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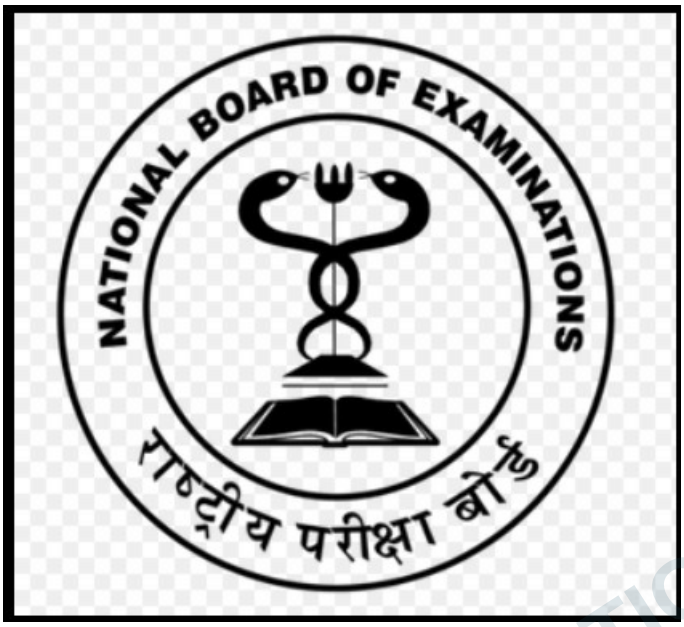

THESIS PROTOCOL

ANTHROPOMETRIC SCREENING OF TYPE 2 DIABETES MELLITUS AS A NON-INVASIVE MARKER OF CARDIOMETABOLIC RISK FACTORS

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May God be with us all…

Jai Hind.

Dr Isha Ghosh

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LIST OF ABBREVIATIONS

WHtR - Waist-to-Height Ratio

T1DM - Type-1 Diabetes

T2DM - Type-2 Diabetes

WC - Waist Circumference

BMI – Body Mass Index

ABSI - A Body Shape Index

DM – Diabetes Mellitus

MAC - Mid-arm Circumference

ROC - Receiver Operator Characteristics

CMP - MI & Cardiomyopathy

CAD - Coronary Artery Disease

CVD - Cardiovascular Disease

GBD - Global Buden of Disease

LDL - Low-Density Lipoproteins

WOF - World Obesity Federation

NCDs - Chronic Noncommunicable Diseases

MetS -Metabolic Syndrome

HDL-c - High-Density Lipoprotein cholesterol

MS - Metabolic syndrome

WC - Waist circumference

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INTRODUCTION

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INTRODUCTION

As per its pathophysiology, diabetes is typically categorised into; (i) “type-2 diabetes -T2DM”, (ii) “type-1 diabetes -T1DM”, (iii) “hyperglycemia in pregnancy encompassing gestational diabetes” and (iv) diabetes with distinctive etiology (including secondary or genetic to drugs, other illnesses, or pancreatic factors). Moreover, T2DM is nearly responsible for 90 percent of diabetes cases which can be prevented to such an extent by embracing a healthy lifestyle [(1)]. Anthropometric measurements namely waist circumference -WC, “waist-to-hip ratio -WHR”, and “body mass index -BMI”, have long been used as non-invasive as well as practical tools for evaluating obesity with associated health risks [(2)]. Regardless of diverse efforts to control T2DM and its associated complications, critical prevention strategies are considered the superior way to control this disease [(3)]. There is a “growing body of literature” highlighting that preventing or controlling obesity within the entire population globally can lessen diabetes risk. Recent evidence by Ortiz-Martínez et al., (2022) [(4)], presented that people with metabolic syndrome more generally have T2DM which is primarily associated with metabolic abnormalities and visceral or abdominal obesity. The anthropometric measurement process is one of the non-invasive and simplest techniques of recognising individuals with diabetes risk while nearly “one-third of patients” who have diabetes asymptomatic and this occurrence is increasing [(5)].

India with approximately 31.7 million people in 2000 topped the world in terms of a higher number of individuals with Diabetes mellitus where the second position was captured by China with nearly 20.8 million [(6)]. The rise of diabetes is relatively high and progressing globally, its occurrence has largely been observed in different developing countries such as India. It has been observed that approximately 77 million people have diabetes in India which is anticipated to increase to more than 134 million by the year 2045[(7)]. Obesity and overweight, mainly central as well as visceral obesity are critical risk factors for T2DM. Although, its importance has not gained due attention within diabetes treatment in contrast to the obtainment of glycaemic control. A study by Jiang et al., (2021) [(8)] illustrated that the general categorisation of obesity depending on BMI may be inadequate.

An epidemiological study by Arellano-Ruiz et al., (2020) [(9)], analysed the predictive BMI value for cardiovascular events and risk factors of cardiometabolic. This association consistently presented that BMI had a relatively lower discriminatory strength compared to waist-to-heigh-ration and waist circumference to distinguish people with relatively great muscle mass other

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than those with excess abdominal obesity or fat. Whereas, another study by Fajkić et al., (2022) [10], highlighted waist circumference as a major reflection in terms of central obesity. The Indian subcontinent with far-reaching financial and economic implications nearly accounted for 11.7 percent of diabetes cases with high mortality as well as high morbidity. A study by Augusthy et al., (2024) [11] suggested BMI and WC are the superior predictors, while another study by Sarma et al., (2020) [12], highlighted that WHtR and WC are far better compared to BMI. Moreover, a study by Mangla et al., (2020) [13] revealed that WHtR is the strongest bio-marker, yet there are few researchers assessing all of them. Also, there were relatively few studies regarding the association of other anthropometric measurements including "mid-arm circumference -MAC" and demispan with T2DM.

As per the opinion of Nishida and Kumanyika (2010) [14], "chronic noncommunicable diseases -NCDs" including "hypertension, heart disease, cancer, and diabetes mellitus" are major causes of premature death, disability, as well as impaired life quality. BMI is presented as "weight in kilograms divided by the square of height in metres" where obesity (BMI ≥ 30) and overweight (BMI ≥ 25.0). Furthermore, it has been observed that one of the major consequences of being overweight or obese is the probability of developing "MetS -metabolic syndrome" which is a complicated condition of different "interrelated risk factors" regarding diabetes and cardiovascular disease -CVDs [15]. As per the data of "The International Diabetes Federation", MetS referred to the presence of enhanced waist circumference with 2 of the following 4 norms; (i) elevated (i) triglyceride, (ii) high blood pressure, (iii) reduced HDL-c levels, and (iv) "fasting plasma glucose level" [16]. The occurrence of MetS is enhancing globally due to the increase in poor lifestyle and obesity alike. Excessive weight of the body is the major reason behind the MetS which leads to the increased production of insulin along with the probability of progressing insulin resistance. As per the view of Sarma et al., [17], insulin resistance has different metabolic influences within the organisms such as enhanced synthesis of "low-density lipoprotein cholesterol", HDL-c degradation, increased plaque formation, and sympathetic activity accordingly. As per the guidelines of the "World Health Organisation -WHO and American Diabetes Association -ADA", diabetes might be diagnosed depending on the plasma glucose concentration. This includes "two-hour plasma glucose during a 75 g oral glucose tolerance test -OGTT" or "glycated haemoglobin A1c -HbA1c", or "fasting plasma glucose -FPG" [18].

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REVIEW OF LITERATURE

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REVIEW OF LITERATURE

Analysis of Obesity in T2DM Patients

"Diabetes Mellitus -DM" refers to the group of metabolic disorders where different environmental and genetic factors guide progressive basal cell mass loss which results in hyperglycemia. T2DM is the most common type of diabetes where different pathophysiological mechanisms cause "deficient beta cell insulin secretion". Diagnosis of T2DM includes; (i) "signs of diabetes plus concentration of blood glucose ≥ 200mg/dl", (ii) glycosylated haemoglobin ≥ 6.5%, (iii) "fasting plasma glucose ≥ 126 mg/dl", and (iv) "2 hours plasma glucose ≥ 200 mg/dl during" the "oral glucose tolerance test". As per the recent data from the "World Obesity Federation -WOF", by 2030 nearly 1 billion people will be obese globally, "including 1 in 7 men and 1 in 5 women" [19].

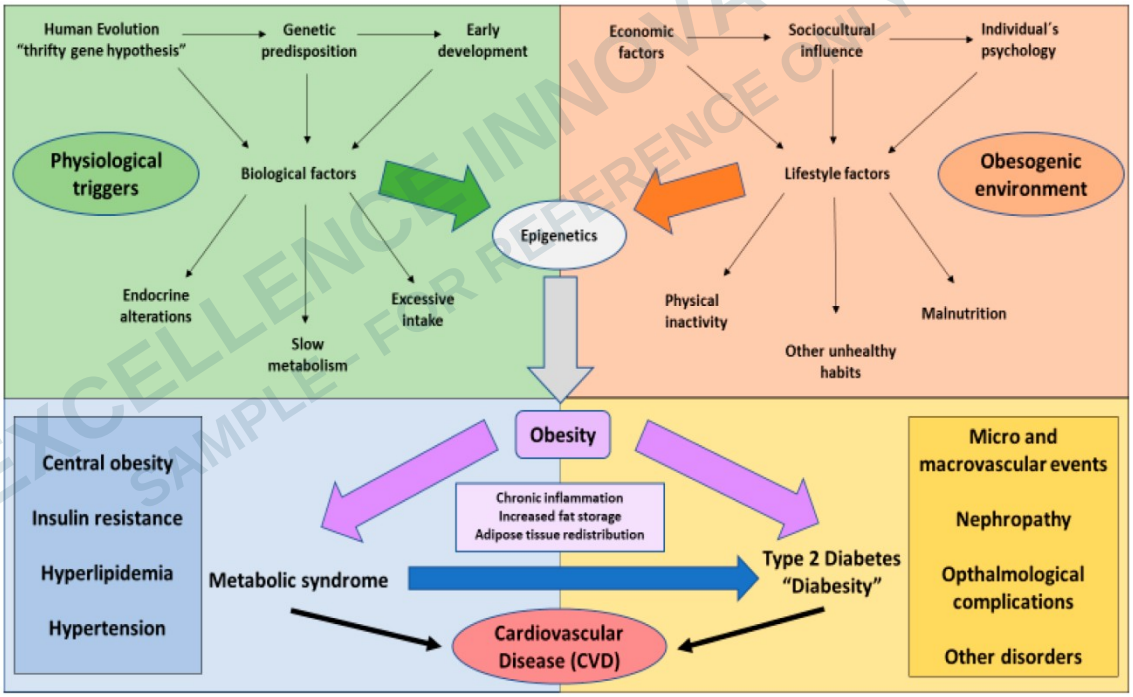

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Figure 1: The Associations between lifestyle and biological factors; that are directly impacted by the obesogenic physiological and environmental changes might interplay with the epigenetic regulations of an individual, hence prompting the prevalence of obesity. The occurrence of metabolic syndrome enhanced the risk of T2DM in obese patients [19]

"National Prevalence Data", probably underestimates the scale of the issue as children and adults of Asian descent experience different obesity regarding pathophysiological transformation at relatively lower BMI values compared to other populations. Hence, the WOF evaluated that nearly 5.5 percent of adults in India fulfil the criteria of BMI that determine obesity within the Caucasian populations [20]. Although, by using a lower cut point of BMI puts the occurrence of BMI at approximately 40.3 percent of adults. In recent times, Asian countries have experienced a time of rapid lifestyle and nutrition transition which caused a commensurate increase in the burden of T2DM and obesity.

Other than ranges mentioned in the above table, there are still some exceptions, which are; (i) lower for Asian people, and (ii) higher for older individuals, pregnant women, ad elite athletes. In particular, Asians appear to have relatively greater body fat/BMI compared to western populations hence, this necessitates specific percentiles [21]. The children of India are critically prone to have central obesity which identified the requirement for early intervention.

Correlation of the Anthropometric Measurements with the Atherosclerotic Cardiovascular Risk Score in Diabetic Patients

Many studies in both Eastern and Western literature have conclusively analysed the prevalence of T2DM and its associated cardiometabolic risks with their eventual mortality and morbidity from cerebrovascular stroke, diabetes, myocardial infarction, and peripheral vascular disease [22]. These studies have also highlighted the role of obesity and overweight in increasing diabetic dyslipidaemia as well as hypertension which further initiates "the risk of CVD". Obesity is "the independent risk factor regarding CVD", for instance, "coronary artery disease -CAD, heart failure, hypertension, and stroke". A study by Lampignano et al., (2020) [22] suggested that anthropometric parameters are relatively good markers of cardiovascular morality within men. The prolonged cardiometabolic risk can be determined utilising simple central obesity and

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anthropometric indices, although the discriminators were not similar in Saudi women and men. Obesity and Diabetes Cardiovascular Disease is quite common in individuals with DM, mainly T2DM, and is connected with an enhanced risk of CVD. Asil et al., (2021) [23] stated that one prime possible mechanism linking "obesity and DM with subsequent CVD" is with low-grade inflammation.

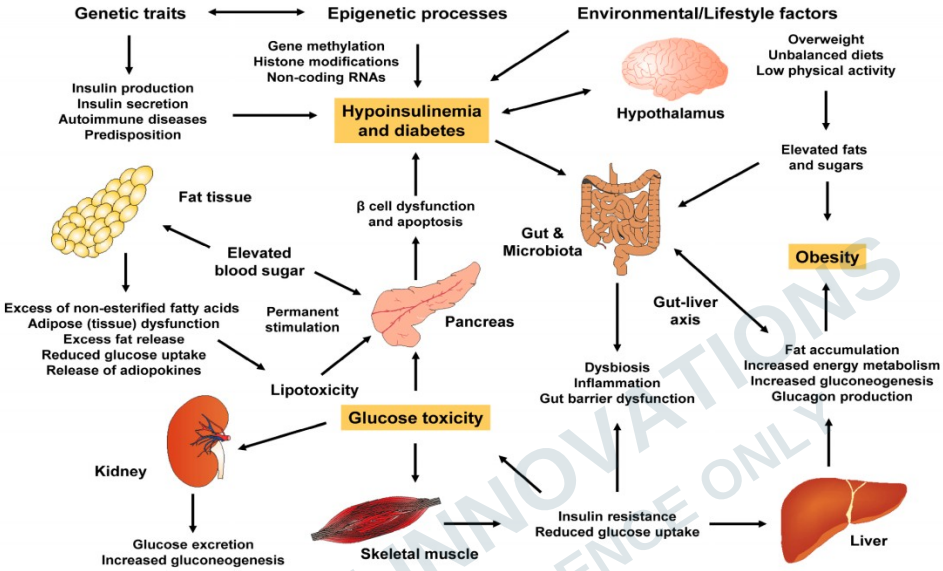

Figure 2: Multifactorial pathophysiology of T2DM and obesity. Epigenetic and genetic factors with unhealthy lifestyles play an important role in the development of T2DM. different factors such as pro-inflammatory cytokines, adipokines, and "non-esterified fatty acids" all together contribute to the accumulation of visceral fat, leakage in the gut barrier, β-cell dysfunction, and alterations within gut microbiota [24]

It has been identified that DM contribute directly to CMP development, rather than exclusively depending on hypertension and coronary atherosclerosis. Mainly, diabetic patients tend to have more cardiac mass, particularly LV mass compared to people without diabetes mellitus [24]. This might be explained by an enhanced "adipocyte release of cytokines" namely resistin and leptin which have critical hypertrophic influences on cardiomyocytes. Diabetes is relatively a critical risk factor for CAD development with a higher prevalence of MI in patients who have diabetic mellitus. Feng et al., (2023) [25] identify that diabetic patients have higher rates of mortality, re-infarctions, and morbidity compared to non-diabetic patients. In addition, CVD influences nearly 32.2 percent of all individuals with T2DM which is responsible for approximately half of all morbidities. As study by Pasdar et al., (2020) [26] highlighted that

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"abdominal or central obesity" as measured by "waist-hip ratio and waist circumference" is a better marker of cardiometabolic risks compared to generalised obesity identified by BMI in both women and men. Anthropometric parameters can be utilised in routine clinical practices to monitor and diagnose excess body fat. It is presently standardised for optimum specificity and sensitivity from "Receiver Operator Characteristics -ROC" [27]. After many multicentric studies, the measurement values have been cut off for the estimation of cardiometabolic risk for Asians as well as Western populations, where mainly the risks run high at rather minimum cut-off points.

Combined with "WC and BMI or WHtR" could present an important tool for utilisation within clinical practice to determine the cardio-metabolic risk in people with excessive body weight [28]. WHtR functioned better compared to the other anthropometric measures in detecting hypertension and diabetes among the population. Currently, "waist-to-height ratio" is identified as the best market for hyperglycaemia, CVDs, and dyslipidaemia. On the other hand, waist circumference has a relatively better determination for high blood pressure. A study by Iliodromiti et al., (2023) [29], have observed that for similar age, BMI, and sex, "South Asians have a higher percentage of body fat" compared to Caucasians.

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Table 1: The classification of BMI for the Asian population

Category	Range of BMI (kg/m^2)
Normal weight	18.5 – 22.9
Underweight	< 18.5
Overweight	23.0 – 24.9
Obesity class I	25.0 – 29.9
Obesity class II	≥ 30.0

Table 2: The classification of WHR for the Asian population

WHR classification for females

Category	WHR range
Low risk	< 0.80
Medium risk	0.80 – 0.84
High risk	≥ 0.85

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WHR classification for males

Category	WHR range
Low risk	< 0.90
Medium risk	0.90 – 0.99
High risk	≥ 1.00

Comparison between the Prevalence of Dyslipidemia and Hypertension in T2DM Patients

T2DM is a specific group of metabolic diseases which are defined by hyperglycaemia due to certain "defects in insulin action, insulin secretion or both". This disease has become a significant public health problem with socioeconomic development impacting the health of people globally. As per the data of "the International Diabetes Federation and the Global Buden of Disease -GBD", nearly 462 million individuals have been diagnosed with this disease, which is similar to 6.28 percent of the entire population [30]. Furthermore, approximately 4 million individuals globally die due to hyperglycaemia and nearly $850 billion spent on treatment for people with diabetes. The WHO along with other responsible authorities stated that only active intervention and prevention can gradually slow down the progression of T2DM or DM at its roots. A patient prescribed with the "Anatomical Therapeutic Chemical Code 10 drug" for the treatment, is considered to have dyslipidemia [31].

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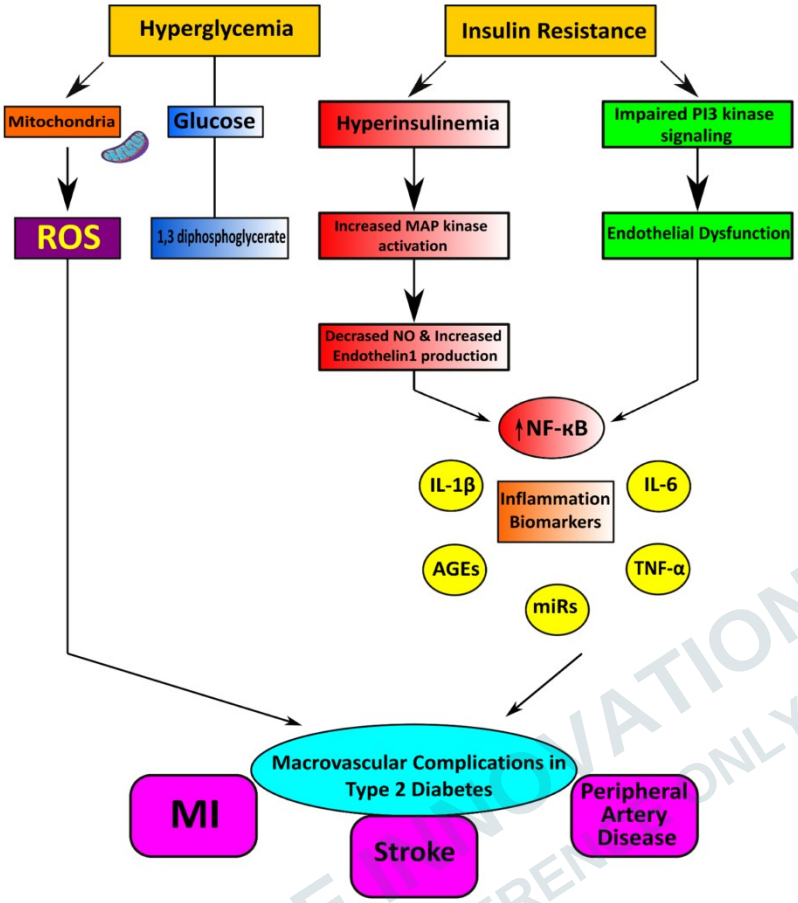

Figure 3: Cardiometabolic disorders caused due to the vascular complications within T2DM [32]

Bodke et al., (2023) [32] illustrated that, comorbidities, for instance, CVD, dyslipidaemia, renal insufficiency, and hypertension related to the determination of T2DM. thus, a concentration of T2DM requires to be accompanied by a critical attribution on its commodities. Nearly 60 percent of individuals with hypertension have DM whereas, approximately 73 percent of people have dyslipidaemia. As suggested by Savvopoulos et al., (2024) [33], the main treatment goal for all people with diabetes is to manage proper glycaemic control to avert organ damage and macrovascular along with microvascular complications. The present suggestion for obese and overweight patients with DM is to weight loss of 5 percent.

Global and regional prevalence of Type 2 Diabetes Mellitus

Abdul Basith Khan et al., (2020)[35] mentioned that despite substantial investment in clinical treatment and pharmacological research, the burden of diabetes-related suffering is growing. This rise far outpaces population growth and ageing. Notably, Western Europe is growing at a faster rate than the global and Asian averages. Despite increased clinical and public health

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spending, this area is losing the war against diabetes. Non-modifiable risk factors like age and family history might be one cause. A highly processed, calorie-dense Western diet, as well as a sedentary lifestyle, may also be contributing causes. Developed countries such as Italy and the United States bear the greatest costs of human suffering from diabetes [(35)].

Hospital-based treatment and subspecialty care are clearly no long-term plans at all. Diabetes preventive resources in healthcare budgets must be similar to treatment expenses. Primary care strengthening and community reorganisation for active lifestyles and good eating may be more cost-effective. Unfortunately, the growing tide of type 2 diabetes outpaces preventative measures by a substantial margin. Lin et al., (2020)[(36)] mentioned that "The International Diabetes Federation" (IDF) found that 451 million adults lived with diabetes in 2017, which can increase to 693 million by 2024, which indicates a stiff rise in the number of diabetes patients. This article also mentioned DALY's rate of diabetes [(36)].

Common Complications of Unmanaged or Poorly Managed T2DM, Such asCardiovascular Disease, Nephropathy, Neuropathy, and Retinopathy

The study by Pelluri et al., (2021)[(37)] mentioned that Microvascular problems such as diabetic retinopathy (DR), diabetic nephropathy (DN), and diabetic neuropathy are severe long-term consequences that afflict around 30% of people with type 1 diabetes and 40% of T2DM patients. DN is the major cause of end-stage renal disease (ESRD) globally, affecting about 20% of T2DM patients throughout the course of their lives. DR is another important cause of blindness for diabetics who are not well managed. T2DM is a deceptive condition with a long period of asymptomatic development. During this time, the body is vulnerable to the consequences of asymptomatic hyperglycemia. According to predictors for diabetic retinopathy, the incidence of diabetic retinopathy was 18% in urban individuals with diabetes mellitus in India, with diabetes duration being one of the strongest predictions. The association between NPDR 83.3% in the poor glycemic control group against 55.8% in the fair glycemic controls group has been linked to education level [(37)].

The study by Seid et al., (2021)[(38)] revealed that cardiovascular disease and microvascular complications are increasing day by day which influences diabetic retinography. Poor management of T2DM results in some unwilling outcomes, such as loss of vision. Longer duration of diabetes, increasing age, and co-morbid hypertension are reasons, which result in such unwilling results when diabetes is not maintained properly. These issues increase macro-vascular complications among Type 2 diabetes mellitus. For this reason, regular check-ups of patients, and active participation and guidance of physicians and other health professionals are

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required. Their guidance will allow the patients to lead a routine life with temporary restrictions so that they can gain their healthy life back [38]. As primary prevention, healthcare professionals prefer early screening to detect this disease at its early stage.

Correlation of Anthropometric Parameters with Presence of ECHO and ECG Parameters of Cardiac Involvement of Diabetic Patients

The anthropometric parameters measure the rate of obesity and heart issues; ECG diffuses changes in ventricular repolarisation, which echocardiography analyses "ventricular hypertrophy", and "diastolic dysfunction". Body mass index (BMI) analyses the issues of underweight and overweight (Luz et al., 2024). In this case, a higher BMI is related to an increasing risk of developing type II diabetes. This general indicator of obesity increases high risk of diabetes. Another anthropometric parameter is waist circumference (WC); for men, the cut-off rate is ">94 cm", while ">102 cm" indicates higher risk. Similarly, for women, the cut-off rate is ">80 cm", while ">88 cm" indicates higher risk [39].

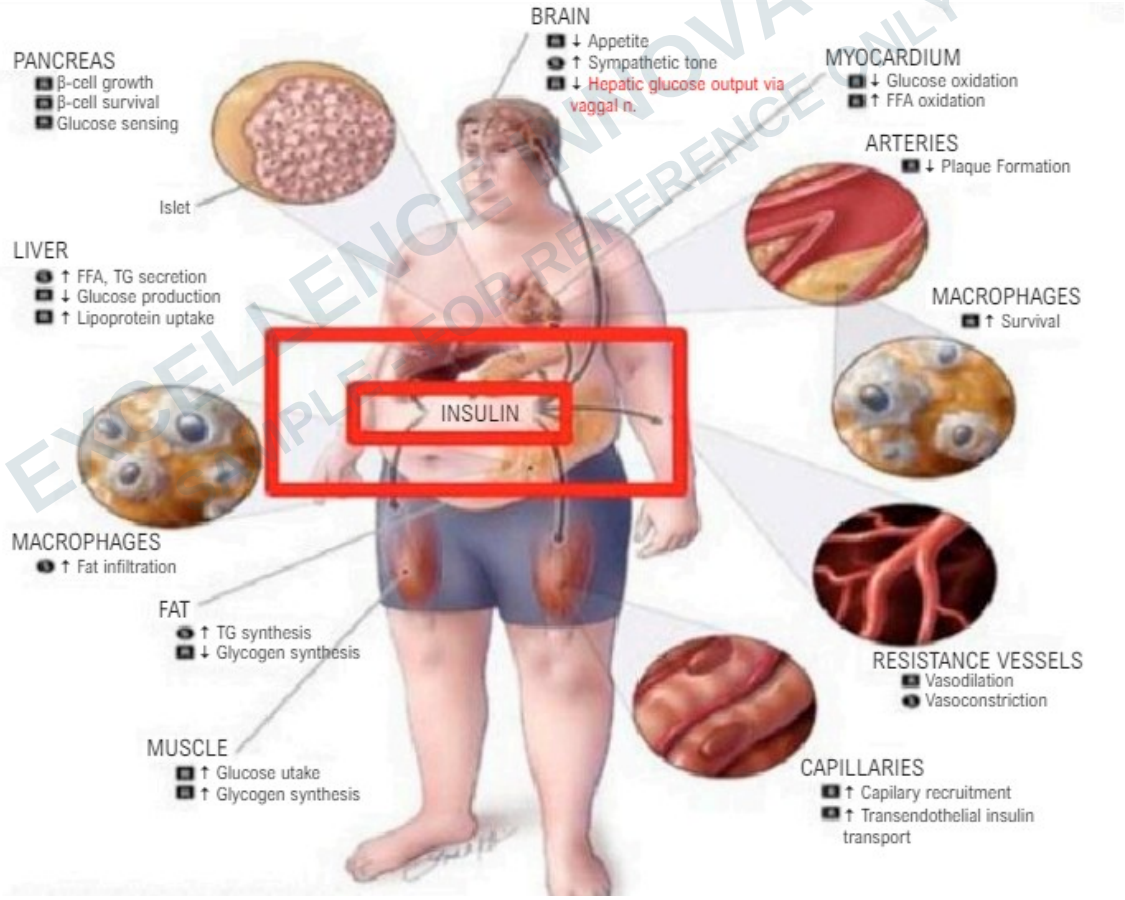

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Figure 4: The relationship between the diagnostic elements of metabolic syndrome and the changes observed in electrocardiographic and echocardiographic assessments in obese patients. It highlights the metabolic and hemodynamic abnormalities, such as high blood sugar, high blood pressure, abdominal obesity, and dyslipidaemia, which occur together and define metabolic syndrome (MS) [39]

Figure 4 presents different aspects that can identify the diabetes issues in a patient's body. A number of the clinical, autopsy, and epidemiological studies have suggested the "presence of diabetic health disease" as a specific "clinical entity"[40]. Palazzuoli et al., (2023) [41] presented a high rate of "pre-clinical diastolic dysfunction" among individuals who have diabetes mellitus. "Diabetic cardiomyopathy" is regarded as "an independent cardiovascular disease and different mechanisms" including autonomic dysfunction, "microvascular disease", interstitial fibrosis, and "metabolic disorders" have been identified as major causative factors [42]. However, a limited number of "population-based research" have been conducted in India to analyses the occurrence of "diastolic dysfunction" among diabetic patients. Similarly, a study by Ceriello et al., (2021) [43] highlighted that the generality of "left ventricular diastolic dysfunction" in normotensive, "asymptomatic patients with T2DM disease" is relatively high. Diastolic dysfunction is more frequent within poorly managed "diabetic patients" and its associated negative consequences are associated with glycaemic management.

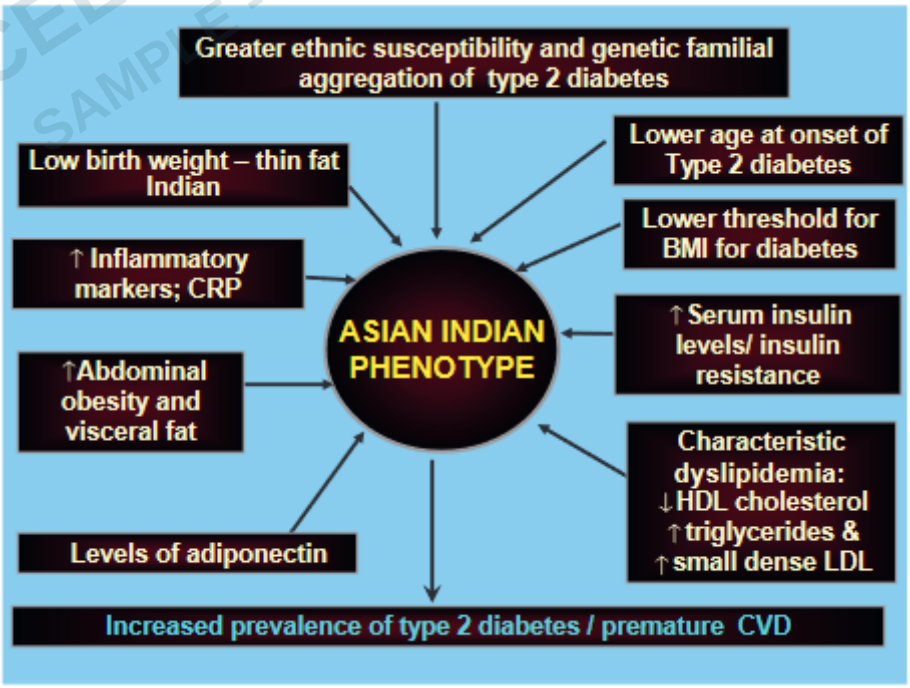

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Figure 5: "The Asian Indian Phenotype" defines a certain accumulation of abnormalities within South Asians, where based on the BMI level they generally have relatively higher total visceral fat, body fat, diabetes prevalence, and insulin resistance when contrasted with the Caucasians [43]

In terms of ECG signs, fibrotic changes, mainly within the basal region of the left ventricle have often been observed within diabetic patients, even though cardiac involvement is therapeutically not yet apparent [44]. "Hyperinsulinemia-induced hypoglycemia" in healthy individuals can easily reduce T-wave amplitude and increase the QTc interval. As per the "Europe and Diabetes study" on the patients with diabetes mellitus with a standard QTc at baseline, gender (female), "systolic blood pressure" and "high haemoglobin A1C values" are related to enhanced prolonged QTc risk factors [45]. It has been observed that both ST depression and QTc prolongation anticipated all-cause mortality within patients with T2DM. Myocardial ischemia is a somewhat painless condition in patients who have diabetes mellitus [46]. Moreover, "cardiac autonomic dysfunction", and "resting ECG abnormalities" have been observed to be signs of silent ischemia within asymptomatic patients with T2DM.

Lifestyle Patterns and Demographics of T2DM Patients

As per the study of Song et al., (2021) [47], the global significance of diseases has transformed dynamically with a major shift within importance from communication diseases to non-communicable ones. Among all the "chronic non-communicable diseases", diabetes mellitus negatively influences the life quality of people by enhancing the probability of mortality and chronic complications. Furthermore, it has been observed that patients who have T2DM have a relatively high risk of cardiovascular disease. Advanced therapies namely "glucagon-like peptide-1 receptor agonists", and the management of optimal glycemic limit are known as major factors that can help to mitigate the adverse effects caused by T2DM [48]. On the other hand, Altobelli et al., (2020) [49] identified that, physical activity -PA is the main term that encompasses different activities that enhance the expenditure of energy and is a significant segment of the "diabetes management plan".

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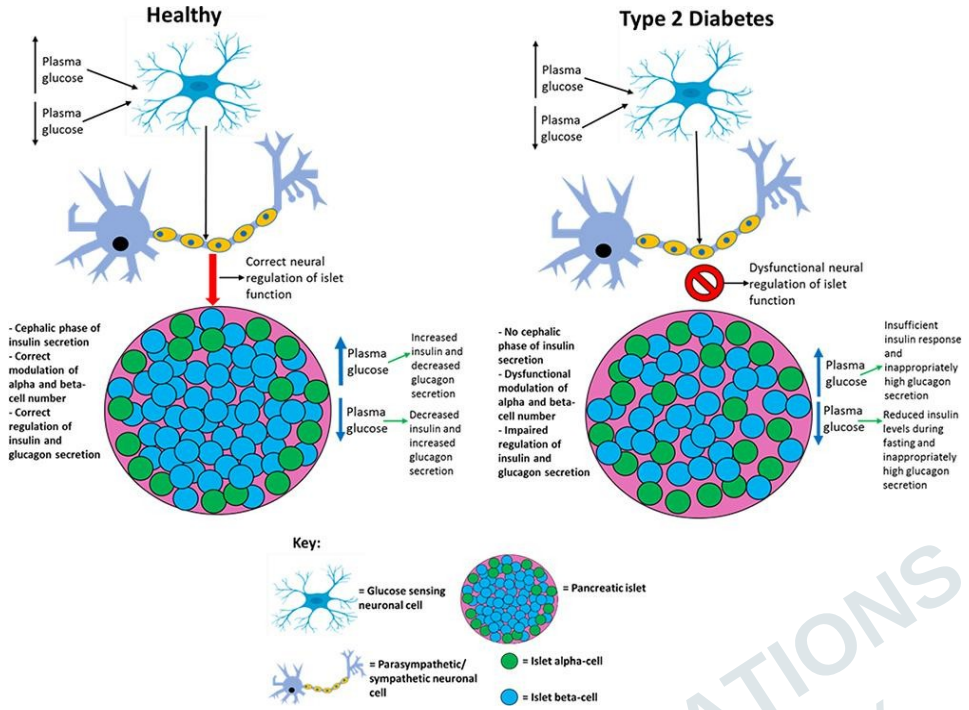

Figure 6: Contrasting the varying neural management of pancreatic islets in T2DM and healthy individuals. Individuals with T2DM do not present the cephalic insulin secretion phase. The dysfunctional neuronal management of pancreatic islets is associated with hyperglucagonemia and reduced beta-cell proliferation [(49)]

A study by Moradi et al., (2023) [(50)], highlighted that "The International Diabetes Federation -IDF" estimated there are nearly 451 million individuals aged between 18 years to 65 years with diabetes worldwide. It has been predicted that this number will extend to nearly 66.7 million by the year 2045. Importantly, it has been predicted that the majority of all individuals with diabetes mellitus are typically undiagnosed and, thus remain untreated which enhances the possibility of T2DM risks [(51)]. The condition of T2DM happens due to increasing insulin secretion loss which is generally combined with insulin resistance. A specific array of critical risk factors is incriminated within the T2DM pathogenesis including ethnicity, age, socio-economic status, family history, obesity, unhealthy lifestyle, and metabolic syndrome [(52)].

Diabetes Prevention More Significantly T2DM

Van Rhoon et al., (2020) [(53)] identifies that there is an immediate requirement for practical approaches to prevent or reduce the emerging diabetes epidemic. Different aspects are thought to be associated with the acceleration of this disease, the most significant being the dynamic

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epidemiological changes due to lifestyle transformation and urbanisation [54]. Furthermore, recognising risk is important while planning the preventive measures to treat diabetes.

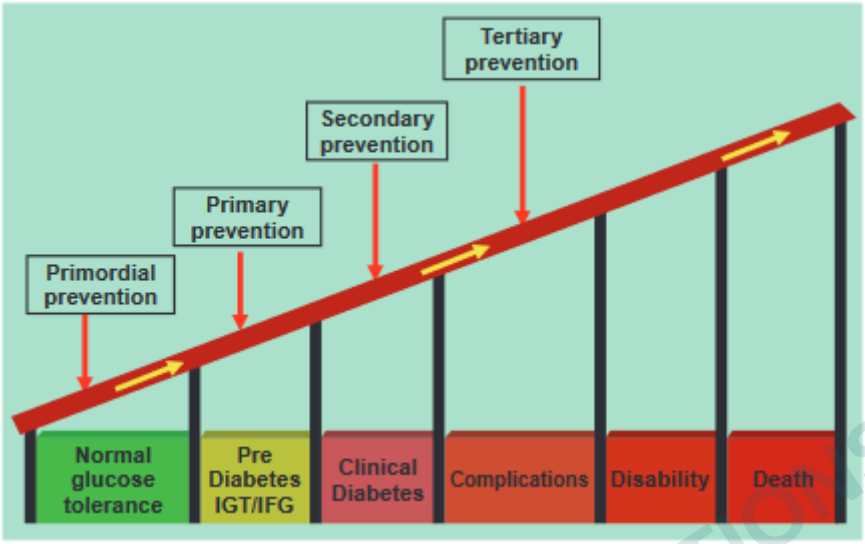

Figure 7: Different prevention measurements of T2DM. Whereas the three phases of prevention are primary prevention, secondary prevention, and primordial prevention [54]

In this context, the primordial preventive measures intend to decrease the risk factors associated with T2DM such as preventing obesity to mitigate the future risk of negative impact caused by diabetes. On the other hand, the primary preventive measures generally target individuals who are in the prediabetes stage to mitigate the "onset of diabetes" [55]. Patients with diabetes must be monitored properly and motivated to lead a healthy lifestyle. As per the opinion of Toi et al., (2020) [56], the condition of T2DM can be prevented with proper management. Secondary prevention refers to the "prevention of the onset of complications" in patients with T2DM. This can be obtained by proper diabetes management through diet, changes in lifestyle, antihyperglycaemic drugs, and physical activity. Zhou et al., (2020) [57] observed that T2DM occurs relatively at an earlier age in India when compared to other ethnic groups.

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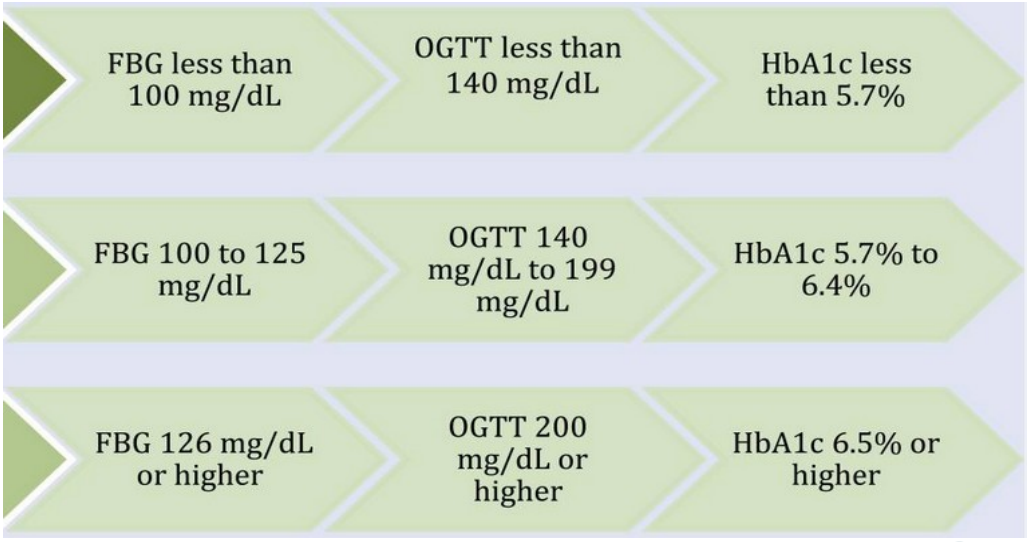

Figure 8: Diabetes and Prediabetes OGTT, HbA1C, and FBG cut-off points as per the ADA [57]

The screening must be done in people who are >30 years aged [58]. It must be conducted at a relatively early age who have below risk factors;

- History of diabetes in the family
- Obese or overweight (BMI equal to or greater than 23 kg per m^2) or have enhanced "waist circumference (more than 80 cm in females and more than 90 cm in males)"
- Dyslipidaemia history
- Hypertension (equal to or greater than 130/80 mmHg)
- Minimum physical activity
- History of macrosomia or gestational diabetes (birth weight more than 3.5 kg)
- Prevalence of CVD (cerebrovascular disease and "ischaemic heart disease)

Different physical intensities and activities are related to a 20 percent to 30 percent reduction of risk associated with diabetes, typically among high-risk patients. "American Diabetes Association", (2021) [59] stated that equal to or more than 2.5 hours per week of walking is related to the reduction of diabetes risk of nearly 27 precent which is "independent of BMI". Lastly, lifestyle changes have also been viewed to advance regression regarding normoglycemia.

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AIMS AND OBJECTIVES

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AIMS AND OBJECTIVES

Research Aims:

This research aims to assess the anthropometric screening of type-2 diabetes mellitus as a non-invasive marker of cardiometabolic risk factors.

Research Question:

What is the role of the anthropometric screening of type-2 Diabetes Mellitus as a non-invasive marker of cardiometabolic risk factors?

Research Objectives:

Primary Objectives

The chief objectives of this research are as follows,

I. To assess generalised obesity as "measured by BMI and central obesity as measured by waist circumference and waist-hip ratio" as per revised guidelines for the Asian population age less than 65 years.
II. To correlate anthropometric measurements with 10-year ASCVD risk as a marker of cardiovascular risk in type-2 diabetes mellitus.
III. To compare the prevalence of dyslipidaemia and hypertension (criteria for metabolic syndrome) in T2DM patients whose anthropometric measurements are above normal cut-off values with those having it normal range.
IV. To evaluate the correlation of anthropometric parameters with the presence of ECG (STEMI, NSTEMI, LVH, IHD sigs, and ischemia signs) and ECHO (Diastolic Dysfunction, RWMA, and LVH) parameters of cardiac involvement.

Secondary Objectives

The secondary objectives of this study are as follows;

I. To analyse and observe demographic patterns, dietary habits, knowledge of complications, and foot care habits of T2DM patients.
II. To discuss complications and prevalence of T2DM and correlate with disease duration and anthropometry with proteinuria, diabetic foot, and retinopathy.

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MATERIALS AND METHODS

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MATERIALS AND METHODS

Study Design: The study design includes observational and cross sectional.

Study Type: This study is analytical.

Study Site: At OPD and IPD of the Department of Medicine at Jagannath Gupta Institute of Medical Sciences and Hospital, Buita, Budge Budge, West Bengal, PIN - 700137.

Study Period: After obtaining the ethical clearance as per NBE guidelines.

Study Population: All diabetic patients attending the medicine Medical College hospital. All subjects who are physician diagnosed patients of diabetes mellitus. This was further confirmed on the basis of prescription investigation report and history taking (FBG 126 mg%, HbA1c > 6.5% without or with clinical symptoms).

Sample Size: "Sample size" has been calculated through "Epi Info (TM) 3.5.3. EPI INFO which is trademark of the Centre for Disease Control and Prevention -CDC". For "statistical analysis data has been entered into a Microsoft excel spreadsheet" and then analysed by "SPSS 27.0 and Graph Pad Prism Version 5". Data has been summarised as standard deviation and mean for "numerical variables while count and percentages for categorical variables". Later unpaired proportions have been compared by "Chi-square test or Fischer's exact test, as appropriate. P-value ≤ 0.05" has been contemplated for "statistically significant".

Sample Size Justification: The prevalence of "type-2 diabetes mellitus" in the Indian adult population has 11.6%, hence for this study, p = 0.116.

The formula utilised for sample size calculation was as follows;

$n = 4pq/(L^2)$

Where,

- n = required sample size
- P = 0.116 (according to the study)
- q = 1 - p
- L = Loss% (Loss of Information)

Calculation:

Here, p - 0.116

$q = 1-p = 1-0.116 = 0.884$

$4pq = 4 \times 0.116 \times 0.884 = 0.4104$

$L^2 = 0.00273$

$L = 0.0522$

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$$Loss\% = 5.22\%$$

$$n = 4pq/(L_2) = 0.4101/0.00273 = 149.2 = 149$$

149 patients have been taken in this study.

Hence, "the number of patients required for this study was 149" with a power of 89% and 95% Confidence of Interval.

Inclusion Criteria:

- Diagnosed case of "type-2 Diabetes Mellitus"
- Aged above 18 years and below 65 years
- Minimum one insulin or anti-diabetic prescribed

Exclusion Criteria:

- Patients aged above 65 years
- Pregnant with diabetes mellitus
- Patients with ESRD on Haemodialysis
- Patients with a known history of CVA and Stroke
- Uncontrolled hypertension (blood pressure ≥ 180/110 mm of Hg)
- Any other type of medical condition unrelated to diabetes
- Patients who are smoker and alcoholic

Sampling Design: This study used a simple random sampling design.

Data Collection: A pre-assessed semi-structured questionnaire based on the study proforma has been made available to every study participant in the direct interview and essential information has been gathered after taking informed consent. All studies have been done at Jagannath Gupta Institute of Medical Sciences and Hospital only. Particulars of patients, brief history of illness, past clinical history with associated risk factors (for instance hypertension and smoking), complications (such as urinary or pulmonary infection), drug history, and medical history (for instance dyslipidemia, diabetes, and abnormalities in thyroid function) have been collected.

Data Analysis: All the information, thus gathered, was put into the "Microsoft Excel Sheet". The Mean ± SD values have been generated through SPSS software version 27.0. Discrete or categorical variables have been analysed by doing a chi-square test. Continuous variables have been analysed for standardised distribution through descriptive tests. Significant p-values which are 0.116 of this set highlighted skewness within the distribution.

Informed Consent or Ethical Consideration: This study has been conducted with prior consent from "Institutional Ethics Committee". Furthermore, written consent has been talen

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from all study participants equally after properly explaining the study procedure to each of them. Consent form was provided in 3 language and it was given the study subjects as per their choice of convenience. They were subjected to detailed history, demographic data (such as, age, sex, occupation, address, contact no., and family income), family medical history of hypertension and diabetes along with current medication that has been taken. Moreover, an addiction history of alcohol and tobacco (whether in chewing form or smoke) has been collected.

Operational Definition:

Blood pressure has been measured in the right arm, both in standing and in sitting condition. Prior to the measurement, a 10-minute rest has been assured to the study participants. Following this, after 30 30-minute interval period, the blood pressure has been measured again. The systolic blood pressure has been determined by the "onset of tapping Korotkoff sound -K1".

Height has been measured with a height measurement rod without shoes and with light clothes. Furthermore, height was taken while the study participants stood in an erect posture by touching the occiput, hip, back, and heels on a straight measuring wall, while they looked straight ahead.

Waist Circumference has been measured in the midpoint between the least palpable border of the iliac crest and the ribs with a non-stretchable measuring tape after expiration.

Hip Circumference has been measured at the highest point of the buttocks with feet and legs together. Data has been computed and weight (in kg) divided by height (in meters square) has been taken as BMI. Importantly, a BMI less than 23 has been taken as the cut-off value and a waist circumference of 90 cm for males and 80 cm for females have been considered cut-off values as per revised guidelines for the Asian population [(60)]. Cut-off values for the waist-hip ratio have been taken as 0.90 for males and 0.80 for women as per the revised protocols [(61)].

Laboratory Analysis: A blood sample has been drawn by a trained phlebotomist in the morning after 12 hours of fasting. Later, 5 ml of fasting venous blood was taken with proper aseptic measurements in a sitting position and was centrifuged for 30 minutes to 45 minutes after collection. "Fasting blood glucose -FBG", "high-density lipoprotein -HDL", total cholesterol -TC and Triglyceride -TG have been measured with the help of the "standard enzymatic method" in Erba XL 640 auto Analyser, where Erba EM 200 is the central laboratory of the medical college. FBG was analysed by the hexokinase process. TG with TGL which is enzymatic method, and HDL by A-HDL which is an automated HDL direct cholesterol assay

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have been determined. The laboratory in the Medical College has standard quality control protocols including internal quality evaluation for precision and monthly 3rd party external quality checks for accuracy. 12 Lead ECG has been performed in the ward by the trained technician and ECHO has been done by qualified Cardiologists.

The Body Measurements: Anthropometric measurements such as height, WC, weight, NC, blood pressure, and HC has been analysed. Different clinical examinations have been performed by individual trained investigators by following standard protocols. Height was measured by a metal rod, weight was measured with an "electrical weight scale", and hip, neck, & waist circumferences were measured with the help of a tape measure. Furthermore, the measurement of the neck circumference plane is located at the main throat node region. The measurement of the waist circumference plane passes via the lower portion of the "bilateral midaxillary costal arch" and the middle of the iliac crest line. On the other hand, the plane of hip measurement was the body circumference at the upper region of the hip portion. WHtR, BMI, and WHR have been calculated by following the below formula;

- WHR = Waistline (cm) / Circumference of the hip (cm)
- BMI = Weight (kg) / Height (m^2)
- WHtR = Waistline (cm) / Height (cm)

Case Record Form or Parameters to be Studies:

- Name
- Age
- Sex
- Occupation
- Address
- Family Income
- Number of Family Members
- Height (meter)
- Weight (Kg)
- Waist Circumference (cm)
- Hip Circumference (cm)
- Waist Hip Ratio
- Lipid Profile
- Blood Pressure
- ECG Findings

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- ECHO Findings
- FBS
- PPBS
- HbA1c
- CRP
- Microalbuminuria

Questionnaire

I. Diet

1. On a normal day how many servings of fruits and vegetables do you have? <2/ 2-5/>5

2. What is the monthly oil consumption per head in the family?

3. How often do you consume these -ghee or butter or fried food or red meat? Daily/ Frequently/ Occasionally/ Never

II. Exercise and Lifestyle

1. Does your work involve moderate or vigorous or severe intensity activity?

2. Do you do regular swimming or walking or cycling or jogging at least half an hour at minimum for 5 days a week?

3. Do you record your weight at a maximal interval of three weeks?

4. Do you have any routine yoga activity?

5. How many hours per day do you spent with your mobile or sitting idle or watching television?

6. Have you gone through any kind of structural weight reduction program?

III. Addiction

1. Do you consume alcohol frequently? How long? Daily or Frequently or Occasionally or Never.

2. For how many years do you have the habit of smoking? Do you chew or smoke tobacco in any form? Present Smoker or Ex Smoker or Never Smoked or Frequently or Occasionally.

3. For how many years you are or were a chronic smoker?

4. How many numbers of cigarettes do you have on a regular basis?

IV. Family History

1. Does any of your parent or siblings have history of hypertension?

2. Does any of your parents or siblings have a history of diabetes?

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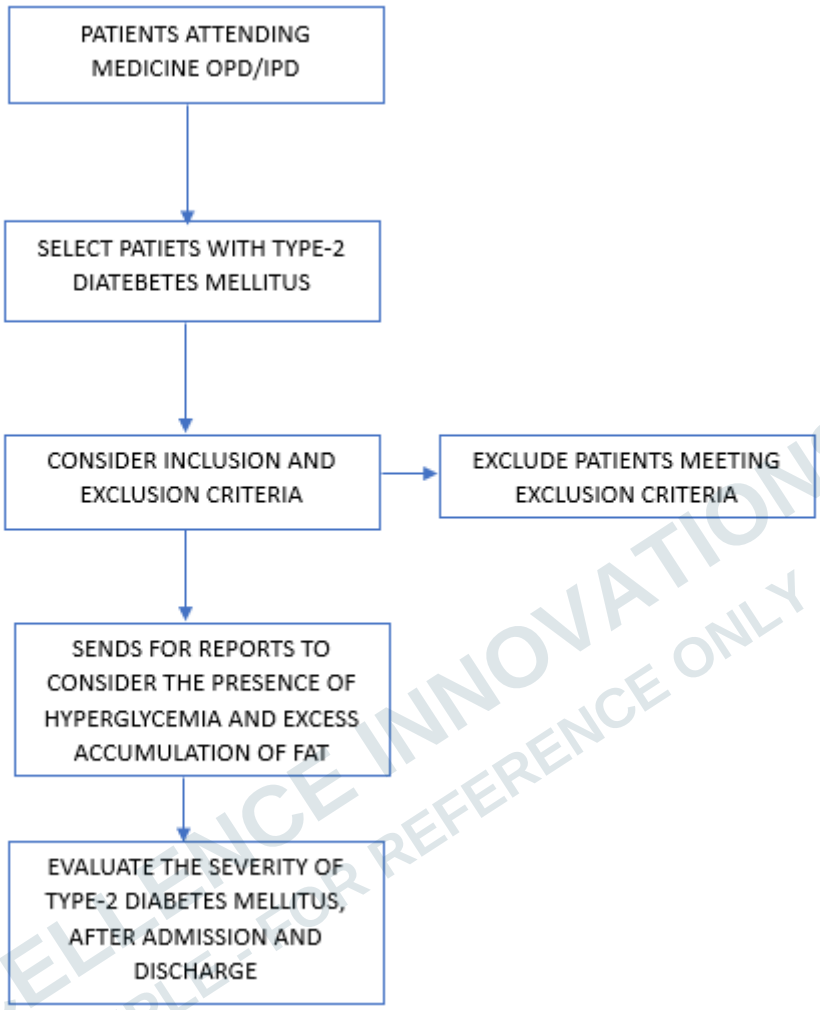
3. If any of your parents has a history of stroke or heart failure or food ulc?

Flowchart for Data Collection



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RESULTS AND ANALYSIS

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RESULT ANALYSIS

Section I

Table 3: Age Distribution of Population

Age	Frequency	Percent	Cumulative Percent
40	9	6.0	6.0
41	4	2.7	8.7
42	4	2.7	11.4
43	2	1.3	12.8
44	4	2.7	15.4
45	10	6.7	22.1
46	7	4.7	26.8
47	5	3.4	30.2
48	6	4.0	34.2
49	5	3.4	37.6
50	3	2.0	39.6
51	7	4.7	44.3
52	6	4.0	48.3
53	9	6.0	54.4
54	4	2.7	57.0
55	5	3.4	60.4
56	7	4.7	65.1
57	6	4.0	69.1
58	7	4.7	73.8
59	4	2.7	76.5
60	2	1.3	77.9
61	6	4.0	81.9
62	8	5.4	87.2
63	6	4.0	91.3
64	6	4.0	95.3
65	7	4.7	100.0

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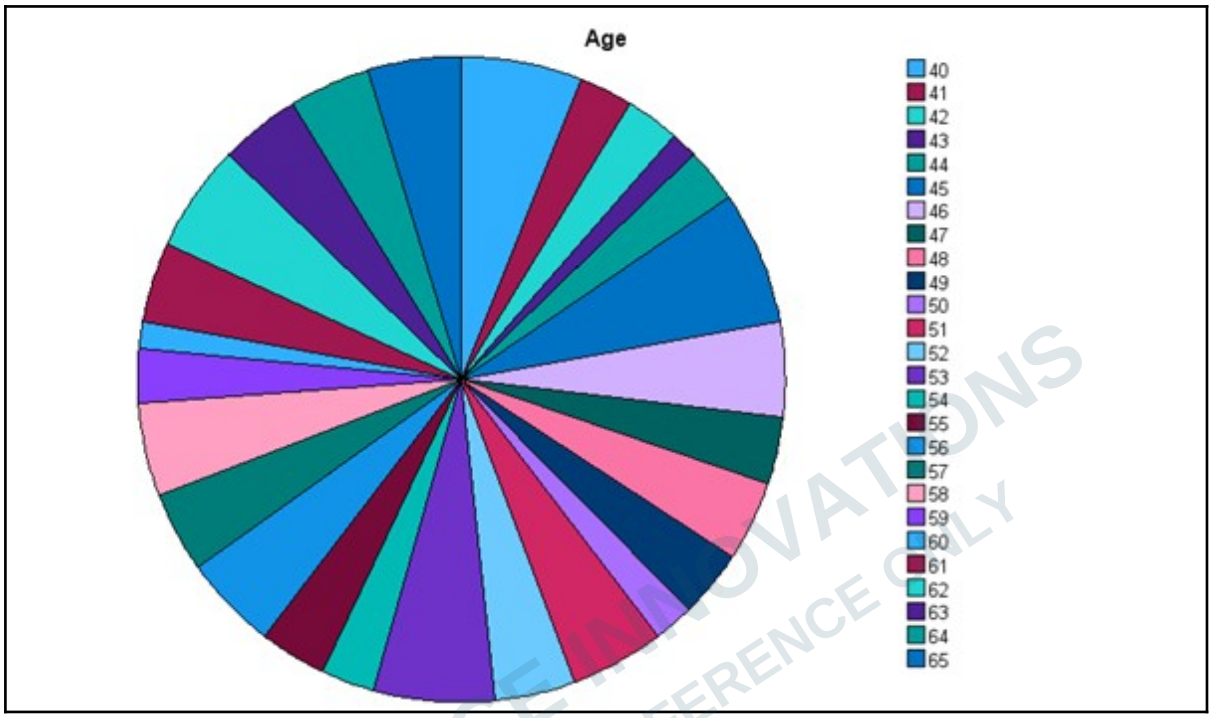
Total	**149**	**100.0**	**100.0**

Figure 9: Age Distribution of Population



The above table and figure highlight the age distribution among the study population by presenting varied percentages, cumulative percentages, and frequency for every distinctive group. The age range within this sample is between 40 years and 65 years. Whereas, ages 40 and 53 have higher frequencies 6.0 percent each (n = 9). The most observable age frequency is 45 where 10 people constitute 6.7 percent of the sample. It has been observed that ages with minimum representation are 43 years and 60 years group where n = 2 (1.3 percent of the entire sample). The cumulative percentage presents a relatively steady enhancement in value extending 100.0 percent at age 65, illustrating the critical distribution of the study sample.

Table 4: Distribution of Study Population According to Sex

Total population	Male	Female
149	71	78

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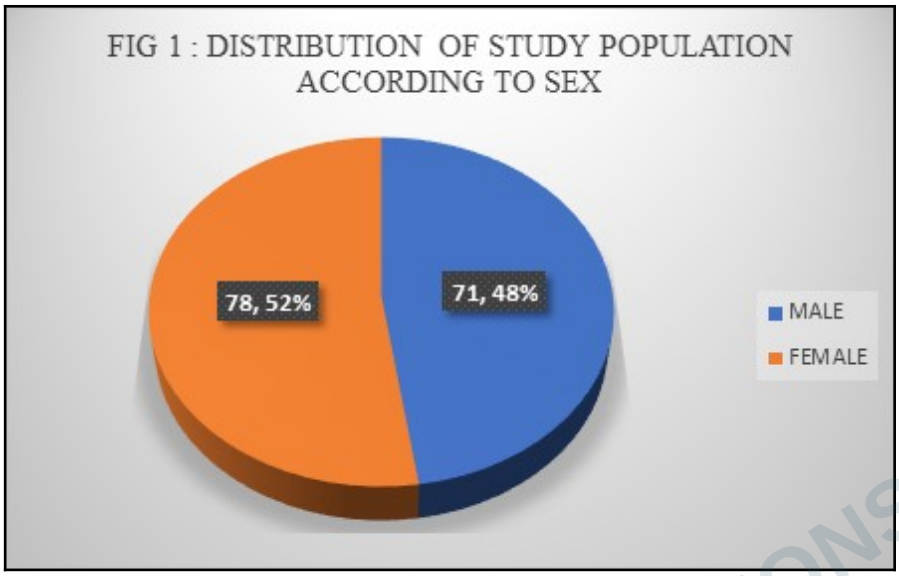
Figure 10: Distribution Of Study Population According to Sex



From the above table and figure, it can be observed that the total study population is 149, where males were 71 (n = 71) which presents 47.65 % of the population and females were 78 (n = 78) which presents 52.34% of the entire population.

Table 5: Distribution Of Female Participants According to Anthropometry

FOR FEMALE	BELOW CUT OFF	ABOVE CUT OFF
BMI (CUT OFF <23)	19 (24.4%)	59 (75.6%)
WC (CUT OFF <80 CM)	9 (11.5%)	69 (88.5%)
WHR (CUT OFF <0.8CM)	0 (0%)	78 (100%)

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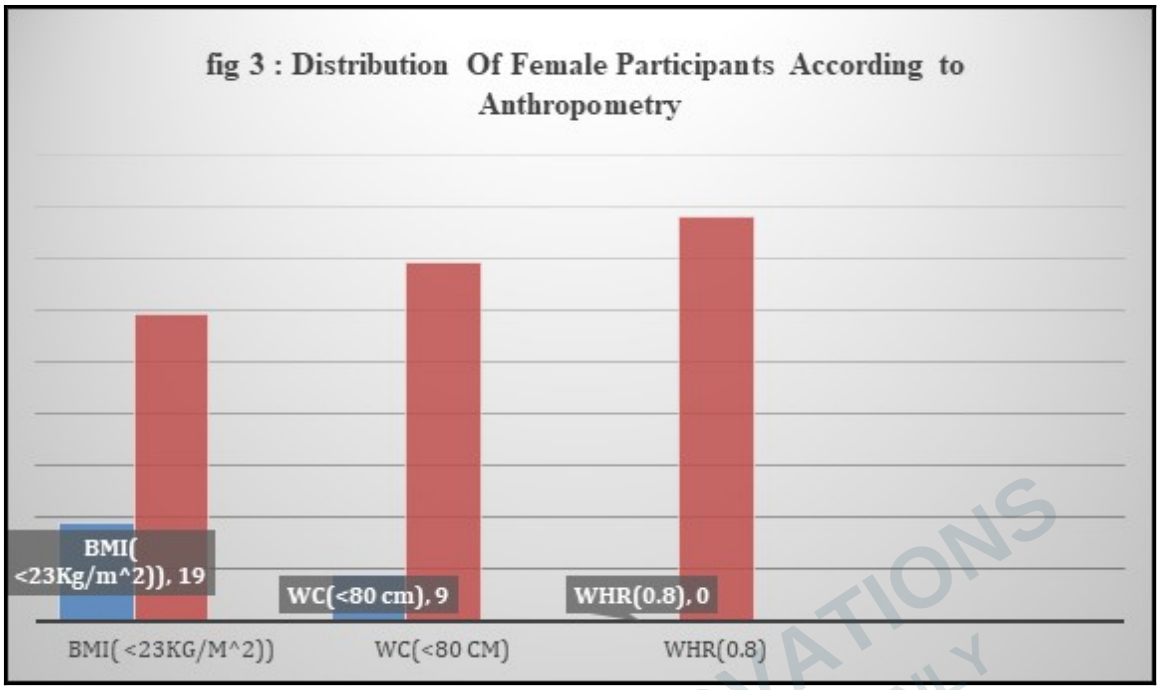
Figure 11: Distribution Of Female Participants According to Anthropometry



The above table and figure present anthropometric data of female participants categorized by different measures—BMI, waist circumference (WC), and waist-to-hip ratio (WHR)—according to the Revised Asian Guidelines. Firstly, BMI, which has a cutoff of less than 23 for Asian females, the data shows that 19 participants (24.4%) are below this cutoff, while 59 participants (75.6%) exceed it suggesting most participants have a BMI higher than the recommended cutoff. Secondly, examining waist circumference (WC) with a cutoff of less than 80 cm, the data reveals that only 9 participants (11.5%) fall below this threshold, while 69 participants (88.5%) are above it. It has been observed that a majority of the females (88.5%) have a WC above the cut-off value (<80 cm) which highlights a relatively higher central obesity prevalence. This is critically associated with an enhanced probability of cardiometabolic conditions such as T2DM. Thirdly, considering the waist-to-hip ratio (WHR) with a cutoff of less than 0.8, it is observed that none of the participants meet this criterion, as all 78 participants (100%) fall above the cutoff. All the female participants in the study population have the waist-hip ratio above cut-off value (<0.8 cm). This result highlights that every study population has an adverse fat distribution. Here, high waist-hip ratio has been observed which indicates that visceral fat associated with the probability of cardiometabolic diseases.

Table 6: Distribution of Male Population According to Anthropometry

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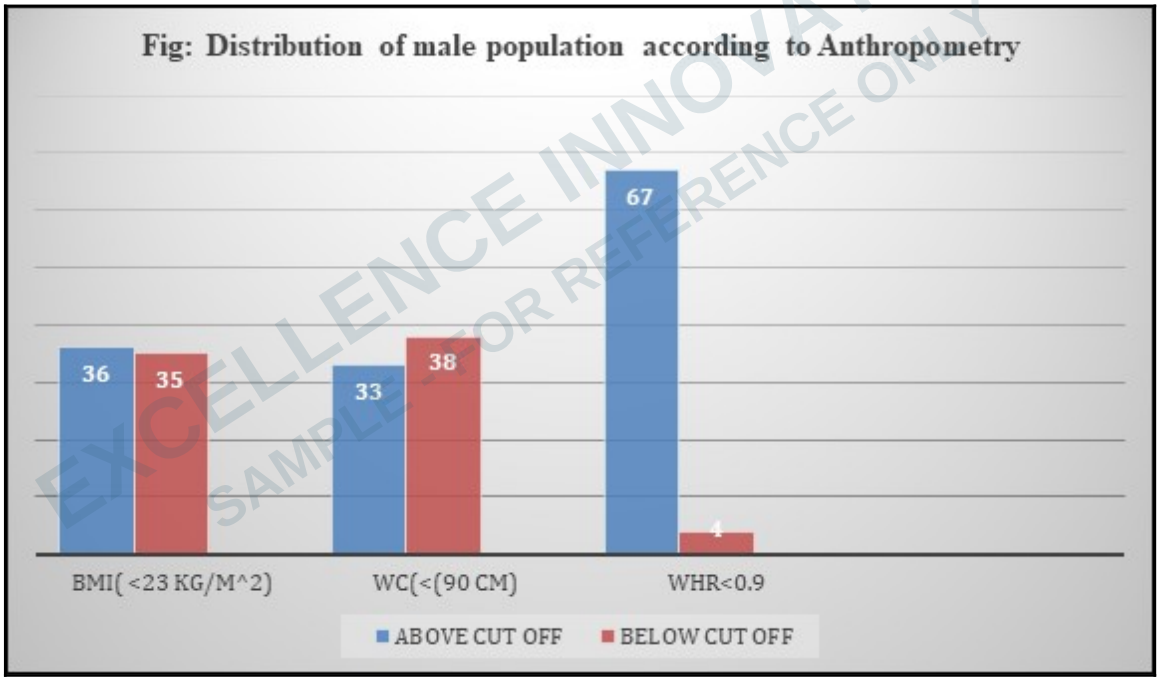
Male Patients	Above Cut-Off	Below Cut-Off	Total
BMI (Cut Off >23kg/m^2)	36(50.7%)	35(49.3%)	71 (100%)
WC (Cut Off >90cm)	33(46.5%)	38(53.5%)	71(100%)
WHR (Cut Off >0.9)	67(94.4)	4(5.6)	71(100%)

Figure 12: Bar Diagram Representing Distribution of The Male Population According to Anthropometry



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The above data is separated into below cut-off and above cut-off categories for distinctive markers. In BMI, the cutoff for Asian males is >23kg/m^2, the data indicates that 36 participants (50.7%) are above this cutoff, while 35 participants (49.3%) fall below it. This exhibits that half of the male participants are obese or overweight which is a critical factor for T2DM also linked with cardiometabolic risks. Whereas in waist circumference (WC), with a cut-off>90cm, the data reveals that 33 participants (46.5%) exceed this threshold, whereas 38 participants (53.5%) are below it. This distribution indicates a fairly even split, showing that a

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significant proportion of male participants have waist circumferences above the recommended guideline. Also, this result highlights a critical proportion regarding central obesity which is associated with cardiometabolic conditions, such as T2DM. Finally, examining the waist-to-hip ratio (WHR), where the cutoff is greater than 0.9, the data shows that 67 participants (94.4%) are above this cutoff, while only 4 participants (5.6%) fall below it. The result highlights a critical portion of the male participants have elevated waist circumference, waist-hip ratio, and BMI, although the occurrence differentiates across the varied markers. The data indicate that a considerable segment of male participants is at high risk for cardiometabolic conditions such as T2DM. The relatively greater percentage of the study population with waist-hip ratio >cut-off value indicated the requirement for interventions by targeting minimising cardiometabolic risk and visceral fat.

Table 7: Distribution of Data in The T2DM Population

PARAMETERS	HIGHEST VALUE	LOWEST VALUE	MEAN VALUE	STANDARD DEVIATION
FBS(mg/dl)	235	65	129	26.4
HDL (mg/dl)	67	29	46.72	8.92
HbA1c	11	5	7.6	1.04
LDL(mg/dl)	181	51	95.24	24.4
TRIGLYCERIDE (mg/dl)	398	76	147.57	48.18
TOTAL (mg/dl) CHOLESTEROL	456	101	177.64	51.21

The above table presents measurements of different biochemical parameters in identifying T2DM as a non-invasive marker regarding cardiometabolic risk factors. The parameters are FBS, HDL, HbA1c, LDL, Triglyceride, and Total Cholesterol. This table also offers the lowest value, highest value, standard deviation, and mean value for every parameter. The relatively high standard deviation (26.4) presents a critical variability within FBS levels this illustrates that some of the study population have critically increased blood sugar levels. Whereas the mean FBS (129 mg/dl) highlights that the average FBS level is over the basis range (<100

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mg/dl), this reveals the presence of hyperglycemia among the study population. The average HDL level (46.72 mg/dl) generally falls in the base range (>50 mg/dl for females and >40 mg/dl for males). This result highlights that the mean HDL level is quite low and this can pose a critical risk factor regarding cardiovascular disease. The average HbA1c (7.6%) is more than the base range which is <5.7%. This result highlights poor control of blood sugar levels and the high occurrence of T2DM among the study population. The average LDL level (95.24 mg/dl) falls in the typical range (<100 mg/dl) which highlights that the mean LDL levels are under control. Whereas, the average triglyceride level (147.57 mg/d) is critically higher than the normal level, which is <150 mg/dl. This result highlights that the selected study populations have the marginal higher triglyceride levels. The average total cholesterol level is 177.64 mg/dl is in the expected range (<200 mg/dl). This highlights that the mean cholesterol level is under control. Both HbA1c and FBS highlights a greater hyperglycemia prevalence and worse blood sugar control among this study participants, highlighted a high occurrence of diabetes.

Table 8: Parameters of Lipid Profile in The Diabetic Population and Distribution According to BMI

	Total subject	**BMI < 23**	**BMI > 23**	**Chi square**	**P Value**
LDL (>100 mg/dL)	63	13	50	10.477	.001
HDL	54	6	48	21.980	.000
Triglycerides (>150 mg/dL)	52	11	41	7.117	.006

The table presents a comparison of lipid profiles among diabetic individuals categorized by Body Mass Index (BMI), specifically BMI less than 23 (BMI < 23) and BMI greater than 23 (BMI > 23), along with corresponding statistical analyses. From the analysis, it can be observed that the chi-square value which is 10.477 and the p = 0.001 highlight a statistically critical association between higher BMI and LDL levels. This highlights that study population have a BMI > 23 with high LDL levels, which is a risk factor for the cardiovascular disease. On the other hand, the p value which is 0.000 and chi-square value which is 21.980 highlights a critical association between higher BMI and HDL levels. A critical number of study populations with

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triglycerides over 150 md/dL have BMI over 23 (41 out of 52). There is a notable association between high BMI and triglyceride levels (where p = 0.006 and chi-square = 7.117). The findings of these results highlight that high BMI level is critically associated with negative lipid profiles (such as low HDL, high triglycerides, and high LDL). These all profiles are main risk factors regarding the cardiometabolic disease, such as cardiovascular disease and T2DM. This important finding undermines the significance of controlling BMI to minimis the associated risks.

Table 9: Lipid Profile in The Diabetic Population and Distribution According to WC

	Male					**Female**				
	WC Above Cut Off <90 cm for male	**WC Above Cut Off <90 cm for male**	**Total**	**Chi Square Value**	**P Value**	**WC Above Cut Off <80 for female**	**WC Above Cut Off >80 for female**	**Total**	**Chi Square Value**	**P Value**
LDL (>100 mg/dL)	26	38	54	8.534	.003	5	59	64	1.924	.128
HDL	18	36	54	15.096	.000	2	52	54	5.596	.013
Triglycerides (>150 mg/dL)	24	29	53	2.733	.069	4	49	53	1.592	.159

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The lipid profile differences in the diabetic population based on waist circumference (WC) reveal significant associations with key lipid parameters. The study showed that individuals with WC above the cutoff had higher percentages of adverse lipid levels compared to those with WC below the cutoff. The p value = 0.003 and chi-square value = 8.534 highlight a critical

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association between high waist circumference and LDL levels in males. This highlights that males who have WC ≥ 90 cm are more probable to have increased LDL levels. Whereas, the majority of the males in the study population with adverse HDL levels where WC ≥ 90 cm. The p value = 0.069 and chid-square value = 2.733 highlights a non-critical relation between the high waist circumference and triglyceride levels in males. The majority of the femal participants have LDL > 100 mg/dL with WC ≥ 80 cm among 59 participants out of 64. The findings of this result illustrate the significance of contemplating gender-specific variations at the time evaluating the association between cardiometabolic risk factors and anthropometric measures. It has been observed that high waist circumference is critically linked with adverse lipid profiles within males, mainly for HDL and LDL. On the other hand, in females, the link is critical for HDL other than triglycerides or LDL.

Table 10: Lipid Profile in The Diabetic Population and Distribution According to WHR

	Absolute value	**WHR Below Cut Off** <0.9	**WHR Above Cut Off** >0.9	**Chi Square Value**	**P Value**
LDL (>100 mg/dL)	64	4	60	.493	.350
HDL (<50mg/dl FOR FEMALE) (<40mg/dl FOR MALE)	54	6	48	1.069	.232
Triglycerides (>150 mg/dL)	53	5	48	.212	.432

The lipid profile in diabetic patients shows significant differences when distributed according to waist-to-hip ratio (WHR) cut-offs. The p-value is 0.350 and chi-square value is 0.493 which highlights a non-significant link between high waist-hip ratio and LDL levels. This illustrated that there is no critical statistical proof than waist-hip ratio more than 0.9 is related with increased LDL levels. The majority of the study population with adverse HDL levels

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constitutes a waist-hip ratio more than 0.9 (48 out of 54). From the analysis, it has been observed that p value is 0.432 and chi-square value is 0.212 presents a non-significant link between higher waist-hip ratio and triglyceride levels. This analysis highlights that LDL and triglyceride levels are significantly associated with WHR in diabetic patients, with higher WHR correlating with worse lipid profiles. The lack of critical p-value and chi-square values highlights that waist-hip ratio might not be an important independent marker for the specific cardiometabolic risks factors within the selected study population.

Table 11: Association of HTN and Anthropometric Parameters

	HTN PRESENT / ON MEDICATION	**HTN ABSENT**	**Absolute value**	**P value (Chi-square test)**
BMI				0.000
<23	9	43	52	
>23	47	48	95	
WC				.002
<80cm for female <90 cm for male	37	81	118	
>= 80cm for female >=90 cm for male	19	12	31	

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WHR				.506
<0.80 for female < 0.90 for male	4	8	12	
>=0.80 for female >=0.90 for male	52	85	137	

The association between hypertension (HTN) and anthropometric parameters such as BMI, waist circumference (WC), and waist-to-hip ratio (WHR) reveals significant correlations. In the above analysis, the chi-square tests present a critical association between hypertension status and high BMI (p = 0.000). This highlights that people with a BMI more of than or equal to 23 are more probable to have HTN or can be on hypertension medications. A majority of the study population with hypertension comprises a waist circumference ≥ 80 cm (females) and ≥ 90 cm (males). In this context, the chi-square analysis presents a critical link between hypertension status and high waist circumference (p = 0.002). This illustrate that people who have high waist circumference are more probable to have hypertension. The majority of the populations who have hypertension have waist-hip ratio, for females (≥ 0.80) and for males (≥ 0.90). There is a no critical relationship between hypertension status and waist-hip ratio (p = 0.506). This indicates that waist-hip ratio is not a reliable marker in terms of hypertension for this selected study populations. Overall, the data indicate that while BMI and waist circumference are associated with HTN.

Section II

Table 12: Distribution of The Population According to ASCVD Score

LOW RISK (<5%)	**71**	**38.8%**
BORDERLINE RISK (>=5%<7.5%)	**23**	**12.6%**
INTERMIDIATE RISK	**40**	**21.9%**

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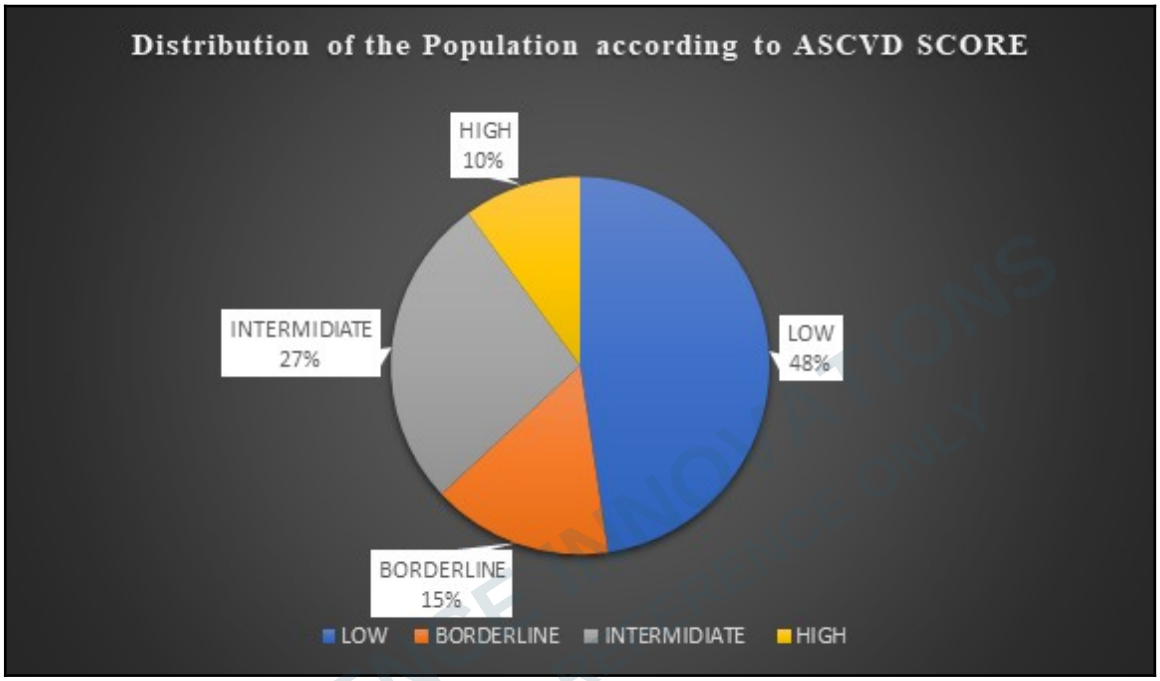
(>=7.5%- <20%)		
HIGH RISK (>20%)	**15**	**8.2%**

Figure 13: Distribution of the Population According to ASCVD Score



The above table and figure highlight the distribution of the population as pet the ASCVD score. This score is mainly utilised to evaluate the probability of developing cardiovascular disease within next ten days. Here, the categories are borderline risk, low risk, high risk, and intermediate risk. From the analysis it has been observed that, the majority of the study populations falls within the low-risk category (38.85) with an ASCVD score <5%. This highlights that a critical segment of the overall populations has a low risk of having cardiovascular disease over the next ten years. Nearly, 12.6 percent of the study population is falls in the borderline risk category where ASCVD score between ≥5% - <7.5%. The participants fall under this category have a nominal increased risk of cardiovascular disease than the low-risk groups. On the other hand, 21.9 percent of the entire populatin falls in the "intermediate risk category" where ASCVD score between ≥7.5% - <20%. The people who fall under this category have moderate cardiovascular disease risk which highlights a need for medical interventions or lifestyle changes to mitigate their risk. The significant distribution exhibits the significance of targeted interventions depending on the distinctive risk categories.

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Table 13: Association Between Anthropometric Parameters and ASCVD Score

ASCVD SCORE	BMI Above Cut Off	BMI Below Cut Off	WC Below Cut Off	WC Above Cut Off	WHR Below Cut Off	WHR above Cut Off
LOW RISK (<5%)	46	24	15	56	63	8
P value	.546		.467		.365	
BORDERLINE RISK (>=5%<7.5%)	15	8	7	16	23	22
P value	.365		.143		.254	
INTERMIDIATE RISK (>=7.5%-<20%)	22	17	5	35	40	39
P value	.345		.546		.453	
HIGH RISK (>=20%)	12	3	4	11	13	2
P value (Chi-square test)	.433		.350		.302	

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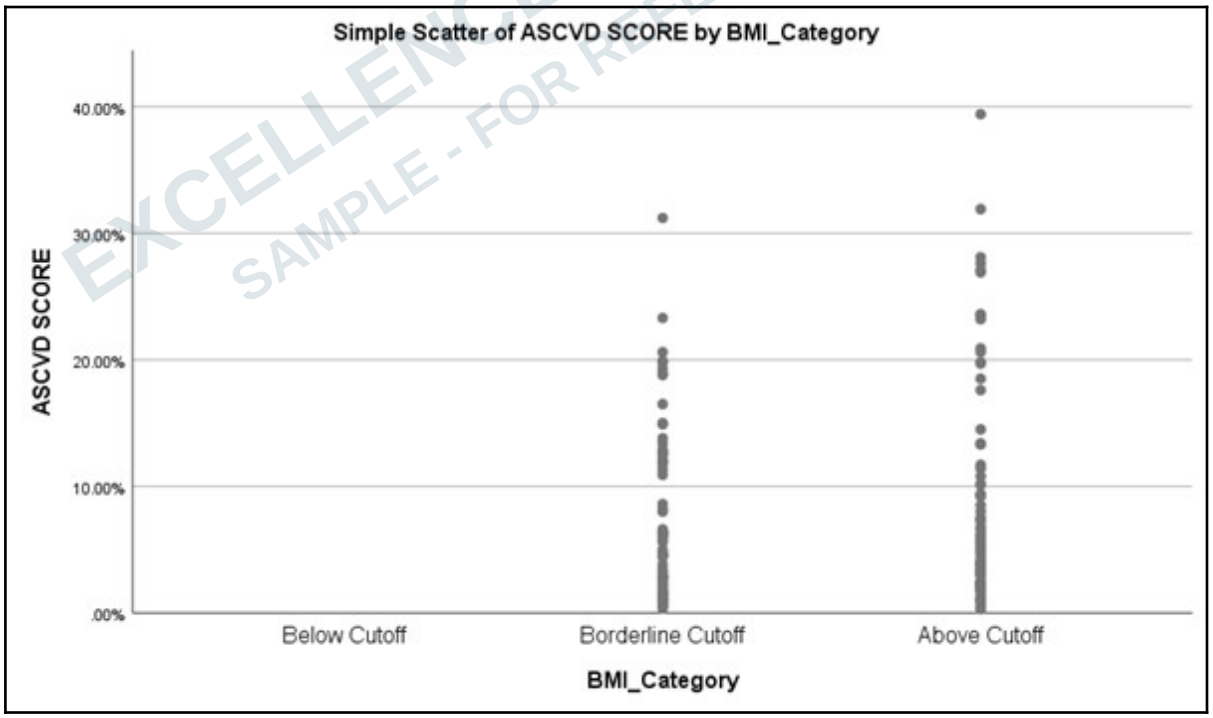
The above table highlights the exploration of ASCVD risk scores regarding the different anthropometric measures. The factors are BMI, waist-hip ratio, and waist circumference. In the low-risk category group, BMI above the cut-off is 46 and below the cut-off is 24 (p = 0.546), waist circumference above the cut-off is 56 and below cut-off is 15 (p = 0.467) and a waist-hip ratio above the cut-off is 8 and below cut-off is 63 (p = 0.365). From this analysis, it can be observed that none of the relations among waist circumference, waist-hip circumference, and BMI are statistically important (p > 0.05). In the borderline risk category, BMI above the cut-off is 15, and below the cut-off is 8 (p = 0.365), waist circumference above the cut-off is 16 and below the cut-off is 7 (p = 0.143), and WHR above the cut-off is 22 and below cut off is 23 (p = 0.254). In the high-risk category group, BMI above cut off is 12 and below cut off is 3 (p = 0.433), WC above cut-off is 11 and below cut-off is 4 (o = 0.350), waist-hip ratio below cut-off if 13 and above cut-off is 2 (p = 0.302). From the results, it has been observed that none of the associations are statistically significant as p > 0.05. This highlights that while these critical anthropometric measures might be linked with high ASCVD risk, though are nor independently critical markers.

Figure 14: Scattered Plot Showing Relation of BMI And ASCVD Score



In this above figure, the X-axis present BMI-category whereas, Y-axis illustrates ASCVD score which ranges from 0 - 40%. Each dot in the above figure highlights ASCVD score of an individual in the distinctive BMI category. This scatter plot exhibits that people with high CMI

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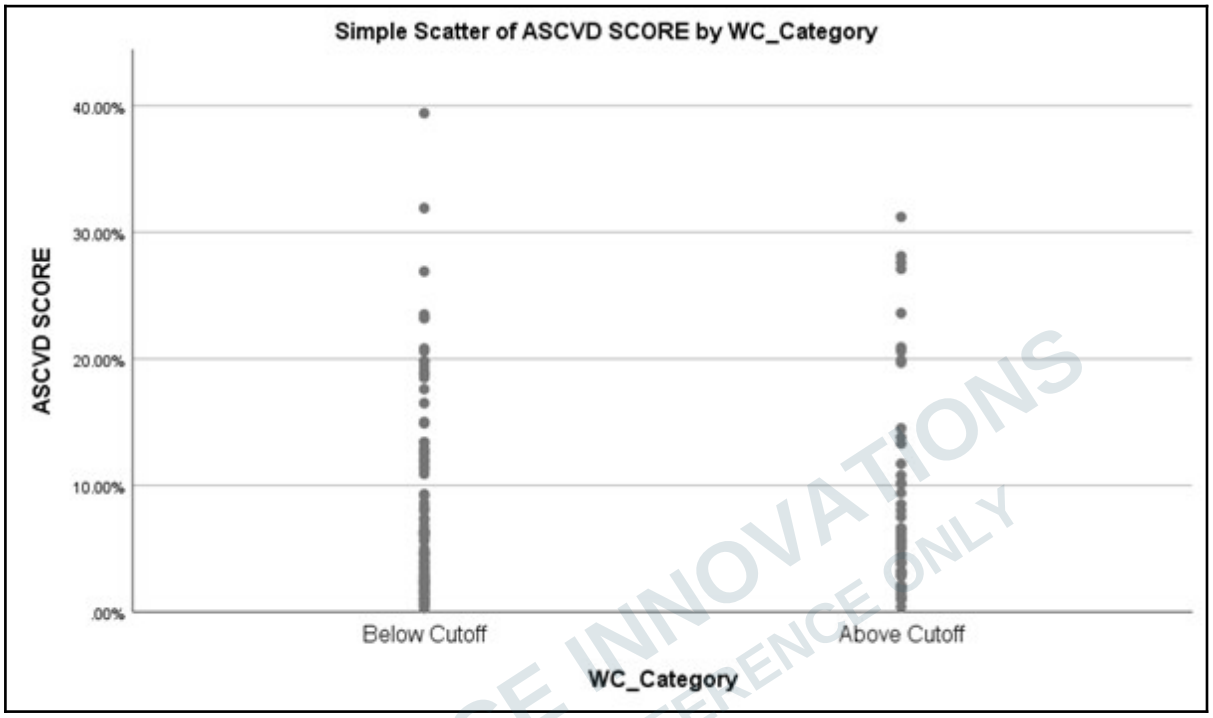
have relatively greater ASCVD scores. This illustrates a critical association between elevated cardiovascular risk and increased BMI.

Figure 15: Scattered Plot Showing Relation of WC and ASCVD Score



In the above figure the X-axis is WC category and Y-axis is ASCVD score which ranges from 0 to 40%. Each dot in the above figure highlights ASCVD score of individuals in the distinctive waist circumference category. The above presented scatter plot presents that the majority of the study population within both waist circumference categories (above and below cut off) have critically low ASCVD scores.

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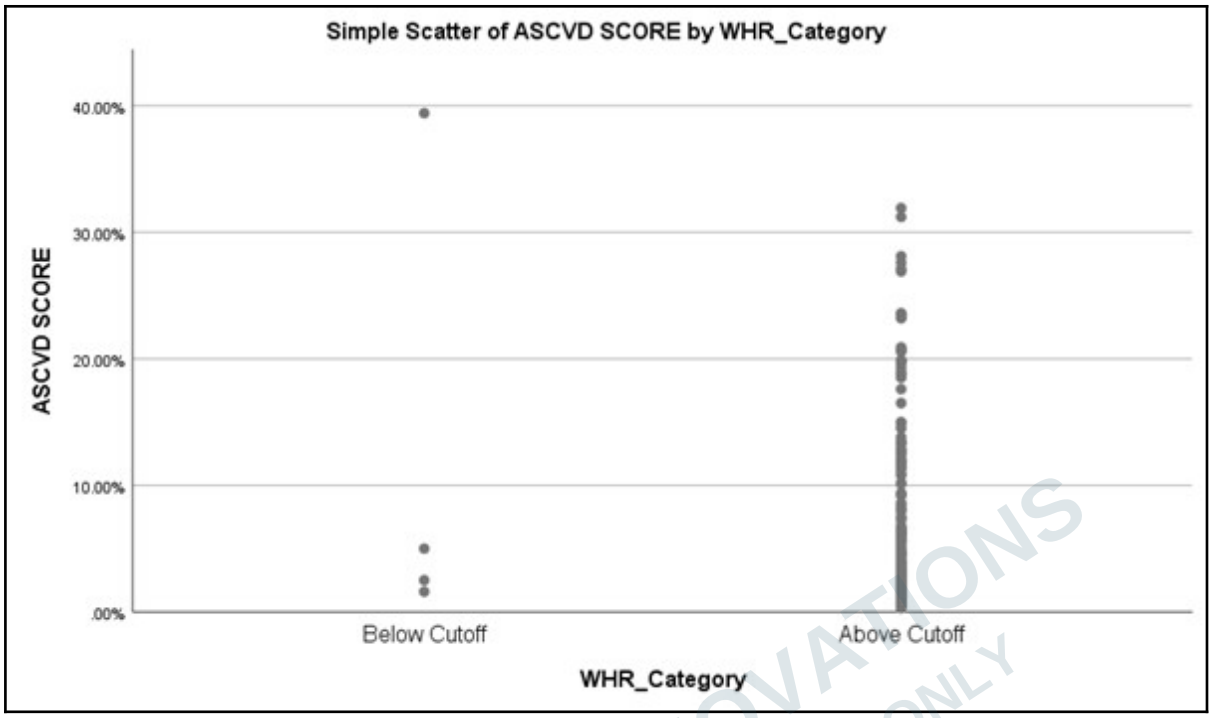
Figure 16: Scattered Plot Showing Relation of WHR And ASCVD SCORE



In the above figure, the X-axis represents waist-hip ratio category and Y-axis highlights ASCVD score which also ranges from 0 to 40%. Each dot in the above figure highlights ASCVD score of an individual in the distinctive WHR category. This scatter plot illustrated that most study populations with waist-hip ratio <cut-off have relatively low ASCVD score, though exceptions have been observed.

Section III

Table 14: Table Of Yardstick T2DM Patients

	Normal	**Prediabetes**	**Diabetes**
Fasting Blood Sugar (FBS)	FBS < 100 mg/dL	100 mg/dL ≤ FBS < 126 mg/dL	FBS ≥ 126 mg/dL
Post Prandial Blood Sugar (PPBS)	PPBS < 140 mg/dL	140 mg/dL ≤ PPBS < 200 mg/dL	PPBS ≥ 200 mg/dL
HbA1c	HbA1c < 5.7%	5.7% ≤ HbA1c < 6.5%	HbA1c ≥ 6.5%

Normal	1

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Prediabetes	3
Diabetes	145
Total	149

The above table highlights the cut-off values regarding the diagnosis of normal, diabetes and prediabetes categories through three biomarkers (FBS, PPBS, and HbA1c). From the analysis, it has been observed that FBS in normal category is < 100 mg/dL, in prediabetes category is 100 mg/dL ≤ FBS < 126 mg/dL and in diabetes category is ≥ 126 mg/dL. Post prandial blood sugar in normal category is < 140 mg/dL, in prediabetes category is 140 mg/dL ≤ PPBS < 200 mg/dL, and in diabetes category is ≥ 200 mg/dL. Lastly, HbA1c in normal categories is < 5.7%, in prediabetes category is 5.7% ≤ HbA1c < 6.5%, and in diabetes category is ≥ 6.5%. From the selected group, the people fall under normal category n = 1, in prediabetes categories n = 3 and in diabetes categories n = 145. These all markers are used to identify the stages of diabetes among the patients.

Table 15: Distribution Of ECG Changes in T2DM Patients

ECG Changes	PRESENT	ABSENT	TOTAL
LVH	44	105	149
ISCHEMIC CHANGES	36	113	149
NSTEMI/STEMI	2	147	149
P value statistics	.423	.520	.056
Chi-square	1.722	1.309	.972

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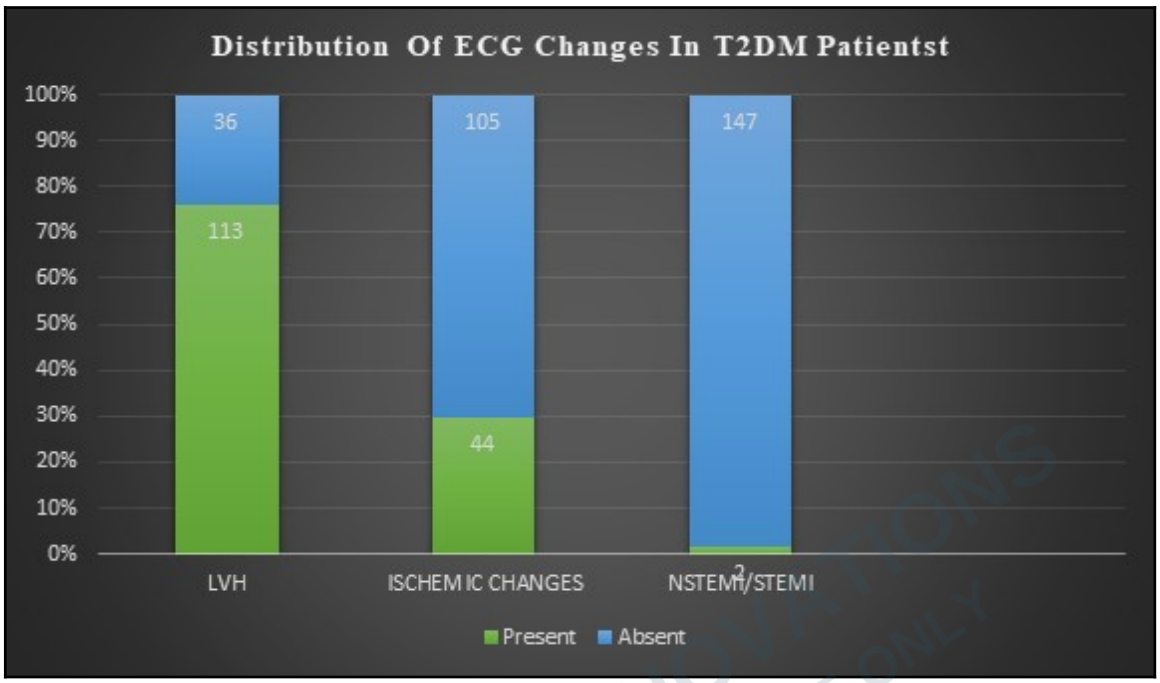
Figure 17: Distribution Of ECG Changes in T2DM Patients Showing 100 % Stacked Column Graph



The above table and figure illustrate the absence and presence of various ECG changes among the study population with T2DM. From the analysis, it has been observed that there is no critical relation between T2DM and LVH where p = 0.423 and chi-square = 1.722. On the other hand, the p = 0.520 and chid-square = 1.309 highlights no critical relations between T2DM and ischemic changes. On the other hand, the p value = 0.056 highlights the approach of statistical importance, though nearly 1.3 percent of study population have STEMI or NSTEMI. This result highlights that these specific conditions are quite rate within the selected population. Therefore, from the analysis exhibits that ischemia and LVH changes are relatively common among the people who have T2DM.

Table 16: Distribution And Association of ECG Changes and Deranged Anthropometry

ECG CHANGES	BMI BELOW CUT OFF <23	BMI ABOVE CUT OFF	WC BELOW CUT OFF <90cm	WC ABOVE CUT OFF	WHR BELOW CUT OFF <0.9	WHR ABOVE CUT OFF

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		>23		**>90cm**		**>0.9**
LVH	**5**	**39**	**3**	**41**	**3**	**41**
ISCHEMIA	**5**	**31**	**0**	**36**	**4**	**32**
MI (NSTEMI/STEMI)	**0**	**3**	**0**	**3**	**0**	**3**

From the above analysis, it has been observed that LVH is commonly identified within people who have BMI above the cut-off value (23). This exhibits a critical association between enhanced LVH risk and high BMI. whereas ischemia is quite frequent in people who have BMI above the cut-off value. This highlights a critical correlation between ischemic changes and high BMI. LVH is quite common in people who have waist circumference of more than 90 cm which highlights that elevated WC is related to the high LVH risk. There is a strong relation between ischemic changes and high WC as observed in the study population who have WC more than 90 cm. Moreover, LVG is more probable in people who have a waist-hip ratio of more than 0.9 which highlights a critical association between enhanced LVH risk and high WHR. MI attributions are quite rare and seem to be linked with enhanced values within anthropometric measures, yet the sample size is relatively small.

Table 17: P-value Statistics

ECG CHANGES	BMI BELOW CUT OFF <23	BMI ABOVE CUT OFF >23	WC BELOW CUT OFF **<90cm**	WC ABOVE CUT OFF **>90cm**	WHR BELOW CUT OFF **<0.9**	WHR ABOVE CUT OFF **>0.9**
LVH	.000		.159		.504	
ISCHEMIA	.001		.005		.322	

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MI (NSTEMI/STEMI)	.267	.678	.776

From the abve table, it can be observed that in LVH for both BMI below cut off <23 and BMI above cut off >23, p value is .000, both WC below cut off <90 cm and above cut off >90 cm, p value is .159, both WHR below cut off <0.9 and above cut off >0.9, p value is .504. In ischemia for both below cut off <23 and BMI above cut off >23, p-value is .001, both WC below cut off <90 cm and above cut off >90 cm, p value is .005, and both WHR below cut off <0.9 and above cut off >0.9, p value is .322. In MI for both BMI below cut off <23 and BMI above cut off >23, p value is .267, both WC below cut off <90 cm and above cut off >90 cm, p value is .678, and both WHR below cut off <0.9 and above cut off >0.9, p value is .776. The findings of these results indicate a significant association between higher BMI, WC, and WHR and the prevalence of LVH.

Table 18: Table Showing Distribution of Echo Changes in The Population

PARAMETERS	PRESENT	ABSENT	TOTAL
DIASTOLIC DYSFUNCTION	58	91	149
RWMA	7	142	149
LVH	44	105	149

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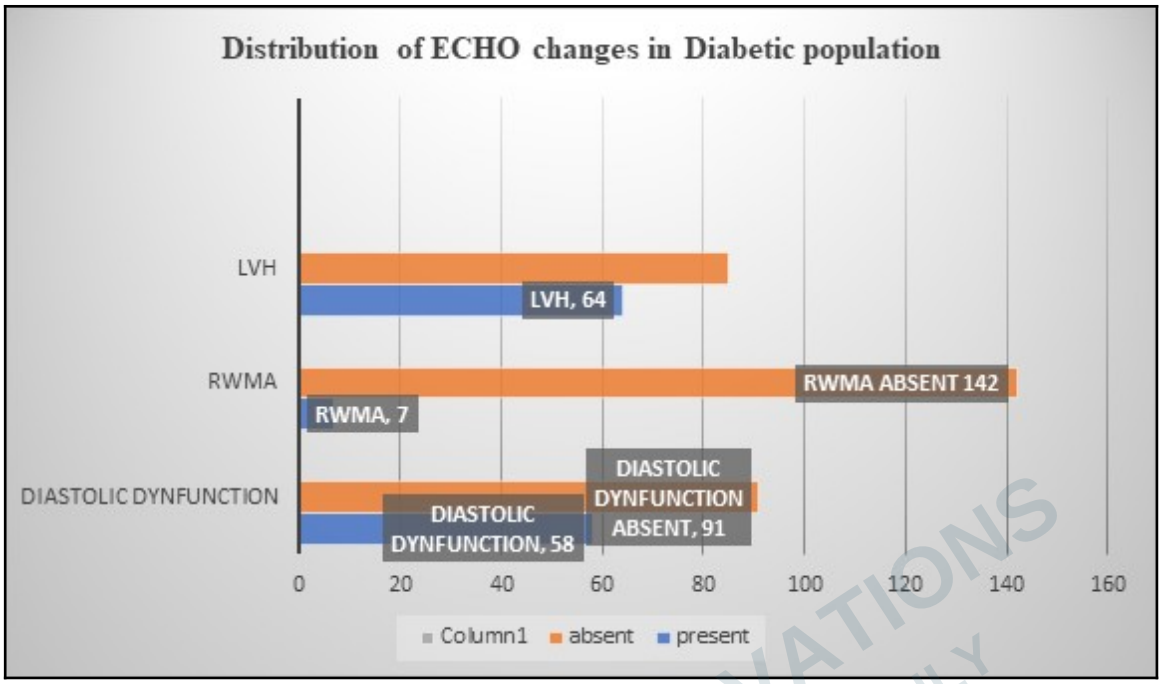
Figure 18: Showing Distribution of ECHO Changes in T2DM Population



From the above table and figure, it has been observed that diastolic dysfunction is present in population where n = 58 and absent in n = 91, LVH present in n = 44 and absent in n = 105, lastly, RWMA present in n = 7 and absent in n = 142.

Table 19: Association of Anthropometry and ECHO Changes

Echo Changes	**BMI**	**WC**	**WHR**
Diastolic Dysfunction			
Above Cut Off	52	18	54
Below Cut Off	6	40	4
Total	58	58	58
P Value	.000	.013	.466
Statistical Significance	Significant	Significant	Significant
LVH			
Above Cut Off	39	44	41
Below Cut Off	5	17	3
Total	44	27	44
P Value	.000	.001	.504
Statistical Significance	Significant	Significant	Significant

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Regional Wall Motion Abnormality			
Above Cut Off	6	3	7
Below Cut Off	1	4	0
Total	7	7	7
P Value	.221	.157	.549
Statistical Significance	Significant	Significant	Significant

Waist circumference and BMI (p = .000) are critical markers, as BMI presents a critical association compared to WC (p = .013). It has been observed that waist-hip ratio is not the critical marker regarding the diastolic dysfunction. On the other hand, none of the anthropometric measures such as WHR, BMI and WC illustrate a critical relation with regional wall motion abnormalities.

SECONDARY-OBJECTIVES

Table 20: Association Between Presence of Retinopathy, Nephropathy and Diabetic Foot and Anthropometry

Parameters	**BMI**			**WC**			**WHR**		
	Above Cut Off	**Below Cut Off**	**P value**	**Above Cut Off**	**Below Cut Off**	**P value**	**Above Cut Off**	**Below Cut Off**	**P value**
Retinopathy	**16**	**1**	**.004**	**6**	**11**	**.110**	**16**	**1**	**.591**
Nephropathy	**44**	**5**	**.000**	**4**	**1**	**.007**	**42**	**7**	**.054**
Diabetic Foot	**5**	**0**	**.108**	**17**	**32**	**.004**	**5**	**0**	**.653**

From the table, it can be observed that BMI (p = .004) presents a critical link which gihkights that a it a reliable predator in terms of retinopathy. Both WC (p = .007) and BMI (p = .54) present a critical association regarding the nephropathy which makes it a significant marker. Lastly, WC (p = .004) is also related with diabetic foot which highlights it as an important predictor.

Table 21: Distribution of T2DM And Presence of Sedentary Lifestyle (Met 1.5 For 6 Hrs.)

Parameter	**Sedentary Lifestyle Present**	**Sedentary Lifestyle Absent**
T2DM Distribution		

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Present	**98%**	**52%**

The above table highlights that the majority of the study population presents a sedentary lifestyle with T2DM (98%). This exhibits a critical association between T2DM prevalence and a sedentary lifestyle. 52% of the population do not lead a sedentary lifestyle though have T2DM. This highlight that T2DM prevalence is comparatively lower compared to the people who have sedentary lifestyles.

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DISCUSSION

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DISCUSSION

This observational and Cross-sectional study was performed at The Dept of General Medicine in Jagannath Gupta Institute of Medical Sciences and Hospital, Busta, a rural Medical College in West Bengal. A total of 149 participants who suffered from T2DM who fit this inclusion criterion have been selected.

Demographic profile:

From the analysis of age distribution, the percentage and frequency of participants aged 40 years - 65 years. This data highlights critically higher frequency at 40 years 45 years, and 53 years, illustrating definite peaks within the population. This data is critical for needed policy-making and healthcare planning as it typically defines the specific demographic patterns in this age group. Moreover, the selected study population is approximately evenly distributed between females (78) and males (71). This selection provides an equilibrium gender presentation for analyses of the cardiometabolic and anthropometric risk factors. These peaks could indicate specific cohort effects or reflect certain population dynamics such as birth rates during those years. Understanding these distributions is essential for targeted public health interventions, especially in areas such as healthcare resource allocation and preventive health screenings. The cumulative percentages help visualize the gradual increase in population with age, culminating at 100% for age 65. According to **Shaikh et al.** [62] there is a mutual interrelationship between the height of the patients and "Type 2 Diabetes Mellitus" as prolonged presence in the disease increases the height of individuals. Generally, external body characteristics such as height, age and weight immensely signify several diseases and their post symptoms as they cannot be considered the signs of hyperglycemia only.

Anthropometric information by sex:

In this study, nearly 59 percent of participants have a BMI more than the cutoff value (23) this highlights a critical proportion with obesity or overweight. Whereas, nearly 100 percent have a waist-hip ratio over 0.8 cm which presents a relatively higher occurrence of central obesity. Nearly, 69 percent of male populations have a WC < 80 cm (above cut-off) which indicates a critically balanced distribution between normal waist circumference and central obesity. On the contrary, nearly, 59 percent of participants have a BMI more than the cutoff value (<23) which highlights a relatively higher occurrence of obesity or overweight. The majority of the female participants have a waist-hip ratio < 0.8 cm, this indicates a uniform probability of

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central adiposity. Lastly, approximately 0 percent of participants have a WC < 80 cm (below cut-off) this presents a critical number of selected participants with significant central obesity. The anthropometric data analyzed according to the Revised Asian Guidelines reveal pronounced gender-specific variations in body measurements, highlighting differing health risks between male and female participants. For females, the data indicate a substantial prevalence of elevated measurements across multiple indicators of obesity. Specifically, 75.6% of female participants exhibited a Body Mass Index (BMI) exceeding the recommended cutoff of 23, suggesting a significant proportion of individuals categorized as overweight. This is further compounded by waist circumference (WC) measurements, where 88.5% of females surpassed the threshold of 80 cm, an indicator of increased visceral fat accumulation. Most strikingly, all female participants (100%) had a waist-to-hip ratio (WHR) above the cutoff of 0.8, signifying widespread central obesity. These elevated anthropometric indicators are critical as they are associated with heightened risks for metabolic disorders such as type 2 diabetes and cardiovascular diseases. As per **A.B.C News**, [63], early signs of "Type 2 Diabetes" can be found in children who have constant high blood sugar levels along with excessive "Ketoacidosis" that may reflect the early signs of the disease. However, the current study has proposed that the maximum male participants exceeded the height range to be higher than 160 cm whereas the height of the maximum female participants did not exceed it. On the other hand, **Medicalnewstoday**,[64] defined that, sudden weight loss is one of the major symptoms of "Type 2 Diabetes" where males have higher blood sugar levels. For this reason, as body cells do not get sufficient energy from the glucose, the body starts to break down fat molecules to generate the energy, causing weight loss. Moreover, the present study has shown a negative contrast between the current and existing findings of prior studies that weight gain in males and females can be a significant sign of "Type 2 Diabetes Mellitus". The high prevalence of these risk factors among females underscores the need for targeted interventions and preventive strategies to address and manage obesity and its related health complications within this demographic.

Prevalence of T2DM in the selected population:

There are different parameters of a lipid profile to determine the T2DM in a population such as FBS, HDL, HbA1c, LDL, Triglyceride, and total cholesterol. Where, 235 ≥ FBS ≥ 65 (129±26.4), 67 ≥ HDL ≥ 29 (46.72±8.92), 11 ≥ HbA1c ≥ 5 (7.6±1.04), 181 ≥ LDL ≥ 51 (95.24±24.4), 398 ≥ Triglyceride ≥ 76 (147.57±48.18), and 456 ≥ total cholesterol ≥ 101 (177.64±51.21). The anthropometric profile of male participants in the study presents a

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distinctive pattern that contrasts with the overall obesity trends observed among females. Although the Body Mass Index (BMI) distribution among males was relatively balanced, with 50.7% exceeding the BMI cutoff and thus indicating a moderate level of overweight, the waist-to-hip ratio (WHR) data reveals a more concerning trend. Specifically, an alarming 94.4% of male participants had a WHR greater than 0.9, a measurement indicative of central obesity. This elevated proportion of males with a high WHR points to a significant tendency towards abdominal fat accumulation, a critical risk factor with profound implications for health. As per, **Klsic, et al. 2023**[72]**,** a comprehensive statistical method, Principlala Component Analysis (PCA), was established to navigate the underlying relation between both the traditional and non-traditional anthropometric measures and prediabetes. The analysis showcased that various derived and formulated anthropometric indices, particularly Visceral Adiposity Index (vAI), Cardiometabolic Index (CMI), and Lipid Accumulation Product (LA), were considered to be more effective in segmenting prediabetes than other non-traditional indices such as Body Adiposity Index (BAI) and Body Roundness Index (BRI).

Central obesity, characterized by excessive fat around the abdominal region, has been increasingly recognized as a key determinant of various adverse health outcomes. Unlike general obesity, which is assessed through BMI and includes all body fat, central obesity specifically targets the distribution of fat, reflecting its concentration in the abdominal area. The potential of the study includes its novel application of PCA to examine these relationships and its relatively large sample size (Yazdanpanah et al. 2020). However, it has limitations, including its cross-sectional design, which precludes establishing causality, and the older age of prediabetes participants compared to controls. This distribution is linked to several metabolic disturbances, including insulin resistance, increased inflammatory markers, and alterations in lipid metabolism, which collectively contribute to the development of conditions such as hypertension, metabolic syndrome, and cardiovascular diseases.

The data highlighting the high WHR among male participants underscore the importance of addressing central obesity as a distinct and critical health issue. Among Mets components, WC in males and females and BP in males were significantly related to the extensive nature of the WC and BP that are above ATP cut-points enhanced the overall likelihood of single and multiple ECG abnormalities with the higher rate of prevalence in the males[73]. The findings of the research paper were independent of the other risk factors such as age, heart rate, smoking,

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education, diabetes, consumption of alcohol, and physical activity. Central obesity is often associated with a higher risk of developing hypertension due to its influence on blood pressure regulation through various pathophysiological mechanisms. From the nationwide database, it is evident that includes above 3.5 million working-age individuals in Japan, research signifies a consistent association between the wider ranges of E CG abnormalities and the consequences of the clinical outcomes (Yagi, 2024). The baseline of the study is featured by a total of 3,698,429 individuals, of whom 2,873,900 (77.7%) had normal ECGs, 623,073 (16.8%) had one minor ECG abnormality, and 144,535 (3.9%) had two or more minor ECG abnormalities and 56,921 (1.5%) had major abnormalities related to ECG. The mean age was 47.1 years and 66.6% were males. Additionally, individuals with central obesity are more likely to experience metabolic syndrome, a cluster of conditions including high blood sugar, abnormal cholesterol levels, and increased blood pressure, which together elevate the risk of cardiovascular diseases. These health issues are particularly concerning in the male population, given the high prevalence of central obesity identified in this study. The BMI, comorbidities such as hypertension diabetes, and dyslipidemia, along with the status of smoking were recorded. The datasets associated with the laboratories that involve the systolic value of the blood pressure, glucose levels, LDL cholesterol, and eGFR[74].

The gender-specific differences in anthropometric measures and associated health risks reveal a pattern where females exhibit higher overall obesity rates, while males display more pronounced central obesity. This divergence highlights the need for differentiated public health strategies and personalized medical care tailored to each gender's unique health challenges. For females, where general obesity and associated risks are more prevalent, interventions should focus on comprehensive approaches to manage overall body weight and reduce obesity-related health complications. Strategies might include promoting balanced diets, encouraging physical activity, and supporting behavioral changes aimed at achieving and maintaining a healthy weight.

Conversely, for males, the focus should be more sharply directed towards managing central obesity and its related complications. Given the high prevalence of elevated WHR and its associated risks, targeted interventions could include specific programs designed to reduce abdominal fat. These might involve exercise regimens that emphasize abdominal fat reduction, dietary modifications to address the unique metabolic needs associated with central obesity,

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and strategies to improve overall cardiovascular health. Additionally, public health campaigns targeting awareness about the risks of central obesity and promoting healthy lifestyle choices could be instrumental in reducing the prevalence of abdominal fat accumulation among males.

Understanding these gender differences in anthropometric measures provides critical insights for developing more effective and personalized public health strategies. Tailoring interventions to address the specific needs and health risks of each gender can enhance the efficacy of health promotion efforts and contribute to better health outcomes. By focusing on central obesity management for males and overall obesity reduction for females, public health initiatives can more effectively target the underlying factors contributing to chronic diseases.

Moreover, incorporating these insights into clinical practice and public health policies can help guide the development of more precise and effective health management strategies. In the light of research focusing on documenting the relations between "body fat distribution patterns connected with lower peripheral adiposity" and "higher abdominal adiposity predicting ASCVD". For individuals of any BMI category, the impact of the waist-to-hip ratio (WHR), is investigated. Because it is a marker of intra-abdominal adipose tissue accumulation in individuals with versus without ideal cardiovascular health (Paulin et al., 2023) [(88)]. The protocol of the World Health Organization (WHO) suggests the current process of measuring waist circumference (Silveira et al., 2020) [(89)]. It explains that this should be measured at the midpoint between the lower margin of the last palpable ribs and the top of the iliac crest. WHR is a more efficient predictor of mortality in older people than waist circumference or BMI. Health care providers can use gender-specific anthropometric data to identify individuals at higher risk for obesity-related health conditions and implement targeted prevention and treatment plans. This approach not only addresses the immediate health risks associated with obesity but also promotes long-term health and well-being.

In summary, the anthropometric profile of male participants reveals a critical need for targeted health interventions focused on central obesity and its related complications. The high prevalence of elevated WHR among males, coupled with its association with various health risks, underscores the importance of addressing central obesity as a significant public health concern. By developing gender-tailored strategies that address the distinct obesity patterns and health risks of males and females, public health initiatives can more effectively promote overall health and reduce the burden of chronic diseases. Understanding and acting on these gender-

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specific differences will enhance the precision and impact of public health strategies, ultimately leading to better health outcomes for both men and women.

Parameters of lipid profile in the diabetic population and distribution according to BMI:

It has been observed after the analysis that increased triglyceride levels are quite common among study participants who have a high BMI ratio. Also, higher BMI is linked with increased LDL ($p = 0.001$) which highlights the worst control of cholesterol. The prevalence indicated relatively low levels of HDL with a high BMI value, though this is not statistically significant as the p-value is 0.000. In a total of 13 participants BMI < 23, and BMI > 23 are subjected to within 50 participants having LDL ($p = .001$). This suggests that diabetic individuals with higher BMI tend to have a higher prevalence of elevated LDL cholesterol levels, emphasizing the association between increased BMI and poorer LDL cholesterol control. In a total of 54 participants BMI < 23, and BMI > 23 were subjected to within 6 participants have HDL ($p = .000$). This indicated that there might be a tendency for HDL levels to vary by BMI category, this differentiation is not quite strong to be contemplated important in this sample. On the other hand, in a total of 52 participants BMI < 23, and BMI > 23 were subjected to within 41 participants have triglycerides ($p = .006$). This indicated that diabetic people with high BMI tend to have a higher prevalence of enhanced LDL cholesterol levels this emphasizes the between increased BMI and poorer LDL cholesterol control. This result signifies that people who have diabetes with higher BMI are more probable to have increased triglyceride levels this highlights an association between poorer triglyceride control and elevated BMI levels.

Mangla et al., [83] observed that WHtR has superior discriminative capability in relation to waist circumference, BMI, height circumferences, and waist-hip-ratio within a cross-sectional observation. Another study, conducted by **Fajkić et al.**, [84] found a significant relation of waist circumference with the prevalence of T2DM as compared with BMI and WHR by utilising anthropometric measures quintiles. Whereas, findings from other different meta-analyses were typically inconsistent. A distinguished longitudinal metal-analysis study was conducted by **Sarma et al.**, [85], whereas **Masroor and Haque** [86], did a cross-sectional meta-analysis observation within Asian populations. Both these observations observed WHtR to be more critically related to the prevalence of T2DM compared to WHR, BMI, and WC. In opposite to this result **Baechle et al.,** [86] found no prominent difference among the anthropometric markers when analyses were done on WC, BMI, and waist-hip-ratio. The analysis of health parameters

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in patients with Type 2 Diabetes Mellitus (T2DM) reveals several critical insights into the interplay between lipid profiles and anthropometric measures, underscoring the need for targeted lipid management strategies. Elevated levels of low-density lipoprotein (LDL) cholesterol, triglycerides, and total cholesterol were prevalent among the study population, indicating a considerable cardiovascular risk. These lipid abnormalities reflect a broader issue of dyslipidemia, which is a well-recognized risk factor for cardiovascular diseases. The mean values for these lipid parameters suggest moderate to high levels of cardiovascular risk, highlighting the urgent need for effective interventions to manage lipid levels and thereby reduce the risk of heart disease in T2DM patients.

Lipid profile in the diabetic population and distribution according to WC:

From the analysis, it has been observed that high waist circumference is related to increased LDL levels within male participants where p = 0.003, though not evident in female participants where p = 0.128. Enhanced triglyceride levels are connected with high waist circumference in male participants which is p = 0.069, though not critically observed within female participants where p = 0.159. Low levels of HDL are critically related to high waist circumference in both females (p = 0.013) and males (p 0.000). The findings of this study undermine the significance of WC as a predictor of dyslipidemia in diabetic patients. The trends observed highlight that observing WC alongside lipid profiles could help in better managing cardiovascular risk in diabetic populations. This also emphasises the requirement for targeted interventions to enhance lipid outcomes in people with central obesity. It can be discussed that elevated WC seems to correlate with a high prevalence of anthropogenic lipid profiles, including increased LDL cholesterol and triglycerides, known risk factors for cardiovascular disease.

Moreover, the distribution of lipid profiles in relation to body mass index (BMI), waist circumference (WC), and waist-to-hip ratio (WHR) reveals significant associations between these anthropometric measures and lipid abnormalities. However, Tang and Zeng (2024) mentioned that WC and ASCVD scores are not directly related; increasing waist circumference impacts harmful levels of or balance between blood pressure and lipid profile [81]. An adverse lipid level and high blood pressure are harmful to the heart's health, which leads that individual to suffer from different heart-related health issues. **Jiang et al.,** [82] argued that T2DM at follow-up and baseline has been defined depending in self-reported present antidiabetic medication intake or physician-diagnosed diabetes during the seven days before the test as per the

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anatomical therapeutic chemical classification system code, A10. Body weight, waist circumference, hip circumference, and height were measured with a significantly comparable standardised process. Higher BMI and WC were consistently linked to increased levels of LDL cholesterol and triglycerides. These findings align with the established understanding that excess body fat, particularly abdominal fat, contributes to dyslipidemia by influencing lipid metabolism and increasing the risk of cardiovascular complications.

Lipid profile in diabetics and distribution according to WHR:

From the result analysis, this study has found that a high waist-hip ratio is linked with increased triglycerides where $p = 0.432$. Variations within HDL levels by waist-hip ratio are not identified to be statistically significant where $p = 0.232$. Lastly, it has been observed that a high level of waist-hip ratio is associated with increased levels of LDL where $p = 0.350$. The analysis of this study found that LDL and triglyceride levels are critically associated with WHR in diabetic patients. It also has been observed that a high WHR value correlates with worse lipid profiles in the study population. However, the waist-to-hip ratio (WHR) emerged as the most strongly correlated measure with adverse lipid profiles. This underscores the role of central obesity as a particularly potent predictor of lipid abnormalities and cardiovascular risk. Central obesity, characterized by an increased accumulation of visceral fat, has been shown to disrupt lipid metabolism more significantly than overall body fat, leading to elevated levels of LDL cholesterol and triglycerides. Joo et al., (2021) mentioned that WC can reflect abdominal adiposity, and can be used as a global tool to measure central obesity; it will also increase the risk of Type II diabetes [(79)]. There is a compelling biological case for a relationship between these two metrics. Furthermore, Xia et al. (2024) revealed that new indices integrating the TyG index with the primary obesity metrics WC and WHtR beat TyG alone in predicting ASCVD incidence [(80)].

These results are consistent with existing literature that emphasizes the importance of central obesity as a key factor in predicting cardiovascular risk among diabetic patients. The strong correlation between WHR and dyslipidemia highlights the need for healthcare providers to consider central obesity as a critical factor in the management of T2DM. It also underscores the importance of incorporating comprehensive care strategies that address both lipid management and anthropometric parameters to effectively reduce cardiovascular risk in this population. By targeting central obesity and managing dyslipidemia through lifestyle

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modifications and pharmacological interventions, healthcare professionals can better address the complex health needs of T2DM patients and improve their overall cardiovascular health.

Association of HTN and anthropometric parameters:

It has been observed from the study that critical association with hypertension has been noticed in the study population who have a high waist-hip ratio where p = 0.506. High occurrence of hypertension has been observed within the study participants who have BMI over than 23 (p = 0.000) and a critical link between hypertension and high waist circumference has been observed (p = 0.002). From the findings, it can be discussed that while waist circumference and BMI are associated with hypertension, waist-hip ratio presents a high correlation, which indicates the significance of waist-hip ratio as a critical predictor of hypertension. The investigation into the relationship between hypertension (HTN) and anthropometric parameters underscores the critical role of waist-to-hip ratio (WHR) as a significant indicator of HTN risk. The analysis revealed a strong correlation between elevated WHR and the presence of hypertension, with a striking 70% of individuals exhibiting a WHR above the established cutoff also presenting with HTN. This substantial association highlights WHR as a particularly valuable metric for assessing hypertension risk, potentially surpassing other measures such as Body Mass Index (BMI) or waist circumference (WC) in predictive accuracy. In the study of Hasani-Ranjbar et al. (2023), the incidence of hypothyroidism was 4.8% in males, almost 13% in women, and 8.8% on average [78]. Hypothyroidism's frequency has nearly doubled to 16.7%. Most people are unaware of high blood pressure in the early stages since it is asymptomatic.

Association Between Anthropometric Parameters and ASCVD SCORE:

Critical associations have been observed between a high waist circumference, waist-hip ratio, and BMI with elevated ASCVD risk. The analysis of this study illustrates a critical association between increased ASCVD risk and higher BMI. Then it can be discussed that study populations with high measurement values are more probable to fall in the higher risk scale regarding ASCVD score. Here, a P-value of 0.467 presents a stronger correlation between high waist circumference and ASCVD risk. This also highlights the significance of managing healthy anthropometric factors to mitigate the cardiovascular risk. Each unique parameter presenting critical predictive value regarding the ASCVD score mainly in the high-risk category of study population. WHR, which assesses the distribution of body fat by comparing

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waist circumference to hip circumference, provides a more nuanced picture of fat distribution than BMI or WC alone. Elevated WHR is indicative of central obesity, a condition where excess fat accumulates around the abdominal area. This type of fat distribution is known to have more detrimental effects on cardiovascular health compared to overall body fat or fat distributed in other areas. Emerging research suggests that in individuals who have established ASCVD, the "BMI-mortality curve" is U-shaped, a phenomenon known as the "obesity paradox" (**Hsuan et al., 2022)** [(76)]**.** Patients who are overweight or mildly to moderately obese have a better life expectancy than those with a normal BMI or extreme obesity. **German et al., (2020)** [(77)] provided the first study to examine the relationship between anthropometric markers of adiposity and incident ASCVD in a cohort of persons with type 2 diabetes in the United States. The strong association between high WHR and hypertension observed in this study supports existing evidence that central obesity is a significant risk factor for developing high blood pressure. Central obesity is associated with several pathophysiological changes, including increased insulin resistance, higher levels of inflammatory markers, and alterations in hormonal balance, all of which contribute to the development and progression of hypertension.

Yardstick T2DM Patients:

It has been observed from this study that fasting blood sugar levels in the normal group < 100 mg/dL (n = 1), in the prediabetes group 100 mg/dL ≤ FBS < 126 mg/dL (n = 3), and in the diabetes level FBS ≥ 126 mg/dL (n = 145). In the normal group, HbA1c is < 5.7% (n = 1), in the prediabetes group HbA1c is 5.7% ≤ HbA1c < 6.5% (n = 3), and in the diabetes level HbA1c is ≥ 6.5% (n = 145). In contrast, while BMI and WC also provide useful information about body fat and obesity, they do not specifically capture the distribution of fat in the abdominal region. BMI measures overall body weight relative to height and does not differentiate between fat and lean mass, nor does it account for the location of fat. WC, although more indicative of abdominal fat than BMI, still lacks the precision of WHR in assessing the relative distribution of fat between the waist and hips. Therefore, WHR's ability to provide a clear indication of central obesity makes it a more specific tool for identifying individuals at higher risk for hypertension and related cardiovascular complications.

Association of ECG changes and deranged anthropometry:

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It can be discussed from the findings of this study that the association and distribution of ECG changes with deranged anthropometry exhibits important association between certain cardiac events and body measurements. The results of this study highlight important correlations between higher waist circumference (p = .159), waist-hip ratio (p = .504), BMI and the occurrence of LVH (p = 0.000). moreover, the variations in BMI, waist circumference, waist-hip ratio and occurrence of ischemia undermine a critical association between ischemic changes and enhanced anthropometric measures on ECG. It can be discussed that p-values of 0.005 for waist circumference (>90cm>), 0.322 for waist-hip ratio, and .001 for BMI exhibit the important influence of higher WHR, BMI, and EC on the incidence of ECG changes. The sudden changes on ECG highlight that MI, LVH, and ischemia pose the significance of managing healthy parameters of anthropometric values in terms of cardiovascular health.

Association of Anthropometry and ECHO Changes:

This study has found for diastolic dysfunction, people with a BMI more than the cut-off present (p = 0.000) this condition compared lower cut-off. For waist circumference (WC), the variations were n = 18 above and n = 40 below the cut-off, on the other hand, for waist-to-hip ratio, it was n = 54 above and n = 4 below the cut-off (p = .466). These findings highlight a relatively low increase within diastolic dysfunction with a lower waist-hip ratio. The values for the left ventricular hypertrophy exhibit high LVH prevalence in people who have lower waist circumference, though this was not as prominent as in waist-hup ratio or BMI (p = .000). This critical analysis highlights the significance of maintaining healthy anthropometric measures to minimise the risk of different echocardiographic abnormalities. These findings also undermine the significance of routine cardiovascular screening in people who have severe diabetes, mainly those who have deranged anthropometric parameters.

Association between the presence of retinopathy, nephropathy and diabetic foot and anthropometry:

From the study it has been observed that the retinopathy value among the study population above cut off is 16 and below cut-off is 1 for BMI (p = .004), above cut-off is 6 and below cut-off is 11 for waist circumference (p = .110), above cut off is 16 and below cut off is 1 for waist-hip ratio (p = .5910. The nephropathy value among the selected study population above cut off is 44 and below cut-off is 5 for BMI (p = .000), above cut-off is 4 and below cut-off value is 1

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for waist circumference (p = .007), above cut-off is 42 and below cut off is 7 for waist-rip ratio (p = .054). The diabetic foot value among the study population above cut off is 5 and below cut-off is 0 for BMI (p = .108), above cut-off is 17 and below cut-off is 32 for waist circumference (p = .004), above cut-off is 5 and below cut off is 0 for waist-hip ratio (p = .653). Hence, it can be discussed that these findings exhibit a critical association between the presence of nephropathy, diabetic foot, and retinopathy for the people who have diabetes.

Distribution of T2DM and the presence of a sedentary lifestyle:

Among all population 98% of the participants present sedentary lifestyle whereas 52% of the population did not lead sedentary lifestyle. From the findings, it can be critically discussed that the statistical analysis generated P-values for BMI, for WC, and for WHR, where all different values exhibited significant correlations. Furthermore, the distribution of T2DM with the presence of a sedentary lifestyle presented a critical contrast. Then it can be discussed that this critical variation highlights the significant impact of physical inactivity on the T2DM prevalence. The findings of this study illustrated the significance of managing healthy anthropometric measures and a disciplined lifestyle to mitigate the prevalence of T2DM and diabetic complications.

This study has determined the waist circumference, waist-hip ratio and BMI to be related to T2DM. The critical odds of a diabetic patient having a relatively high WC was 3.5 times compared to people who do not have diabetes. Various anthropometric cut-off values for diverse populations, always make the differentiations critical as well as limit generalizability. In the majority of the research, BMI acted poorly as a critical anthropometric predictor regarding T2DM which is in contrast to this study where BMI has been observed to be one of the sensitive markets for diabetes, mainly among females. This study is an effort to recognise the discriminatory power of different anthropometric measures and their relation with type-2 diabetes Mellitus with the help of hospital cases. Regardless of the small size of the study sample, undisputedly waist circumference might be validated as the individual most feasible, convenient measures that could be utilised across diverse populations for its important association with T2DM. The findings from this study advocate for the inclusion of WHR in routine health assessments as a simple, cost-effective, and informative measure for identifying individuals at risk of hypertension. Incorporating WHR measurement into regular health evaluations can enhance the early detection of individuals who may benefit from targeted

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interventions to manage or prevent hypertension. Additionally, these results emphasize the need for health professionals to focus on abdominal fat distribution in their assessments of cardiovascular risk, rather than relying solely on BMI or WC. By highlighting the importance of WHR, this study supports a more nuanced approach to hypertension risk assessment and underscores the value of central obesity measures in comprehensive cardiovascular risk management.

Implications for Public Health and Future Research:

The findings from this study underscore critical implications for public health strategies and future research, particularly in light of the high prevalence of overweight, central obesity, and associated metabolic risk factors observed in the population. The data reveal a pressing need for targeted interventions aimed at promoting healthier lifestyles and mitigating the burden of chronic diseases such as hypertension, diabetes, and cardiovascular conditions. Given the significant associations between anthropometric measures and adverse health outcomes, public health programs must prioritize regular and systematic anthropometric assessments to monitor body fat distribution and identify individuals at risk. These assessments should be integrated into routine health evaluations to facilitate early detection of obesity-related complications and enable timely intervention.

To address the challenges posed by central obesity and metabolic risk factors, public health initiatives should focus on personalized interventions that target weight management and lipid profile improvement. Programs that encourage healthy eating, increased physical activity, and behavior modification can be instrumental in reducing the prevalence of obesity and its associated health risks. The fat causing abdominal obesity releases free fatty acids and pro-inflammatory cytokines into the bloodstream leading to a higher waist-hip ratio (WHR). This metabolically condition results in endothelial dysfunction with enhanced arterial stiffness. The increasing WHR ratio causes plaque formation within the walls of arteries causing atherosclerosis **(Chen et al., 2024)** [(90)]**.** Moreover, incorporating educational components that emphasize the importance of maintaining a balanced diet and engaging in regular physical activity can empower individuals to make informed health choices and adopt sustainable lifestyle changes.

The gender-specific differences observed in the anthropometric data and health parameters further highlight the necessity for tailored intervention strategies. The study's findings suggest

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that women may face particular challenges related to central obesity, as indicated by their higher prevalence of elevated waist circumference and waist-to-hip ratio. Interventions for women should therefore focus on strategies to reduce abdominal fat and improve overall body composition. These may include targeted physical activities that promote fat loss in the abdominal region and dietary modifications designed to address specific metabolic needs. On the other hand, men in the study exhibited significant associations between waist-to-hip ratio and adverse health outcomes. Interventions for men could be more effective if they focus on managing waist-to-hip ratio through lifestyle modifications that address central obesity, potentially including tailored exercise programs and dietary adjustments.

Future research should aim to explore the underlying causes of the observed demographic patterns and health disparities to better understand the factors contributing to these differences. Longitudinal studies would be particularly valuable in this context, as they can provide insights into the progression of health conditions over time and assess the effectiveness of various intervention strategies. Such studies could track changes in anthropometric measures, lipid profiles, and other health parameters, offering a more comprehensive view of how these factors evolve and interact over the lifespan.

Additionally, future research should examine the impact of lifestyle factors such as diet, physical activity, and socioeconomic status on the health outcomes of this population. Investigating how these variables influence obesity and related health risks could inform the development of more effective and holistic public health policies. For example, understanding the relationship between socioeconomic status and access to healthy food options or opportunities for physical activity could lead to targeted efforts to address disparities and improve health equity.

Furthermore, exploring the role of cultural and environmental factors in shaping health behaviors and outcomes can provide valuable context for designing culturally appropriate and contextually relevant interventions. By considering the diverse needs and circumstances of different population subgroups, public health strategies can be better tailored to address specific challenges and promote overall well-being.

In summary, the implications of this study emphasize the need for a multifaceted approach to public health that integrates regular anthropometric assessments, personalized interventions,

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and targeted strategies to address gender-specific health needs. By focusing on these areas and supporting future research into the underlying causes and contributing factors, public health initiatives can more effectively address the growing burden of chronic diseases and improve health outcomes across diverse populations.

the demographic and anthropometric analysis conducted on individuals aged 40 to 65 years offers a valuable and comprehensive insight into the health status and risk factors prevalent within this age group. This age bracket is particularly critical as it often represents a period where individuals are at increased risk for chronic diseases such as cardiovascular conditions, type 2 diabetes, and hypertension. The analysis reveals significant associations between various anthropometric measures—such as Body Mass Index (BMI), waist circumference (WC), and waist-to-hip ratio (WHR)—and health outcomes, including lipid profiles and hypertension. These findings highlight the crucial role of these anthropometric indicators in identifying individuals at elevated risk for developing chronic health issues.

The observed relationships between anthropometric measures and lipid profiles illustrate how body fat distribution, particularly central obesity as indicated by elevated WHR, correlates strongly with adverse lipid profiles such as elevated LDL cholesterol and triglycerides. This association emphasizes the need for regular monitoring of lipid levels as part of routine health screenings, especially in individuals exhibiting signs of central obesity. The prevalence of dyslipidemia among those with higher BMI and WC further underscores the importance of addressing weight management as a central component of chronic disease prevention and management.

Similarly, the significant correlation between high WHR and hypertension underscores the role of central obesity as a key risk factor for elevated blood pressure. With 70% of individuals with a WHR above the cutoff also presenting with hypertension, it becomes evident that WHR is a critical measure for assessing hypertension risk. This finding supports the inclusion of WHR in regular health assessments to identify individuals who may benefit from early intervention and management strategies aimed at controlling blood pressure.

The demographic analysis also reveals important gender-specific differences in anthropometric measures and health outcomes. For example, women in the study exhibited a higher prevalence of elevated waist circumference and waist-to-hip ratio, suggesting a greater challenge with

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central obesity compared to men. On the other hand, men showed a strong association between waist-to-hip ratio and adverse health outcomes, indicating a heightened risk related to abdominal fat distribution. These gender-specific patterns highlight the need for tailored public health interventions that address the unique health risks faced by men and women. Personalized approaches that consider these differences can enhance the effectiveness of health promotion efforts and improve overall health outcomes.

Public health initiatives should thus focus on incorporating regular and comprehensive anthropometric assessments into routine health care practices. By routinely measuring BMI, WC, and WHR, health care providers can more accurately identify individuals at risk for chronic diseases and implement targeted interventions. For instance, lifestyle modification programs, including dietary changes and increased physical activity, should be tailored to address specific anthropometric risk factors. Additionally, public health campaigns can be designed to raise awareness about the importance of maintaining a healthy weight and managing central obesity, particularly in at-risk populations.

Incorporating these findings into public health strategies also involves addressing broader social and environmental factors that contribute to obesity and chronic disease. Efforts to improve access to healthy food options, promote physical activity, and support behavior change can complement individual-level interventions and contribute to more sustainable improvements in population health. Understanding the interplay between lifestyle factors, socioeconomic status, and health outcomes can inform more equitable and effective public health policies.

Future research should build on these findings by exploring the underlying mechanisms driving the observed associations and disparities. Longitudinal studies could provide insights into the progression of health conditions and the impact of various intervention strategies over time. Research examining the influence of lifestyle factors, cultural practices, and socioeconomic conditions on health outcomes will be crucial for developing comprehensive and contextually relevant public health interventions.

Overall, the demographic and anthropometric analysis of this study population underscores the importance of targeted health screenings and interventions. By addressing the specific needs of different demographic groups and considering the broader determinants of health, public

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health initiatives can more effectively promote well-being and reduce the burden of chronic diseases. The integration of these findings into public health strategies will ultimately contribute to healthier populations and improved quality of life for individuals across the age spectrum.

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LIMITATIONS OF THE STUDY

1. This study has been done in a single center along with a small sample size which may not properly present the majority of the population of West Bengal.
2. The study was done at a tertiary care Hospital or Medical College; thus the probability of hospital bias cannot be overstated.
3. As this is a "cross-sectional observational study, cause and effect association" between risk factors or drug therapy or co-morbidity and the relationship between "anthropometric screening of T2DM" and "cardiometabolic risk factors". The study design also limits the capability to obtain proper conclusions regarding the causality over time. The small sample size also restricts the generalisability of the entire findings to wider populations.
4. The pre-defined endpoint for the final result has not been used. Here, mainly hospital discharge is utilised as the endpoint. Furthermore, anthropometric measurements further be subjected to the study variability, as a consequence of different observer or technique errors.
5. There is a significant lack of information on T2DM outcomes in prolonged post-hospitalisation patients.
6. Possible demographical or racial bias in the prevalence of T2DM cannot be excluded.

RECOMMENDATIONS

It can be recommended that;

1. Longitudinal studies can be used which can offer deep insights into the prolonged and progressing impact of recognised risk factors.
2. A more diverse and larger sample can be used that encompasses varied ethnicities, socio-economic statuses, and age groups accordingly.
3. It is important to integrate basic guidelines for anthropometric measurements to mitigate observed error and variability from the study.
4. Here, in the study can be used different objective measures for information collection such as direct dietary evaluation whenever possible. It will help to enhance the data accuracy and mitigate any biases from the study.
5. It suggested to use of a vast range of anthropometric measurements and biomarkers to grasp the constructive analysis of cardiometabolic risk. This will offer an entire evaluation of risk factors and health status.

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6. The subgroup analysis can be conducted to analyse the relationship between the variables as this can be differentiated across different regional and cultural aspects.
7. In order to get a more general overview, it is important to conduct a prolonged follow-up period to assess the development of cardiometabolic complications gradually.

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SUMMARY AND CONCLUSION

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BACKGROUND AND OBJECTIVES:

The prevalence of "diabetes mellitus" is forecasted to double globally in 2030 with the highest increase in India. The burden of diabetes is increasing rapidly in different developing nations such as India as well. Obesity and overweight, typically central along with visceral obesity are the major modifiable risk factors for T2DM. It is also associated with LDL, HDL, insulin resistance, and hypertension which guides metabolic syndrome as well as related cardiovascular disease. The prevalence of obesity and overweight blended with wrong dietary choices, smoking, stress, environmental pollution, physical inactivity, and family history has critically enhanced the cardiometabolic factors. Furthermore, its fatal consequences in developing nations and has been long recognised as a probable "modifiable risk factor". Although, its important has not been acknowledged due to attention within the diabetes treatment in relation to the obtainment of glycaemic control. It has been observed that the general categorisation of obesity depending on BMI may be relatively inadequate. Different epidemiological studies analysed the predictive range of BMI for cardiovascular events and "cardiometabolic risk factors". This study has presented that, to early-detection of diabetes, mainly T2DM, waist-circumference, hip circumference, and "waist-to-height ratio" as an important reflection.

METHODS:

A "cross-sectional observational study" has been carried out in the "Department of General Medicine at JIMS & Hospital". A total of 149 diabetic patients with a minimum prevalence of T2DM of age group less than more than 50 years old and without having critical co-morbidity has been chosen. Required information has been gathered by a "pre-tested semi-structured questionnaire" which was further followed by in-detailed physical attributions, and related laboratory assessment for the evaluation of diabetes with the clinical profile. All the selection process has been conducted based on the study inclusion and exclusion criteria.

RESULTS AT A GLANCE:

1. The population is nearly evenly separated between females (52.34%) and males (47.65%).
2. 88.5% have the WC cut-off (80 cm) and 75.6% have the BMI cut-off (23 kg/m^2) for females.
3. 50.7% have a BMI cut-off (23 kg/m^2) and 45.6% have a WC cut-off (90 cm) for males.
4. The mean HDL level which is 46.72 mg/dL is lower than the suggested range which makes it a risk factor for cardiovascular disease.

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5. The mean HbA1c which is 7.6% is more than the normal range, highlighting adverse blood glucose levels and high T2DM prevalence.
6. The mean LDL level which is 95.24 mg/dL is in the basic range.
7. High WC and BMI are related to enhanced LDL levels in females and males.
8. HTN is critically related to high WC and CMI which undermines the influence of central fat distribution and obesity on the regulation of blood pressure.
9. The majority of the population is categorised in the low-risk group for ASCVD.
10. The BMI and EC are important markers for the diagnosis of T2DM.
11. The retinopathy and nephropathy both are critically related to BMI and WC though diabetic foot is related to greater WC.

CONCLUSION

In conclusion, this study undermines the significance of anthropometric measurements in relation to the early detection of T2DM with the related cardiometabolic risk. The anthropometric measurements include “waist-to-hip ratio”, “body mass index”, waist circumference, and “waist-to height ratio”. It has been observed that these identified measurements are emphasised as non-invasive, practical, and cost-effective tools for early diagnosis of T2DM. This study has found that nearly 90 percent of the study population have been recognised with serious stage of T2DM. It has also found from the study that a total diabetic population of India will increase from 77 million to more than 134 million by 2045. Moreover, visceral and central obesity is a significant risk factor in terms of T2DM. Lastly, this study has found a strong correlation among increased LDL, HDL, hypertension, and triglycerides. Here, WC, HC an WHtR have been recognise as an important marker for the early-detection of T2DM.

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APPENDICES

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ANNEXURE – 1

Study Proforma

Anthropometric screening of type 2 diabetes mellitus as a non-invasive marker of cardiometabolic risk factors

Particulars of the patient

- Name……..
- Age……
- Sex……
- Address…....
- Registration No. …..
- Contact No……..
- Religion……..
- Occupation…….
- Date of Admission/examination……..

Chief Complaints

1…… for…….

2……. for…….

History of Present Illness

(analysis of chief complaints)

Mode of onset:

Progress:

(analysis of associated symptoms)

(general symptoms)

(effect of treatment)

Past Medical History

- Triglycerides
- Waist Circumference
- Hip Circumference
- Hypertension
- Fasting Blood Sugar
- Type-2 Diabetes Mellitus
- Waist-to-hip Ration

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Family History

- Father-alive/died at the age of…….of…….
- Mother-alive/died at the age of……..of……....
- Diabetes/Hypertension/I.H.D/Dyslipidaemia/similar disease

Personal & Social History

Single/Married……Earning member……Addiction

No. of children…….Dietary habit……..Smoking……per day…..

Housing condition…….Bowel habit……..Alcohol…….per day…..

Drugs/Exposure to STD/AIDS

Diabetes/hypertension/dyslipidaemia duration

Other associated known comorbidities

Treatment or Drug History

Menstrual History(Female)

GENERAL EXAMINATION

- Whether patient is conscious, alert and co-operative
- Facies : any angle of mouth deviation
- Decubitus : supine position in bed
- Neck veins : engorged/pulsatile
- Anemia(pallor): mild/moderate/severe
- Jaundice: mild/moderate/severe
- Cyanosis: central/peripheral
- Clubbing:
- Edema: Pedal/Sacral

PULSE

BLOOD PRESSURE VITALS

RESPIRATION

TEMPERATURE

OTHERS:

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ANNEXURE – 2

CONSENT FORM

INFORMATION FOR PARTICIPANTS OF THE STUDY

- **Title of the project:ANTHROPOMETRIC SCREENING OF TYPE 2 DIABETES MELLITUS AS A NON-INVASIVE MARKER OF CARDIOMETABOLIC RISK FACTORS**
- **Name of the investigator:** Dr. Isha Ghosh

  Purpose of this project/study: To find out anthropometric correlation with cardiometabolic risk in type 2 Diabetes.
- **Procedure of the study:** Cross sectional and observational study
- **The benefits to be expected from the research to the participant or to others and the post-trial responsibilities of the investigator:** NON INVASIVE PARAMETER OF ANTHROPOMETRY CAN SUGGEST EARLY LIFESTYLE MODIFICATION CHANGE TO REDUCE DISEASE BURDEN.
- Any risks expected from the study to the participant: No
- Maintenance of confidentiality of records : YES
- Provision of free treatment for research related injury : NA
- Freedom to withdraw from the study at any time during the study period without the loss of benefits that the participant would otherwise be entitled
- **Address and telephone number of the investigator**: JIMSH resident Quarter, Ph-9836392113

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ANNEXURE – 3 (A)

Participant consent form

Protocol Studynumber:_____

- Patient identification number for thisstudy: _____
- Title of theproject: **:ANTHROPOMETRIC SCREENING OF TYPE 2 DIABETES MELLITUS AS A NON INVASIVE MARKER OF CARDIOMETABOLIC RISK FACTORS**_____
- Name ofPrincipalinvestigator:

- Dr. ISHA GHOSH Tel. No(s). 9836392113

- The contents of the informationsheetdated_____that was provided have been read carefully by me / explained in detail to me, in a language that I comprehend, and I have fully understood the contents. I confirm that I have had the opportunity to askquestions.
- The nature and purpose of the study and its potential risks / benefits and expected duration of the study, and other relevant details of the study have been explained to me in detail. I understand that my participation is voluntary and that I am free to withdraw from the study at any time, without giving any reason, without my medical care or legal right beingaffected.
- I understand that the information collected about me from my participation in this research and sections of any of my medical notes may be looked at by responsible individuals from JIMSH, BudgeBudge. I give permission for these individuals to have access to myrecords.

I agree to take part in the abovestudy ----------	Date: Place:

- NameofParticipant:_____Son/Daughter/spouseof:_____

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-
- Complete postaladdress:_____
-
- This is to certify that the above consent has been obtained in my presence.
-
- ---------- ……
  …….
- Signatures of the Principal Investigator Signatures of the Witness

ANNEXURE – 3 (B)

অবহিত সম্মতিপত্র

- প্রোটোকলস্টাডিনম্বর:
- এইগবেষণারজন্যরোগীসনাক্তকরণনম্বর:
- প্রকল্পেরশিরোনাম:
-
- প্রধানতদন্তকারীরনাম:
- টেলিফোননা(গুলি)।
-
- প্রদত্ততারিখেরতথ্যপত্রেরবিষয়বস্তুআমারদ্বারামনোযোগসহকারেপড়াহয়েছে/ আমারকাছেবিশদভাবেব্যাখ্যাকরাহয়েছে,
  এমনএকটিভাষায়যাআমিবুঝতেপারিএবংআমিবিষয়বস্তুসম্পূর্ণরূপেবুঝতেপেরেছি।
  আমিনিশ্চিতকরছিযেআমিপ্রশ্নজিজ্ঞাসাকরারসুযোগপেয়েছি।
- অধ্যয়নেরপ্রকৃতিএবংউদ্দেশ্যএবংএরসম্ভাব্যঝুঁকি/ সুবিধাএবংঅধ্যয়নেরপ্রত্যাশিতসময়কালএবংঅধ্যয়নেরঅন্যান্যপ্রাসঙ্গিকবিবরণআমাকে বিস্তারিতভাবেব্যাখ্যাকরাহয়েছে।
  আমিবুঝিযেআমারঅংশগ্রহণস্বেচ্ছাসেবীএবংআমিকোনোকারণছাড়াই,

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আমারচিকিৎসাসেবাবাআইনিঅধিকারপ্রভাবিতনাকরেযেকোনোসময়অধ্যয়নথেকেপ্রত্যাহারকরতেমুক্ত।

- আমিবুঝিযেএইগবেষণায়আমারঅংশগ্রহণথেকেআমারসম্পর্কেসংগৃহীততথ্যএবংআমার যেকোনমেডিকেলনোটেরবিভাগগুলি JIMSH, Budgebudge-এরদায়িত্বশীলব্যক্তিরাদেখতেপারেন।
  আমিএইব্যক্তিদেরআমাররেকর্ডঅ্যাক্সেসকরারঅনুমতিদিই।

আমিউপরেরগবেষণায়অংশনিতেসম্মত --- স্বাক্ষর / বামবুড়োআঙুলেরছাপ)	তারিখ: স্থান:

-
-
-
- অংশগ্রহণকারীরনাম: এরপুত্র/কন্যা/পত্নী:
-
- সম্পূর্ণডাকঠিকানা:
-
- এটিপ্রত্যয়িতকরারজন্যযেউপরেরসম্মতিটিআমারউপস্থিতিতেপ্রাপ্তহয়েছে।
-
- ---------- .....
- প্রধানতদন্তকারীরস্বাক্ষরসাক্ষীরস্বাক্ষর

তারিখ:

গবেষকএরস্বাক্ষর
তারিখ:

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ANNEXURE – 3 (C)

सहमतिपत्र

मुझे कोअध्ययनकेसभीपहलुओं,

केबारेमेंजांचकर्ताद्वारामेरेद्वाराज्ञातभाषामेंमौखिकरूपसेबतायागयाहै।

मुझेपरीक्षणकेसभीपहलुओंपरचर्चाकरने,

सवालपूछनेऔरपरीक्षणमेंभागलेनेकेलिएसहमतिदेनेकाअवसरदियागयाहै।

मैंसमझताहूंकिइसअध्ययनमेंमेरीभागीदारीस्वैच्छिकहैऔरमैंकिसीभीसमयवापसलेनेकेलिएस्वतंत्रहूं,

बिनाकिसीकारणकेऔरमेरेअधिकारोंऔरविशेषाधिकारप्रभावितहुएबिना।

मैंसमझताहूंकिइसअध्ययनमेंपरीक्षणमेंकोईमहत्वपूर्णजोखिमशामिलनहींहै।

मैंसमझताहूंकिमेरेडेटाकोगोपनीयरखाजाएगा, लेकिनसंस्थाकेप्रमुखअन्वेषक,

नैतिकतासमितिद्वारानियुक्तव्यक्तिजहांअध्ययन**s**जारहाहैऔरनियामकप्राधिकारीकोवर्तमानअध्ययनऔ

रभविष्यकेइसकेसंबंधमेंअनुसंधानमेंरिकॉर्डतकपहुंचहोगीइसकीसहमतिडेतीहु।

अगरमैंअपनासहमतिअध्ययनसेवापसलेताहूंतोभीमैंइसपहुंचसेसहमतहूं।

हालांकिमैंसमझताहूंकिमेरीपहचानउजागरनहींकीजाएगीऔरसूचनाकीगोपनीयताबनाएरखीजाएगी।

मैंइसअध्ययनसेउत्पन्नकिसीभीडेटाकोशैक्षणिकउद्देश्यकेलिएप्रतिबंधितनहींकरनेकेलिएसहमतहूं।

मैंस्वेच्छासेइसअध्ययनमेंभागलेनेकेलिएसहमतहूं।

अध्ययनमेंभागलेनेवालेअन्वेषककाहस्ताक्षर

केहस्ताक्षर / बाएंअंगूठेकानिशान

तारीख :

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MASTERCHART

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Sr No	Age	Sex	Height (CM)	WEIGHT (KG)	BMI	Waist circumference (Cm)	Hip circumference (cm)	WAIST HIP RATIO	Fasting Blood Sugar	PBS (Post prandial blood Sugar)	HbA1c	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)	ONANTI HYPERTENSIVE MEDICATION ORHYPERTENSIVE	LIPID PROFILE						NSTEMI	ECG changes			ECHO			Proteinuria	Retinopathy	Diabetic foot	SMOKER	ASCVD SCORE
															TC	LDL	HDL	TG	DYSLIP			STEMI	signso	LVH	Diasto	RWMA	LVH					

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																			IDEMIA			fIHD		licDysfunction							
1	56	M	169	65	22.8	85	89	0.9551	98	139	6.5	120	78	NO	156	90	48	140	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	8.20%
2	58	M	161	66	25.5	90	89	1.0112	139	289	7.9	130	90	YES	170	110	36	167	YES	NO	NO	YES	NO	YES	NO	NO	NO	YES	NO	NO	17.60%
3	62	M	163	74	27.9	91	96	0.9479	156	256	7.8	135	86	YES	178	140	34	156	YES	NO	NO	YES	YES	YES	NO	YES	YES	NO	NO	NO	26.90%
4	61	M	168	64	22.7	84	89	0.9438	99	136	6.6	123	72	NO	159	90	54	145	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	12.70%
5	53	F	163	71	26.7	93	102	0.9118	168	230	8.1	130	88	YES	156	118	45	178	YES	NO	NO	NO	YES	YES	NO	NO	NO	YES	NO	NO	4.10%
6	45	M	17	76	26	88	96	0.	97	13	5.	12	80	NO	13	67	50	11	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.

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			1					9167		0	4	9			0			0													90%
7	59	F	165	62	22.8	85	92	0.9239	114	167	6.6	129	78	NO	145	68	51	140	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	NO	4.70%
8	62	F	151	79	34.6	113	114	0.9912	201	187	6.7	146	78	YES	236	149	29	248	YES	NO	NO	YES	YES	YES	NO	YES	YES	NO	NO	20.60%
9	49	M	173	68	22.7	86	96	0.8958	130	206	7.6	112	82	NO	150	78	57	145	NO	NO	NO	YES	NO	NO	YES	YES	NO	NO	NO	NO	2.70%
10	52	F	159	57	22.5	64	78	0.8205	102	116	6.3	109	74	NO	146	67	50	132	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.60%
11	65	M	182	65	19.6	83	89	0.9326	110	134	6.1	126	78	NO	136	91	42	167	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	19.30%
12	52	F	157	55	22.3	88	100	0.88	101	114	6.9	136	89	YES	141	55	36	398	YES	NO	NO	YES	YES	YES	NO	YES	YES	NO	NO	NO	4.60%
13	44	M	176	65	21	73	78	0.9359	127	312	8.1	116	84	NO	167	65	49	122	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	2.20%

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14	64	M	177	69	22	83	82	10.0122	169	226	7.5	123	85	NO	145	70	35	146	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	19.80%
15	56	F	153	71	30.3	98	105	0.93333	1336	156	7	104	86	NO	1800	1101	33	127	YES	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	4%
16	62	F	144	73	35.2	116	112	1.03357	114	124	7.6	120	86	YES	2871	1811	53	325	YES	YES	NO	YES	YES	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO	11.70%
17	40	F	154	67	28.3	90	101	0.89111	130	346	7.1	114	82	NO	156	511	30	76	YES	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.70%
18	42	F	149	50	22.5	84	89	0.94388	118	245	7.3	113	70	NO	123	78	56	120	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.40%
19	64	M	152	69	29.9	79	88	0.89773	143	261	7.6	127	78	YES	167	67	43	102	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	23.50%
20	40	M	154	54	22.8	82	89	0.92133	116	146	7.5	131	90	NO	145	125	54	325	NO	NO	NO	YES	YES	YES	NO	NO	YES	YES	NO	NO	NO	NO	NO	1%
21	54	M	160	81	31.	106	110	0.9	206	333	81.	110	70	YES	198	120	58	245	YES	NO	NO	NO	NO	YES	YES	YES	NO	YES	YES	NO	NO	NO	NO	7.5

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					6			636																								0%
22	53	F	149	54	24.3	95	99	0.9596	104	284	7.6	122	90	NO	240	84	32	197	YES	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	6.30%
23	61	M	154	59	24.9	86	88	0.97733	95	3011	81.1	102	78	NO	155	86	34	172	YES	NO	NO	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO	12.40%
24	46	F	159	57	22.5	87	89	0.97755	142	1611	7	108	84	NO	141	88	55	100	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.70%
25	64	M	165	68	25	89	96	0.92711	151	2118	7.7	133	83	NO	148	112	41	76	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	20.80%
26	49	F	140	58	29.6	82	90	0.91111	130	2288	7.5	132	78	NO	146	64	30	95	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	3.30%
27	56	F	150	83	36.9	120	113	1.06119	110	148	7	133	90	YES	217	136	41	299	YES	NO	NO	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	NO	8.50%
28	41	M	158	54	21.6	91	88	1.03441	65	110	61.1	117	86	NO	131	98	44	83	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.10%

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29	53	F	145	55	26.2	105	96	1.0938	164	418	8.6	132	98	YES	147	82	56	163	YES	NO	NO	YES	YES	YES	NO	YES	YES	YES	NO	NO	3.10%
30	52	M	179	70	21.8	81	84	0.9643	156	368	7	149	78	YES	247	85	47	115	YES	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	16.50%
31	61	M	164	60	22.3	79	83	0.9518	116	254	6.3	148	92	YES	168	67	45	159	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	23.30%
32	47	M	169	67	23.5	101	105	0.9619	125	253	9	117	81	NO	151	81	43	130	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	3.20%
33	55	F	166	54	19.6	84	86	0.9767	121	244	7	130	81	NO	156	92	47	173	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	8.60%
34	40	F	165	68	25	109	107	1.0187	108	386	8	135	94	YES	207	60	52	145	YES	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	2%
36	63	M	167	64	22.9	96	99	0.9697	129	312	9	112	82	NO	154	127	47	164	YES	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	13.80%
37	51	F	163	82	30.	89	94	0.9	123	240	7	156	88	YES	257	82	53	183	YES	NO	NO	YES	YES	YES	NO	YES	YES	YES	NO	NO	NO	7.4

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					9			468																							0%
38	45	M	173	68	22.7	85	90	0.9444	152	216	7.7	119	78	NO	137	88	47	99	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.90%
39	53	F	164	56	20.8	109	105	1.0381	132	344	8.5	118	79	NO	141	89	51	89	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.90%
40	64	M	169	86	30.1	113	111	1.0118	155	280	9	124	92	YES	233	62	45	183	YES	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	NO	NO	27.60%
41	57	M	171	71	24.3	101	100	1.0118	143	308	9	149	81	YES	2401	158	58	146	YES	NO	NO	NO	YES	YES	NO	YES	YES	NO	NO	NO	NO	19.90%
42	48	F	154	73	30.8	90	94	0.9574	111	351	7	123	94	YES	208	65	44	170	YES	NO	NO	YES	YES	YES	NO	YES	YES	YES	NO	NO	NO	3.60%
43	46	F	155	78	32.5	90	96	0.9375	102	333	7	139	92	YES	120	105	51	100	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	1.30%
44	61	M	162	59	22.5	85	91	0.9341	121	351	7	138	86	NO	182	130	67	79	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	14.90%

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45	55	M	177	64	20.4	83	89	0.9326	109	267	7.2	109	75	NO	188	101	46	123	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	8.00%
46	57	F	159	78	30.9	102	103	0.9903	140	211	8	149	81	YES	196	68	39	102	YES	NO	NO	YES	YES	NO	NO	YES	YES	YES	NO	NO	NO	10.80%
47	45	M	168	62	22	84	89	0.9438	100	188	7	128	83	NO	160	120	46	142	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	3.00%
48	49	F	145	70	33.3	95	91	1.0444	142	242	8	132	79	YES	162	121	38	149	YES	NO	NO	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO	3.80%
49	40	F	162	71	27.1	90	94	0.9574	91	323	8	109	90	NO	105	125	51	104	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	0.30%
50	41	F	160	56	21.9	83	88	0.9432	101	278	7.3	104	83	NO	146	67	56	145	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.40%
51	49	F	163	79	29.7	93	98	0.949	157	257	9	141	84	YES	233	128	42	117	YES	NO	NO	NO	YES	YES	NO	YES	NO	NO	NO	NO	NO	6.20%
52	54	M	172	85	28.7	102	103	0.990	91	209	9	138	85	NO	201	106	40	139	YES	NO	NO	NO	YES	YES	NO	YES	YES	NO	NO	NO	NO	13.30

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								3																						%
53	51	F	155	54	22.5	110	106	1.0377	113	342	6.9	120	68	NO	134	78	53	88	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.40%
54	44	F	159	67	26.5	92	95	0.9684	92	306	9	146	84	YES	168	118	47	120	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	2.40%
55	53	M	173	75	25.1	98	101	0.9703	134	351	9	102	79	NO	227	98	33	189	YES	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	10.20%
56	58	F	151	63	27.6	109	105	1.0381	148	393	7	141	89	NO	172	114	50	136	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	5.80%
57	48	F	156	54	22.2	79	86	0.9186	91	157	7	112	66	NO	143	79	51	98	NO	NO`	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.00%
58	53	M	173	60	20	84	89	0.9438	163	211	8	126	84	NO	236	117	56	142	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	20.60%
59	60	M	166	79	28.7	96	89	1.0787	126	246	84	138	85	YES	244	107	42	121	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	27.10%
6	4	F	15	8	33	10	10	1	14	25	0.	12	8	N	16	7	2	14	YE	N	N	YE	N	YE	N	YE	N	N	N	N	3.

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0	4		4	0	.7	1	1		9	1	5	6	0	O	7	7	9	4	S	O	O	S	O	S	O	S	O	O	O	O	00%
61	59	F	164	78	29	105	103	1.0194	145	167	81.1	110	87	YES	161	123	51	183	YES	NO	YES	YES	YES	YES	YES	YES	NO	NO	NO	NO	5.00%
62	51	F	154	80	33.7	88	109	0.80073	152	344	9	108	82	NO	205	96	44	168	YES	NO	NO	NO	NO	NO	NO	YES	YES	YES	NO	NO	2.50%
63	62	M	168	64	22.7	81	86	0.94119	1111	145	6.8	126	76	NO	1305	75	52	171	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	12.60%
64	63	M	159	81	32	109	108	1.00093	141	321	9	147	80	YES	132	103	57	118	NO	NO	NO	NO	YES	YES	NO	YES	YES	YES	NO	NO	19.70%
65	46	F	151	53	23.2	113	103	1.09711	126	149	7	132	84	NO	187	86	67	121	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.20%
66	47	F	149	54	24.3	86	90	0.95556	114	262	8	114	78	NO	222	66	58	135	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.60%
67	48	M	173	71	23.7	79	87	0.9088	1164	189	7	106	81	NO	185	75	60	107	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	2.80%
64	F	1	6	2	1	1	0	1	3	9	1	9	Y	2	6	2	1	Y	N	N	Y	Y	Y	N	Y	Y	N	N	N	1	

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8	3		50	4	8.4	03	12	.9196	01	43	.1	60	5	ES	23	3	9	45	ES	O	O	ES	ES	ES	O	ES	ES	O	O	O	0.10%
69	53	M	177	76	24.3	84	89	0.94388	148	271	7	146	92	YES	207	123	56	108	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	12.00%
70	52	F	157	63	25.6	87	95	0.91588	138	282	9	116	75	NO	123	89	32	139	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	2.40%
71	50	M	173	67	22.4	83	88	0.94328	115	171	7.1	110	82	NO	243	78	57	163	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	5.80%
72	50	F	172	73	24.7	112	89	1.25844	153	242	7.2	147	81	NO	198	121	59	132	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	2.80%
73	63	M	174	76	25.1	89	98	0.90827	127	326	8	114	80	NO	278	79	43	165	YES	NO	NO	NO	NO	YES	NO	YES	NO	NO	NO	NO	NO	NO	23.20%
74	45	M	164	70	26	95	97	0.97944	151	374	8	141	87	NO	216	82	35	123	NO	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO	NO	NO	NO	8.00%
75	57	F	147	63	29.2	91	104	0.87	166	368	8	156	84	NO	122	88	48	177	YES	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	4.80

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								5																						%
76	40	F	156	79	32.5	96	100	0.96	113	376	7	124	74	NO	1011	114	45	122	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.40%
77	45	M	160	76	29.7	98	106	0.92455	235	374	11	148	76	YES	456	69	52	189	YES	NO	NO	YES	YES	YES	YES	YES	YES	YES	NO	NO	20.90%
78	45	F	154	86	36.3	114	107	1.06544	118	395	9	122	95	YES	223	80	45	132	NO	NO	NO	YES	YES	YES	NO	NO	YES	NO	YES	NO	3.20%
79	48	F	158	62	24.8	83	88	0.94432	90	261	76	108	74	NO	157	71	54	122	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.000%
80	62	F	161	73	28.2	86	90	0.95556	129	277	74	140	76	YES	250	108	29	163	YES	NO	NO	NO	YES	YES	NO	YES	NO	NO	NO	NO	19.80%
81	58	F	156	72	29.6	101	99	1.02029	189	338	89	122	80	NO	206	62	46	142	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	NO	5.50%
82	54	M	163	71	26.7	95	99	0.95596	150	231	7	124	91	YES	238	95	44	162	YES	NO	NO	NO	NO	YES	NO	YES	NO	NO	NO	NO	14.50%
83	56	M	16	59	21.	80	84	0.9	12	30	6.	12	82	NO	11	69	45	13	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	6.1

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			5		7			524	2	9	9	2			1			4												0%
84	65	M	157	67	27.2	86	88	0.9773	1651	301	9	156	94	NO	147	81	33	189	NO	NO	NO	YES	YES	YES	NO	YES	YES	NO	NO	NO	31.90%
85	62	F	153	52	22.2	79	86	0.9186	1112	2201	7.1	130	84	NO	116	70	47	130	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	6.10%
86	65	F	153	53	22.6	76	84	0.9048	1044	2733	7.4	113	82	NO	114	104	51	134	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	6.40%
87	55	F	164	62	23.1	81	87	0.9311	1577	2207	7	150	95	YES	243	115	42	126	YES	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	10.90%
88	54	F	159	81	32	88	92	0.9565	1544	3655	8	156	94	NO	334	134	42	193	YES	NO	NO	YES	YES	YES	NO	YES	YES	YES	NO	NO	11.40%
89	56	M	160	65	25.4	84	91	0.9231	1154	2547	7	111	78	NO	210	127	33	108	YES	NO	NO	NO	NO	YES	NO	NO	YES	NO	NO	NO	13.40%
90	62	M	169	62	21.7	78	80	0.9750	90	2117	7.6	98	85	NO	170	93	45	129	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	11.30%

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91	46	F	159	79	31.2	107	105	10.019	164	376	8.9	114	91	NO	137	120	43	172	YES	NO	NO	YES	NO	YES	NO	YES	NO	NO	NO	NO	10%
92	47	F	163	80	30.1	82	94	0.87233	118	211	8	148	93	YES	169	111	58	182	YES	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	2.40%
93	63	M	167	61	21.9	97	99	0.97981	131	385	7	149	89	YES	235	63	54	126	YES	NO	NO	YES	YES	NO	YES	YES	NO	NO	NO	NO	NO	31.20%
94	63	F	165	58	21.3	78	86	0.9007	97	224	8	110	78	NO	118	69	56	104	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	4.60%
95	58	F	158	84	33.6	88	93	0.94625	116	234	7	105	80	NO	181	65	58	129	NO	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO	NO	NO	3.10%
96	51	M	156	52	21.4	84	88	0.95455	142	236	8	132	82	NO	121	64	35	164	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	5.60%
97	52	M	168	62	22	83	107	0.77557	129	298	7	128	81	NO	143	107	52	130	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	5.00%
98	42	F	150	53	23.6	87	95	0.915	106	375	9	131	81	NO	156	114	59	146	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.70%

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								8																						
99	48	F	163	62	23.3	114	82	1.3902	105	297	9	125	87	NO	1100	1100	47	163	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.00%
100	41	F	152	81	35.1	113	94	1.2021	149	234	7	145	77	YES	2022	70	45	164	YES	NO	NO	NO	NO	YES	YES	NO	YES	YES	NO	NO	NO	NO	3.00%
101	40	F	159	56	22.2	84	88	0.9545	89	126	7.1	124	74	NO	1455	67	51	87	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	0.60%
102	40	F	156	60	24.7	79	84	0.9405	130	275	8	144	91	YES	167	113	54	153	YES	NO	NO	NO	NO	YES	NO	NO	YES	NO	NO	NO	NO	NO	1.40%
103	64	M	161	85	32.8	91	94	0.9681	94	228	7.9	139	77	NO	169	85	49	195	YES	NO	NO	NO	NO	NO	YES	NO	YES	YES	NO	NO	NO	NO	9.20%
104	65	F	155	66	27.5	90	97	0.9278	165	366	7	107	81	NO	158	87	44	192	YES	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO	NO	NO	NO	7.30%
105	59	M	157	72	29.2	89	106	0.8396	123	248	7.3	141	77	YES	335	115	34	167	YES	NO	NO	YES	YES	YES	YES	NO	YES	YES	NO	NO	NO	NO	39.40%
10	5	M	16	6	22	8	8	0.	10	20	7	11	6	N	19	8	4	13	N	N	N	N	N	N	N	N	N	N	N	N	N	N	11

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6	7		4	1	.7	4	8	9545	5	5		3	6	O	4	6	0	4	O	O	O	O	O	O	O	O	O	O	O	O	.70%
107	40	M	168	73	25.9	84	87	0.9655	142	285	9	123	82	NO	162	72	35	190	YES	NO	NO	NO	NO	YES	NO	YES	YES	NO	NO	NO	2.20%
108	62	M	161	59	22.8	81	83	0.9759	127	290	7	140	87	NO	181	106	54	140	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	18.90%
109	47	F	150	60	26.7	83	87	0.954	120	167	6.9	146	77	YES	194	92	50	105	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	3.50%
110	61	F	161	56	21.6	78	83	0.9398	147	186	6.5	102	67	NO	103	116	56	128	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	2.80%
111	51	M	164	65	24.2	80	86	0.9302	99	196	7.3	122	79	NO	179	122	46	108	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	6.30%
112	45	F	145	72	34.2	110	113	0.9735	152	256	86.6	150	82	YES	167	124	56	130	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO	NO	NO	2.10%
113	59	F	147	76	35.2	93	99	0.9394	163	273	83.3	141	92	YES	143	123	37	100	YES	NO	YES	YES	YES	YES	yes	YES	yes	NO	NO	NO	9.30%

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114	55	F	148	76	34.7	96	110	0.87277	108	301	9	160	76	NO	2000	103	33	148	YES	NO	NO	YES	YES	YES	NO	YES	YES	NO	NO	NO	9.40%
115	52	F	156	59	24.2	88	91	0.9677	166	204	7.6	104	82	NO	101	60	32	112	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	1.50%
116	50	M	148	77	35.2	114	110	1.0364	110	371	8	118	79	NO	235	111	54	187	YES	NO	NO	NO	YES	YES	NO	YES	YES	YES	NO	YES	NO	6.60%
117	40	M	167	64	22.9	84	89	0.9438	130	351	8	118	82	NO	240	78	55	137	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	2.30%
118	46	F	145	52	24.7	104	107	0.9772	155	2402	9	133	77	YES	236	61	34	131	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	6.60%
119	56	F	146	61	28.6	94	100	0.944	123	369	7	118	76	YES	165	113	30	138	YES	NO	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	6.80%
120	43	F	157	62	25.2	85	90	0.9444	116	2472	8	120	86	NO	186	121	57	126	NO	NO	NO	NO	YES	NO	NO	YES	NO	NO	NO	NO	NO	1.00%
121	57	M	165	62	22.8	86	89	0.9663	145	397	9	129	81	NO	238	68	58	185	YES	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	13.40%

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122	51	M	156	66	27.1	107	106	10.0094	149	224	9	123	80	NO	165	87	58	140	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	4.50%
123	45	M	166	64	23.2	86	90	0.9556	1118	2667	8	143	91	YES	169	78	54	171	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	3.80%
124	58	M	169	76	26.6	111	113	0.98233	1206	3162	9	102	76	NO	106	115	38	103	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	NO	NO	NO	6.10%
125	42	M	168	72	25.5	80	87	0.91955	1296	3622	7	132	88	YES	175	198	60	1302	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	2.10%
126	45	F	151	61	26.8	107	103	1.03888	1611	2211	7	118	76	NO	137	72	45	191	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	NO	NO	1.00%
127	65	M	153	71	30.3	107	109	0.98177	1300	2366	8	115	88	YES	197	105	32	136	YES	NO	NO	YES	YES	YES	NO	NO	YES	NO	NO	NO	NO	28.10%
128	45	F	157	56	22.7	79	86	0.91866	1154	2744	8	143	77	YES	116	159	33	151	YES	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	2.40%
129	46	M	166	63	22.	82	83	0. 9	156	211	7	138	79	YES	160	108	45	111	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	4.6

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					9			88																							0%
130	57	M	163	67	25.2	109	108	1.0093	106	283	8	110	79	NO	131	71	57	146	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	5.60%
131	55	F	169	60	21	84	88	0.9545	91	267	7.3	115	79	NO	226	67	58	106	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	3.40%
132	42	M	171	73	25	88	92	0.9565	161	243	7.6	130	81	NO	213	108	43	179	YES	NO	NO	NO	NO	YES	NO	NO	YES	NO	NO	NO	NO	3.90%
133	41	F	152	82	35.5	92	97	0.9485	114	364	9	113	79	NO	103	107	32	193	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO	0.70%
134	64	F	147	58	26.8	90	96	0.9375	128	223	8	144	88	YES	214	155	41	196	YES	NO	NO	YES	YES	YES	NO	YES	YES	NO	NO	NO	NO	18.50%
135	65	M	164	60	22.3	82	87	0.9425	135	358	8.9	117	81	NO	118	89	45	108	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	15.00%
136	53	F	146	61	28.6	100	102	0.9804	156	311	9	140	87	YES	137	112	47	134	YES	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	3.90%
1	4	M	1	6	2	7	8	0	1	3	8	1	9	Y	2	1	5	1	Y	N	N	N	Y	Y	N	N	N		N	N	6

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37	44		72	6	2.3	9	4	.9405	66	69	.6	35	2	ES	43	57	1	88	ES	O	O	O	ES	ES	O	O	O	NO	O	O	.10%
138	48	M	160	58	22.7	78	84	0.9286	116	256	7	145	94	YES	129	94	46	117	NO	NO	NO	NO	YES	NO	NO	YES	NO	NO	NO	NO	4.40%
139	47	F	153	81	34.6	106	108	0.98115	160	346	86.6	103	88	YES	210	62	55	336	YES	NO	NO	NO	YES	YES	NO	YES	YES	YES	NO	NO	1.70%
140	46	F	155	71	29.6	108	110	0.98188	170	275	82.2	111	78	YES	214	127	55	143	YES	NO	NO	NO	YES	YES	NO	YES	NO	NO	YES	NO	1.90%
141	63	M	168	78	27.6	113	114	0.99122	119	206	75.5	128	94	YES	210	106	51	194	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	NO	23.60%
142	49	M	171	66	22.6	78	83	0.9398	98	189	71.1	131	88	YES	197	73	55	134	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	6.40%
143	58	F	151	71	31.1	90	96	0.93755	133	266	76.6	125	76	NO	168	121	58	105	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	4.00%
144	56	F	157	55	22.3	78	89	0.87	115	134	71.1	136	81	NO	119	82	57	140	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	2.70

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								64																							%
145	65	M	162	58	22.1	81	86	0.9419	130	283	7.6	116	89	NO	179	143	48	143	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	18.80%
146	58	F	152	81	35.1	108	106	1.01889	126	348	84.1	103	90	YES	186	150	42	165	YES	NO	NO	YES	YES	YES	NO	YES	NO	NO	NO	NO	5.20%
147	60	M	168	64	22.7	83	87	0.9544	106	146	6.9	118	78	NO	157	67	46	107	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	12.00%
148	61	M	166	60	21.8	79	86	0.9186	117	145	6.9	122	68	NO	143	70	45	117	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	12.90%
149	51	F	165	61	22.4	81	88	0.9205	89	167	71.1	130	78	NO	134	87	56	116	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.60%
150	53	M	178	79	24.9	83	91	0.9121	102	134	73.3	126	82	NO	156	77	49	90	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	6.40%

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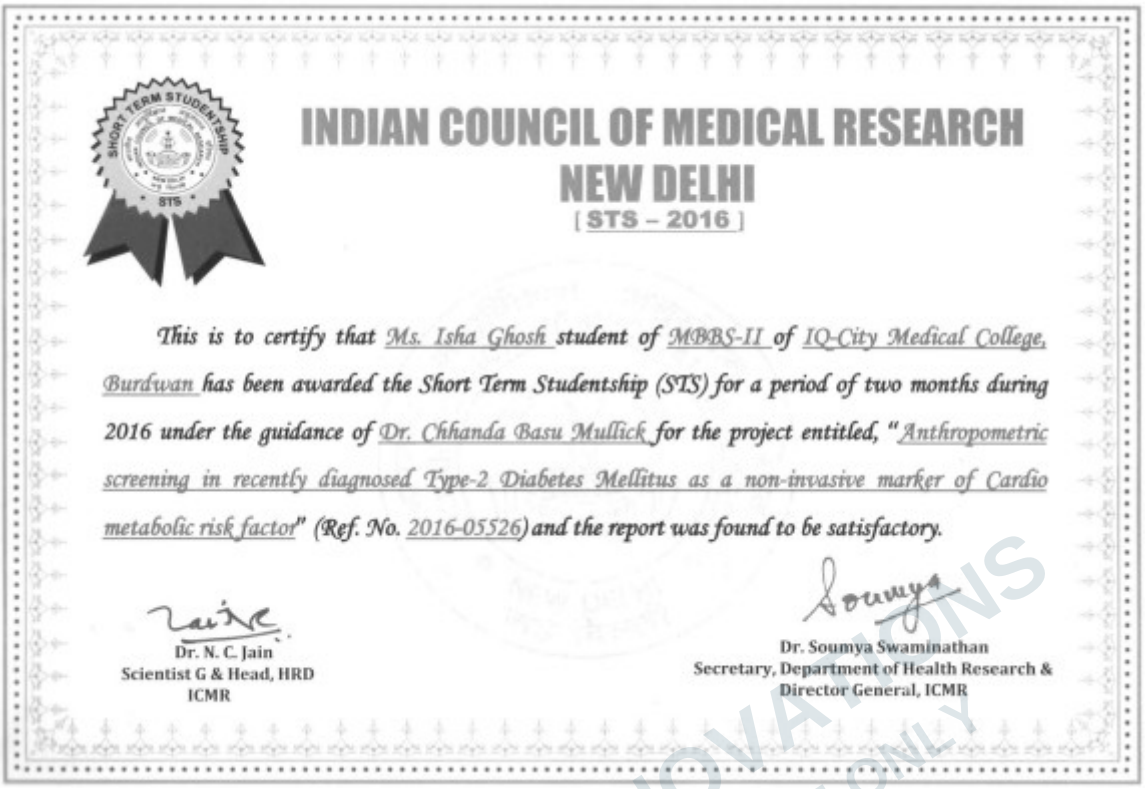

INDIAN COUNCIL OF MEDICAL RESEARCH
NEW DELHI
[STS – 2016]

This is to certify that Ms. Isha Ghosh student of MBBS-II of IQ-City Medical College, Burdwan has been awarded the Short Term Studentship (STS) for a period of two months during 2016 under the guidance of Dr. Chhanda Basu Mullick for the project entitled, "Anthropometric screening in recently diagnosed Type-2 Diabetes Mellitus as a non-invasive marker of Cardio metabolic risk factor" (Ref. No. 2016-05526) and the report was found to be satisfactory.

Dr. N. C. Jain
Scientist G & Head, HRD
ICMR

Dr. Soumya Swaminathan
Secretary, Department of Health Research &
Director General, ICMR

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