Determination of Body Mass Index and Waist Circumference in Type II Diabetes Mellitus in Patients at Thika Level 5 Hospital

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Abstract

Diabetes mellitus is a universal health problem due to its chronic nature severity of complications mobility and mortality. BMI provides a simple numeric measure of a person's body mass for a given height using Waist Circumference to assess abdominal fat. A high waist circumference or a greater level of abdominal fat is associated with increased risk for chronic diseases like Type II diabetes, high blood pressure and heart disease. The purpose of this study was to determine the body mass index and waist circumference in Type II diabetes mellitus patients attending Thika Level 5 hospital in relation to age, gender and social economic status. A descriptive cross sectional study design was employed. The study targeted patients' age 36-60 years, with a study sample of 117 diabetic patients. Weight and height were measured using a weighing machine and height meter respectively and BMI calculated. A tape measure was used to take the waist circumference. There was no strong relationship between the body mass index and waist circumference in patients with type II diabetes mellitus. We recommend that new ways of evading sedentary lifestyle and exercising should be embraced.

Keywords: BMI, WC, Type II Diabetes Mellitus

Overview

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action or both. The chronic hyperglycaemiain diabetics is associated with long-term damage, dysfunction and failure of various organs, especially the eyes, kidneys, nerves, heart and blood vessels. Several pathophysiological processes are involved in the development of diabetes mellitus. These

range from autoimmune destruction of the beta-cells of the pancreas (Robertson and Harmon, 2006) with consequent insulin deficiency to abnormalities that result in resistance to insulin action. Deficiency and insufficient action of insulin on target tissues leads to carbohydrates, fats and proteins metabolism abnormalities.

For families in USA with a child who has diabetes, the corresponding figure is 10% (WHO, 2002). Studies in India estimate that for a low- income Indian family with a diabetic adult, as much as 25% of the family income may be devoted to diabetes care. Thus diabetes is a costly disease not only for affected individuals and their families but also for the health systems in sub- Saharan Africa, diabetes mellitus distribution was estimated to be 0.01%.in 2000 and is projected to rise to 0.12% by the year 2025(ADA, 2002).

In Kenya, it was estimated to be 1.06% in 2000 and would possibly rise to 1.32% by the year 2025(Hillary et al, 1998). In the study area it has been estimated to be 8.3 % Kenya National Diabetes Fact Sheet (Jan. 26, 2011).

The body mass index (BMI), or Quetelet index, is a measure for human body shape based on an individual's mass and height and is defined as the individual's body mass divided by the square of their height. Although BMI is not actually a measure of body fat, it connects well with body fat and has become the medical standard for assessing the degree of body fatness (Lori et al, 2002).

A study published in JAMA in 2005 showed that overweight people had a similar relative risk of mortality to normal weight people as defined by BMI, while underweight and obese people had a higher death rate. High BMI is associated with Type II diabetes only in persons with high serum gamma- glutamyltranspetidase. In an analysis of 40 studies involving 250,000 people, patients with coronary artery disease with normal BMI were at higher risk of death from cardiovascular disease than people whose BMIs are in the overweight range (BMI 25-29.9). In the overweight, or intermediate range of BMI (BMI 25-29.9), BMI failed to discriminate between body fat percentage and lean mass. (Lori and

Mary, 2002). The study concluded that accuracy of BMI in diagnosis of obesity is limited, particularly for individuals in the intermediate BMI ranges in men and in the elderly. These results may help to explain the unexpected better survival in overweight or mild obese patients (Romero- Corral et al, 2008).

Waist circumference (WC) is a measure of the distance around the abdomen. It is one of the most practical tools to assess abdominal fat for chronic disease risk and during weight loss treatment. A high waist circumference or a greater level of abdominal fat is associated with an increased risk for type II diabetes, high cholesterol, high blood pressure and heart disease when the BMI is between 25 and 34.9 (BMI greater than 25 is considered overweight and a BMI greater than 30 is considered obese) (McKinley, 2011). Overweight individuals with apple-shaped body types deposit fat in the abdominal region and are at greater risk of developing heart disease and diabetes. The overweight individuals with pear- shaped body types deposit fat in the hips and thighs where it is primarily subcutaneous. (Lori, 2002)

The number of people with diabetes mellitus is increasing due to population growth, aging, urbanization, and increase in obesity and physical inactivity (Hillary, 2004). Available data indicate a range of 1 case per 1,350 children at 5 years to 1 case in 360 children at 16 years as having type 1 diabetes mellitus. The distribution of diabetes for all age groups worldwide was estimated to be 2.8 % in 2000 and 4.4% in 2030. The number of people with diabetes is projected to rise to 171 million in 2000 to 366 million in 2030 (WHO, 2002)

The major factors identified for developing diabetes are inheritance (genetic predisposition) and environmental factors such as nutrition resulting to increased body mass, waist circumference and chemical toxins (WHO,2000)The world prevalence of diabetes among adults (aged 36 -60 years) will be 6.4%, affecting 285 million adults by 2030. Between 2010 and 2030, there will be a 69% increase in number of adults with

diabetes in developing countries and a 20% increase in developing countries like Kenya (WHO, 2010 Atlas) people realize this once the disease has already developed and therefore awareness at the community level should be advocated for purposes of disease prevention.

In developing countries, those most frequently affected by type II diabetes mellitus are in the middle productive years of their lives, aged between 36 and 60 (WHO, 2002). Thika being a developing town faces the threat of its citizens who are in the working bracket being affected by type II diabetes mellitus. By determining body mass index, waist circumference in type II diabetes mellitus, the results will help the middle aged Kenyans manage their eating habits and exercise to cut down their body weight that would predispose them to type II diabetes mellitus. Study area was at Thika level 5 hospital. The hospital is located within Kiambu County in Kenya. A descriptive cross sectional study was done on 201 patients attending Thika level 5 hospitals diabetic clinic.

Inclusion Criteria: Diabetic patients between the ages of 36 -60 years attending Thika level 5 hospital diabetic clinic. *Exclusion Criteria:* All diabetic patients that were pregnant, diabetic patients below 36 years and above 60 years. Glucose oxidase method glucose only was used. A glucometer was placed on a flat firm bench. The patient sat comfortably and middle finger disinfected using spirit swab, allowed to dry and pricked on the side of the figure tip. The first drop of blood was wiped with a dry cotton wool and the subsequent drop put on the test area of the test strip that was already inserted in a test glucometer. The results displayed on the glucometer screen were read and recorded on the lab request from the R_1 filled in the data collection sheet. Patients were thereafter instructed to step on the weighing machine placed on a leveled ground and weight recorded on the data collection sheet in kilograms. The patient was instructed to stand straight on the height meter and face forward at the angle of 90^0 and height measurement recorded in centimeters and later converted to meters.

The top hipbone was located and tape measure placed evenly around the bare abdomen at the level of the hip bone and the readings recorded in centimeters.

Ethical Consideration: Approval for this study was granted by the ethical consideration committee at Mount Kenya University and the letter submitted to relevant authority at Thika Level 5 Hospital. Consent was sort from patients/guardians and confidentiality of patient observed.

Data Analysis: Data was collected from 201 individuals, entered in Microsoft Excel, exported to SPSS version 20, analyzed by SPSS and chi-square test and presented on tables, bar graphs and pie charts.

FBS level was used as the dependent variable and BMI, WC, Gender and Age as predictors. Descriptive statistics on predictor mean, and Standard deviations based on Gender was also sought.

Descriptive

Comparison of Variables Based on Gender

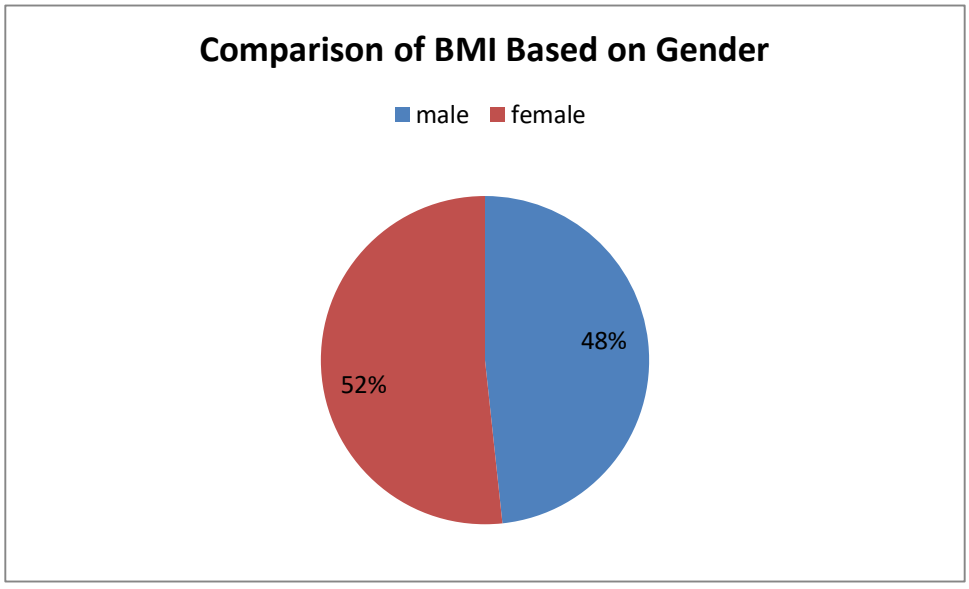

Figure 1: Comparison of BMI Based on Gender

The mean BMI of females was (27.29kg/m^2) while that of males was (25.50kg/m^2).

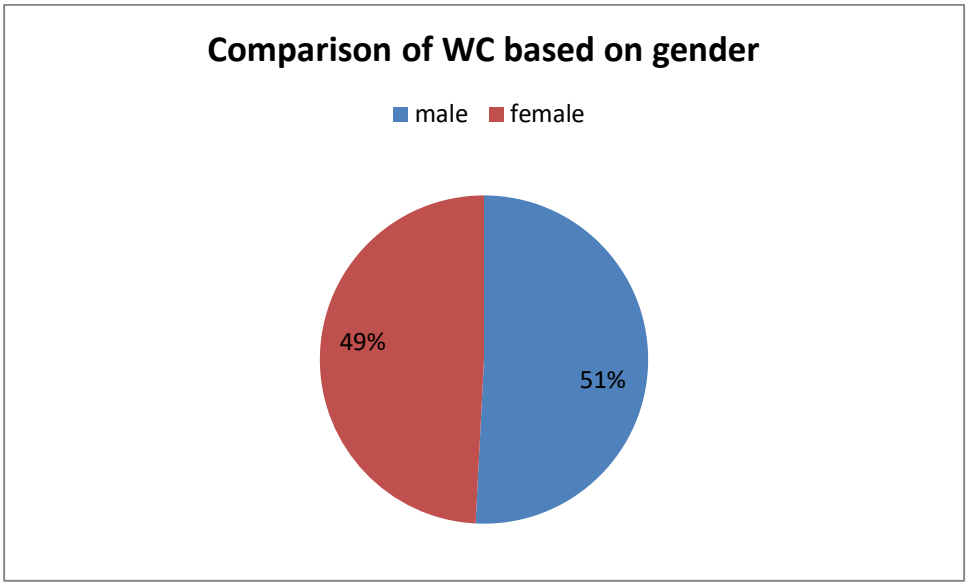

Figure 2: Comparison of WC Based on Gender.

The mean WC for males was 89.54 cm and that of females was 86.67cm.

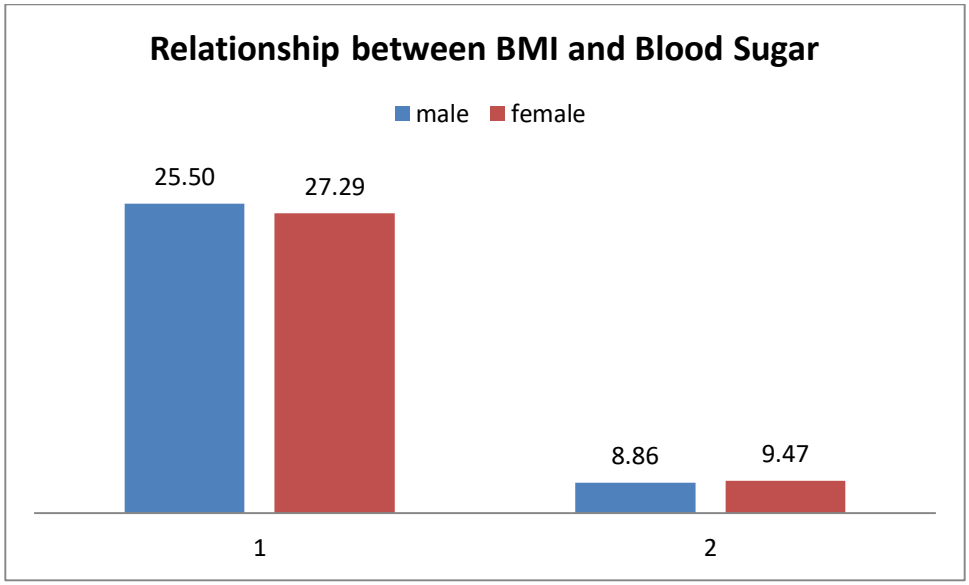

Figure 3: Relationship between BMI and Blood Sugar

The mean BMI of males was 25.5kg/m2 with a FBS of 8.86mmol/l while that of females was 27.29kg/m2 with a FBS of 9.47mmol/l.

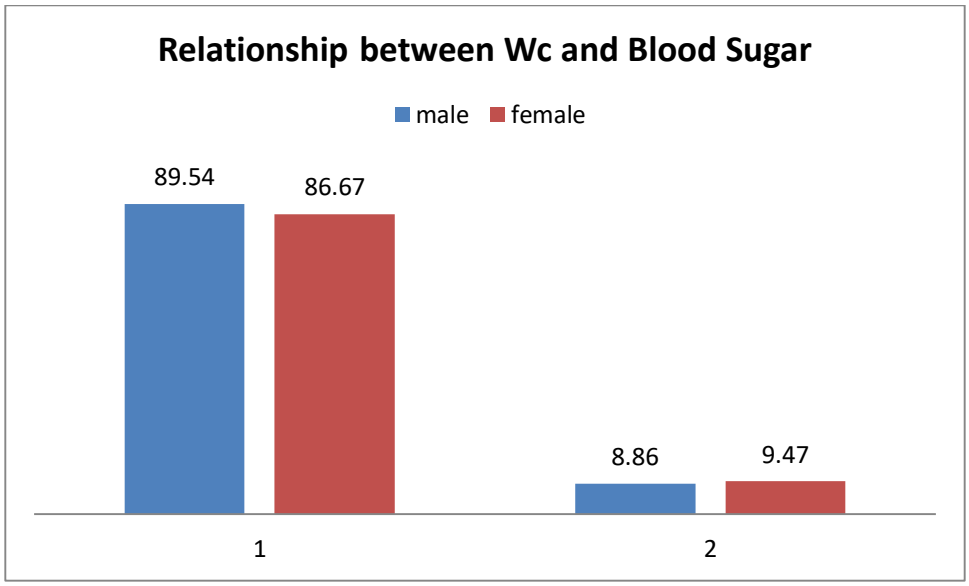

Figure 4: Relationship between WC and Blood Sugar

The mean WC for males was 89.54cm with a FBS of 8.86mmol/l while that of females was 86.67cm with a FBS of 9.47mmol/l.

Table 1: Comparison of Mean BMI of Both Genders within Various Age Groups

The table below shows the comparison between the mean BMI in kg/m2 between both genders distributed in the same age groups.

Age Group(yrs)	Mean BMI of Men(kg/m2)	Mean BMI of Female(kg/m2)
40-45	25.25	27.6
46-51	25.65	27.32

52-57	25.82	27.35
58-63	24.73	26.63

Discussion

The purpose of this study was to establish whether there's a relationship between body mass indices, waist circumference and type II diabetes mellitus. This study aims to get the Descriptive Statistics, compare the means of stipulated variables with respect to gender. The purpose of this study was also to compare BMI and FBS against their respective reference values and come to a conclusion. The study relied on the independent samples student t-test to compare the means of the variables. Under the null hypothesis, the *t*-statistic has a student's T-distribution with $n1 + n2 - 2$ degrees of freedom.

Comparison of BMI and WC of People with Type II Diabetes Mellitus Based on Gender

From the results obtained it clearly indicates that the study sample subjects were all overweight having a BMI greater than 25kg/m2 compared to the non- diabetic control group according to WHO whose BMI was between 18.5 to 25kg/m2.WHO regards BMI of below 18.5kg/m2 as underweight and might attribute it to malnutrition while one of above 25kg/m2 is overweight.

The populations mean BMI of 26.7kg/m2 was just over the normal weight. From the crosstabs analysis, 41.3% had normal weight (18.5kg/m2 to 25kg/m2) of whom 26.9% were females and 14.4% males while 58.7% of the population was overweight (over 25) of whom 42.8% were females and 15.9% males. Comparison of the BMI based on gender showed no significant difference statistically. There was that there's no strong evidence of gender associated difference in the mean BMI.

Comparison of WC based on gender also gave no significant difference statistically; the non –diabetic control sample as presented by WHO showed that males have WC of 102 cm while females 88cm, diabetic males and females had 89.54cm and 86.67cm respectively. Thus there was no strong evidence of gender associated difference in the mean WC.

Comparison of BMI, WC and Type II Diabetes Mellitus

Comparison of BMI and FBS showed that; both genders were overweight with increased FBS levels. According to WHO a non –diabetic individual has FBS level of less than 7.0 mmol/l. This result therefore shows a relationship between BMI and FBS.

Comparison of WC and FBS indicated that both males and females had normal WC of 89.54cm and 86.67cm respectively as compared to a control group which had 88cm for females and 102cm for males. The FBS were still high despite the normal WC results. Thus there was no relationship between the two variables.

Comparison of the BMI and WC within Various Age Groups of Diabetic Patients

Comparison of BMI for both genders within the various age groups indicated that, all age groups are equally overweight. Thus Age and WC are not, while BMI is a significant predictor of Type II Diabetes Mellitus.

Conclusion

Results of this study support the thesis that males and females had identical distributions patterns for type II diabetes mellitus. The mean BMI for the sampled population was 26.7. The crosstabs indicated that more than 58% of the population is in the range of overweight to obese and were therefore at risk of contracting type II diabetes mellitus. No underweights were recorded in the population.

Additionally, 70.1% of the population with 7.8mmol/l FBS concentration were at a high risk of contracting type II Diabetes Mellitus.

Regression analysis indicated that BMI was a better prediction of Type II diabetes mellitus than age and WC since variation in BMI was highly associated with variation of blood sugar levels. Thus very high and low BMI impacted blood sugar levels adversely and can potentially cause type II diabetes mellitus. Age was found to be second in relative importance to variationsin blood sugar levels. The implication is that susceptibility to high blood sugar levels increased with increase in age.

Recommendations

1. There is need for stakeholders in the health sector to pursue further research to establish why the average FBS levels among patients in Thika Hospital level V are higher than the nationwide average.
2. Deliberate efforts should be made to educate the people on the need to avoid sedentary lifestyles and unhealthy feeding habits. A low carbohydrate diet plan for the age group would go a long way in combating this menace.
3. Efficient Insulin distribution and administering by the ministry to public hospitals be encouraged.
4. The government and stakeholders should embark on facilitation for the affected to attain improved individual care and metabolic control.
5. Further research should be carried out to assess the outcomes of the interventions.

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