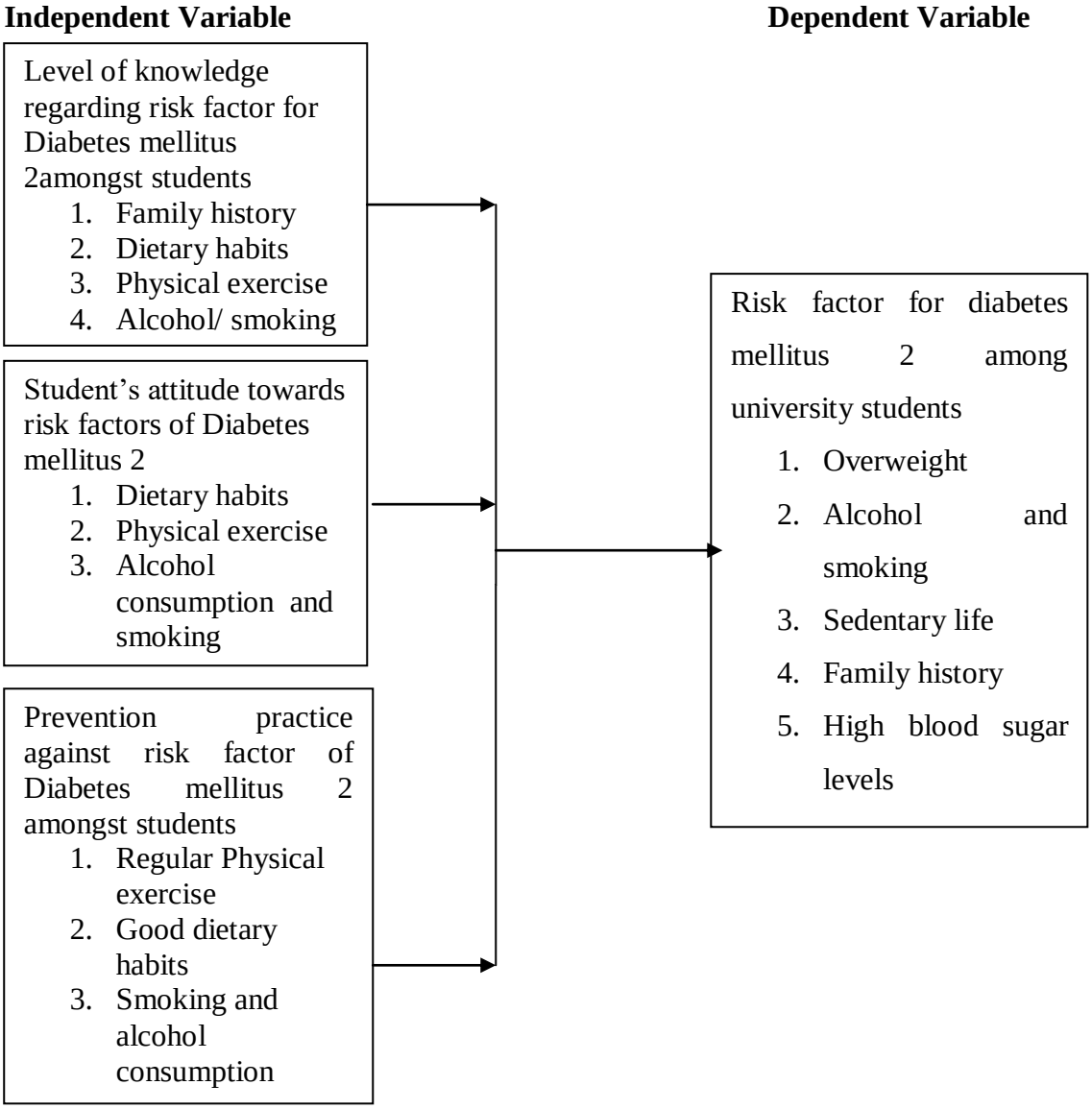

Figure 2: Conceptual Framework

Source: Researcher (2018)

2.3 Summary of the variables

Dependent Variable refers to the resultant variable that the researcher seeks to study and find out whether it is influenced by certain factor or not. It helps us to determine the effect of independent variable on the unit under measurement. In this particular case the dependent variable is risk factors for diabetes mellitus type 2. Independent

Variables; this remain static and is not changed by other variables. It is defined as Individual variable which the research perceives to have an influence on the dependent variable.

2.3.1 High Blood Glucose

Clinically it refers to elevation of fasting blood sugar to more than 7 mmol/L, a value more than 11mmol/L in random blood glucose test and afigureof more than 11.1 mmol/L in an oral glucose tolerance test (American Diabetic Association, 2010).

2.3.2Family history

The risk of an individual of getting diabetes increase when one's parents develop diabetes at younger age of less than50 years and decreases relatively when the parents develops diabetes at the age of more than 50 years. If both parents are diabetic the chance of that person of getting diabetes is 50%. Some genetic mutation elevates the chances of getting Diabetes mellitus 2. The mutations can also work in synergies among themselves and the environment to raise the chances of getting diabetes (American Diabetes Association 2016).

2.3.3Physical activity

This refers to regular aerobic exercise. This can include activities such as walking, swimming and biking and some jobs that are physically engaging. The recommended is half an hour of aerobic exercise for up to five days every other week (American Diabetes Association 2016).

2.3.4 Dietary habits

The best diet is the one that has high fiber, minimal fats, plenty of fruit and vegetables, very few animal sourced foods, non -sugary food and non -processed carbohydrates. Foods with low glycemic index are preferred to those with high glycemic index as they help the body achieve a desirable and stable blood glucose level. Foods with low glycemic index are classically high fiber foods. Services of a trained and experienced nutritionist should be invoked where need be in order to get an expert view Diabetes and High Blood Pressure Information Prescription; (Bilous 2010).

High fiber foods that characteristically have low glycemic index have a positive impact in our health. Food with high glycemic index cause sudden elevation in blood glucose as opposed to those with low glycemic index that accomplish steady blood glucose Diabetes care (2019).

2.4 Empirical Literature

2.4.1 Socio Demographic Related Factors

Diabetes mellitus type 2 is known to contribute more than 85% of the total diabetes cases in high income countries and could contribute a larger percentage in poorer countries (International Diabetes federation 2013). Urbanization, speedy cultural changes increased aged citizen have seen through the increase of Diabetes mellitus type 2. (IDF, 2013). Urbanization of societies accounts significantly for the speedy global increase in prevalence and incidence of Diabetes mellitus 2 which lead them to adopt unhealthy dietary habits (Lyssenko *et al*., 2013).

About 50% of all diabetic adult tend to fall within the age of 40 to 59 years, only 20% of this diabetic person live in high income countries, meaning that the rest poorer countries (IDF, 2013). Chan *et al.*, 2009 in a study indicates that, low education is

significantly linked with diabetes mellitus type 2.studies in Denmark that ran for three years, elaborated that old age and genetic factor were the central non-modifiable factors (Rasmussen *et al.,* 2011).

Urbanization and urban living account partly for the increase of Diabetes mellitus 2 in Africa (Dahiru *et al.,* 2011).

Age, social class and tribe were significantly linked with the prevalence and risk factors for Diabetes mellitus 2 in Nigeria. This research highlights the relationship of every risk factor with adult diabetes in Nigeria. Those aged 50 years and above had a notable s prevalence of diabetes mellitus. Participant in the higher social economic class showed significantly elevated occurrence of type 2 diabetes as opposed to those in lower social economic class (Ebenezer *et al.,* 2013)

2.4.2 Behavioral Related Factors

Researchers have highlighted the relationship between certain risk factors and Diabetes mellitus 2. Use of tobacco, inactiveness, and poor diet, are the regularly recorded risk factors for Diabetes mellitus 2 (Lyssenko *et al.*, 2013).

Researches from Denmark indicated that the most significant adjustable risk factors for diabetes mellitus were diet, exercises, overweight, and smoking and alcohol consumption (Rasmussen *et al.,* 2011). In Africa, raise of Diabetes mellitus 2 is contributed by lack physical exercise, low fiber diet, rapid cultural changes, behavioral habits and sedentary lifestyle (Dahiru *et al.,* 2011).A study on prevalence and risk factors of Diabetes mellitus 2 in West Africa indicates that, there was significant association of physical inactivity, hereditary factors, and Alcohol intake with type 2 Diabetes. Participant who drank moderately had decreased chances of acquiring

Diabetes mellitus 2 whereas those who drank heavily had more chances of acquiring diabetes (Ebenezer *et al.,* 2013).

Physical exercise is one of the modifiable risk factor for Diabetes mellitus 2 and it is known to help keep Diabetes mellitus 2 at bay and also help reduce complication associated with Diabetes mellitus 2 for those who are already living with diabetes. Physical exercises is known to help increase sensitivity of cells to insulin, achieve stable blood glucose, help to loss calories, keep the lipid profile in desirable level and give good muscle tone just a few to mention (Wei *et al.,* 2010).

Heavy drinking and Diabetes mellitus 2 has been linked through research, where drinking has been identified as a risk factor (Ebenezer *et al.,* 2013). It has chronically emerged that heavy drinkers are at elevated level of acquiring diabetes as compared to moderate and nondrinkers. A study in Paris done prospectively showed that diabetic persons have raised chances of dying from liver cirrhosis which is linked with alcoholism (ADA, 2016). Men who drank more than 21 standard drinks every week had more risk for diabetes as compared to those who took one or less standard drink (American Diabetes Association2016).

2.4.3 Bio-Medical Related Factors

According to Lyssenko *et al*., 2016), abnormal BMI, hypertension, and genotype hereditary, are probably the centrally recognized risk factors for Diabetes mellitus 2. Studies have shown that obesity and hypertension accounts significantly for the surge in Diabetes mellitus 2 in Africa (Balkau *et al.,* 2011).

Family history was seen to be independently linked with Diabetes mellitus 2 in a study done in Ghana, at 95% confidence interval, an odd ratio of 3.8 was obtained (Ina *et al*., 2012). A case control study was carried out in Kenyan hospital on risk factors for

Diabetes mellitus 2 among diabetic patients and it elaborated two risk factors; family history of diabetes had a relative risk of 2.2 at p value of 0.0131 whereas obesity had a relative risk of 2.0 at p value of 0.0010 (Masemiano *et al.,* 2010). A study done in Nigeria indicated that persons with family history of adult diabetes had increased chances and risk factors of developing the disease by 9.45 time as compared to those who didn't have a history of diabetes in their family (Dahiru *et al*., 2011).

2.4.4 Epidemiology for Type 2 Diabetes

In the western countries, according to Thunander *et al.,* 2014, diabetes mellitus 1 constitute 90% of all cases of diabetes among children whereas diabetes mellitus 2 commonly occur among the elderly. Strikingly, the incidence of Diabetes mellitus 2 among children in Taiwan accounts for 50% of all diabetes cases, while that of Hong Kong is more than 90% (Wei *et al.,* 2010).unlike DM1, Diabetes mellitus 2 is linked closely with a family history of diabetes, where 80% of the victims have diabetic parents. Some obese and overweight patients may not necessarily present typical Diabetes mellitus 2 symptoms. About 30% of the patients with Diabetes mellitus 2 present a picture of diabetes ketoacidosis (Amemiya, 2013), which is mostly mistaken for DM1.The diagnosed autoimmune Diabetes mellitus 2 is mostly an autoimmune DM1 among persons with elevated BMI and is characterized with insensitivity to insulin (Rosenbloom *et al*., 2014).The Hemoglobin A 1 c test results are normally markedly elevated in this patient, functioning of β-cell compromised and it may be necessary to put them on insulin much earlier. It is recommended that children diagnosed with Diabetes mellitus 2 should be subjected to diabetic autoantibody testing, because elevated levels of islet cell autoimmunity my erroneously lead them to be introduced to insulin too early.

Sub-Saharan Africa have recorded a substantial upsurge of Diabetes mellitus 2 in the past five decades, from less than 1% in some countries in 1960s to an average of 4.3% regionally in 2012, in comparison to a 6.4% prevalence internationally at present time (Hall *et al*., 2011).

Prevalence of diabetes mellitus 2 is elevated in low income earner countries across the globe, which typically have large and high population growth rate. Diabetes mellitus 2 prevalence will have risen up to 69% by 2030 as compared to that of 2010 (Hadigan *et al*, 2014).Diabetes mellitus 2 has been linked with HIV infection beside other risk factors such as obesity race and gender (Steyn *et al*, 2011).

2.4.5 Etiology and Pathogenesis for Diabetes mellitus 2

Inability of body cells in the extremities to utilize insulin, it may vary from principally insulin resistance and relative shortage of insulin to principally reduced insulin production with insulin or without is called diabetes mellitus (Diabetes care, 2019). Insulin resistance refers to breakdown of it intended action in metabolic processes, there are other clinical manifestation of insulin resistance syndrome apart from diabetes and they are normally linked with Diabetes mellitus 2.Other manifestations of this syndrome include obesity, kidney damage, high blood pressure and abnormal blood lipid values (Rosenbloom *et al.*, 2014).

2.4.6 Diagnosis of diabetes

Glycated hemoglobin test is a gold standard for diagnosis of type 2 diabetes mellitus which can give an average of blood glucose for up to 90 days. The principle of the test is to determine the amount of glucose linked to the hemoglobin in the red blood cells

and express it in percentage. The percentage of glucose attached on the hemoglobin increase with increase in plasma blood sugar of an individual.

If a value of 6.5% or more is obtained for at least two separate occasions, the patient is most likely diabetic. A normal person should have a value of at most 5.6%. Prediabetic condition is indicated by values that don't fall within the above named two categories and it usually between 5.7 and 6.4 % which could imply that an individual has an elevated likelihood of developing Diabetes mellitus 2(American Diabetic Association, 2010). This test is contraindicated among expectant mothers and those with rare hemoglobin variant because the precision of the test is compromised.

Random blood sugar test; here the patient is subjected to a whole blood, serum or plasma glucose analysis. A patient is considered diabetic if he/she has a value of more than 11.1 mmol/L (200 mg/dl). The patient is regarded as non-diabetic if the value is less than 11.0 mmol/L. This test does not give room to predict the pre-diabetic condition. The blood sample is collected and test done in total disregard of whether or when the patient ate (American Diabetic Association, 2010).

Fasting blood sugar test; after fasting for 8 hours and 6 hours in adult and children respectively a serum, plasma or whole blood will be tested. According to American Diabetic Association, 2010, diabetics is confirmed when a value of more than 7mmol/l (126 mg/dl) is obtained after at least two independent tests are carried out. A normal person is expected to have a value of 5.6 or less (100 mg/dl). A person whose value don't fall between the two named categories i.e. 5.7-6.9 mmol/l (100 to 125 mg/dl) is described as prediabetic because his/her blood glucose is beyond the normal reference range but still below the limit to be pronounced diabetic.

As for oral glucose tolerance test the patient is advised to withdraw from eating for not less than 8 hours. Upon reaching to the laboratory/hospital, a fasting glucose test is

done. The patient is the offered a standardized sugary drink for oral consumption and his/her blood sugar is taken in a regular manner within two hours since ingestion of sugary drink. A normal person is expected to have a value of 7.7mmol/L(139mg/dl) and below. A diabetic person will show a value of more than 11.1mmol/l(200mg/dl). Those with range of above 7.8 mmol/L to less than 11.0 mmol/L will fall under prediabetic category (American Diabetic Association, 2010).

2.4.7Management of Diabetes mellitus 2

Successful treatment is possible through several means that includes proper diet, consistent aerobic exercise, blood sugar lowering medication and insulin therapy. Deliberate implementation of these remedies in their proper manner can help patient have stable blood glucose and keep at bay diabetes related complications (Diabetes Care. 2019).

2.4.7.1Healthy Eating

Healthy diet can be attained by being vigilant and watchful as we choose what to eat on a daily basis, a good diet is characterized by food high in fiber content, low to moderate fats food such as fruits, whole grain and herbs, moderated animal sourced foods, reduced processed carbohydrates and non-sugary foods. Food with high glycemic index are treacherous to our health as they tend to cause sudden upsurge of blood sugar as opposed to those with low glycemic index that tend to give us the desirable stable blood glucose. These foods with low glycemic index are typically high in fiber. Advice of qualified and competent dietician can be sought after, where necessary in order help with design of a desirable meal plan that is pocket friendly, locally available, liking considerate and lifestyle friendly (McKulloch DK 2015).

2.4.7.2 Physical Activity

Regular aerobic exercise is of paramount importance to all including people who have type 2 diabetes. Before venturing into any exercise regime, a check up with a doctor preferably a cardiologist should be sought after and then enjoyable activities should be chosen such as walking, swimming and biking.

The target is a weekly 30 minutes of exercise for at least five days, for beginner they should start slowly and proceed gradually to hit the target. Blood sugar is lowered by aerobic exercise and as such, for diabetic persons. It is of great importance is to measure blood glucose before embarking on physical exercise. As such, if the blood sugar is comparatively low a snack is recommended to mitigate chances of getting low blood sugar in scenario where a person is on medication that tend to lower blood sugar (American Diabetes Association 2016).

2.4.7.3 Monitoring your Blood Sugar

Blood sugar level should be taken and recorded often depending on the treatment plan of the patient and according to the doctor's advice. This helps the patient to keep their blood glucose level within their target limits. It is pertinent that the diabetologist train the patient on how certain actions can alter their blood glucose such as exercise, a meal, and alcohol just to mention a few (Tintinalli *et al* 2011).

2.4.7.4 Diabetes Medications and Insulin Therapy

A desirable blood sugar level for Diabetes mellitus 2 patients can be achieved through deliberate proper diet and physical exercise only, however sometimes medication and insulin therapy may be needed. The choice of the measures to be taken depends on the blood glucose level and health complication the patient may have. Drugs from various

classes are normally administered in different combination to help keep blood sugar level on check (American Diabetes Association 2016).

2.3 Critical Review and Research Gaps Identification

A study was carried out by Ferrian (2011) to find out the risk factors for Diabetes mellitus 2 among the students of Midwest public university. Various aspects tied to risk factor for Diabetes mellitus 2 were interviewed through questionnaires and included perception on risk, susceptibility and self-efficacy about the disease. The study concluded that male student had elevated chances of getting Diabetes mellitus 2 than their female counterpart. The overriding risk factors for Diabetes mellitus 2 in this populace were inactive life and overweight. On HBM construct of perceived susceptibility, those who had increased risk of getting Diabetes mellitus 2 felt more susceptible to the disease and both those who had genetic predisposition to Diabetes mellitus 2 and those who didn't have it, showed the same level of perceived seriousness to the disease. As for the self-efficacy construct, 75% of the respondents felt that they had what it takes to prevent Diabetes mellitus 2.However, the study used purposive sampling technique which introduced the Potential for bias and inaccuracy in the researcher's criteria and the resulting sample selections, as well as results that could not be generalized this is because the researcher selected the sample from certain health-oriented clubs at a university. In this particular study the sample size was obtained from two different universities which helped to increase on the degree to which the results could be generalized, also stratified sampling and simple random sampling techniques was used to obtain the participant which enhanced randomness of picking the participants.

Sealey and Reyes (2014) in the United States carried out a research to determine the existing risk factors among students in higher institution of learning and their professed susceptibility to acquiring Diabetes mellitus 2.A sample size of 660 participants was selected and after giving a written consent they filled questionnaires which contained question in the spheres of lifestyle behaviors ,demographic aspects and their insight about the risk of getting Diabetes mellitus 2.This cross-section study applied SPSS to analyses the data .It was concluded that the student had a misconception of their individual risk to Diabetes mellitus 2 , where they had underrated the risk. The prevalence of risk of Diabetes mellitus 2 was high at 30%, with substantive mean difference between the existing risk and the professed risk of Diabetes mellitus 2.The finding of the study call for an urgent intervention to curb Diabetes mellitus 2 among this target population. While this study used open ended questions, which allowed collection of detailed information, the study did not measure the height and weight of the students in order to calculate their BMI. Instead, students reported their weight and height from which their BMI was calculated. This might have led to collection of unreliable data since student's measurements specifically the weight might have changed from their previous measurements. Measuring the anthropometric measurements of the respondents during the study would have increased the reliability of the data collected. In this study the researcher took the height and weight measurements of the participant, therefore the BMI values calculated were true presentation of the participants.

A research was carried out by Randy *et al* (2016) in India among Asian Indian to determine the extent of knowledge concerning Diabetes mellitus 2.The drive of the study was to help formulate public health education and preventive program to reduce new incidence of Diabetes mellitus 2.A sample size of 983 participant were selected

from Visakhapatnam, Andhra Pradesh and data regarding risk factors, knowledge about Diabetes mellitus 2, lifestyle and prevention was collected. A large number of students were cognizant of Diabetes mellitus 2, 50% of the students selected were cognizant that Diabetes mellitus 2 is preventable and only 40 % were aware that physical activity could reduce chance of acquiring Diabetes mellitus 2. The findings obtained clearly indicate that customized preventive program need to be installed for this target population. However convenient sampling technique was used which allowed the issue of biased sample and results obtained cannot be generalized to the population. In this particular study the sample size was obtained from two different universities which helped to increase on the degree to which the results could be generalized, also stratified sampling and simple random sampling techniques was used to obtain the participant which enhanced randomness of picking the participants.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

The chapter outlined the methods and designs. The study covered the research design, the target population, the sample and sampling procedure, the research instruments, validity and reliability of the instruments, the procedure of data collection, data analysis and the ethical considerations.

3.1 Research Design

Descriptive cross-sectional study design research was used. In this study it helped the researcher to make out important areas of concern that can be used by health education promoters to design and effect diabetes prevention programs customized for university students (Cottrell & McKenzie, 2011).

3.2 Target Population

This was university students; it is from this group that the researcher obtained the study population.

3.2.1 Study Population

The enrolled students in Mount Kenya University Kigali campus was 2780 and that of Gitwe university was 978 students and this formed the study population. It is also from this group that the researcher obtained the study sample.

3.3SampleSize

3.3.1 Sample Size Determination

For Mount Kenya University the sample size was 268 students whereas for Gitwe University, the sample size was94 students. The sample size was calculated using Yamane formula for sample size determination for defined small population (N) (2780 and 978 =3758) and margin error of 5% (Yamane, 1967). Then the sample size was distributed according to the proportion of population size (n_x = (N_x / N) * n) in each university.

$$n = N/\left(1+N\left(e\right)^2\right)$$

n = 3758 ÷ [1+3758(0.05) ^2] =362,

For Mount Kenya University = n_x = (N_x / N) * n = 2780/3758*362 =268

For Gitwe University= = n_x = (N_x / N) * n = 978/3758*362 ==94

Therefore, the sample size for Mount Kenya University was 268 students and Gitwe University was 94 students. This actual number was then derived from sample sizes from the stratums (departments) calculated through proportionate stratification in a manner that allowed sample size of each stratum to be directly proportional to their respective population size using the formula highlighted below:

n_x = (N_x / N) * n (http://stattrek.com)

key,

n is total sample size

n_x is the sample size for stratum *x*

N_x is the population size for stratum *x*

N is total population size,

Table 2: Strata Sample Size Distribution for the Respondents

University	Stratum	Population	Method	sample size
Mount Kenya university	Medical Laboratory technology	146	n_x = (146 / 2780) * 268	14
	Department of Nursing	266	n_x = (266 / 2780) * 268	26
	Department of business management	1280	n_x= (1280 / 2780) * 268	123
	Department of Public Health	180	n_x = (180 / 2780) * 268	18
	Department of journalism	208	n_x= (208 / 2780) * 268	20
	Department of education	700	n_x = (700 / 2780) * 268	67
Gitwe university	Department of education	430	n_x = (430 / 978) * 94	41
	Department of Nursing	266	n_x = (266/ 978) * 94	26
	Department computer science engineering	180	n_x = (180 / 978) * 94	17
	Department computer science management	102	n_x = (102 / 978) * 94	10
	Total	3578		362

Source: Researcher

3.3.2 Inclusion Criteria

The study participant included willing continuing students in September to December 2018 semester. (Marie Bernard, 2018).

3.3.3 Exclusion Criteria

The study excluded continuing students who were not willing to take part in the study (Marie Bernard, 2018).

3.3.4 Sampling Technique

The study employed both proportionate stratified sampling and simple random sampling techniques. Proportionate stratified sampling technique involved dividing the two study population into strata separately i.e. department of business management, department of education, department of journalism, department of public health, department of nursing and department of science in medical laboratory as shown in table 3.1 ,whereupon each stratum was subjected to simple random sampling to get sample size simple random sampling method was applied in each stratum to select the required number of students per department(Ben-Shlomo *et al*2013).

A list of participant in each stratum was prepared and each name was given a unique number. The numbers were written on small pieces of paper, then placed in a bucket and mixed properly with hand. One paper was picked at a time from the bucket until respective number in each stratum was reached as shown in the table above. All names that were picked from the bucket become the study sample (Ben-Shlomo *et al*2013).

3.4Data Collection Instruments

Pretested questionnaire was used to collect data on the demographic characteristics, level of knowledge regarding risk factor for Diabetes mellitus 2 among the students, attitude of university students towards risk factors of Diabetes mellitus 2and preventive practice against risk factors for diabetes mellitus 2.

Level of knowledge was determined by administering a set of alpha cronbach questions that are related to risk factors of Diabetes mellitus 2. The respondent either replied with true, false or I don't know. Each question answered correctly attracted one mark, which was always a yes. The aggregate was converted into percentages and the level of

knowledge was grouped as follows: less than 50% (Low), Moderate (50% to 69%) and High (≥70%). Details of tally sheet are provided in appendix III.

A Likert scale was used to measure the level of attitude on risk factors for Diabetes mellitus 2 among the students using the nine (9) statements. The scale was as indicated: those who strongly agree; those who agree; those Neutral; those who disagree; those who strongly disagree. Highest attainable tally was 45 while the lowest tally was 9. The aggregate was converted into percentages and the level of attitude was grouped as follows: Low (<50%), Moderate (50-69%) and High (≥70%) (Robinson, 2014).Details of tally sheet are provided in appendix IV.

A serving of vegetables and fruits was categorized as per the WHO STEPS questionnaire. A single serving of vegetables was defined as half a standard plate of green leafy vegetables like dodo and spinach, ¼ of a plate of other vegetables like tomatoes, carrots, pumpkin, cabbage, fresh beans and onion or ½ cup of vegetable juice. A single serving of fruits was defined as one medium sized fruit or half a glass of fruit juice. A standard alcoholic drink was defined as one standard, 500 ml bottle of beer, one single measure of spirits of 30ml, one medium size glass of wine of 120ml or a single measure of a local brew that contains about 10 grams of ethanol as per the WHO STEPS questionnaire. Physical exercise and aerobics were measured on the basis of whether they engaged in physical exercises, how often per week and for how long the session lasted. The practice was derived by summating the tallies. The highest possible tally was 12 and the lowest tally was 0. The mean was computed and the level of practice was classified as follows: Adequate practice (mean and above) and In-adequate practice (below the mean). Details of tally sheet are provided in appendix V.

3.5Piloting of Research Instruments

3.5.1 Pre-Testing questionnaire

Pilot test was done to the questionnaire with the aim of guaranteeing their validity, feasibility and reliability**.** The practicability, reliability and the validity of the questionnaire, was achieved through pre-testing of the questionnaire (Charlotte Emma Hilton, 2017). Twenty Students from Rwanda University of Tourism Technology and Business were picked randomly and questionnaire was administered to them. Several aspects were observed and recorded and this included: Ease of understanding the questions, the questions that were not easily understood was rephrased. Places where they made mistakes and hesitated in answering question such as where they were multiples choices were made clearer (Willis, 2016).

3.5.2 Validity

Haradhan (2017) refer to validity as the extent with which the instruments measure the variable with the intended accuracy it claims. Internal validity was achieved by carrying out a pilot study of the questionnaire that helped to boost on data collection and also helped to capture the challenges relating to understanding of the tools by the respondents. Since the data was collected in various universities the samples were regarded as independent units and consistency in responses came in handy in confirming the validity of data .Validity was achieved by adopting the strategy of triangulation where two data analyst were engaged to analyze the data independently (Pelto, 2017).

3.5.3 Reliability

Several aspects were adopted to ensure reliability and they included constant data comparison where data collected from the two universities were constantly compared,

data collected was used comprehensively and use of table in the research (Eliane , 2015).Further in ensuring reliability the research instruments were used by the same researcher in all research sites(Gidron ,2013).

3.6 Data Analysis

Verification for comprehensiveness and uniformity was checked on the data, captured in computer and coded using SPSS (Statistical Package for Social Scientist) version 26 for data analysis. The data was analyzed and interpreted according to the objectives of this study. Tables and figures have been used for results presentation (Coghlan*et al 2014*).For quantitative data, descriptive statistics using frequency and proportions were used to analyze each study objective.

The relationship between dependent and independent variable (adequate practice was determined through cross tabulations using chi-square test. Significance level was considered at p value < 0.05. Multivariable analysis was done with the use of binary logistic regression to determine variables that were independently significant by controlling the confounding variables. During the binary logistic regression, adequate practice was defined or coded as *'1'* and in-adequate practice was coded as *'0'* (Hidalgo *et al* 2013).

3.7 Ethical Approval

Certificate of ethical clearance as attached in appendix VI was issued by Mount Kenya University Ethics Review Committee on 20th September 2018 after a review that found out that all ethical concerns had been addressed.

3.7.1 Confidentiality

Discreteness was exercised with the information gathered from the participants. The application of the information was and will remain strictly limited for academic purposes. The questionnaire forms filled did not capture the name of the students and was kept in a lockable cabinet.

3.7.2 Plagiarism

All information by any researcher that was quoted and used in the process of completion of this study was fully acknowledged and credited; in additional to that the finding will be timely disseminated to the entire and relevant interested parties without prejudice.

3.7.3 Consent

Participants were engaged in this study in a voluntary manner without any coercion or bribery after clear explanation of the topic and purpose of the study. The recruited research assistant explained to the respondents the objective of the study and also their right and obligation as participant in the study. On the same breath it was brought to their knowledge, of their right to withdrawal from participating in the study at any stage of the study. The participants were provided with explanation forms and consent form to read through and understand and seek clarifications where unclear. Once the participants were satisfied with the information and assurance provided, they signed a consent form. It was after this that participants were included in the study.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

A total of 348 students out of 362 consented to participate in the study from Mount Kenya University Kigali Campus and Gitwe University. The response rate was 96.1%.

The results are presented in sections that cover: demographic characteristics of the students; anthropometric characteristics and blood glucose, level of knowledge regarding risk factor for Diabetes mellitus 2 among students, attitude of university students towards risk factors of Diabetes mellitus 2 prevention practice against risk factor of Diabetes mellitus 2 amongst students of Mount Kenya and Gitwe Universities Rwanda. Factors associated with adequate preventive practice against risk factor of Diabetes mellitus 2 amongst students of Mount Kenya and Gitwe Universities Rwanda and factors associated with adequate preventive practice against risk factor of Diabetes mellitus 2amongst students of Mount Kenya and Gitwe Universities, Rwanda.

The findings were discussed and supported with explanations from respondents and the researcher comments. The researcher also discussed how this study reinforced other studies and literature by comparing and contrasting.

4.1 Socio-Demographic Characteristics of the Respondents

The main characteristics assessed were age, gender, residence, university enrolled, occupation, student living arrangement and family history of diabetes mellitus 2.Demographic characteristics are presented in table 3.

Table 3: Socio-Demographic Characteristics of the Respondents

Variables	Frequency (N=348)	Percent (%)
University enrolled		
Mount Kenya University	259	74.4
Gitwe University	89	25.6
Age in years		
19-25	243	69.8
26-30	51	14.7
31-35	29	8.3
>35	25	7.2
Gender		
Male	183	52.6
Female	165	47.4
Residence		
Urban	199	57.2
Rural	149	42.8
Student living arrangement		
Live alone	92	26.4
Live with student	103	29.6
Live with parent/guardian	153	44.0
Occupation		
Employed	68	19.5
Self employed	77	22.1
Student	203	58.3
Family history of diabtes2		
Yes	17	4.9
No	308	88.5
Not sure	23	6.6

Source: Field Data (2019)

According to Table 3, about three quarter of the respondents (74.4%) were from Mount Kenya University Kigali Campus while the remaining (25.6%) were from Gitwe University. Majority of the students were aged between 19 to 25 years at a percentage of 69.8%. Slightly more males (52.6%) participated in the study compared to females (47.4%). More than half (57.2%) were from urban areas. Regarding living arrangement, the highest percentage was living with their parents or guardians at 44 %. In concern to occupation, most of them were students (58.3%), and 4.9% of participants indicated family history of Diabetes mellitus 2.

4.2 Presentation of Findings

4.2.1Knowledge Regarding Risk Factor for Diabetes mellitus 2 among the Students

An analysis of knowledge regarding risk factors of Diabetes mellitus 2 is summarized in Table 4.

Table 4: Knowledge Regarding Risk Factor for Diabetes mellitus 2 among the Students

Variables	Frequency (N=348)	Percent (%)
Increased physical activity decrease diabetes mellitus 2		
Yes	268	77.0
No	54	15.5
Do not know	26	7.5
Family history increases diabetes mellitus 2		
Yes	232	66.7
No	68	19.5
Do not know	48	13.8
Obesity and overweight increases diabetes mellitus 2		
Yes	275	79.0
No	24	6.9
Do not know	49	14.1
Hypertension is major risk for diabetes mellitus 2		
Yes	144	41.4
No	23	6.6
Do not know	181	52.0
Sugary and oily food increase chances of diabetes mellitus 2		
Yes	240	69
No	20	5.7
Do not know	88	25.3
Alcohol consumption increases chances of diabetes mellitus 2		
Yes	127	36.5
No	35	10.1
Do not know	186	53.4
Tobacco use is a risk for diabetes mellitus 2		
Yes	121	34.8
No	39	11.2
Do not know	188	54.0
Good diet reduce the chance of diabetes mellitus 2		
Yes	247	71.0
o	43	12.4
Do not know	58	16.7
Regular screening for blood glucose levels is a good practice that can help one to detect pre-diabetic stage before type II diabetes sets in		
Yes	125	35.9
No	97	27.9
Do not know	126	36.2
Diabetes mellitus 2 is potentially avoidable disease if its risk factors are identified early and avoided		
Yes	175	50.3
No	102	29.3
Do not know	71	20.4

Source: Field Data (2019)

Majority of the students (77.0%) indicated that increased physical activity can decrease chances of getting diabetes mellitus 2 while the remaining reported otherwise.

Considerable percentage of respondents (19.5%) was not aware that family history increases diabetes mellitus 2 and 13.8% did not know whether it is a risk for diabetes mellitus 2. Although majority (79.0%) of the respondents indicated that obesity and overweight increases diabetes mellitus 2, considerable percentage 14.1% did not know. Surprisingly, more than half (52.0%), (53.4%) and (54.0%) were not aware that having hypertension, alcohol consumptions and tobacco use are risk factor for diabetes mellitus 2 respectively.

About a quarter (25.3%) also did not know that sugary and oily food increase chances of diabetes mellitus 2. Most of the respondents (71.0%) claimed that healthy or good diet can reduce the chance of diabetes mellitus 2 while the remaining either indicated otherwise (12.4%) or did not know (16.7%). About a quarter (27.9%) indicated that regular checkup for blood glucose levels is not a good practice that can help one to detect pre-diabetic stage. Similarly, considerable percentage (29.3%) said even if the risk factors of diabetes mellitus 2 are identified early, the disease cannot be avoided.

4.2.2Level of Knowledge Regarding Risk Factor for Diabetes mellitus 2 among the Students

The level of knowledge on risk factor for Diabetes mellitus 2 among the students was assessed using the ten (10) statements presented in Table 4 and the tally assessment is presented in Appendix iii. The maximum attainable tally was 10 and the minimum tally was 0. The aggregate was converted into percentages and the level of knowledge was grouped as follows: Low (less than 50%), Moderate (between 50 and 69%) and High (more than 70%).

Most of the respondents (61.5%) had moderate level of knowledge on risk factors/causes of diabetes mellitus 2. However, about a quarter (25.3%) had low level

of knowledge and those with high level of knowledge on the same were 12.9% (Figure 3).

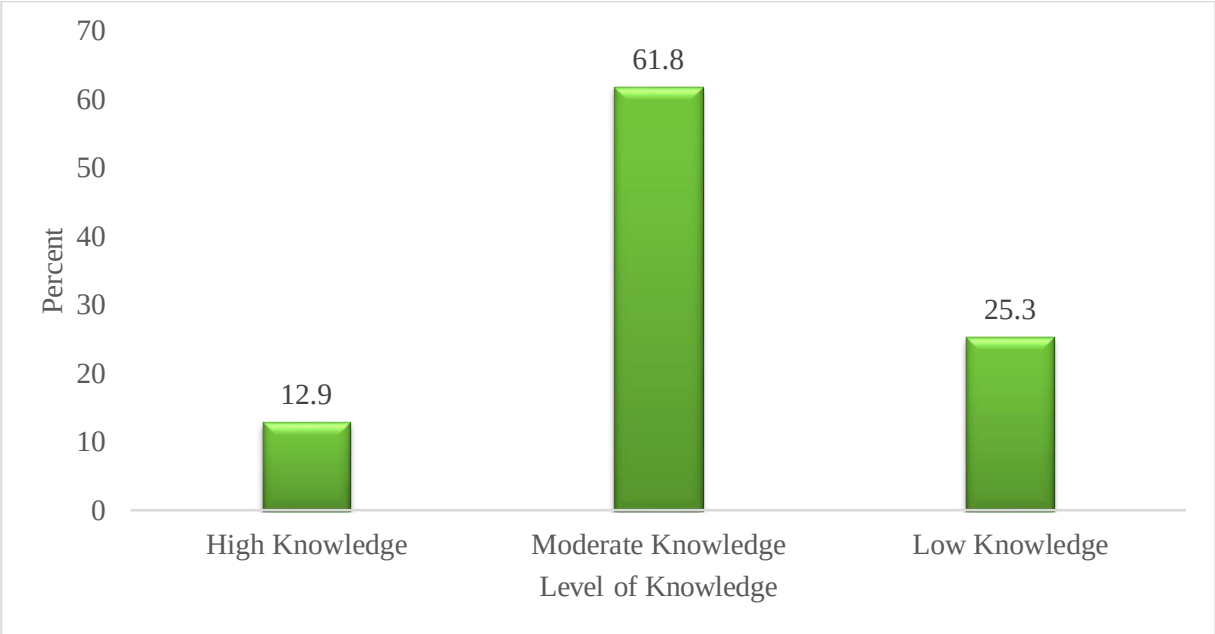

Figure 3: Level of Knowledge Regarding Risk Factor for Diabetes mellitus 2 among the Students

4.3Attitude toward Diabetes mellitus 2Risk Factors among University Students

The attitude of university students towards risk factors of Diabetes mellitus 2 was assessed using a liker scale as demonstrate in Table 5.

Table 5: Attitude toward Diabetes mellitus 2 Mellitus Risk Factors among University Students

Statement	Strongly agree, n(%)	Agree, n(%)	Neutral, n(%)	Disagree, n(%)	Strongly disagree, n(%)
Dietary instructions should be written out for diabetic patient	**146(42.0)**	133(38.2)	51(14.4)	11(3.2)	7(2.0)
Taking alcohol while on diabetic medication is not a serious problem	24(6.9)	57(16.4)	73(21.0)	90(25.9)	**104(29.9)**
Diet and physical activity are not as important as medication in management of diabetes	44(12.6)	59(17.0)	85(24.4)	79(22.7)	81(23.3)
I have a strong drive to manage my diet	**145(41.7)**	132(37.9)	51(14.7)	13(3.7)	7(2.0)
I am confident and sure that I can make dietary choices that are suitable for me	**122(35.1)**	100(28.7)	74(21.3)	28(8.0)	24(6.9)
I know that my family history of Diabetes mellitus 2 can predispose me to Diabetes mellitus 2	156(44.8)	126(36.2)	48(13.8)	11(3.2)	7(2.0)
I know that physical exercise is important in preventing and managing diabetes	138(39.7)	142(40.8)	57(16.4)	7(2.0)	4(1.1)
I know that tobacco consumption in all its forms can increase my chances of getting Diabetes mellitus 2	43(12.4)	62(17.8)	69(19.8)	92(26.4)	82(23.6)
I know that alcohol consumption can increase my chances of getting Diabetes mellitus 2	24(6.9)	61(17.5)	82(23.6)	85(24.4)	96(27.6)

Source: Field Data (2019)

As indicated in Table 5, the highest percentages (42.0%), (41.7%) (35.1%) and (44.8%) strongly agreed that dietary instructions should be written on food labels , felt self-motivated to manage diet, felt that they knew enough about themselves to make right dietary choices and family history of Diabetes mellitus 2 can predispose to Diabetes mellitus 2 respectively. The highest percentage (29.9%) also strongly disagreed that taking alcohol while on diabetes medication is not a serious problem. About quarter of the respondents (23.3%) strongly disagreed that Diet and physical activity are not as important as medication in management of diabetes followed by those who disagree (22.7%) on the statement.

The highest percentage also strongly agreed (39.7%) and agreed (40.8%) on physical exercise is important in preventing and managing diabetes. However, considerable percentages strongly disagreed (23.6%) and disagree (26.4%) on tobacco consumption in all its forms can increase chances of getting Diabetes mellitus 2. Similarly, the highest percentages strongly disagreed (27.6%) and disagree (24.4%) on alcohol consumption can increase chances of getting Diabetes mellitus 2.

4.3.1 Level of attitude toward Diabetes mellitus 2Mellitus Risk Factors among University Students

The overall attitude level on risk factor for Diabetes mellitus 2 among the students was assessed using the nine (9) statements presented in Table 4 and the tally assessment is presented in Appendix iv. The maximum attainable tally was 45 and the minimum tally was 9. The aggregate was converted into percentages and the level of attitude was grouped as follows: Low (less than 50%), Moderate (between 50- and 69%) and High (more than 70%).

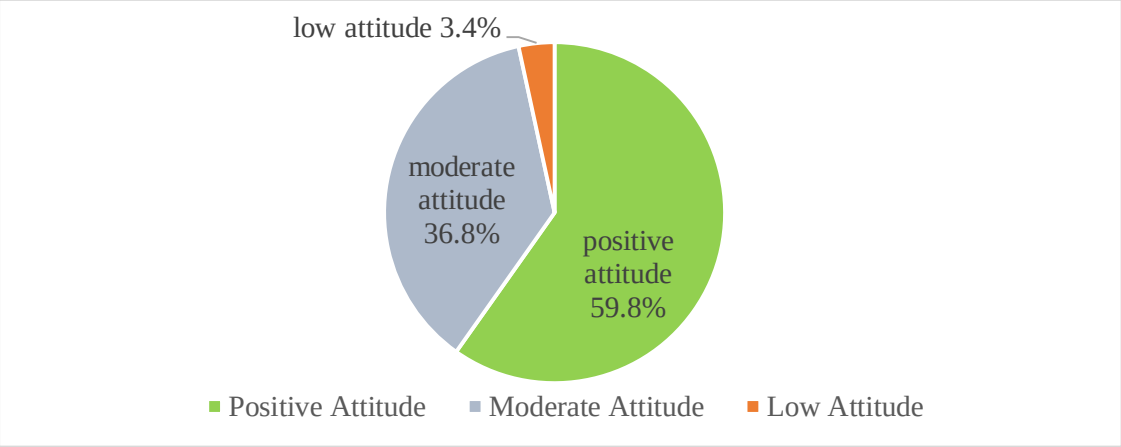

Table 6: Level of Attitude toward Diabetes mellitus 2 risk factors among the students

Most of the respondents (59.8%) had positive attitude on risk factors of Diabetes mellitus 2 followed by moderate (36.8%) while only 3.4% had low attitude (Figure 6).

4.4Prevention practice against risk factor of Diabetes mellitus 2 amongst the Students

The descriptive analysis of prevention Practice against risk factor of Diabetes mellitus 2 prevention among the students is summarized in table 7.

Table 7: Prevention practice against risk factor of Diabetes mellitus 2 among the Students

Variables	Frequency (N=)	Percent (%)
Whether consume tobacco		
Yes	42	12.1
No	306	87.9
Taking tobacco everyday (n=42)		
Yes	28	66.7
No	14	33.3
Number of cigarettes per day (n=28)		
1 to 4	8	28.6
5 to 9	10	35.7
10 to 14	5	17.9
15 to 19	4	14.3
> 20	1	3.6
Whether consume alcohol		
Yes	219	62.9
No	129	37.1
Consumed alcohol for last 1 year (n=219)		
Yes	110	50.2
No	109	49.8
Frequency of alcohol intake per week (n=110)		
1-2 days	74	67.3
.3-4 days	21	19.1
5-6 days	15	13.6
Number of drinks per day (n=110)		
1-2 drinks	55	50.0
3-5 drinks	39	35.5
5-10 drinks	10	9.1
>10	6	5.5
Number of days in a week fruits is consumed		
No fruits consumed	24	6.9
One time	100	28.7
Two times	55	15.8
Three times	61	17.5
Four times and more	108	31.0
Number of days in a week vegetables are consumed		
One time	119	34.1
Two times	59	16.9
Three times	58	16.6
Four times and more	113	32.4
Engaged in occupation and physical activity		
Yes	172	49.3
No	177	50.7
How many days a week engaged in occupational and physical activity (n=172)		
One time	35	20.3
Two times	34	19.8

Three times	28	16.3
Four times and more	75	43.3
Duration of session (n=172)		
< 30 minutes	80	46.5
30 minutes-1 hour	51	29.7
>1hr	41	23.8
Aerobic activities for 10 minute		
Yes	128	36.8
No	220	63.2
Frequency of aerobic activity per week (n=128)		
Once per week	48	37.5
Twice per week	30	23.4
Thrice per week	17	13.3
Four times and more	33	25.8

Source: Field Data (2019)

According to table 7, about one tenth of the respondents (12.1%) had consumed tobacco in their life and majority of this (66.7%) used to take tobacco every day with the highest percentage (35.7%) taking 5 to 9 cigarettes per day. Most of the students (62.9%) had taken alcohol in their life. Among those who had consumed alcohol in their life, almost half (50.2%) were consuming alcohol in the last one year and majority of this (67.3%) used to take alcohol in every one or two days.

The students were requested to indicate the number of days in a week fruits were consumed and the highest percentage (31.0%) were eating fruits four times and more followed those who were consuming one time per week (28.7%). Similarly, 34.1% of the students were eating vegetables once a week followed by those consuming four time and more (32.4%).

About half of the students (49.3%) were engaging in heavy physical activities or their work requires heavy activities. Those with heavy physical activities, the highest percentage (43.3%) were involved four times and more per week. In regard to aerobic activities, 36.8% of the students were doing aerobics activities for 10 minutes. Among

those who used to engage in aerobic activities, the highest percentage (37.5%) were doing once a week followed by those doing four times and above per week (25.8%).

4.4.1Prevention practice against risk factor of Diabetes mellitus 2 among the Students

The overall practice level on risk factor for Diabetes mellitus 2prevention among the students was assessed using the six (6) statements presented in Table 7 and the tally assessment is presented in Appendix v. The maximum attainable tally was 12 and the minimum tally was 0. The mean was computed and the level of practice was classified as follows: Adequate practice (mean and above) and In-adequate practice (below the mean).

Most of the students (60.6%) scored adequate Prevention practice against risk factor of diabetes mellitus 2 prevention while the remaining (39.4%) scored in-adequate Prevention practice against risk factor of diabetes mellitus 2.

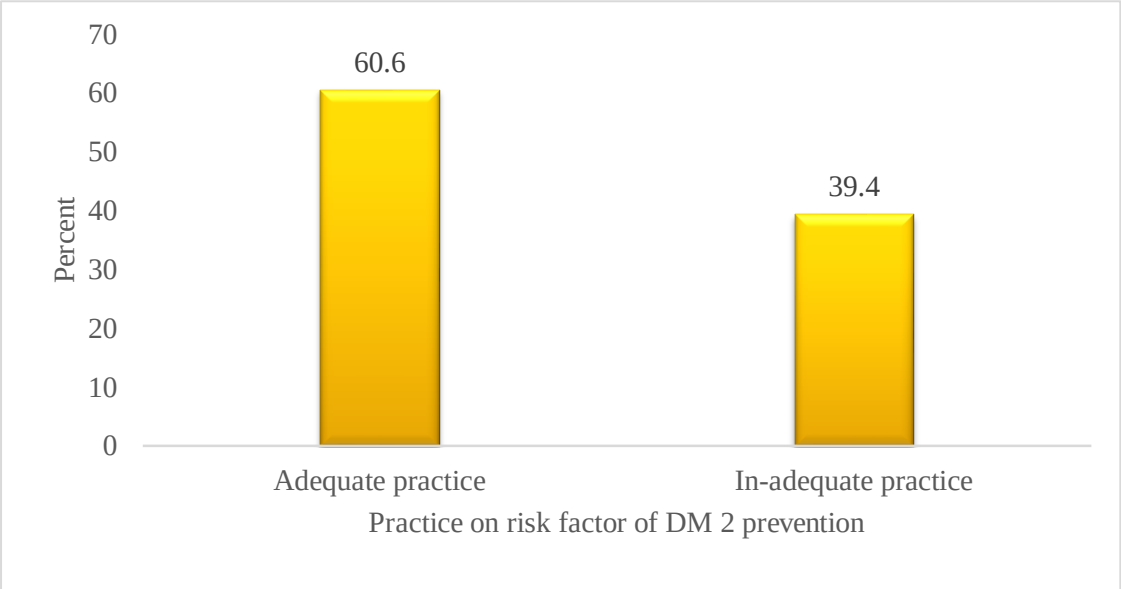

Figure 4: Level of Prevention practice against risk factor of diabetes mellitus 2 amongst students

4.5 Factors Association with Adequate Prevention practice against risk factor of Diabetes mellitus 2 Prevention

4.5.1 Association between Socio-Demographic and Prevention practice against risk factor of Diabetes mellitus 2

Table8 indicates Bivarate analysis of the association between socio-demographic characteristics and practice on risk factor of Diabetes mellitus 2 prevention.

Table 8: Association between Socio-Demographic and Prevention practice against risk factor Diabetes mellitus 2

Variables	Adequate practice		In-adequate practice		COR	95%CI		p value
	n	%	n	%		Lower	Upper	
University enrolled								
Mount Kenya University	146	56.4	113	43.6	Ref			
Gitwe University	65	73.0	24	27.0	2.10	1.24	3.56	**0.006**
Age in years								
19-25	148	60.9	95	39.1	1.04	0.45	2.41	0.930
26-30	29	56.9	22	43.1	0.88	0.33	2.33	0.795
31-35	19	65.5	10	34.5	1.27	0.42	3.83	0.676
>35	15	60.0	10	40.0	Ref			
Gender								
Male	100	54.6	83	45.4	Ref			
Female	111	67.3	54	32.7	1.71	1.10	2.64	**0.016**
Residence								
Urban	118	59.3	81	40.7	0.88	0.57	1.36	0.556
Rural	93	62.4	56	37.6	Ref			
Student living arrangement								
Live alone	55	59.8	37	40.2	0.91	0.53	1.54	0.719
Live with student	61	59.2	42	40.8	0.89	0.53	1.48	0.645
Live with parent/guardian	95	62.1	58	37.9	Ref			
Occupation								
Employed	54	79.4	14	20.6	3.01	1.57	5.77	**0.001**
Self employed	43	55.8	34	44.2	0.99	0.58	1.68	0.962
Student	114	56.2	89	44.8	Ref			
Family history of diabtes2								
Yes	10	58.8	7	41.2	0.76	0.21	2.77	0.680
No	186	60.4	122	39.6	0.81	0.34	1.98	0.648
Not sure	15	65.2	8	34.8	Ref			

COR= Crude Odds Ratio; CI= Confidence interval; Ref= Reference

Source: Field Data (2019)

There was significant association between university enrollment and Prevention practice against risk factor of Diabetes mellitus 2as elaborated in Table 8. Students from Gitwe University were 2.1 times more likely to practice adequately on risk factor

of Diabetes mellitus 2 prevention [OR=2.10; 95%CI=1.24 - 3.56; P=0.006] compared to those enrolled at Mount Kenya University Kigali Campus. Female students were 1.71 times more likely to practice adequately on risk factor of Diabetes mellitus 2 prevention [OR=1.71; 95%CI=1.10 - 2.64; P=0.016] than their male counterparts. Moreover, employed students were significantly more likely to practice adequately on risk factor of Diabetes mellitus 2 prevention [OR=3.01; 95%CI=1.57 - 5.77; P=0.001] than those who were students. However, there was no significant association among the other variables.

4.5.2 Relationship between Knowledge, Attitude and Prevention practice against risk factors of Diabetes mellitus 2.

Table 9 points out an analysis of the relationship between knowledge, attitude and practice on risk factor of Diabetes mellitus 2prevention.

Table 9: Relationship between Knowledge, Attitude and Prevention practice against risk factor of Diabetes mellitus 2 Prevention

Variables	Adequate practice		In-adequate practice		COR	95%CI		p value
	n	%	n	%		Lower	Upper	
Level of knowledge								
High Knowledge	36	80.0	9	20.0	3.33	1.44	7.74	**0.005**
Moderate Knowledge	127	59.1	88	40.9	1.20	0.73	1.98	0.469
Low Knowledge	48	54.5	40	45.5	Ref			
Attitude								
Positive Attitude	135	64.9	73	35.1	5.55	1.46	21.13	**0.012**
Moderate Attitude	73	57.0	55	43.0	3.98	1.03	15.40	**0.045**
Low Attitude	3	25.0	9	75.0	Ref			

COR= Crude Odds Ratio; CI= Confidence interval; Ref= Reference

Source: Field Data (2019)

As indicated in Table 9, both level of knowledge and attitude were statistically significantly associated with practice on risk factor of Diabetes mellitus 2 prevention. Students with high level of knowledge had about 3 times more likely to adequately practice on risk factor of Diabetes mellitus 2 prevention [OR=3.33; 95%CI=1.44 - 7.74; P=0.005] compared to those with low level of knowledge. Similarly, students with positive attitude on the risk factors of Diabetes mellitus 2 were 5.5 times [OR=5.55; 95%CI=1.46 - 21.13; P=0.012] and with moderate level of attitude were 4 times [OR=3.98; 95%CI=1.03 - 15.40; P=0.045] more likely to adequately practice on risk factor of Diabetes mellitus 2 prevention compared to those with low attitude.

4.5.3 Multivariate Analysis for Factors Associated with Adequate Prevention practice against risk factor of Diabetes mellitus 2.

Multiple regression analysis was performed in order to identify factors independently associated with adequate preventive practice against risk factor of Diabetes mellitus 2 among students. Five (5) factors that associated with adequate practice on Diabetes mellitus 2preventionat P<0.05 during bivariate analysis were subjected concurrently in a multiple regression analysis. These factors consisted of: university enrollment, gender, and occupation, level of knowledge and level of attitude. Upon fitting these factors using binary logistic regression and by specifying *'backward conditional'* method with removal at P<0.05, all factors remained in the final analysis or reduced model (Table 10).

Table 10: Multivariate Analysis for Factors Associated with Adequate Prevention practice against risk factor of Diabetes mellitus 2.

Variables	AOR	95%CI		p value
		Lower	Upper	
University enrolled				
Mount Kenya University	Ref			
Gitwe University	2.17	1.25	3.78	**0.006**
Gender				
Male	Ref			
Female	1.69	1.06	2.71	**0.027**
Occupation				
Employed	3.35	1.69	6.62	**0.001**
Self employed	1.01	0.58	1.77	0.972
Student	Ref			
Level of knowledge				
High Knowledge	4.42	1.77	11.03	**0.001**
Moderate Knowledge	1.38	0.81	2.35	0.240
Low Knowledge	Ref			
Level of Attitude				
Positive Attitude	7.78	1.85	32.73	**0.005**
Moderate Attitude	5.44	0.98	3.16	0.062
Low Attitude	Ref			

AOR= Adjusted Odds Ratio; CI= Confidence interval; Ref= Reference

Source: Field Data (2019)

Students from Gitwe University were significantly 2.17 times more likely to practice adequately on risk factor of Diabetes mellitus 2 prevention [OR=2.17; 95%CI=1.25 - 3.78; P=0.006] as opposed to the ones enrolled at Mount Kenya University Kigali Campus. Female students were significantly 1.69 times more likely adopt preventive practice against Diabetes mellitus 2 risk factors [OR=1.69; 95%CI=1.06 - 2.71; P=0.027] than their male counterparts. Moreover, employed students were significantly 3.3 times more likely to practice adequately on risk factor of Diabetes mellitus 2 prevention [OR=3.35; 95%CI=1.69 - 6.62; P=0.001] than those who were students. Students with high level of knowledge had about 4.4 times more likely to adequately practice on risk factor of Diabetes mellitus 2 prevention [OR=4.42; 95%CI=1.77 - 11.03; P=0.001] compared to those with low level of knowledge. Similarly, students with positive attitude on the risk factors of Diabetes mellitus 2 were significantly 7.7 times more likely to adequately practice on risk factor of Diabetes mellitus 2 prevention [OR=7.78; 95%CI=1.85 - 32.73; P=0.005] compared to those with low attitude.

4.6 Discussion

The current study revealed that the level of knowledge about Diabetes mellitus 2 among the students was good and acceptable knowledge at 61.5%.Questions on physical exercise as a way of alleviating Diabetes mellitus 2, obesity and overweight as a risk factor for Diabetes mellitus 2 and place of diet in reducing Diabetes mellitus 2 had a tally of 77%, 79% and 71% respectively. Sugary and oily food as a risk factor of Diabetes mellitus 2 also had a good tally of 69%.This is collaborated by a similar study on students where nearly 69.2% of cases had good and acceptable knowledge. (Abuobaida *et al* 2017.)

The study shows that the attitude of students toward Diabetes mellitus 2 was at 59.8%.44.8% of the student strongly agreed that family history of Diabetes mellitus 2 could predispose them to Diabetes mellitus 2, 39.7% believed that physical exercise was important in prevention and management of Diabetes mellitus 2, 41.7% of the participant felt that they had the ability to motivate themselves in choosing and managing their diet. This study gives similar results to a study done by Mohammed AA et al 2018 on students that showed that 50% of the students had good attitude toward Diabetes mellitus 2.

The distribution of participants in this study according to the practices to reduce risk for Diabetes mellitus 2 was adequate at 60.6%, while the rest 39.4% scored inadequate practice. About tobacco consumption only 12.1% (42students) of the participant had ever taken tobacco in their life .Even so only 8% (28 students) of the participants engaged in the practice on a daily basis with only one student taking 20 or more cigarettes per day.50.2% of the participant had taken alcohol for the last one year. Almost half of the participant engaged in physical activity either by virtue of their occupation or deliberate physical exercise. The result of this current study indicates that only a third of the participant ate fruits at 31.0% and vegetable at 32.4% at least 4 times in a week, this is mirrored by a similar study by Mohammed *et al* 2018where only a third of the participant engaged in proper diet.

As for the Association between socio-demographic and practice on risk factor of Diabetes mellitus 2 prevention, female students were 1.71 times more likely to practice adequately on risk factor of Diabetes mellitus 2 prevention [OR=1.71; 95%CI=1.10 - 2.64; P=0.016] than their male counterparts, this is pegged on the fact that female have a better health seeking behavior as compared to male which collaborate with a study on gender and health seeking behavior in Australia which found out that Women are were

doing better in health information seeking especially in the internet which had positive residue effect on how that information was used in managing health conditions(Tong, *et al* 2014)

In this study, female students were significantly 1.69 times more likely adopt preventive practice against Diabetes mellitus 2 risk factors [OR=1.69; 95%CI=1.06 - 2.71; P=0.027] than their male counterparts. In parallel study comparing female against male in adopting and applying preventive measure on oral health indicated that women showed more care to their oral health which was demonstrate by brushing using medium strength toothbrush , brushing more than twice a day and choosing toothpaste as instructed by their dentist(Azodo *et al* 2012).

In the current study, Most of the respondents (61.5%) had moderate level of knowledge on risk factors/causes of diabetes mellitus 2. However, about a quarter (25.3%) had low level of knowledge and those with high level of knowledge on the same were 12.9%.In a parallel study about health seeking behavior in both rural and urban areas on non-communicable disease indicated that there was basic knowledge on causes and symptoms of NCD .This information is informal and formal and at time traditional or provided by health care workers, this is comparable to the current study (Idriss *et al* 2020).

Working students were more likely to practice on Diabetes mellitus 2 prevention practices than those who were not working this could be attributed to government policy that obligate and encourage workers especially in the public sector to dress in sport costumes every Friday and break up at to 2 pm to start sporting activities .the government has also introduced car free zone once a month to encourage people to engage in physical exercise. Women were more likely to practice on Diabetes mellitus

2 risk factors prevention than their male counterpart according to this research; this could squarely be caused by women better health seeking behavior.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This section will see the researcher summaries the results of the study, draw conclusion emanating from the result, recommend action to be taken by stake holder as per the finding and suggestion for further studies.

5.1 Summary of Findings

5.1.1 Knowledge Regarding Risk Factor for Diabetes mellitus 2 among the Students

Most of the respondents (61.5%) had moderate level of knowledge on risk factors/causes of diabetes mellitus 2. However, about a quarter (25.3%) had low level of knowledge and those with high level of knowledge on the same were 12.9%.

5.1.2 Attitude toward Diabetes mellitus 2 Mellitus Risk Factors among University Students

The maximum attainable tally was 45 and the minimum tally was 9. The aggregate was converted into percentages and the level of attitude was grouped as follows: Low (less than 50%), Moderate (50-69%) and High (more than 70%). Most of the respondents (59.8%) had positive attitude on risk factors of diabetes mellitus 2 followed by moderate (36.8%) while only 3.4% had had low attitude.

5.1.3 Practice on prevention of Risk Factor of Diabetes mellitus 2 among the Students

The maximum attainable tally was 12 and the minimum tally was 0. The mean was computed and the level of practice was classified as follows: Adequate practice (mean and above) and In-adequate practice (below the mean). Most of the students (60.6%) scored adequate practice on risk factors of diabetes mellitus 2 prevention while the remaining (39.4%) scored in-adequate practice towards risk factors of diabetes mellitus 2 prevention.

5.1.4 Association between Socio-Demographic and Practice on Risk Factor of Diabetes mellitus 2 Prevention

There was significant association between university enrollment and practice on risk factor of Diabetes mellitus 2 prevention. Students from Gitwe University were 2.1 times more likely to practice adequately on risk factor of Diabetes mellitus 2 prevention [OR=2.10; 95%CI=1.24 - 3.56; P=0.006] compared to those enrolled at Mount Kenya University Kigali Campus. Female students were 1.71 times more likely to practice adequately on risk factor of Diabetes mellitus 2 prevention [OR=1.71; 95%CI=1.10 - 2.64; P=0.016] than their male counterparts. Moreover, employed students were significantly more likely to practice adequately on risk factor of Diabetes mellitus 2 prevention [OR=3.01; 95%CI=1.57 - 5.77; P=0.001] than those who were students. However, there was no significant association among the other variables.

5.2 Conclusion

The level of knowledge on risk factors for Diabetes mellitus 2 among students was above average, there was an increased preventive practice against risk factor for diabetes mellitus 2 among students with higher knowledge on risk factors for Diabetes mellitus 2.This means if health education is done it can help reduce incidence of Diabetes mellitus 2.

Most students had a good attitude towards Diabetes mellitus 2 risk factors, which according to the study is important in determining whether a student practiced prevention measures against risk factor for Diabetes mellitus 2 or not . A student with a positive attitude towards Diabetes mellitus 2 was more likely to play preventive practice against Diabetes mellitus 2 than those who had a low attitude.

Most of the students showed adequate preventive practice against risk factors for Diabetes mellitus 2.Adequate preventive practice against risk factors for Diabetes mellitus 2 was linked to positive attitude and adequate knowledge on risk factors for Diabetes mellitus 2, participant with high knowledge and positive attitude were more likely to adequately practice prevention against risk factors for Diabetes mellitus 2. The study also concludes that gender played an important role in practice of preventive measure against risk factors of Diabetes mellitus 2, where female participant were more likely to practice.

Factors independently associated with adequate preventive practice against risk factor of Diabetes mellitus 2 among students included: gender, University enrolled, high knowledge on risk factors for Diabetes mellitus 2, positive attitude towards Diabetes mellitus 2and employed. Among these factors, level of knowledge and attitude against Diabetes mellitus 2 had the highest reference value at 4.4 and 7.7 respectively.

5.3 Recommendations

Knowledge and attitude of students toward Diabetes mellitus 2 risk factors were the most important factors that influenced whether a student practiced adequately on prevention of risk factor for Diabetes mellitus 2 or not . For this reason health educators and the university should come up with health lifestyle education programs and clubs that can be used as a media through which knowledge and good attitude can be inculcated among the students so that they can make deliberate and from a knowledgeable point of view better decision on their dietary plan and other lifestyle habits.

From this study female students were significantly more likely adopt preventive practice against Diabetes mellitus 2 risk factors than their male counterparts. For this reason the study recommends special programs that would target male students as they seem to be at more risk of acquiring diabetes mellitus 2.

5.4 Suggestions for Further Study

1. Studies on the same subject incorporating a larger population and larger sample size so that the result can be largely representative of Rwandan student population should be done.
2. Research should be done on Rwandan university students in order to find out the diabetes mellitus 2 risk factors that are there among them.

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APPENDICES

Appendix I: Research Consent Form

RESEARCHER: WAMBUGU FRANCIS KAROMO

REG. NUMBER: MPH/53188/2016

TITLE OF STUDY: Diabetes mellitus 2risk factors among Mount Kenya University students

INSTRUCTIONS

1. Read keenly the entire content of this form

2. Mark with a tick in each of the boxes accordingly.

3. You are free to seek ant clarification for anything that is not clear.

4. Endorse a signature at the end

I understand the purpose of this research after an in-depth explanation by the researcher. ☐

I am cognizant that I will give a blood sample from a finger, I will take weight, height, blood pressure measurement and answer question related to knowledge and risk of Diabetes mellitus 2. ☐

I know that I have liberty to drop from this study at one point should it become necessary. ☐

I realize that the information I will offer will be treated with privacy and I will remain anonymous in any writing or publication begotten from this study. ☐

I am in comprehension of the fact that this study will not attract any form of monetary or material compensation. ☐

Without any coercion I offer my consent to give information on this research. ☐

RESEACHER

Signature: ……..…….

Date: ……

RESPONDENT

Signature: ……..…….

Date: ……

Appendix II: Questionnaire

Instructions:

1. Use the symbol ✓ in the box ie [ ] corresponding to question, to indicate your answer.

Respondent`s University:ie

GITWE/MKU……

Course of the respondent:iebmls/bscn,bbm

……

Section A: Socio-demographic data of the respondents

1. Age of respondents (years)
    1. 19-25[ ]
    2. 26-30[ ]
    3. 31-35[ ]
    4. >35 [ ]

2. Sex of respondents

    Male [ ] Female [ ]

3. Area of residence
    1. Urban [ ]
    2. rural [ ]

4. Living status
    1. Live alone [ ]
    2. Live with a student [ ]
    3. Live with parents/guardian [ ]

5. What is your work status?

    Employed [ ]

    Self employed [ ]

    Unemployed [ ]

6. Family history

1. Have you ever had a diabetes mellitus case in your family?

a. Mother/father [ ]

b. Grandparent [ ]

c. Sibling [ ]

d. None [ ]

e. Not sure [ ]

SECTION B

Behavioral Measurements

Tobacco Use

6. Do you sniff, smoke or consume any tobacco derivatives?

Yes [ ] No [ ] *if no go to 10*

7. Do you presently consume tobacco products every day?

Yes [ ] No [ ]

8. How many cigarettes do you consume daily?

9. At what age did you start smoking?

Alcohol Consumption

10. In your life have you drank alcohol?

Yes [ ] No [ ] *If No, go to section c*

11. At what age did you start taking alcohol?

Age in years……

12. Within the last 12 months have you consumed any alcohol?

Yes [ ] No [ ] *If No, go to section c*

13. If you consume alcohol, how many times per week do you take alcohol?

Less than 2 days [ ]

3-4 days [ ]

More than 5 days [ ]

14. On average how much alcohol do you consume every time you drink?

(Specify type of drink)……..

1-2 [ ]

3-5 [ ]

5-10 [ ]

More than 10 [ ]

SECTION C

Diet

1. On a regular week, how often do you eat fruits?

One [ ]

Two [ ]

Three [ ]

Four [ ]

Five [ ]

Six [ ]

Seven [ ]

2. Whenever you eat fruits, how may serving do you?

One [ ]

Two [ ]

Three [ ]

More than 3 [ ]

3. How often do you take vegetables on a normal week?

One [ ]

Two [ ]

Three [ ]

Four [ ]

Five [ ]

Six [ ]

Seven [ ]

4. Whenever you take vegetables, what is the number of servings you take?

One [ ]

Two [ ]

Three [ ]

More than 3 [ ]

SECTION D

Physical Activity

1. In your day to day life do you engage in action that can cause heavy breathing and increase in heart beat?

Yes [ ] No [ ] *If No, go to 4*

2. In your normal week, how often do engage in action that cause heavy breathing and increase in heart beat?

One [ ]

Two [ ]

Three [ ]

Four [ ]

Five [ ]

Six [ ]

Seven [ ]

3. How long are you engaged in action that cause heavy breathing and increase in heart beat on your normal day?

At least 30 minutes [ ]

Between 30 minutes and one hour [ ]

Over 1 hours [ ]

4. Do you engage for not less than 10 minutes in aerobic exercise that cause heavy breathing and increase in heart beat?

Yes [ ] No [ ] *If No, go to 7*

5. How often do you engage in aerobic exercise that cause heavy breathing and increase in heart beat in your normal week?

One [ ]

Two [ ]

Three [ ]

Four [ ]

Five [ ]

Six [ ]

Seven [ ]

6. On a normal day, what amount of time is delegated to aerobic exercise?

At least 30 minutes [ ]

Between 30 minutes and one hour [ ]

Over 1 hours [ ]

SECTION F

Anthropometric characteristic and blood glucose and arterial blood pressure

Tallness (m)……

Body mass (kg)……

Blood glucose level …….

SECTION G

The level of knowledge of risk for diabetes type 2 .

1. Increased physical activity can decrease the chances of developing Diabetes mellitus 2.

True [ ] False [ ] Not sure [ ]

2. A person with a history in family of Diabetes mellitus 2 has increased chances of getting diabetes type II.

True [ ] False [ ] Not sure [ ]

3. Obesity and overweight (BMI > 25 $kg/m^{2)}$is a risk factor for type II diabetes.

True [ ] False [ ] Not sure [ ]

4. Hypertension is a major risk factor for diabetes mellitus 2

True [ ] False [ ] Not sure [ ]

5. Excessive consumption of sugary food stuff and oily foods are not risk factors for diabetes type II.

True [ ] False [ ] Not sure [ ]

6. Excessive consumption of alcohol is a risk factor for Diabetes mellitus 2

True [ ] False [ ] Not sure [ ]

7. Avoidance of smoking can significantly reduce chances of Diabetes mellitus 2?

True [ ] False [ ] Not sure [ ]

8. **Eating diet rich in fruits and vegetables doesn't reduce one's risk of getting diabetes type II**

True [ ] False [ ] Not sure [ ]

9. Regular screening for blood glucose levels is a good practice that can help one to detect pre-diabetic stage before type II diabetes sets in.

True [ ] False [ ] Not sure [ ]

10. Impaired glucose tolerance is a risk factor of Diabetes mellitus 2

True [ ] False [ ] Not sure [ ]

SECTION H

The attitude towards diabetes type 2 among university students

Match with one of the options below as responses for each of the following statements:

- I Strongly agree
- I Agree

- I am Neutral
- I Disagree
- I Strongly disagree

In general, I believe that:

1. Instruction about the foods should be indicated on the labels even if the diabetic patient is illiterate; they can have somebody to explain the dietary information for them at home

2. Taking alcohol while on diabetic medication is not a serious problem

3. Diet and physical activity are not as important as medication in management of diabetes

4. I have a strong drive to manage my diet.

5. I am confident and sure that I can make dietary choices that are suitable for me.

6. I am aware that my family history of Diabetes mellitus 2 can predispose me to Diabetes mellitus 2.

7. I know that physical exercise is important in preventing and managing diabetes.

8. I know that tobacco consumption in all its forms can increase my chances of getting Diabetes mellitus 2.

9. I know that alcohol consumption can increase my chances of getting Diabetes mellitus 2

Appendix III: Tally of Diabetes mellitus 2 risk factors level of Knowledge

The overall level of knowledge tally regarding risk factor for Diabetes mellitus 2 among the students was assessed using ten (10) statements and their answers and reward was designed as shown:

- Increased physical activity decrease diabetes mellitus 2 (Yes =1; No = 0; Do not know= 0)
- Family history increases diabetes mellitus 2 (Yes =1; No = 0; Do not know= 0)
- Obesity and overweight increases diabetes mellitus 2 (Yes =1; No = 0; Do not know= 0)
- Hypertension is major risk for diabetes mellitus 2 (Yes =1; No = 0; Do not know= 0)
- Sugary and oily food increase chances of diabetes mellitus 2 (Yes =1; No = 0; Do not know= 0)
- Alcohol consumption increases chances of diabetes mellitus 2 (Yes =1; No = 0; Do not know= 0)
- Tobacco use is a risk for diabetes mellitus 2 (Yes =1; No = 0; Do not know= 0)
- Good diet reduce the chance of diabetes mellitus 2 (Yes =1; No = 0; Do not know= 0)
- Regular screening for blood glucose levels is a good practice that can help one to detect pre-diabetic stage before type II diabetes sets in (Yes =1; No = 0; Do not know= 0)
- Diabetes mellitus 2 is potentially avoidable disease if its risk factors are identified early and avoided (Yes =1; No = 0; Do not know= 0)

The overall tally was calculated by summating the tallies. The highest possible attainable tally was 10 and the lowest tally was 0. The aggregate was converted into percentages and the level of knowledge was categorized as follows: Low (less or equal to 50%), Moderate (between 50 to 69%) and High (70% and above).

Appendix IV: Level of Attitude Tally Regarding Risk Factor for Diabetes mellitus 2 among the Students

The overall level of attitude tally regarding risk factor for Diabetes mellitus 2 among the students was assessed using the nine (9) statements whose responses and tallies were structured as follows:

- Instruction about the foods should be indicated on the labels, whether the diabetic patient is illiterate or not.(I Strongly agree =5; I Agree = 4; I am Neutral =3; I Disagree= 2; I Strongly disagree = 1)
- Taking alcohol while on diabetic medication is not a serious problem(I Strongly agree =1; I Agree = 2; I am Neutral =3; I Disagree= 4; I Strongly disagree = 5)
- Diet and physical activity are not as important as medication in management of diabetes(I Strongly agree =1; I Agree = 2; I am Neutral =3;I Disagree= 4; I Strongly disagree = 5)
- I have a strong drive to manage my diet.(I Strongly agree =5; I Agree = 4; I am Neutral =3; I Disagree= 2; I Strongly disagree = 1)
- I am confident and sure that I can make dietary choices that are suitable for me.(I Strongly agree =5; I Agree = 4; I am Neutral =3; I Disagree= 2; I Strongly disagree = 1)

  I know that:
- Hereditary history of Diabetes mellitus 2 can predispose me to Diabetes mellitus 2(I Strongly agree =5; I Agree = 4; I am Neutral =3; I Disagree= 2; I Strongly disagree = 1)
- Physical exercise is important in preventing and managing diabetes (I Strongly agree =5; I Agree = 4; I am Neutral =3; I Disagree= 2; I Strongly disagree = 1)
- Tobacco consumption in all its forms can increase my chances of getting Diabetes mellitus 2(I Strongly agree =5; I Agree = 4; I am Neutral =3; I Disagree= 2; I Strongly disagree = 1)
- Alcohol consumption can increase my chances of getting Diabetes mellitus 2(I Strongly agree =5; I Agree = 4; I am Neutral =3; I Disagree= 2; I Strongly disagree = 1)

Overall tally was then generated by aggregating the tallies. The maximum attainable tally was 45 and the minimum tally was 9. The aggregate was converted into

percentages and the level of attitude was classified as follows: Low (> 50%), Moderate (50-69%) and High (70% and above)

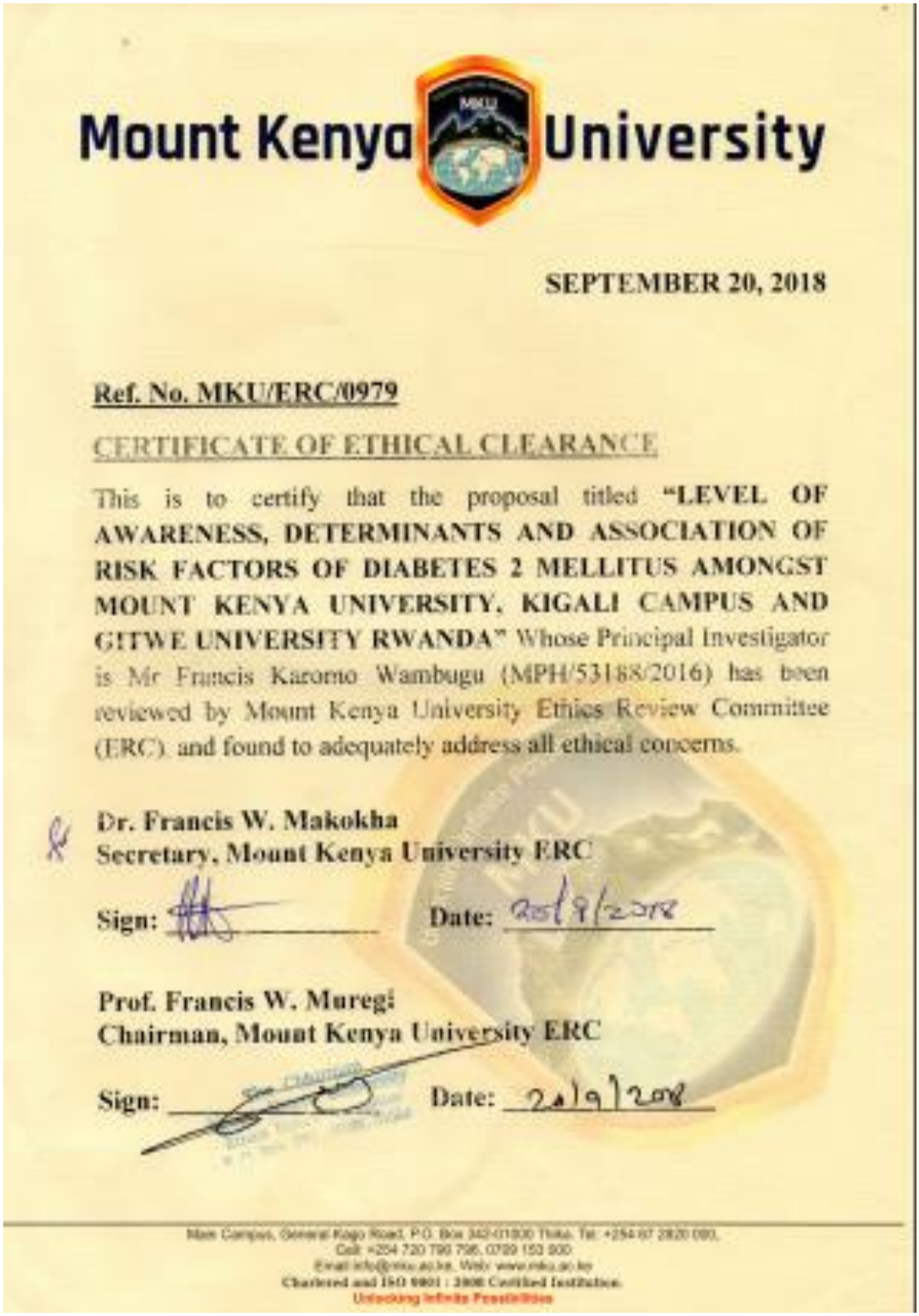
Appendix V: Overall Practice Tally Regarding Risk Factor for Diabetes mellitus 2Prevention among the Students

The overall level of practice tally regarding risk factor for Diabetes mellitus 2prevention among the students was assessed using the six (6) statements whose responses and tallies were structured as follows:

- Whether consume tobacco(Yes =0; No =1)
- Whether consume alcohol(Yes =0; No =1)
- Number of days in a week fruits is consumed (No fruits consumed =0, One time=1, Two times=2, Three times=3, Four times and more= 4).
- Number of days in a week vegetables are consumed (No fruits consumed =0, One time=1, Two times=2, Three times=3,Four times and more= 4)
- Engaged in strenuous occupation/physical activity(Yes =1; No =0)
- Aerobic activities for 10 minute(Yes =1; No =0)

The overall practice was generated by aggregating the tallies. The maximum attainable tally was 12 and the minimum tally was 0. The mean was computed and the level of practice was classified as follows: Adequate practice (mean and above) and In-adequate practice (below the mean).

Appendix VI: Certificate of Ethical Clearance



Mount Kenya University

SEPTEMBER 20, 2018

Ref. No. MKU/ERC/0979

CERTIFICATE OF ETHICAL CLEARANCE

This is to certify that the proposal titled **"LEVEL OF AWARENESS, DETERMINANTS AND ASSOCIATION OF RISK FACTORS OF DIABETES 2 MELLITUS AMONGST MOUNT KENYA UNIVERSITY, KIGALI CAMPUS AND GITWE UNIVERSITY RWANDA"** Whose Principal Investigator is Mr Francis Karomo Wambugu (MPH/53188/2016) has been reviewed by Mount Kenya University Ethics Review Committee (ERC) and found to adequately address all ethical concerns.

Dr. Francis W. Makokha
Secretary, Mount Kenya University ERC

Sign: _____ **Date:** 20/9/2018

Prof. Francis W. Muregi
Chairman, Mount Kenya University ERC

Sign: _____ **Date:** 20/9/2018

Main Campus, General Kago Road, P.O. Box 342-01000 Thika. Tel: +254 67 2820 080,
Cell: +254 720 790 796, 0799 153 900
Email: info@mku.ac.ke, Web: www.mku.ac.ke
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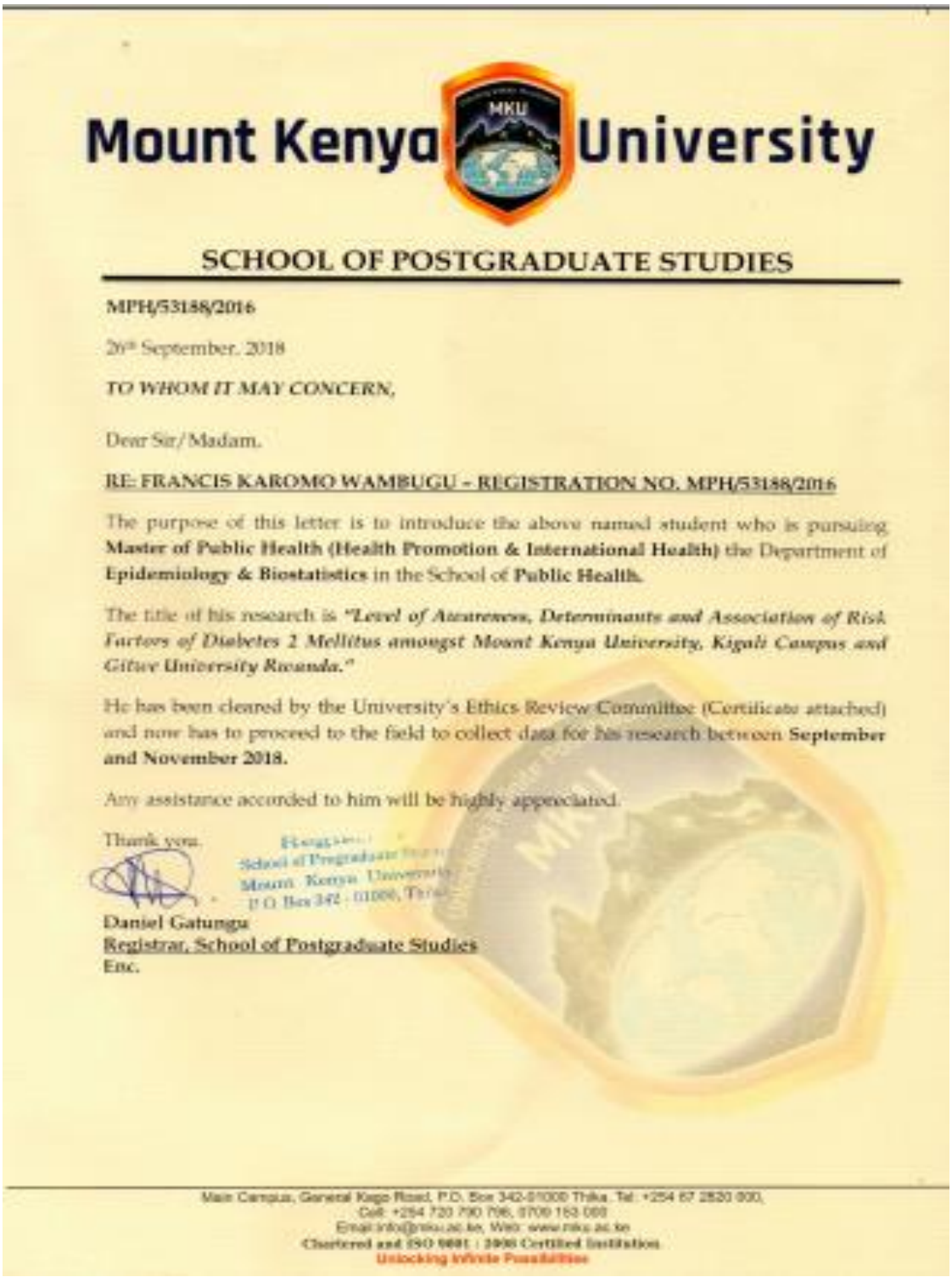
Appendix VII: Introduction Letter



Mount Kenya University

SCHOOL OF POSTGRADUATE STUDIES

MPH/53188/2016

26th September, 2018

TO WHOM IT MAY CONCERN,

Dear Sir/Madam,

RE: FRANCIS KAROMO WAMBUGU – REGISTRATION NO. MPH/53188/2016

The purpose of this letter is to introduce the above named student who is pursuing **Master of Public Health (Health Promotion & International Health)** the Department of **Epidemiology & Biostatistics** in the School of **Public Health.**

The title of his research is ***"Level of Awareness, Determinants and Association of Risk Factors of Diabetes 2 Mellitus amongst Mount Kenya University, Kigali Campus and Gitwe University Rwanda."***

He has been cleared by the University's Ethics Review Committee (Certificate attached) and now has to proceed to the field to collect data for his research between **September and November 2018.**

Any assistance accorded to him will be highly appreciated.

Thank you.

School of Postgraduate Studies
Mount Kenya University
P.O. Box 342 - 01000, Thika

Daniel Gatungu
Registrar, School of Postgraduate Studies
Enc.

Main Campus, General Kago Road, P.O. Box 342-01000 Thika. Tel: +254 67 2820 000,
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Appendix VIII: Local Authority Data Collection Authorization Letter

REPUBLIC OF RWANDA

Kicukiro, November 15th, 2018
Ref. n°[illegible]/ 07.0103.05/18

CITY OF KIGALI
KICUKIRO DISTRICT
P.o Box: 657 Kigali

WAMBUGU FRANCIS KAROMO
MOUNT KENYA UNIVERSITY RWANDA
Tel: +250786653939

RE: Data Collection Approval

Dear Sir,

Reference is made to your letter dated November 9th, 2018 requesting the authorization to conduct a research on «**Level of Awareness, Determinants and Association of Risk Factors of Diabetes 2 Mellitus amongst Mount Kenya University, Kigali Campus and Gitwe University Rwanda**». A case study of Kicukiro District.

After examining your request and according to the Law N° 45/2013 of 16/06/2013, starting on statistical activities organization in Rwanda, we have the pleasure to inform you that you are authorized to conduct your research in the District.

In order to assure the accuracy of collected data you should submit your research draft to the District before submission of the final report to your University.

Thank you.

Dr. NYIRAHABIMANA Jeanne

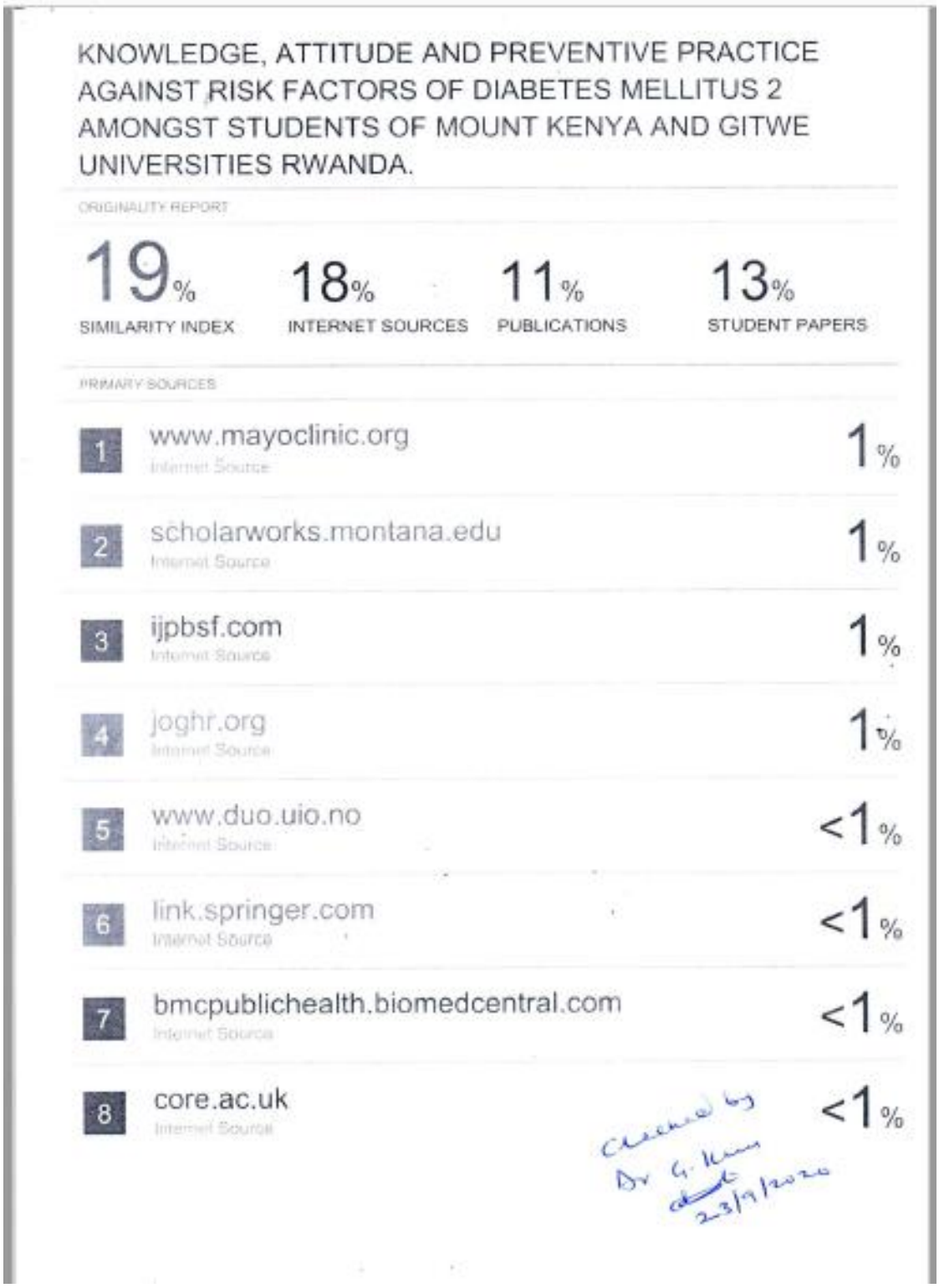
Mayor of Kicukiro District

Ce:

- Vice Mayor of the District (all)
- Executive Secretary of the District
- Statistics Service

Website: www.kicukiro.gov.rw Email: info@kicukiro.gov.rw Hotline: 4575

Appendix IX: Similarity Index



KNOWLEDGE, ATTITUDE AND PREVENTIVE PRACTICE AGAINST RISK FACTORS OF DIABETES MELLITUS 2 AMONGST STUDENTS OF MOUNT KENYA AND GITWE UNIVERSITIES RWANDA.

ORIGINALITY REPORT

19%	18%	11%	13%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

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2	scholarworks.montana.edu Internet Source	1%
3	ijpbsf.com Internet Source	1%
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5	www.duo.uio.no Internet Source	<1%
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Checked by
Dr G. Kinu
23/9/2020