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# Association of Diabetic Patients in the Area of Kanpur with Abnormal Body Mass Index and Blood Pressure

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**ABSTRACT**
The entire investigation was conducted at the Rama Medical College, Hospital, and Research Centre in Kanpur in collaboration with the Central Research Laboratory department. The major goal was to establish a link between high blood pressure and an abnormal body mass index in diabetic individuals in this area. At the time of enrollment, the participants' average age was almost 45.339.1 years. Between patients and controls, there were substantial differences in the mean HbA1c levels for hypertension. At the outset of hypertension, the mean blood pressure values were primarily systolic and were shown to be statistically significant. Additionally, it was observed that the patients' systolic blood pressures gradually rose along with their BMI. Between the diabetic and non-diabetic groups, there was a statistically significant rise in systolic blood pressure (p 0.0001).

***Keywords:*** systole and diastole, body mass index, hypertension, statistically significant

## I. INTRODUCTION

According to the WHO (1998), obesity is a public health issue of epidemic proportions. The definition of obesity as well as a review of the research on its prevalence, causes, risk factors, physiological problems, and anticipated economic costs is all covered in this chapter.

### 1.1 Obesity: Definition and Classification

Excess adipose tissue is a defining characteristic of obesity, which is typically measured using Quetelet's index, also known as the body mass index (BMI). Only people who are extremely muscular could be mistakenly labeled as overweight or obese according to BMI, which has been employed in numerous large-scale epidemiological investigations (Prentice, 1998). By dividing body weight (kg) by the square of height (m2), the BMI is determined. A BMI of 30 kg/m2 is generally accepted as the threshold for adult obesity, according to World Health Organization (WHO) guidelines based on the correlations between BMI and all causes of death (see table 1.1). Due to the random variations in height and body composition that occur during childhood, the definition of childhood obesity is difficult and imperfect. Cut-off points with an international focus have nevertheless been published (Edmunds, Waters, & Elliott, 2001; Cole, Bellizzi, Flegal, & Dietz, 2000).

**Table 1:** WHO classification of individuals with underweight and overweight conditions based on BMI

| Classification | BMI (kg/M2) | Risk of Comorbidities |
|---|---|---|
| Underweight | <18.5 | Low |
| Overweight | 25.0-29.9 | Increased |
| Healthy Weight | 18.5-24.9 | Average |
| Obese Class1 | 30.0-34.9 | Moderate |
| Obese Class 11 | 35.0-39.9 | Severe |
| Obese Class III | (Morbid) >40.0 | Very Severe |

Despite the fact that BMI is a popular measure for classifying obesity, it must be understood that the cut-off point is arbitrary and the primary purpose of the categories is to allow comparison with other nations (James, Leach, Kalamara, & Shayeghi, 2001). The BMI cutoff mark shows an elevated risk of health issues. It does not follow that everyone with a BMI above 30 kg/m2 will experience the health effects of obesity.

### Diabetes

Diabetes is a chronic illness that develops when the body either cannot use the insulin that the pancreas makes properly or does not create enough of it (1). There are primarily two forms of diabetes: type 1 diabetes and type 2 diabetes,

both of which require daily insulin injections. Type 2 diabetes is the other prevalent type and is defined by insulin resistance or relative insulin insufficiency (1, 2). 90% of people with diabetes worldwide have type 2 diabetes, which is the most prevalent type (1). With more individuals at risk of catastrophic complications from diabetes, the prevalence of type 2 diabetes is continuing to rise. The risk of suffering a myocardial infarction or stroke is two to four times higher in people with type 2 diabetes. In addition, it is one of the main causes of kidney failure, blindness, and amputation of limbs (1, 3-5). Patients with diabetes have not seen a similar decline in longer-term case fatality rates of cardiovascular disease (CVD) (6), despite trials of secondary prevention after myocardial infarction showing as good or better short-term effects of interventions in patients with diabetes as in patients without (6). Population-based studies of the trends in CVD risk factors in people with and without diabetes reveal varying trends that are not in their favor (7). Only 13% of patients with diabetes in general practice adhere to the recommendations for CVD preventive targets, according to studies (8). According to earlier research, diabetes and its consequences can be delayed or prevented with the use of appropriate lifestyle changes and/or medication (9–12). Therefore, the need for quick, accurate, and acceptable technologies to identify at-risk individuals is justified.

**The Prevalence of Type 2 Diabetes**

An estimated 285 million people worldwide (aged 20 to 79) had diabetes in 2010; the prevalence was 6.4% (13). In developing countries, the number of adults with diabetes is predicted to rise by 70% between 2010 and 2030, while it will rise by 20% in industrialized nations (13). The metabolic syndrome, also known as insulin resistance, has been linked to an increased risk for type 2 diabetes development as well as cardiovascular disease (CVD) in several studies (16–17). This clustering of features includes high plasma glucose, obesity, dyslipidemia (high triglyceride and total cholesterol levels, low HDL cholesterol levels), and hypertension. The main reasons for the sharp rise in type 2 diabetes prevalence are environmental and lifestyle variables (18–20). Those who are more susceptible to these alterations are presumably identified by genetic characteristics. Furthermore, research has indicated that some ethnic groups are more likely than others to develop diabetes (21, 22).

**Diabetes Type 2 Risk Factors**

The relationships between various risk factors and the likelihood of developing type 2 diabetes have been extensively studied. The most often identified risk factors for type 2 diabetes are body mass index (BMI), lipids, hypertension, smoking, physical inactivity, low education, dietary habits, family history, and, most recently, particular genes (26-32).

**Hypertension**

One of the major contributors to the global illness burden is hypertension (1). Large observational studies have found that hypertension is linked to an increased risk of cardiovascular illness, including stroke, ischemic heart disease, and other vascular diseases (2–5). In fact, there has been a correlation between blood pressure levels and an increased risk of cardiovascular disease across the full blood pressure distribution (6–8) and within the normal blood pressure range (9–11). According to the rule of half (12–14), treatment and awareness of high blood pressure have been insufficient for 50 years. This means that only half of people who were identified as having hypertension were aware of their condition, only half of those who were aware received treatment, and only half of those who received treatment met their treatment objectives. Although medication has helped reduce cardiovascular events, there is still room for improvement in the management of high blood pressure and hypertension (15).

It is crucial that healthcare professionals adhere to the guidelines for precise blood pressure measurement. To prevent and treat high blood pressure, BP should be classified as normal, raised, or stage 1 or 2 hypertension. Normal blood pressure is defined as <120/<80 mm Hg; high blood pressure is 120-129/< 80 mm Hg; stage 1 hypertension is 130-139 or 80-89 mm Hg; and stage 2 hypertension is ≥ 140 or ≥ 90 mm Hg. It's crucial to assess a person's blood pressure level using an average based on ≥ 2 readings taken on ≥ 2 different dates before diagnosing them with hypertension. To confirm the diagnosis of hypertension and to titrate BP-lowering medication, out-of-office and self-monitoring of blood pressure measures are advised in addition to clinical interventions and telehealth coaching. Office/clinic 140/90, HBPM 135/85, daytime ABPM 135/85, nighttime ABPM 120/70, and 24-hour ABPM 130/80 mm Hg are the corresponding blood pressure readings based on location and techniques. Prior to making a diagnosis of hypertension, it is appropriate to screen for the existence of white coat hypertension in people with untreated systolic blood pressure (SBP) >130 but >160 mm Hg or diastolic blood pressure (DBP) >80 but 100 mm Hg. It is appropriate to screen for masked hypertension with daytime ABPM or HBPM in persons with elevated office BP (120–129/< 80) but who do not fulfill the criteria for hypertension.

## III. METHODS

Body mass index (BMI) is calculated using the following formula: Weight (kg)

$$\text{BMI (kg / m2)} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

**Table 2:** Measuring the body mass index

| BMI (kg/m2) | Weight Status |
|---|---|
| 18.5 to 24.9 | Healthy weight Healthy weight |
| Below 18.5 | Underweight |
| 25.0 and above | Overweight |
| 30.0 and above | Obese |

**HbA1c**

**Supplies Needed**

2 milliliters (ml) of the patient's blood were taken for testing. Blood will be drawn from a vein and placed in a tube containing a 1:2 (W/W) anticoagulant mixture made up of sodium fluoride and ethylene diammine tetra acetic acid (EDTA). 2 ml of blood can be drawn with 5 milligrams of the combination. To ensure full mixing, the tube should be vigorously shaken.

**Definitions for Operations**

The International Diabetes Federation's recommendation for glycemic management, HbA1c values below 6.5%, was followed in this study. An evaluation of blood glucose management during the previous three to four months can be made using the HbA1c test. Cation exchanger high-performance liquid chromatography (HPLC) is used to measure it. Method of gathering data

Data was gathered via a questionnaire, anthropometric and physical measurements, and a review of medical records. The patients responded to a brief questionnaire while receiving instruction in Bahasa Melayu from a single research assistant. Age, sex, monthly household income, degree of education, and occupation type are socio-demographic variables.

Sedentary employment, which involves a lot of sitting or no physical exercise, is divided into two categories: active jobs, which require movement. The duration of diabetes, family history of diabetes and obesity, smoking habit, dietary fibre intake habit, and level of physical activity are all included in the clinical histories of the patients. If the patient was smoking at the time of the research, he was regarded as a smoker.

**Population and Study Design**

This research is cross-sectional. Patients with type 2 diabetes mellitus visiting a diabetic clinic in HUSM, Kubang Kerian Kelantan, in February 2010 make up the source population. Malay people and adults over the age of 18 who have type 2 diabetes mellitus are included in the criteria. Patients with diabetes mellitus type 2 who had only recently been diagnosed (within the past year), those with diabetes type 1, gestational diabetes, and/or chronic renal disease were excluded. Random sampling was used consistently.

**Analysis of Data**

Version 12.0.1 15 of the Statistical Packages for Social Sciences (SPSS) was used to analyse the data. We looked at the distributions and frequencies. The continuous variables were presented as the median and interquartile range, or mean and standard deviation. For categorical variables, frequencies and percentages were determined. Using Pearson product moment correlation and the correlation coefficient r, the relationship between anthropometric measurements and HbA1c was examined. The association's strength and direction were also examined. Using a scatter plot, assumptions and outliers were examined.

**Blood Pressure Checking**

Blood pressure should be measured in a consistent manner to prevent the misdiagnosis of hypertension.
style (81, 82). It is known that intra-individual blood pressure variance, rather than the so-called "white coat effect" (83), causes an overestimation of hypertension; hence, repeated readings are advised (84).
The most recent ESH/ESC guidelines also advise (28):

- To wait three to five minutes before taking the patient's blood pressure.
- To take a minimum of two readings of blood pressure while seated, one to two minutes apart.
- If it is regarded as suitable, take into account the average of the two blood pressure readings.
- To utilise a conventional bladder (12–13 cm broad and 35 cm long), but to have an additional larger and smaller bladder on hand for large (>32 cm) and thin (>17–22 cm) arms, respectively.
- Regardless of the patient's position, the cuff must be at the level of the heart.

Additionally, the ideal environment is a calm, cosy space with a reasonable room temperature. The patient should have avoided eating, smoking, exercising, or consuming caffeine recently (29, 82). The phase I (appearance) and phase V (disappearance) of the Korotkoff sounds should be utilised to determine the systolic and diastolic blood pressures, respectively, when using the auscultator method. Sitting and supine blood pressure readings are equivalent as long as the

arm is supported at heart level (82). The observer should use a precise and well-maintained instrument and be well-versed in blood pressure measuring techniques (28, 85).

## IV. RESULTS

Tables 1 and 2 provide summaries of the descriptive statistics for the two data sets. Age on average for the Participants' average age at registration was 45.33 ± 9.1 years. Patients with and without diabetes had significantly different mean HbA1c values for hypertension. At the beginning of hypertension, the mean blood pressure values were primarily systolic and were found to be statistically significant. Both patient groups' systolic blood pressure levels were shown to rise steadily as BMI increased. Between the diabetic and non-diabetic groups, there was a statistically significant rise in systolic blood pressure (p 0.0001).

**Table 3:** Calculation of hypertension in patients and controls that are both diabetic and not diabetic

| S.N. | Characteristics | Hypertension in patients with T2DM (n=55) | Hypertension in patients without diabetes (n=105) |
|---|---|---|---|
| 1. | Sex distribution<br>Male<br>Female | 44.3% (n=25)<br>55.3% (n=30) | 35.2% (n=37)<br>64.7% (n=68) |
| 2. | BMI distribution<br>Overweight<br>obesity | 71.4% (n=40)<br>28.5% (n=15) | 67.6% (n=71)<br>32.4% (n=34) |

**Table 4:** Calculation of the hypertension parameter in cases and controls who are both diabetic and not diabetic

| S.N. | Characteristics | Hypertension in patients with T2DM (n=55) | Hypertension in patients without diabetes (n=105) | P value |
|---|---|---|---|---|
| 1. | Mean age | 45.33±9.1 | 43.27±9.6 | 0.1887 |
| 2. | Mean blood pressure Systolic (mmHg) | 128.5±18.7 | 120.38±17.6 | 0.0069 |
| 3. | Mean BMI (kg/m2) | 28.7±2.9 | 38.7 ±2.7 | < 0.0001 |
| 4. | Mean HbA1C (%) | 7.8±1.0 | 5.2±0.7 | <0.0001 |

## V. KNOWLEDGEMENT

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## VI. CONCLUSION

Similar results from this study were published in February 2010 in HUSM, Kubang Kerian Kelantan. As stated by Reaven and Banting in 1988, the data was also connected to other coworkers.

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