CONICITY INDEX AS A SCREENING TOOL FOR CARDIOVASCULAR RISK FACTORS IN INDIANS

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CERTIFICATE – I

This is to certify that this dissertation entitled "CONICITY INDEX AS A SCREENING TOOL FOR CARDIOVASCULAR RISK FACTORS IN INDIANS" submitted byDr.V. ANIRUDH SRINIVAS is a bonafide original work carried out by him under theguidance of Dr.Chandrasekar, Professor, Department of General Medicine,Govt. Stanley Medical College, Chennai towards the partial fulfillment ofuniversity regulations for the award of M.D. General Medicine Degreeexamination of the Tamil Nadu Dr. M.G.R Medical University, Chennai to beheld in May,2023.

GUIDE

Prof.Dr.I ROHINIM.D.
Unit Chief,
Department of General Medicine,
Stanley Medical College & Hospital,
Chennai

Dr. I. ROHINI, M.D
(GENERAL MEDICINE)
ASSOCIATE PROFESSOR OF MEDICINE
Reg. No. 47290
GOVT. STANLEY MEDICAL COLLEGE & HOSPITAL,
CHENNAI-600 001.

HOD

Prof.Dr.S.PARIMALA SUNDARI M.D.,
Head of the Department
Department of GeneralMedicine,
Stanley Medical College &Hospital,
Chennai

Professor and Head of
Department of Medicine,
Govt. Stanley Medical College & Hospital
Chennai - 600 001

Dean,

Prof.Dr.P.BALAJIM.S.,FRCS.,Ph.D.,FCLS.,
Government Stanley Medical College and Hospital,
Chennai

DEAN
STANLEY MEDICAL COLLEGE
CHENNAI - 600 001

DECLARATION

I, Dr.V. ANIRUDH SRINIVAS , solemnly declare that the dissertation titled" CONICITY INDEX AS A SCREENING TOOL FOR RISK FACTORS IN INDIANS" is a bonafide work done by me at Government Stanley Hospital, Chennai between April 2021 and July 2022 under the guidance and supervision of Prof.Dr.I ROHINI M.D.,Professor of Medicine, Government Stanley hospital, Chennai. I also declare that this bonafide work or a part of this work was not submitted by me or any other forward degree or diploma to any other university, board either in India or abroad. This dissertation is submitted to the Tamil NaduDr. M.G.R Medical University, towards the partial fulfillment of requirement for the award of M.D. Degree (Branch – I) in General Medicine.

Place: Chennai

Date: 12|12|2022

Signature of the candidate

Dr V. ANIRUDH SRINIVAS

Reg No:200120101031

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This is to certify that this dissertation work titled "CONICITY INDEX AS A SCREENING TOOL FOR CARDIOVASCULAR RISK FACTORS IN INDIANS" of the candidate Dr.V Anirudh Srinivas with Registration Number 200120101031 for the award of M.D. DEGREE in the branch of BRANCH-I (GENERAL MEDICINE). I personally verified theouriginal.com website for the purpose of plagiarism check. I found that the uploaded thesis file contains, from introduction to conclusion pages and result shows7 percentage of plagiarism in the dissertation.

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Dr. I. ROHINI, M.D
(GENERAL MEDICINE)
ASSOCIATE PROFESSOR OF MEDICINE
Reg. No. 47290
GOVT. STANLEY MEDICAL COLLEGE & HOSPITAL,
CHENNAI-600 001.

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LIST OF ABBREVIATIONS

AG: abdominal girth

AO: Abdominal obesity

AUC: Area under curve

BIA: Bioelectrical impedance

BMI : Body Mass Index

CHD: Coronary Heart Disease

CI: Conicity Index

CT: Computed tomography

CVD: Cardiovascular disease

DEXA: Dual energy x ray absorptiometry

FFA: Free fatty acids

FFM: Fat free mass

FFMI: Fat-free mass index

FM : fat mass

FMI: fat mass index

FRS: Framingham Risk Score

GLUT – 4: Glucose transporter 4

GO: Generalised obesity

HbA1C: Glycosylated haemoglobin

HC: Hip Circumference

HDL: High- density cholesterol

HIV: Human Immunodeficiency Virus

ICMR- INDIAB: Indian Council of Medical Research–India Diabetes

IDF: International Diabetes federation

IL-6: Interleukin 6

IRS – 1: Insulin Receptor Substrate – 1

IRS- 2: Insulin Receptor Substrate – 2

LDL: Low- density cholesterol

MCP-1 : Monocyte chemoattractant protein 1

MI: Myocardial Infarction

MMIF: Macrophage Migration Inhibiting factor

MRI: Magnetic resonance imaging

NASH: Non- alcoholic steatohepatitis

NCEP- ATP III: National Cholesterol Education Program-Adult Treatment Panel III

NHANES: National Health and Nutrition Examination Survey

NF- κβ: nuclear factor kappa beta

NSAIDS: Non – steroidal anti-inflammatory drugs

PROCAM: Prospective Cardiovascular Mϋnster

SAD : Sagittal abdominal diameter

SAT: Subcutaneous adipose tissue

SCORE: Systematic Coronary Risk Evaluation

TBW: Total body water

TG: Triglyceride

TNF – α: Tumor Necrosis factor alpha

TSH: Thyroid stimulating hormone

VAT: Visceral Adipose Tissue

VLDL: Very low-density lipoprotein

WC: Waist circumference

WHR : Waist – to – hip ratio

WHtR: Waist – to – height ratio

LIST OF TABLES

LIST OF GRAPHS

LIST OF FIGURES

TABLE OF CONTENTS

ABSTRACT

ABSTRACT

Title – Conicity Index As A Screening Tool For Cardiovascular Risk Factors In Indians.

Background and objectives –

Anthropometric indices and body measurements are used as indicators of measures of body fat distribution since axial computed tomography (the gold standard to assess body fat distribution) is expensive as well as time-consuming. The most appropriate anthropometric index to assess body fat distribution still remains unclear. Measures of centralized adiposity like Waist circumference (WC) Waist-To-Hip-Ratio (WHR), etc are superior to Body Mass Index (BMI) which is the most commonly used and available index, indetecting cardiovascular risk factors.

Conicity Index (CI) is relatively unknown anthropometricindex which allows for comparison of abdominal adiposity between individuals of varying height, weight, and populations, as the formula contains the height, weight and waist circumference. Waist circumference, Waist-to-hip ratio et care good representatives of abdominal obesity, have shown variable results in predicting cardiovascular risk factors among different races and populations globally. In Western populations CI as a predictor ofcardiovascular risk factors has been studied but there are very few studies on Indians on the use of CI for prediction of cardiovascular risk factors.

Objectives –

To study the utility of Conicity Index as a screening tool for cardiovascular risk factors in Indians and compare CI with other anthropometric measures like BMI, WHR, WC etc. as a correlate of cardiovascular risk factors.

Methods:

Subjects above the age of 18 years availing the Master Health Checkup facility at Government Stanley Medical College and Hospital were taken into the study. Anthropometric measurements like waist circumference, hip circumference, weight and height were taken. A brief medical history was taken and physical examination was done. Fasting blood glucose, post prandial blood glucose, fasting lipid profile, and serum TSH was tested. Statistical analysis of the data was done to arrive at a cut-off of CI as a screening tool for cardiovascular risk.

Results- A positive but weak correlation was found between CI and cardiovascular risk. The cut-off value of CI to enable an action level to prevent cardiovascular mortality was 1.23. A stronger correlation was found between WHtR and cardiovascular risk. WHtR was found to be a better screening tool in men and women. CI also correlated strongly with waist circumference, PPBS, SBP.

Interpretation and Conclusion – A better correlation was found between WHtR and cardiovascular risk in men and women, signifying that increasing waist circumference, and therefore abdominal obesity has a strong role in the causation of cardiovascular morbidity and mortality. These findings to inculcate the fact that measures of abdominal obesity are required to determine the metabolic risk factors of an individual to start on primary preventive strategies against cardiovascular diseases , hence enabling us physicians to reduce the global cardiometabolic risk.

Keywords: Obesity; abdominal obesity; cardiovascular risk factors.

INTRODUCTION

INTRODUCTION

India as well like all developing countries getting engulfed in obesity which is now a worldwide pandemic Obesity is due to an imbalance in energy intake and energy expenditure. Changes in diet and work from home lifestyle are other contributing factors towards increase in cases of obesity which is accompanied by changes in economy and the resultant globalisation. Recently increase in central adiposity or abdominal obesity is particularly implicated in the development of diabetes [1], hypertension , and cardiovascular co-morbidities. Metabolic syndrome refers to the co-existence of several known cardiovascular risk factors, including hypertension, insulin resistance, atherogenic dyslipidemia and obesity. These conditions are interconnected and have common pathways, mediators and mechanisms. It is imperative to identify patients with metabolic syndrome as they are at high risk of developing cardiovascular disease and type 2 diabetes, both of which contribute significantly to morbidity and mortality. The value of metabolic syndrome as a scientific concept remains controversial. The presence of metabolic syndrome alone cannot predict global cardiovascular disease risk. Abdominal obesity, a marker of 'dysfunctional adipose tissue', is the most prevalent manifestation of metabolic syndrome – hence it is a very important in clinical diagnosis of metabolic syndrome. Better risk assessment algorithms are needed to quantify cardiovascular disease risk on a global scale. At every visit to a doctor , anthropometric measures can be used to assess central adiposity and to initiate a cardiovascular risk factor screening and by which we can introduce to the general public, a simple concept of modifiable risk factor reduction. Body Mass Index (BMI) is the most commonly used anthropometric index to assess the prevalence of overweight and obesity. There are several criticisms to using BMI as a sole marker for obesity as it does not enunciate the composition of body weight. The most prevalent form of this cluster of metabolic abnormalities linked to insulin resistance is found in patients with abdominal obesity, especially with an excess of intra-abdominal or visceral adipose tissue (VAT). Several anthropometric indices such as waist circumference (WC) , waist – to hip ratio (WHR) , waist to height ratio (WHtR) have been used as clinical measures of central obesity. [2] Obesity is defined by a state of chronic, low-grade inflammation which is associated with increased markers of inflammation and oxidative stress [3] and its well known that oxidative stress accelerates atherosclerotic disease process.

Visceral adiposity has been connected to Type 2 diabetes, and cardiovascular disease risk factors such as insulin resistance and dyslipidemia[4.] Nevertheless, the quest for best adiposity indices as markers of cardiovascular risk remain still unassailable and very few studies have been performed in Asian populations in this regard. Waist-to-hip ratio (WHR), waist circumference (WC) or sagittal abdominal diameter (SAD) - the height of the abdomen when the patient is in the supine position - are a few standard measures used in general practice to estimate the visceral adiposity. It is thought that WC represents visceral and subcutaneous fat while hip circumference (HC) reflects subcutaneous fat only. Conicity Index (CI) is an anthropometric index, first described by Valdez 5 et al, developed based on a model that suggests people who accumulate fat around the abdomen have a shape similar to a double cone with base at the waist, whereas those people who have less fat in the central region have the shape of a cylinder. CI includes the variables of weight, height and WC, hence weakening the correlation between WC and height, inferring that central obesity is associated with higher risk for cardiovascular disease than general obesity. Evidence has pointed out that Asian populations have different associations between BMI, percentage of body fat, and health risks as compared to European populations. Higher percentage of body fat at lower BMIs also reflects increased risk of disease (i.e., diabetes and heart disease), risk factors for chronic disease, and death in Asian populations. Use of anthropometric indices such as the CI during routine health check ups may provide a breakthrough for early initiation of primary preventive strategies. Various studies from WHO reveal that there are ethnic-specific cut-off values for different anthropometric parameters. Recent studies have identified ethnic specific cutoffvalues for BMI, WC, HC, WHR and WHtR for Asians, North Americans, South Americans, Africans, Hispanic, Middle-Eastern, Aboriginals and Pacific in landers. Minimal studies have been done to determine the cut off values of anthropometric indices for the risk of metabolic complications in Indian population..

AIM AND OBJECTIVES

Aim

1. To study the utility of Conicity Index as a screening tool for cardiovascular risk factors in Indians

Objective

1. To compare CI with other anthropometric measures like BMI, WHR, WC etc. as a correlate of cardiovascular risk factors.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

OBESITY

World Health Organisation defines overweight and obesity as abnormal or excessive fat accumulation that can impair health. Body mass index (BMI) is used by the World Health Organisation to define severity of overweight and obesity across populations.[6]

Obesity is one of the most common and among the most neglected public health problems in both developed and developing countries. [7]According to the WHO World Health Statistics Report 2012, globally one in six adults is obese. [8]Obesity is now a pandemic affecting all age groups in the 21st century with the rates almost tripling since 1975. [9]

Most of the world's population live in countries where overweight and obesity kills more people than underweight. In 2016, more than 1.9 billion adults were overweight. Of these over 650 million wereobese. Globally, there are more people who are obese than underweight – this occurs in every region except parts of sub-Saharan Africa and Asia.

Studies from different parts of India have provided evidence of the rising prevalence of obesity[10].However, to date, there has been no nationally representative study on the prevalence of obesity in India.

Obesity is generally classified as generalized obesity (GO) and abdominal obesity(AO). Generalised obesity – is defined as a BMI ≥ 25 kg/m2for both genders based on the World Health Organisation Asia Pacific Guidelines with or without abdominal obesity.[11] Abdominal obesity – is defined as a waist circumference (WC) ≥ 90 cm for men and ≥ 80 cm for women with or without generalised obesity. [12] Based on The ICMR-INDIAB study [13], an cross-sectional nationalstudy on the prevalence of diabetes and related disorders such as obesity and hypertension, the prevalence of abdominal obesity was higher than generalised obesity and urban residents had a higher prevalence of both forms of obesity than rural residents. This study shows that large increases in prevalenceof obesity not only in urban areas but also in rural areas in India and with further urbanisation, sedentary lifestyle and behaviour we can expect further increase in theincidence and prevalence of obesity in India.

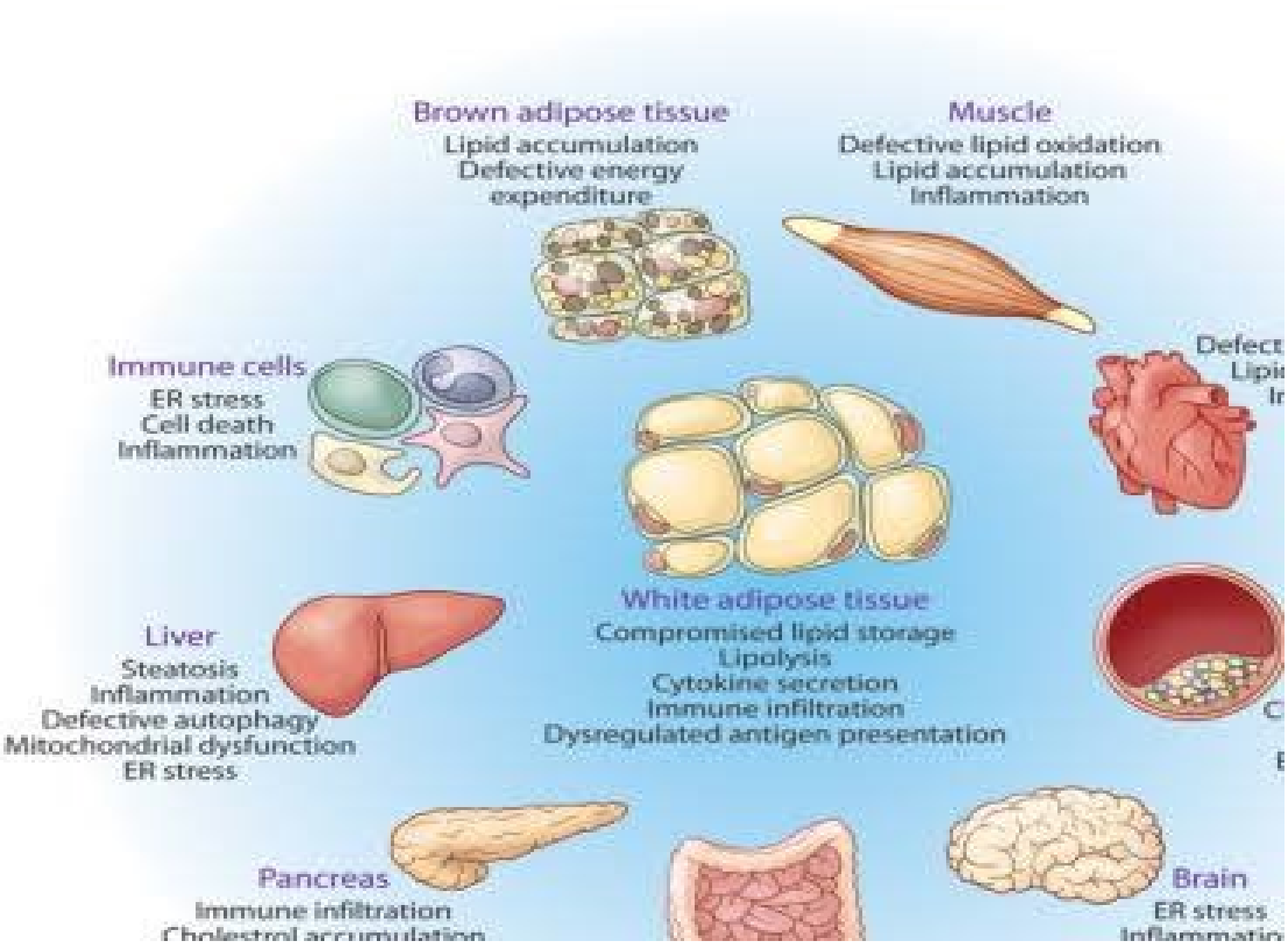
The "Asian Indian" phenotype actually refers to the fact that Indians have a greater predisposition to abdominal obesity and accumulation of visceral fat. This phenotype enumerates that despite relatively lower prevalence rates of generalised obesity, there tends to be a greater degree of central obesity and increased body fat, particularly increased visceral fat leading to higher plasma insulin levels and insulin resistance. [14]

PATHOPHYSIOLOGY AND EFFECTS OF OBESITY

Obesity is an exaggeration of normal adiposity and is a major player in the

pathophysiology of various metabolic abnormalities like diabetes mellitus, insulin resistance, dyslipidemia, hypertension, and atherosclerosis, , mainly due to its secretion of excessive adipokines Obesity is a major contributor to metabolic dysfunction involving lipid and glucose, but on a broader scale, it influences organ dysfunction involving every organ system. Obesity contributes to immune dysfunction due to effects from adipokine secretion and is a major risk factor for many cancers, including hepatocellular, oesophageal, and colon cancers.

The accelerating effects of obesityon the worsening of metabolicsyndrome and cancer has the potential to be profoundly devastating to humans.[15]Hence,methods for prevention or effective treatment of obesity is imperative. Stored fat is required for survival during starvation where the person is nutritionally deprived. Free fatty acid toxicity is prevented by storing of triacylglycerol within the adipocytes as these free fatty acids in the vasculature will produce oxidative stress by disseminating throughout the body.[15] However obesity is created by the excessive storage which leads to release of excessive free fatty acids due to enhanced sympathetic state of obesity. Excessive free fatty acids then incites lipotoxicity, as lipids and their metabolites createoxidant stress to the endoplasmic reticulum and mitochondria. This affects adipose aswell as non-adipose tissue, causing its pathophysiology in many organs, such asthe liver and pancreas, and in the metabolic syndrome. The excessively released free fatty acids alsoinhibit lipogenesis, leading to inadequate clearance of serum triacylglycerol levels thatcontribute to hypertriglyceridemia.



Release of free fatty acids by endothelial lipoproteinlipase from increased serum triglycerides within elevated β lipoproteins causeslipotoxicity that results in dysfunction of insulin receptor leading to a insulin resistant state creating hyperglycemia with compensated hepatic gluconeogenesis. Free fatty acids also decrease utilisation of insulinstimulated muscle glucose, contributing further to hyperglycemia. Lipotoxicity has direct effect on pancreatic β-cell as it decreses its secretion and eventually resulting in β-cell exhausation[15]

Sites and Function of Adipokines

Adipocytes are multi dimensional as they not only store triacylglycerol in fatdepots at various body sites to provide energy reserves, but in aggregate form thelargest endocrine tissue which constantly communicates with other tissues by secretagogues, such as the proteohormones lectin, adiponectin, andvisfatin.These proteohormones help the body regulate fat mass[16] along with insulin.Other genegroups that contribute to adipokines are cytokines, growth factors, andcomplement proteins.Gluteal fat appears to be largely inert with respect to endocrine function, as this fat isused largely for long-term energy reserves.Visceral fat depots release inflammatory adipokines, which, along with free fatty acids,provide the pathophysiologic basis for comorbid conditions associated with obesitysuch as insulin resistance and type 2 diabetes mellitus.

Visceral adipokines are transported by the portal venous system into the liver, causingnon-alcoholic steatohepatitis (NASH), and to other systemic complications. Adipocytes also stimulate fat-associated macrophages that also secrete monocytechemoattractant protein 1 (MCP-1), macrophage migration inhibiting factor (MMIF),and resistin, all of which leads to enhaced resisitance to insulin.[17]These macrophages contribute to the enhanced inflammatory state by enhancing the mitogen-activated protein kinase family (C-Jun N-terminalKinase, inhibitor ofNF-KB Kinase b, andphosphatidylinositol3-Kinase), inducing the transcription factor NF-KB that allows dephosphorylation of the IRS-1 and -2 docking proteins. The latter inhibits the GLUT4 transporter of glucose, enhancing insulin resistance.

The gradually increasing pro-inflammatory state resulting from increased obesity that promotesinsulin resistance also mediates atherogenesis throughout its development, from intiaition of early endothelial fatty streaks to late-plaque formation, rupture, and thrombosis.Vasoactive endothelial growth factor, plasminogenactivator inhibitor-1, angiotensinogen, renin, and angiotensin IIare secreted by white adipocytes, especially in and around the blood vessels that contribute to vasomotordysfunction which cause hypertension and endothelial injury.This process is followed bythe formation of foam cells due to the enhanced endothelial uptake ofoxidized lowdensity lipoproteins, free fatty acids, and other metabolites that accumulate as aresult of peroxidation of fatty acids occurring due to dysfunctional dyslipidemic β-lipoproteins.

Both endothelial and adipose cell lipoprotein lipase activity are alsodecreased by inflammatory cytokines such as IL-6. Hence by inhibiting lipolysis theyincrease serum triacylglycerol levels accentuating hyper-triglyceridemia.Asatherosclerosis progresses with macrophage and smooth–muscle cell infiltration, thereis productionof other cytokines like MCP-1, MMIF, and endothelin-1,whichcatalyses the evolution ofatherosclerotic plaques within thevascular wall. Other adipokine procoagulants include plasminogenactivator inhibitor-1, IL-6, tumor growth factor-β, and TNF-α, which cause thrombosis, especially fromruptured atherosclerotic plaques. Remodeling of collagen results from the action of matrix metalloproteinases alsosecreted by adipocytes, which causes atheroma cap thinning and plaque rupturethat precipitates release of the tissue factor, also promoting intravascular thrombosis. [18]

Anti-inflammatory secretagogues.

Adipose cells also secrete antiinflammatory hormones, such as adiponectin, visfatin, and the complement-related acylation-stimulating protein, which exert beneficial effects by inhibiting inflammatoryadipokines. In this fashion, protective hormones and complement proteins become bothanti-inflammatory and anti-atherogenic in action, as they concomitantly enhanceinsulin sensitivity andimprove vascular endothelium dysfunction.It is probablethat adiponectinreceptor deficiency, inflammatory adipokines, as well as excessive fatty acids, allcontribute to insulin resistance and other comorbidities of obesity.Interestingly, leptin may act as both an anti-inflammatory and proinflammatory secretagogue, in that it enhances insulin sensitivity for glucose uptake inmuscle but promotesinflammation and angiogenesis at other sites. [16]

METABOLIC SYNDROME OR SYNDROME X.

The concept of Syndrome X was intoduced by Gerald Reavan in 1988 which was put forth as a independent risk factor for coronary heart disease (CHD)which included insulin resistance, hypertension, hypertriglyceridemia amd low and high density lipoprotiens.Kaplan suggested that upper-body orvisceral obesity also needs to be considered as part of the syndromeand as a major riskfactor for CHD and Type 2 diabetes , independent of overall obesity.Subsequently,many studies confirmed that visceral obesity [20]was correlated with metabolic syndromeand its individual components.

As per the NCEP ATP III definition [21], three ormore of the following five criteria should be present:waist circumference over 40 inches (men)or 35 inches (women), blood pressure over 130/85 mmHg,fasting triglyceride (TG)level over 150 mg/dl, fasting high-density lipoprotein (HDL) cholesterol levelless than40 mg/dl (men) or 50 mg/dl (women) and fasting blood sugar over 100mg/dl.

This defintion is most commonly used criteria of metabolicsyndrome as it incorporates the key features of insulin resistance, visceralobesity, atherogenic dyslipidemia and hypertension. Morever it involves measurements and laboratory results that are feasible to physicians as well as patients, enabling its broad clinical andepidemiological application.

The recent definitions of metabolic syndrome is basically basedon four remarkableproperties: insulin resistance, visceral obesity, atherogenic dyslipidemia and endothelialdysfunction. Out of these,insulin resistance and visceral obesity appeasr to be mandatory for syndrome X. Weight loss can providetremendous improvementsin patients of metabolic syndrome. Interestingly, patients whoareobese maynot manifest any of the other components of metabolic syndrome, which means both predisposition to insulin resistance and obesity are required to manifest the clinical metabolic syndrome.The criteria of high serum TG levels and low HDL levels projects the importance of atherogenicdyslipedemia which is the by product of insulin resistance and visceral obesity. Endothelialdysfunction,another by product of insulin resistance, occurs due to the pro inflammatory adipokines and FFAs that arereleased from stored fat cells. Both atherogenicdyslipidemia and endothelial dysfunction that is in termsof hypertension contribute mechanistically to thedevelopment of atherosclerosis and CVD.[22]

CARDIOVASCULAR DISEASES IN INDIA

The results of Global Burden of Disease study state age standardised CVD death rate of 22 per 1 lakh population in India is much higher than that of global average of 235. CVDs strike Indians a decadeearlier than the western population.In 2016, CVDs contributed to 28.1% of total deaths and 14.1% of totalDALYs comapred with 15.2% and 6.9% respevctively in 1990. Prevalence varies by site, agegroup studied, and diagnostic criteria used, but an urban prevalence of about 10% inurban adults aged ≥ 35years is a credible estimate based on several surveys. [23] The prevalence of CAD in Indians living in India is 21.4% for diabetics and 11% for non diabetics. The prevalence of CAD in rural parts of country isnearly half than that in urban population.

ABDOMINAL OBESITY AND CARDIOVASCULAR RISK

In a multi system review of all cohort studies and RCTs of CVD in association with waist circumference and waist- to – hip ratio, the risk ofincident CVD increases in men and women with elevations in WC or WHR is the common inference point.

Precisely, a increase of 1cm in WC is associated with a 2% increase and a 0.01 increasein WHR is associated with a 5% increase in risk of future CVD after adjusting for ageand cohort characteristics.This meta- analysis included 15 studies with 2,58,114participants and analysed 4,355 events (12 CHD and 3 strokes). [24]

ASSESSMENT OF OBESITY

Cadaveric analysis is the gold standard for body composition analysis.No in vivo technique is consided tomeet the highest criteria of accuracy.The assessment methods often measure only certain aspects of obesity—for example, totalor regionaladiposity. They also produce varied results when they are used to estimatemorbidity and mortality. Transient increase in body fat also leads to increase in non fat tissues like also referred to as lean tissue like fibrovascular tissues, heart muscle, bone mass, truncaland postural musculature.This lean tissue mass has higher density (1g/ml) than fat (0.7g/ml) which is furtherincreased by physical activity and hence reducing the adipose cells.Highly precise, sophisticated and costly techniques for measuring body fat distribution and body are available but not feasible to generalpractitioner hence can be applied for esearch purposes only.So surrogate markers of body fat that is anthropometric measures have avery crucial value in bothclinical and epidemiological aspects

Fat mass (FM) and fat free mass (FFM)

Body composition analysis methods are based on a simple assumption that body consists of two independennt components which are fat mass(FM) and fat-free mass (FFM). The FM is anhydrousand the water content of theFFM is constant. Thus, by measuring one component, others can becalculated.FFM can be calculated thus:

FFM = TBW/hydration constant

FM = body weight (W) – FFM

FFM is composed of all non-fat tissues and represents the main active component from the metabolic point of view.The FM index (FMI) and the FFM index (FFMI) were calculated as the ratio of FM and FFM to thesquare of the person's height in meters, as in the BMI.

Computed tomography

CT gives a three-dimensional high-resolution image volume of the complete or selected parts of the body, computed from a large number of X-ray projections of the body from different angles.

As opposed to the previously described techniques,CT can accurately determine fat in skeletal muscle tissue and in the liver by computiing the differences in the attenuation. CT has the potential of givingdirect volumetricmeasurements of different tissue and organfat depots. However, CTbased bodycomposition analysis is in most cases limited to two-dimensional analysisof one or a limited number of axial slices of the body, leading to the utilization of thearea measured as a proxy for the volume.

There are two reasons for this limitation: first,in order tominimize the ionizing radiation dose the scanned body part is minimal as it in particular with ethical considerations of reserch studies on healthy subjects. Second, its a very laborious task in manualdiatillation ofdifferent compartments in the imageswhich can be reduced bylimiting the analysis to a few slices rather than a complete three-dimensionalvolume.The precision is reduced as the exact location of slices in relation to internal organs can's bediscerned and hence will vary between scansby this approach. However, CT, together with MRI, istoday considered the gold standard for bodycomposition analysis, in particular regional body composition analysis.

Magnetic resonance imaging

The differential magnetism of nuclei in the elements like hydrogen in water and fat in the cells is used to produce the images of soft tissue by MRI. Itis an imaging technique which estimates the volume betterascompared to the mass ofadipose tissue. There are some difficulties in comparing the data with othermethods. First, in order to derive fatmass, it is necessary to assume the fat content of adipose tissue andthe density of fat.Thers significant variance in the fat content of adipose tissue but the density of fat isrelatively a constant. A second problem is that fatmass seen by MRI is only that is present in adipose tissue.Thus other techniques such as densitometry, hydrometry, or multicomponent models quantify adifferent entity fromMRI, total FM versus adipose tissue mass. MRI also has relatively high cost and limitedavailability. [26]MRI is currently the best ,only accurate and viable option for the estimation ofregional body composition especially intra abdominal adipose tissue.

DEXA

Dual energy X ray absorptiometry uses the differential absorption of X rays of two different energies and its calculation requires the allowance for overlying soft tissue. This calculated value is used for measuringthe bone mineral mass. This algorithm can be altered to calculate fat and fat free mas from the wholebody scans[26] DEXA vary according to body shape and outcome and the sensitivity and specificityactually reduces in the trunk area. DEXA may provide usefulinformation on relative fat and lean massesas a single measurement in an individual,particularly with respect to limb lean mass.It is not possible toobtain direct compartmental volumetric measurements, so regional volume estimatesare obtainedindirectly using anatomical models.The distribution between Visceral Adipose Tissue and SubcutaneousAdipose Tissue needs to be estimated from ananatomical model predicting the SAT thickness.

Measurements of ectopic fat in organs such as liveror muscle is also inadequate in DEXA.Although the reliability of DEXA may be influenced by fat free mass (FFM) hydration,its accuracy is considered acceptable under normal and most clinical conditions.

Bioelectrical Impedance

Bioelectric impedance analysis (BIA) measures impedance of the body to a smallelectric current. Impedance is the frequency-dependent opposition of a conductor to theflow of an alternating electriccurrent. The model treats the body asa single cylinder, with measurements made between electrodesplaced manually on thewrist and ankle. Adjustment of bioelectrical data for height allows estimation oftotalbody water (TBW) [26]In practice, this requires the empirical derivation of regressionequations [27]relating height^2/impedance to TBW. These equations are then appliedsubsequently to predict TBW, which is converted to Fat Free Mass (FFM)

Men: FFM = -10.68 + (0.65 height^2) / resistance + (0.26 weight) + (0.02 resistance)

Women: FFM = -9.53 + (0.69 height^2)/ resistance + (0.17 weight) + (0.02 resistance)

Densitometry

The Archimedes' principle is used in desitometry. Assuming a two-component model with different densitiesfor fat mass and fat-free mass and correcting for the air volume in the lungs, the totalbody fat percentage can be estimated. The difference of the body weight in air and water is used tocompute the body's density. Obviously, this technique cannot give anymeasurements of the distribution of adipose tissue or lean tissue .[26]

ANTHROPOMETRIC INDICES

BMI

Lambert Adolphe Jacques Quetelet, a Belgian-born sociologist, astronomer, and mathematician, is responsible for developing the Body Mass Index. In the mid-19th century, Quetelet was searching for away to relate an individual's height to their ideal weight as a tool for studying populations. In 1835, Quetelet noted that the body mass relationship to height innormal young adults was leastaffected by height when the ratio of weight to heightsquared was used rather than merely using the ratioof the weight to height or weight to height raised to the third power.

By squaring the height, it reduces the contribution ofleg length in the equation and tends to normalize the body mass distribution at eachlevel of height; that is, it reduces the effect of a variance in height in therelationship ofweight to height. This was considered to be important because most of body fat is inthe trunk.

WHO cut – off points for normal BMI have been lowered for Asian populations.It was concluded that theproportion of Asian people with a high riskof type 2 diabetes and cardiovascular disease is substantial atBMIs lower than theexisting WHO cut-off point for overweight (> or =25 kg/m2). [27]

Variable	Consensus guidelines for Asian Indians [a]	Prevalent International Criteria
Generalized obesity (BMI cut-offs in kg/m^2)	Normal: 18.0–22.9 Overweight: 23.0–24.9 Obesity: ≥25	Normal: 18.5–24.9 [b] Overweight: 25.0–29.9 [b] Obesity: ≥30 [b]
Abdominal obesity (Waist circumference cut-offs in cm)	Men: ≥90 [c] Women: ≥80 [c]	Men: ≥102 [d] Women: ≥88 [d]

BMI that is Body Mass Index is the most universally used simple anthropometric measure to estimate the prevalence of obesity within a group of people. It has been found to be constantly related with an higher risk of CVD and type 2 diabetes. This measurement fails to account for variation in distribution ofadiposity and abdominal fat mass, which can vary across populations and regions. It can also differwithin a narrow range of BMI. [25]

BMI can indicate the relative amount of body fat on an individual's frame but does not directly calculate body fat percentage. BMI tends to overestimate body fat in those with a lean body mass (e.g., athletes or bodybuilders) and underestimates excess body fat in those with an increased body mass. Individuals with abdominal (visceral) obesity are at a greater risk of acquiring multiple pathological conditions and have a higher morbidity and mortality rate. However, BMI has no way to account for thisvariable.It was first recognized in France by Dr Jon Vague [30] in the 1940-1950s.In the calculation of BMI, height is squared to reduce the contribution of leg length in taller people, as most body mass remains within the trunk. Of concern is that with this normalization, the equation distributes equal mass to each height level, which subtracts from the utility of BMI in studies of differing body types. It is also essential to understand that BMI has limited use in evaluating bodyweight health in people of shortstature and does not account for differences in body types.

WAIST CIRCUMFERENCE (WC)

Waist circumference is a simple measure and potentially better indicator than BMI as a marker of better health. In fact it as good as BMI or skin fold thickness for total body fat and is the best anthropometricpredictor of visceral fat.Waist to hip ratio tends to be higher with people of increased abdominal fator wasting of large musclegroups as their waist circumference is relatively larger than that of hips.Waist circumference is minimallyrelated to height,so correction for height (as in waist-to-height ratio) does not improve its relation withintra-abdominal fat[31]. Hence waist circumference alone is better indicator than waist to hip ratio and waist to height ratio.Although waist circumference is a better marker of abdominal fat accumulation thanthe body mass index,an elevated waistline alone is not sufficient to diagnose visceralobesity. Hence measurement of waist cirumference is helpful in refining the patient's risk but this relationship is linear and hence theres noevidence to propose a cut off for abdominal obesity [32]

Certain ethnic groups like Asian and african have a greater risk of coronary heart disease than Europeans at the same cut off levels of waist circumference. Two individuals can have different body shapes basedon distrobution of muscle and fat tissue and yet they canhave same BMI.

Waist cirucmference is simpler and easily understood by common public as it a single measurement whereas ratio and derivatives can be tricky[2]

WAIST – TO – HIP RATIO

This anthropometric measure was brought out in the assumption that it would indicate body fat distribution better but it did not . Infact it acted inversely stating increased hip circumference actually had lower risks of diabetes and coronary heart disease as larger hip circumference actually meant largermuscle mass which is typically reduced in type 2 Diabetes and lack of exercise.[31]

WHR has been suggested to be a superior predictor of CVD risk because it includes ameasurement of hip circumference, which is inversely associated withdysglycaemia,dyslipidaemia, diabetes, hypertension,CVD, and death.

Increased hip circumfernce has a protective association with cardio metabolic risk as it suggests increase hip subcutaneous fat,gluteal muscle and total leg muscle mass. In the INTERHEART trail, Myocardial infarction cases were compared with asymptomatic controls where in increased waist to hip ratio was associated with a significant increased risk of myocardial infarction. [34]

In the EPIC- Norfolk study the authors actually reported that over a follow up of 9.1 years a large hip circumference was protective against CHD on the other hand larger wasit circumfernce was associatedwith elevated heart disease risk.[35]WHR seems to be more advantageous over WC but it is more difficult to perform and less relaiblemeasure than WC. Technically a non obese and obese individual can have same WHR when there'ssimultaneous weight change[36]. Disrobement is required in the measure ment of hip circumfernce which may lead to reluctance in many patients.

WAIST – HEIGHT RATIO

Waist to height ratio was put forth by Dr. Margaret Ashwell 20 years ago where in WHtR should be considered by physcians as a single marker of screening for cardiometabolic risk. Infact she proposed acut off value WHtR=0.538 as a risk assesment tool.[39]

WHtR has a very clear relationship with lower mortality andlower morbidity in CHD and stroke and is much better than BMI.[40 41]Whereas shorter people have higher metabolic risk than taller people withthesame WC.Shorter people were at a higher risk and 30% more prevalence of metabolic syndrome whengrouped by WC , not by WHtR. [41]Both height and central adiposity should be considered whenidentifying individuals at higher metabolic risk, and the WHtR appears to be the bestalternative tool.

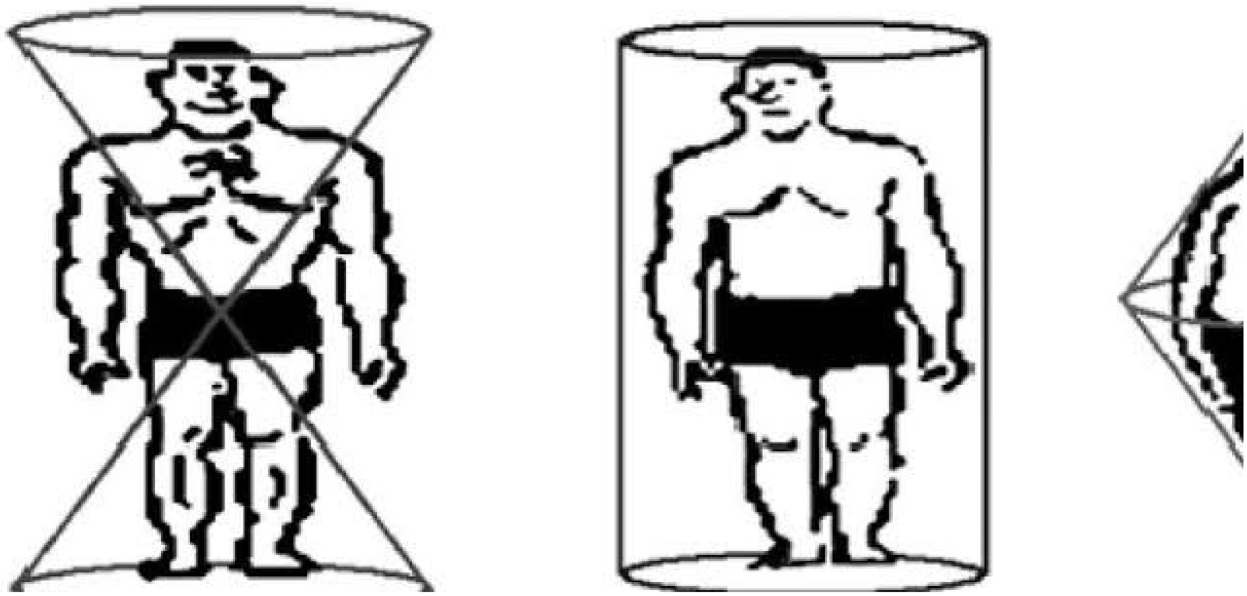
CONICITY INDEX

Conicityindex is calculated by the formula which involves waist circumference , body weight and heightRodolfo Valdez [5] proposed the conicity index (CI) in 1991, which assesses obesity and distribution of fat tissue, considering that central

$$\text{Conicity index} = \frac{\text{Waist circumferenc}}{0{,}109\sqrt{\frac{\text{Weight (k}}{\text{Height (m}}}}$$

obesity, is more significantly associated with increased incidence of CVD.

The accumulation of body fat around the waist leads to a body shape which changes from cylinder to biconic or double cone that is two cones with common base at waist. Theoritically, conicity index rangesfrom 1.0 which is a perfect cylinder to 1.73 a perfect double cone.



The value increases with increases in accumulation of abdominal fat. The derivation of formulae is asfollows: If a person of a certain height (Ht, in m) and weight (Wt, in kg) is viewed as a cylinder,the external circumference (C1, in m) of such a cylinder will be

$$C1=\left(\frac{4pi}{D}\right)^{0.5} * \left(\frac{Wt}{ht}\right)^{0.5}$$

where D is human body density (in kg/m3).Likewise, viewing the same person as a double cone, the outermost circumference (C2,in m) of such adouble cone will be

$$C2 = \left(\frac{12pi}{D}\right)^{0.5} * \left(\frac{Wt}{Ht}\right)^{0.5}$$

Assuming that the true abdominal girth (AG) of that person lies somewhere betweenthose two circumferences, then the relationship can be expressed as:

$$C1 < AG < C2$$

In order to have a more index-like inequality, all terms are divided by C1

$$1 \leq \frac{AG}{C1} \leq \frac{C2}{C1}$$

Therefore,

$$1 \leq \frac{AG}{C1} \leq (3)^{0.5}$$

If the average human body density is used the formula of conicity index becomes

$$Conicity\ Index = \frac{AG}{0.109 * \left(\frac{Wt}{Ht}\right)^{0.5}}$$

The value of Human body density should have a narrow range. The density of fat free body is 1100 kg/m^3 and with abdominal adiposity is 900 kg/m^3. The advantages of conicity index over other waist ratios are that it is on a likely model and is adjustable tovarying human heights and weights. It has a designatedupper and lower limit. The formulae allows builtin adjustment of waistcircumference for height and weight allowing direct comparisons of abdominaladiposity between individuals and population. It doesnot require hip circumference to asses fat distribution. Above points are the advanatges of Conicity index over Waist to Hip ratio.

The modifiable risk factors are obesity, hypertension, dyslipidemia,diabetes, pre-diabetes, smoking. Non – modifiable risk factors are age, gender, race andfamily history.

CARDIOVASCULAR RISK ASSESSMENT

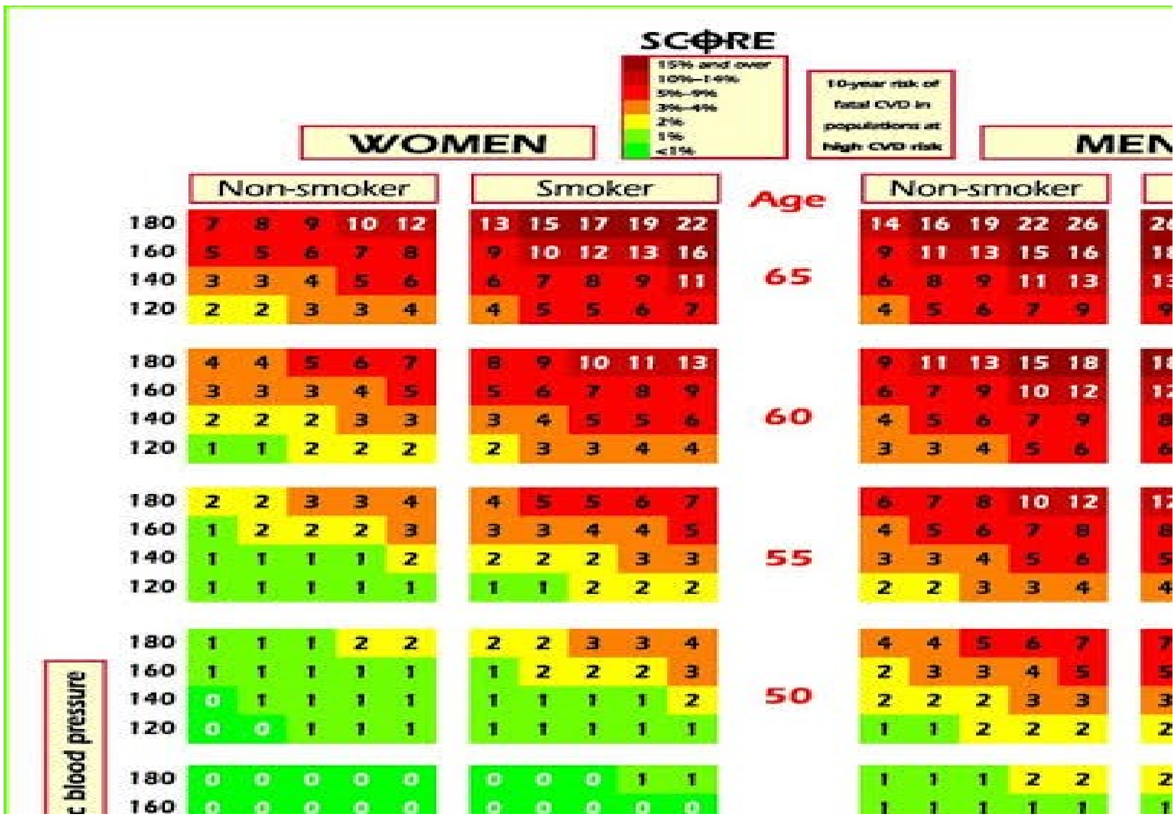
Variety of scores/scales have been developed to estimate cardiovascular risk. Thebest algorithm that is most suitable to predict the likelihood of having coronary arterydisease is not yet known.

FRAMINGHAM RISK SCORE (FRS)

On the basis of data obtained fromthe Framingham Heart Study [42], The Framingham Risk Score was developed to estimate the 10-year risk of developing coronaryheart disease.Framingham risk scorepredicts for 10-year risk of having any cardiovascular event. Itis used in non-diabeticpatients aged 30-79 with no prior history ofcoronary heart disease.The sex-specific scores applies age, total and high-density lipoprotein cholesterol,systolic blood pressure, treatment for hypertension, smoking, and diabetic status.A score below 10% is considered low, 10%-20% intermediate, and 20% high10-year risk of cardiovascular events. [42]

SYSTEMATIC CORONARY RISK EVALUATION (SCORE)

This algorithm was used in European population to predict the risk for cardiovascular deathThe SCORE[43] risk charts are intended forrisk stratification in



the primary prevention of cardiovascular disease.The SCORE predicts 10-year risk on fatal cardiovascular disease resulted in a modelwhich included gender, age, systolic blood pressure, total cholesterol, and smoking.Ascore of 0%-4% was consideredlow, 5%-9% intermediate, and >10% high risk ofcardiovascular death in 10 years

PROCAM

The PROCAM 44 score includes 8 independent risk variables, ranked in order ofimportance: age, LDL cholesterol, smoking, HDL cholesterol, systolic blood pressure,family history of premature myocardial infarction, diabetes mellitus, and triglycerides.A score below 10% is considered low, 10%-20% intermediate, and >20% high 10-yearrisk of coronary events. [44]The scoring system accurately predicted observed coronary events with an area under the receiver-operatingcharacteristics curve of 82.4% compared with 82.9% for the Cox model withcontinuous variables. [44]

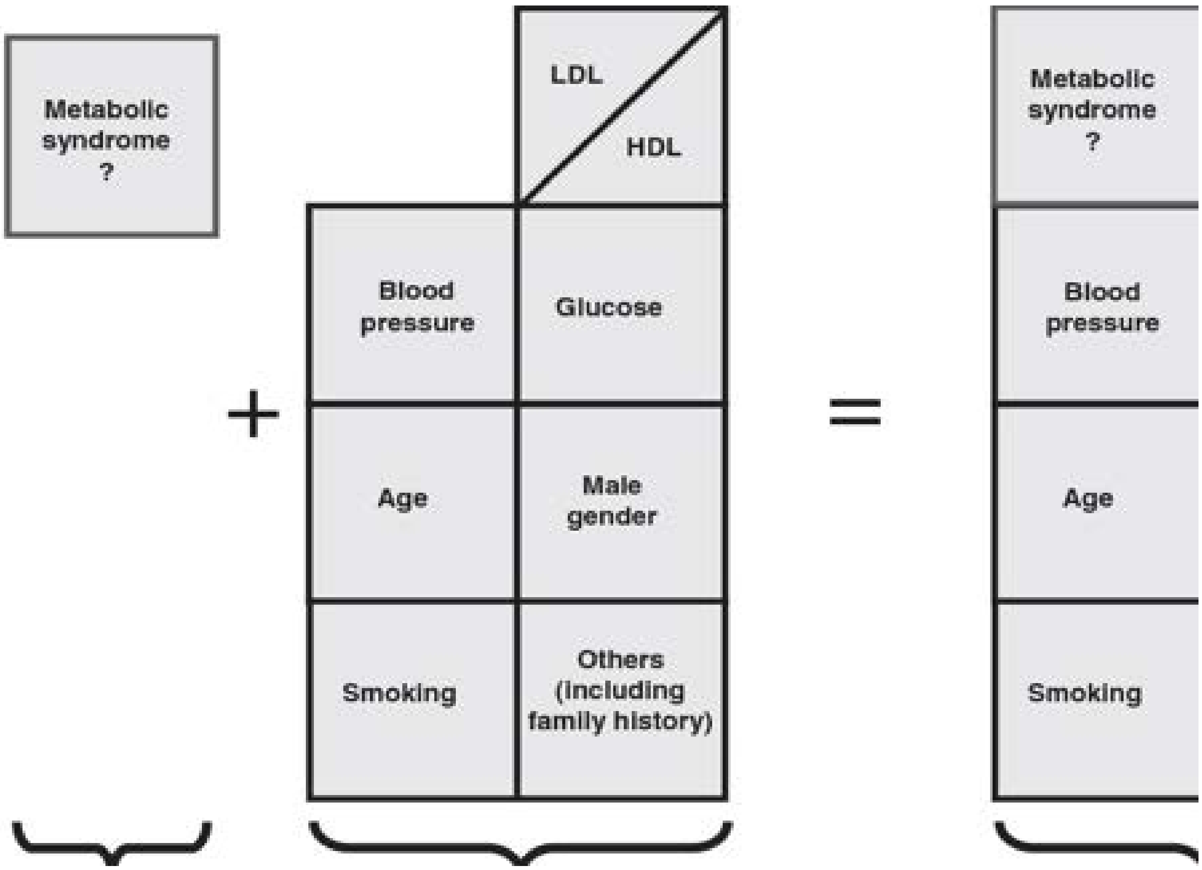
PROCAM score	Cardiovascular risk
≤20	<1%
21 - 28	1 - 2%
29 - 37	2 - 5%
38 - 44	5 - 10%
45 - 53	10 - 20%
54 - 61	20 - 40%
≥62	>40%

GLOBAL CARDIOMETABOLIC RISK

The concept of global cardiometabolic risk emerged whenthe components of metabolic syndrome is notincluded in calculating the CVD risk. Although numerous studies have suggested that metabolicsyndrome is asspciated with 2 fold increase in CVD risk , this increase in relative risk cannot substantiateabsolute risk.

Cardiovascular risk scores like Framigham risk score , European SCORE chart or PROCAM score donot consider metabolic syndrome parameters in their scoring criteria. So the model of global cardiometabolicrisk will allow metabolic syndrome to be one of the modifiable risk factor in CVD.The Framingham risk scores fails to capture all the features of metabolic syndrome. Infact it takes into consideration the traditional risk fatcors such as type 2 diabetes ,smoking or LDL cholesterol but fails to address the concept of insulin resistance. Infact it fails to asses the lifetime risk of cardiovascular death in young adults with obesity and metabolic syndrome.

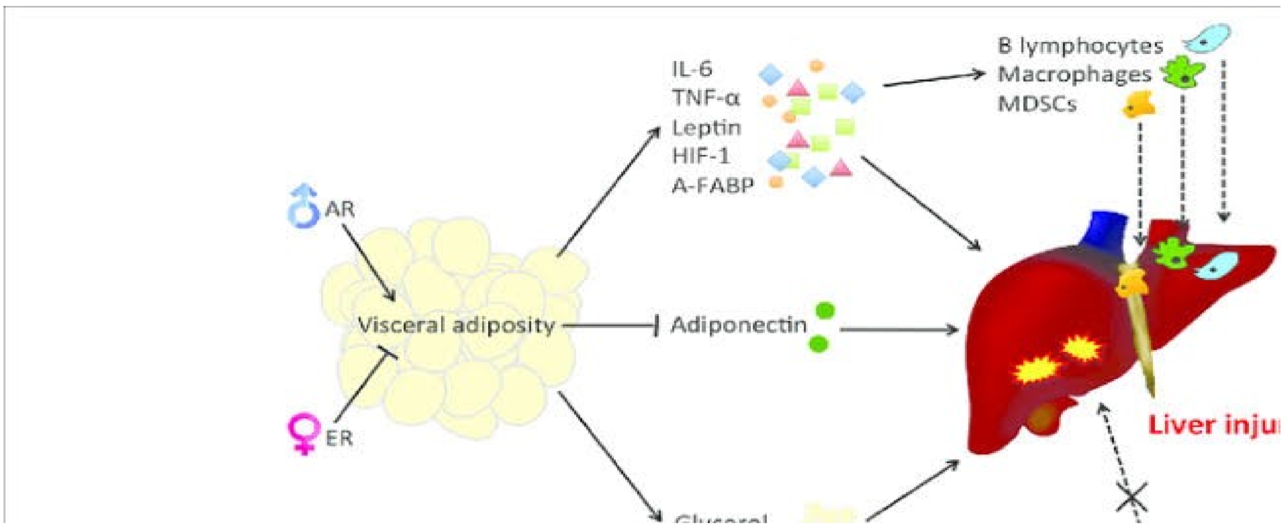
In the Asian phenotype the cardiometabolic evenst tend to occur at an younger age hence we shouldespecially pay attentionto young individuals with the metabolic syndrome who may not be considered atelevated risk of CVD because of their young age.until we get a universalconsensus on the importance of considering the metabolic syndrome in global CVD risk assessment.



PATHOPHYSIOLOGY OF OBESITY – RELATED METABOLICDISTURBANCES

MRI and computed tomography have reached theconclusion that it is the excess of intra-abdominal or visceral adipose tissue and not theamount of subcutaneous abdominal fat which is the key correlate of themetabolicabnormalities observed in overweight/obese patients. [45] The accumulation of intraabdominal (visceral) adiposity is associated with increased risk of metabolicabnormalities such as insulin resistanceand dyslipidemia.

Visceral obesity is considered to be a marker of dysmetabolic state and one of the causes of metabolic syndrome. It represents a intermediate phenotype where there’s relative inability of subcutaneous adiposetissue to act as a protective sink for excess dietary triglycerides which leads to fat depositions in visceraslike liver heart and skeletal muscle.[45]



Three pathways have beenproposed to explain the relation of visceral adiposity to the metabolic syndrome

1. The production of excess concentrations of free fatty acids due to the hyperlipolytic state of omentallipid tissue leads to direct toxicity of hepatocytes imapiring several metabolic functions of liver causingglucose intolerance ,hypertriglyceridemia and hyperinsulinemia.

2.Adipose tissue releases so many proinflammatory cytokines and adipokineswhose endocrine activity leads to the insulin resistant, prothrombotic and hypertensive state.

3. Sedentary population who cannot store their energy surplus in subcutaneous adipose tissue would be characterised by accumulation of fat at undesried sites such as the visceras.

These mechanisms provide a plausible explanation of all the metabolic abnormalities created in metabolic syndrome by visceral adiposity.

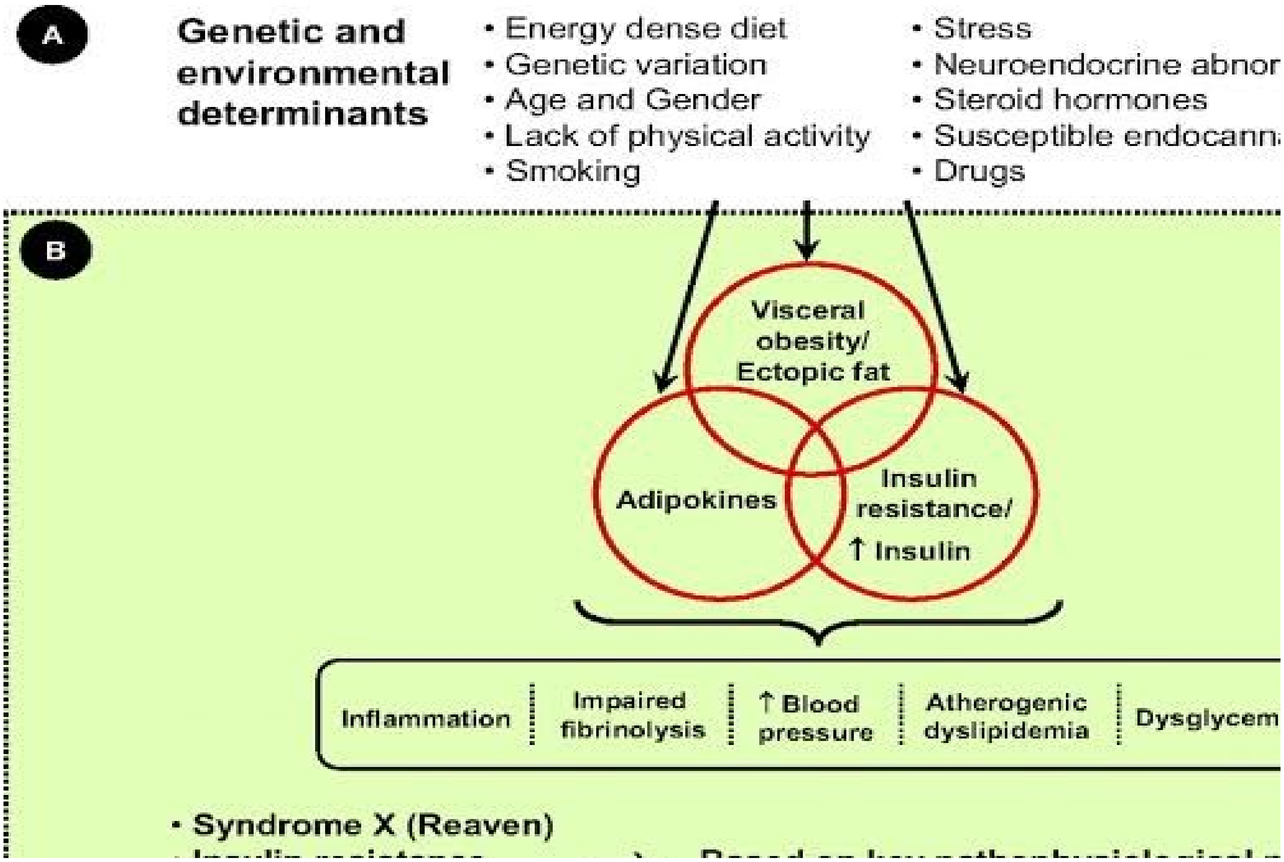


Figure : Simplified model illustrating the possible correlates (A) of insulin resistance oftenfound among individuals with excess visceral/ ectopic fat. Panel B emphasizes the notionthat theinsulin resistance syndrome concept was based on pathophysiological considerations, whereas panel C highlights the fact that NCEPATP III and IDF metabolic syndrome is an entity identifiedin clinical practice by the presence of simple screening tools.[45]

METHODOLOGY

METHODOLOGY

SOURCE OF DATA

Subjects visiting the general medicine OPD of Government Stanley Medical College April 2021 and July 2022.

INCLUSION CRITERIA

All subjects above the age of 18 years availing the Health facility at medicine department in Government Stanley Medical College and Hospital.

EXCLUSION CRITERIA

- Age less than 18 years
- Pregnant women.
- Those with significant ascites.
- Those with history of malignancy, HIV and other causes of cachexia.
- Those with untreated hypothyroidism.
- Those with established secondary hypertension.
- Those on medications causing alterations in body shape/weight such asNSAIDS, steroids, antidepressants, diuretics etc.
- Those with already established heart diseases.

METHOD OF COLLECTING DATA

A total of 185 subjects were included in this study after sample size calculation using N Master software. Informed consent was taken prior to enrolment into the study A brief medical history was taken with particular reference to diabetes, hypertension, history of smoking, family history of myocardial infarctions and medications which modify body weight. Anthropometric measurements like waist circumference, hip circumference, height, weight were measured using WHO-Stepwise approach to surveillance or NHANES[46] guidelines as appropriate.

Waist circumference was measured using a non-stretch rubber tape, horizontally halfway between the lower border of the last palpable rib and the top of the iliac crest. Hip circumference was taken at the uppermost lateral border of ilium. These measurements were taken in standing position with the subjects in standing position with arms and feet at neutral position. Each measurement was taken twice. The difference between the 2 measurements if more than 1 cm was repeated. If less than 1 cm was averaged. Weight was measured in light clothing, without shoes to the nearest 0.1kg. Standing height was measured, without shoes, to the nearest 0.1cm.

Fasting blood glucose, post prandial blood glucose, fasting lipid profile and serum TSH was tested in all subjects. Blood pressure was measured using a standard sphygmomanometer at the level of heart in sittingpositionin the right arm, after five minutes of rest, with legs uncrossed.

Fasting and post prandial blood glucose, Lipid profiles were analysed using Biochemicalanalyser Erba Manheim XL-640.Serum TSH was tested using DXI600 analyser

PROCAM score was used to predict the cardiovascular risk of the subject using is lipid profile medical history and examination for the purpose of this study which included Triglyceride level HDL LevelsDiabetic history History of Coronary artery disese in Family History of Smoking and others.

STATISTICAL ANALYSES

The master chart was created with all quantitative variables like age, BMI, WC, WHR were summarised and presentedusing descriptive statistics such as mean and standard deviation.Qualitative variables like gender, presence of diabetes and hyperetnsion were presented using frequencies and percenatges.

Sensitivity,specificity, Receiver Operating Characteristic curve for CI in predicting cardiovascularrisk was calculated and an optimal cut-off value was calculated.

Pearson’s correlationco-efficient wasused to calculate correlations between CI and other anthropometricindices and cardiovascular riskfactors. Statistical software namely SPSS version 29.0(IBM SPSS Statistics, Somers, NY, USA) wasused for analysis of data. Graphicalrepresentation of data has been done using MS Excel and MS Word.

Significant figures

+ Suggestive significance (P value: 0.05<P<0.10)

* Moderately significant (P value: 0.01<P <=0.05)

** Strongly significant (P value: P<=0.01)

<u>SAMPLE SIZE ESTIMATION</u>

N MASTER software was used to estimate the sample size. Based on a study done byAdithi [61] et al , it was found that the sensitivity and specificity of Conicity Index inpredicting cardiovascular risk was 70%. In the present study, considering a relativeprecision of 1.5% and a confidence interval of 95%, sample size is estimated (by theformula given below) to be 150.

$$\text{Sample size } (n) \text{ based on sensitivity} = \frac{Z^2_{1-\alpha/2} \times S_N \times (}{L^2 \times Preval}$$

$$\frac{Z^2_{1-\alpha/2} \times S_P}{}$$

Where n= required sample size

S_N=anticipated sensitivity

S_P= anticipated specificity

Alpha= size of the critical region (1- Alpha is the confidence level)

$Z_{1-alpha/2}$= Standard normal deviate corresponding to the specified size of the critical region (Alpha)

L= Absolute precision desired on either side(half width of confidence interval of sensitivity / specificity)

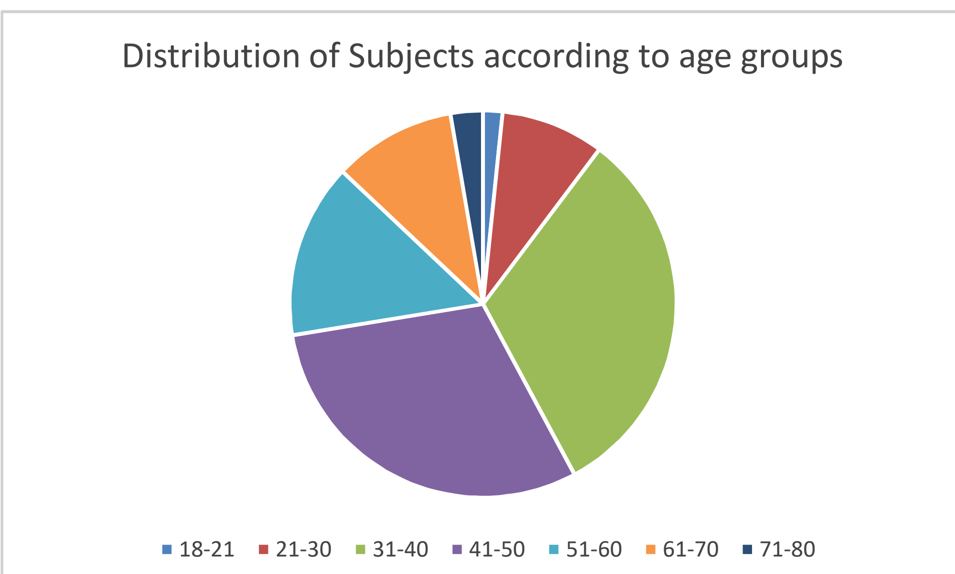
RESULTS

RESULTS

Table 3 Distribution of subjects according to age group

Age group(in years)	Frequency	Percentage
18-20	3	1.6
21-30	16	8.6
31-40	59	31.9
41-50	56	30.3
51-60	27	14.6
61-70	19	10.3
71-80	5	2.7

Graph 1:Pie chart showing distribution of sunject according to age group

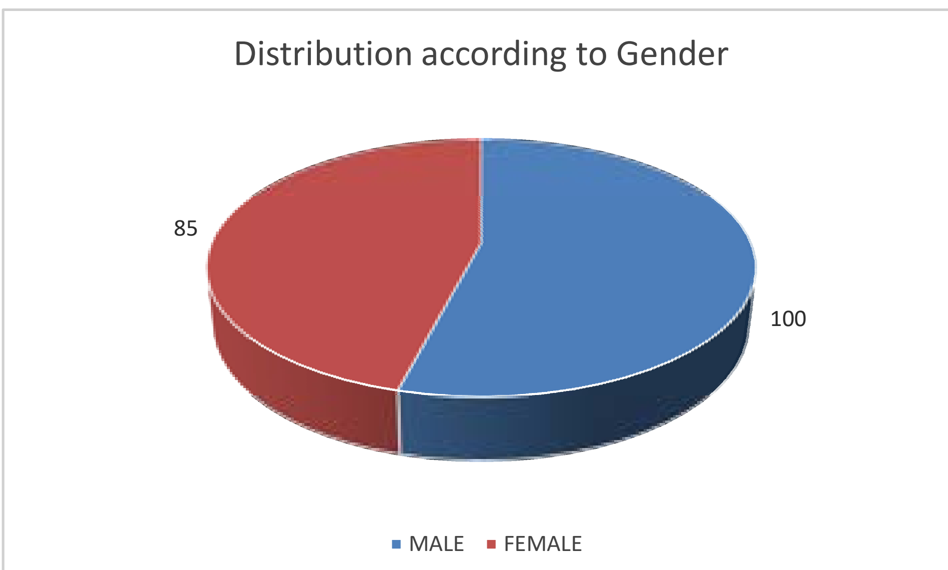


- Most of the population was in the age group of 31-40 years around 32%

Table 4: Distribution of subjects according to gender

Gender	Frequency	Percentage
Male	100	54
Female	85	46

Graph 2 : Pie chart showing distribution of subjetcs according to gender

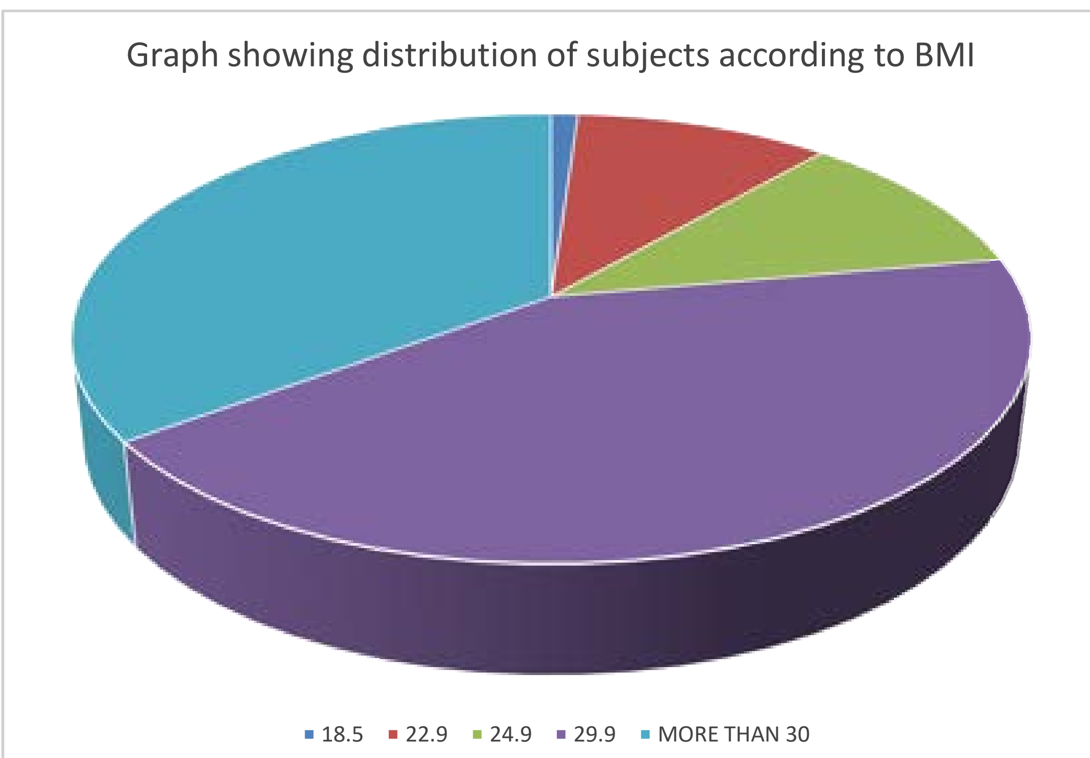


- Male consisted of higher population (54%) as comapred to female (46%) in the study group.

Table 5: Distribution of subjects according to BMI

BMIrange	Frequency	Percentage
Less than18.5	2	1.1
18.5-22.9	19	10.3
23-24.9	20	10.8
25-29.9	79	42.7
More than 30	65	35.1

Graph 3 : Pie Chart showing distribution of subjects according to BMI

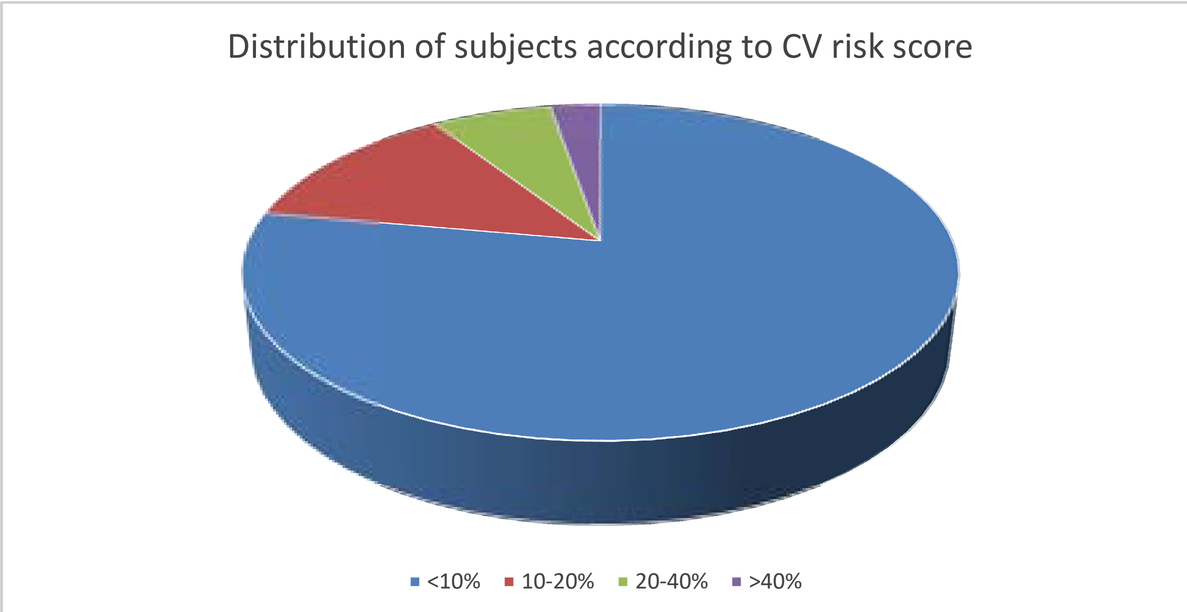


- 88.6 % of persons studied were overweight (i.e. having a BMI > 23 kg/m2 upto 30 kg/m2).
- 35.1% were obese (BMI > 30 kg/m2)
- Only 10.3% of persons in this study belonged to the normal BMI category of 18.5– 22.9 kg/m2.

Table 6: Distribution of subjects according to CV risk

CV risk	Frequency	Percentage
<10%	144	77.8%
10-20%	24	13%
20-40%	12	6.6%
>40%	5	2.7%

Graph 4 : Pie chart showing distribution of subjects according to CV risk

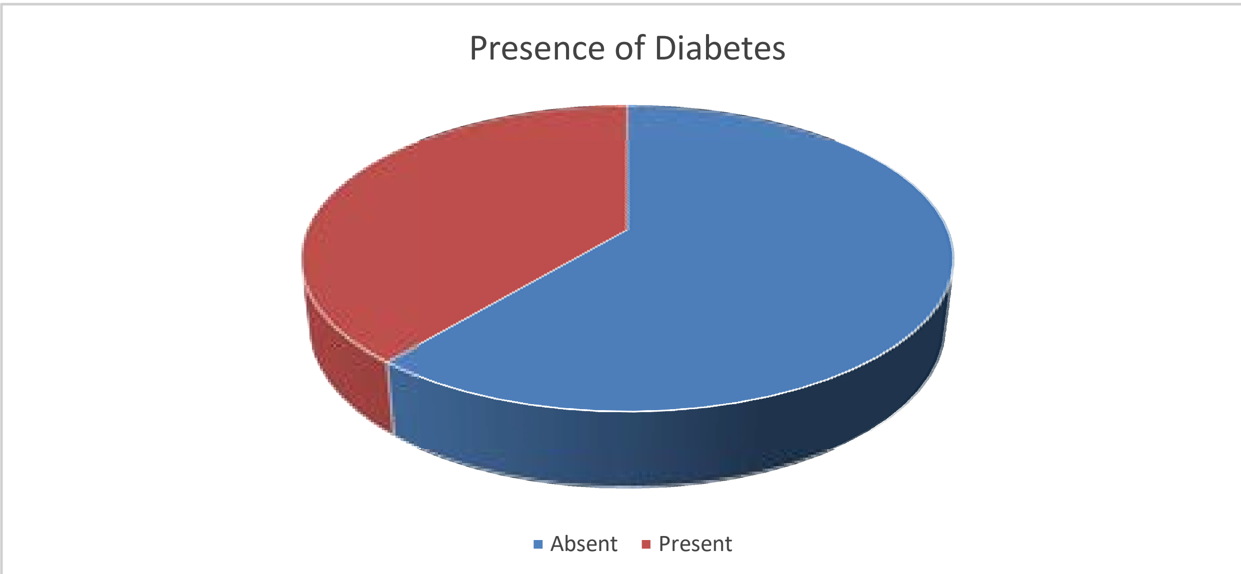


- There was a 10- year cardiovascular risk of < 10% (calculated by PROCAM score) in 77.8% of the subjects.

Table 7: Distribution of subjects according to presence of diabetes

Diabetes	Frequency	Percentage
Present	72	38.9%
Absent	113	61.1%

Graph 5: Pie chart showing the distribution of subjects according to presence of Diabetes

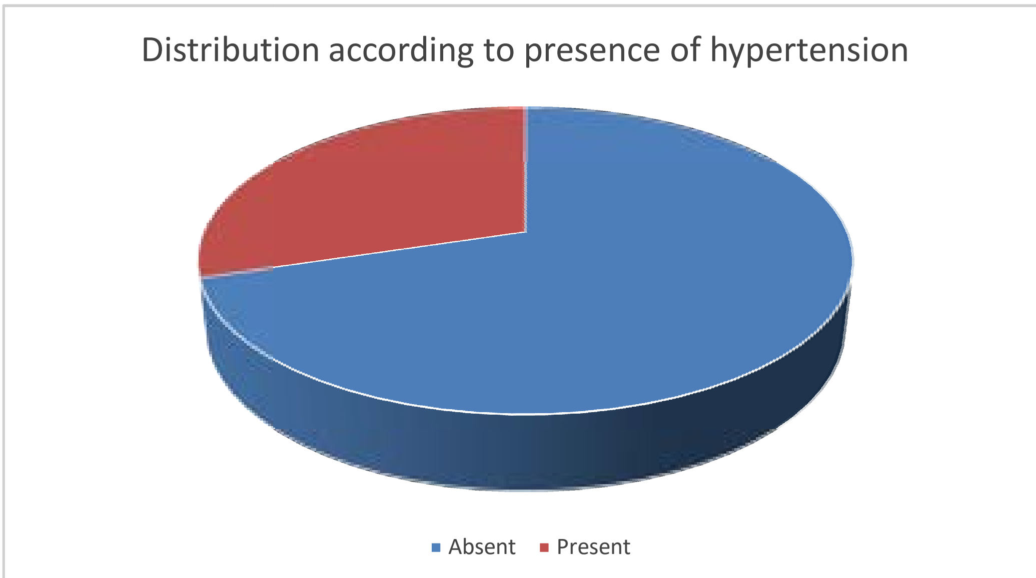


- 38.9% were known diabetics

Table 8: Distribution of subjects according to presence of hypertension

Hypertension	Frequency	Percentage
Present	55	29.7%
Absent	130	70.3%

Graph 6: Pie chart showing distribution of subjects according to presence of hypertension



- 29.7 % of the subjects were known hypertensive.

Table 9: Overall demographic features and means

Demographic parameter	Mean	Standard Deviation	Range
Age	45.98	12.74	20-80
Waist Circumference	91.42	11.71	63.75-117.5
Hip Circumference	93.18	10.07	70.25-125.75
BMI	28.13	4.56	16.4-44
Waist to Hip Ratio	0.98	0.06	0.80-1.10
Waist to Height Ratio	0.573	0.07	0.408-0.744
Conicity Index	1.253	0.09	1.03-1.52
SBP	127.64	17.3	100-180
DBP	81.28	11.87	60-120
Total Cholesterol	193.8	44.1	109-415
Triglycerides	158.65	75.03	54-638
HDL	45.91	8.75	20-85
LDL	116.55	36.61	39-298
FBS	123.19	62.29	66-375
PPBS	183.9	114.3	81-606
TSH	3.58	4.42	0.02-43.8

- The mean waist circumference was 91.42 cm with a SD of 11.71 cm, mean WHR was 0.98 with a SD of 0.06, and mean WHtR was 0.573 with a SD of 0.07.
- Mean BMI was 28.13 with a SD of 4.56
- Mean Conicity Index was 1.253 with a SD of 0.09 and a range of 1.03 to 1.52

Table 10 : Means of various parameters among male and female

	Male		Female	
	Mean	SD	Mean	SD
Waist Circumference	94.12	11.83	88.24	10.79
BMI	27.46	4.24	28.92	4.81
Waist to Hip Ratio	1.01	0.04	0.94	0.05
Waist to Height Ratio	0.556	0.07	0.57	0.06
Conicity Index	1.281	0.09	1.22	0.09

- Mean WC among men is 94.12 cm with a SD of 11.83, mean WC amongwomen is 88.24 cm with a SD of 10.79
- Mean CI among men is 1.281 with a SD of 0.09 and 1.22 with a SD of0.09 among women.

Table 11: Comparison of mean WC, BMI ,WHR, WHtR,CI among age groups

Age group		WC	BMI	WHR	WHtR	CI
18-20 years	Mean	76.58	25.21	0.92	0.46	1.09
	SD	6.01	1.02	0.04	0.03	0.04
21-30 years	Mean	87.91	26.74	0.99	0.54	1.22
	SD	10.35	3.91	0.04	0.07	0.08
31-40 years	Mean	90.24	27.42	0.97	0.56	1.24
	SD	9.77	3.71	0.06	0.05	0.09
41-50 years	Mean	91.4	29.15	0.97	0.58	1.23
	SD	11.53	5.06	0.06	0.06	0.07
51-60 years	Mean	92.87	28.43	0.99	0.59	1.27
	SD	13.34	5.05	0.05	0.08	0.1
61-70 years	Mean	93.7	28.47	0.99	0.59	1.28
	SD	13.23	5.21	0.05	0.08	0.09
71-80 years	Mean	102.85	27.446	1.05	0.63	1.41
	SD	10.11	1.94	0.02	0.04	0.08
P Value		0.007	0.147	0.006	0.004	0.02

- As age increased, the mean WC, mean WHR, mean WHtR and mean CI increased (all achieving statistical significance of $p < 0.05$)

Table 12 : Comparison of mean WC,BMI,WHR,WHtR, CI among BMI Ranges

BMI Range		BMI	WC	WHR	WHtR	CI
<18.5	Mean	17.4	66.75	0.92	0.43	1.18
	SD	1.37	2.82	0.03	0.02	0.01
18.5-22.9	Mean	20.82	75.2	0.95	0.46	1.19
	SD	1.33	8.61	0.06	0.04	0.102
23-24.9	Mean	24.09	85.05	0.97	0.52	1.25
	SD	0.475	7.75	0.05	0.04	0.09
25-29.9	Mean	27.52	91.45	0.98	0.57	1.265
	SD	1.55	8.778	0.05	0.04	0.095
>30	Mean	32.9	99.43	0.98	0.63	1.26
	SD	2.52	9.17	0.06	0.05	0.08
P value		0.001	<0.001	0.170	<0.001	0.158

Table 13: Comparison of mean SBP, DBP,FBS, PPBS,TGL among BMI Ranges

BMI Range		SBP	DBP	FBS	PPBS	TGL
<18.5	Mean	122.5	80	86.5	95	149.5
	SD	31.82	28.28	17.68	19.8	119.5
18.5-22.9	Mean	115.5	72	99.55	132.45	143.7
	SD	15.04	10.05	33.21	57.49	54.35
23-24.9	Mean	121.9	76.91	150.04	227.67	153.91
	SD	13.18	9.68	88.68	155.8	78.4
25-29.9	Mean	127.22	81.72	113.47	174.83	160.14
	SD	15.27	9.62	43.6	94.02	70.86
>30	Mean	134.13	85.15	134.83	199.89	163.39
	SD	18.76	13.25	74.29	129.12	84.98
P value		<0.001	<0.001	0.045	0.169	0.415

- As BMI increased, the mean WC, and WHtR increased with statistical significance.
- As BMI increased, the mean SBP, DBP and FBS increased (all achievingstatistical significance).
- Mean PPBS also increased but these did not achieve statistical significance

Table 14: Correlation of CI with other parameters

		CONICITYINDEX
WC	Pearson coeffcient	0.784**
	P value	<0.001
BMI	Pearson coeffcient	0.212*
	P value	0.004
WHR	Pearson coeffcient	0.641**
	P value	<0.001
WHtR	Pearson coeffcient	0.702**
	P value	<0.001
SBP	Pearson coeffcient	0.356**
	P value	<0.001
DBP	Pearson coeffcient	0.264**
	P value	<0.001
TGL	Pearson coeffcient	0.155*
	P value	0.04
FBS	Pearson coeffcient	0.114
	P value	0.12
PPBS	Pearson coeffcient	0.183*
	P value	0.012
CV RISK	Pearson coeffcient	0.344**
	P value	<0.001

*Moderately significant (P value: 0.01<P <=0.05)

** Strongly significant (P value: P<=0.01)

- A very strong correlation was obtained between CI and WC (r= 0.784)
- A strong correlation was obtained between CI and WHtR (r = 0.702)

- A moderately strong correlation was obtained between CI and WHR (r = 0.641)
- A positive but weak correlation was obtained between CI and SBP (r= 0.356)and CI and CV risk score (r= 0.344).

Table 15: AUC and cut off value of anthropometric indices by ROC curve analysis

Anthropometric Index	Area under the curve	P value	Cut off	Sensitivity	Specificity
Conicity index	0.729	0.042	1.23	70.7%	50%
Body Mass Index	0.642	0.051	27.61	73.2%	50.3%
Waist Circumference	0.730	0.043	90.02	73.2%	54.9%
Waist to Hip Ratio	0.695	0.047	0.978	80.5%	57.2%
Waist to Height Ratio	0.755	0.045	0.573	75.6%	59%

- AUC curve for CI as a screening tool for CV risk is 0.729, with a sensitivity of70.7% and a specificity of 50%. (p = 0.04). Cut-off value is 1.23
- Similarly, AUC for WC as a screening tool for CV risk is 0.730, with a sensitivity of 73.2% and a specificity of 54.9%. (p 0.04). Cut-off value is 90 cm.
- AUC for WHtR as a screening tool for CV risk is 0.806, with a sensitivity of 75.6% and a specificity of 59%. (p = 0.045). Cut-off value is 0.573.

Table 16: AUC and cut off of Conicity Index in males and females

Anthropometric Index	Area under the curve	P value	Cut off	Sensitivity	Specificity
Conicity index	0.729	0.042	1.23	70.7%	50%
Conicity index for Male	0.662	0.063	1.27	57.78%	54.1%
Conicity index for Female	0.801	0.05	1.23	86.7%	59.6%

- CI as a screening tool for cardiovascular risk was calculated separately for males and females but no statistically significant difference was found.

Table 17: Number of subjects with CI> 1.23

	No of Subjects	Percentage
Male	67	61%
Female	43	39%
Total	110	100%

- 110 out of 185 (59.4%) of participants had a CI higher than the calculated cut-off of1.23.

Table 18: AUC for WC in males and females

Anthropometric Index	Area under the curve	P value	Cut off	Sensitivity	Specificity
WC for Male	0.630	0.069	90.63	69.2%	39%
WC for Female	0.873	0.042	90.375	86.7%	71.4%

- WC for females has an AUC of 0.873, cut – off value of 90.3 cm, sensitivity of 86.7 % and aspecificity of 71.4%.

Table 19 : AUC for WHtR in males and females

Anthropometric Index	Area under the curve	P value	Cut off	Sensitivity	Specificity
WHtR for Male	0.682	0.042	0.57	73.1%	63.5%
WHtR for Female	0.916	0.031	0.61	93%	80%

- WHtR for males has an AUC of 0.682, with a p value of 0.042, cut-off value of 0.57, sensitivity of 73.1% and specificity of 63.5%.

Table 20 : Comparative AUC in men

Anthropometric Index	Area under the curve	P value	Cut off	Sensitivity	Specificity
Conicity index	0.662	0.063	1.27	57.78%	54.1%
Body Mass Index	0.611	0.066	27.66	61.5%	51.4%
Waist Circumference	0.630	0.069	90.63	69.2%	39%
Waist to Hip Ratio	0.635	0.061	1.02	73.1%	61.8%
Waist to Height Ratio	0.682	0.042	0.57	73.1%	63.5%

- In males, best AUC for WHtR is 0.682, with p = 0.042, sensitivity of 73.1% and specificity of 63.5%

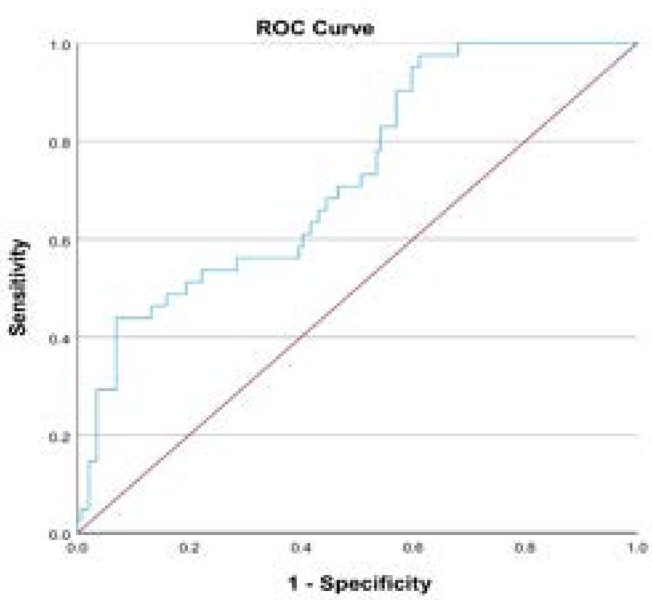
Table 21: Comparative AUC in women

Anthropometric Index	Area under the curve	P value	Cut off	Sensitivity	Specificity
Conicity index	0.801	0.048	1.23	86.7%	59.6%
Body Mass Index	0.728	0.07	27.68	93.3%	47.1%
Waist Circumference	0.873	0.042	90.37	86.7%	71.4%
Waist to Hip Ratio	0.711	0.087	0.973	66.7%	80%
Waist to Height Ratio	0.916	0.031	0.61	93%	80%

- In females, best AUC was for WHtR, with AUC = 0.916, $p < 0.001$. sensitivity of 93% and specificity of 80%.

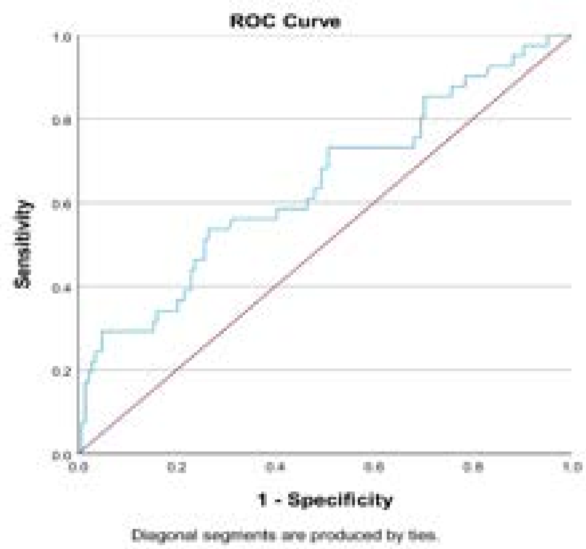
Graph 7: ROC curve of Conicity Index

- AUC is 0.729, p = 0.042, sensitivity is 70.7% specificity is 50%. Cut off 1.23

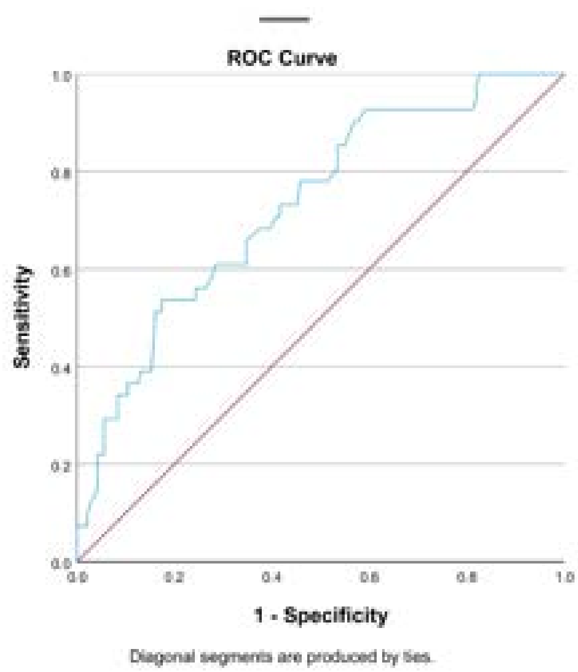


Graph 8: ROC curve of Body Mass Index

- No statistically significant AUC obtained

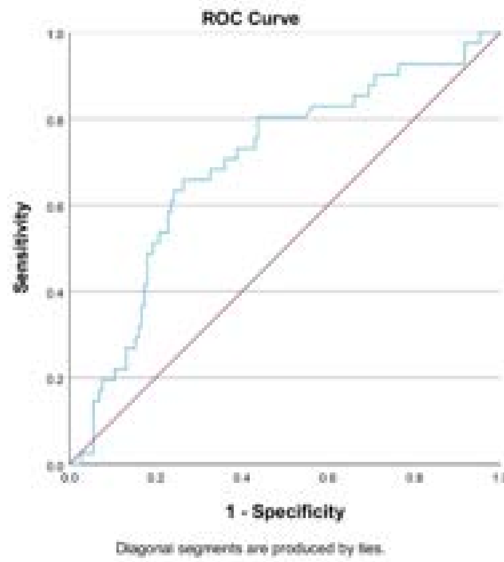


Graph 9: ROC curve of Waist circumference



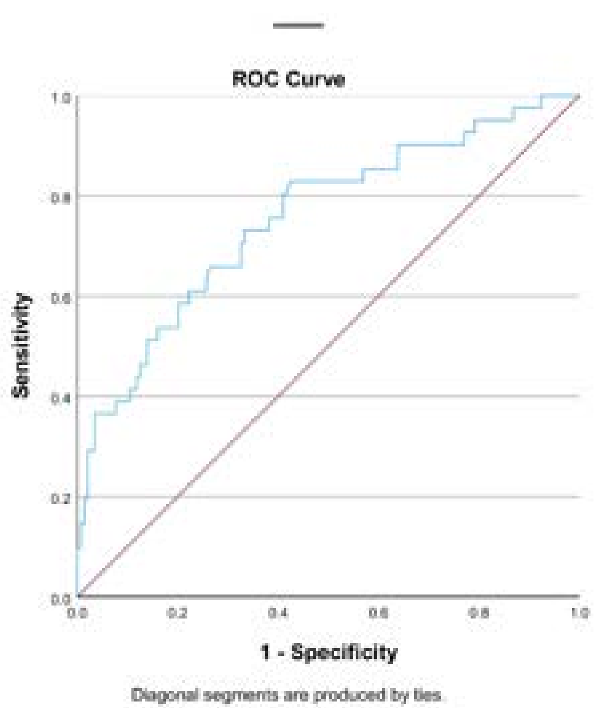
- AUC is 0.730, p = 0.043, sensitivity is 73.2% and specificity is 54.9%. Cut off 90.62cm

Graph 10: ROC curve of Waist to Hip ratio



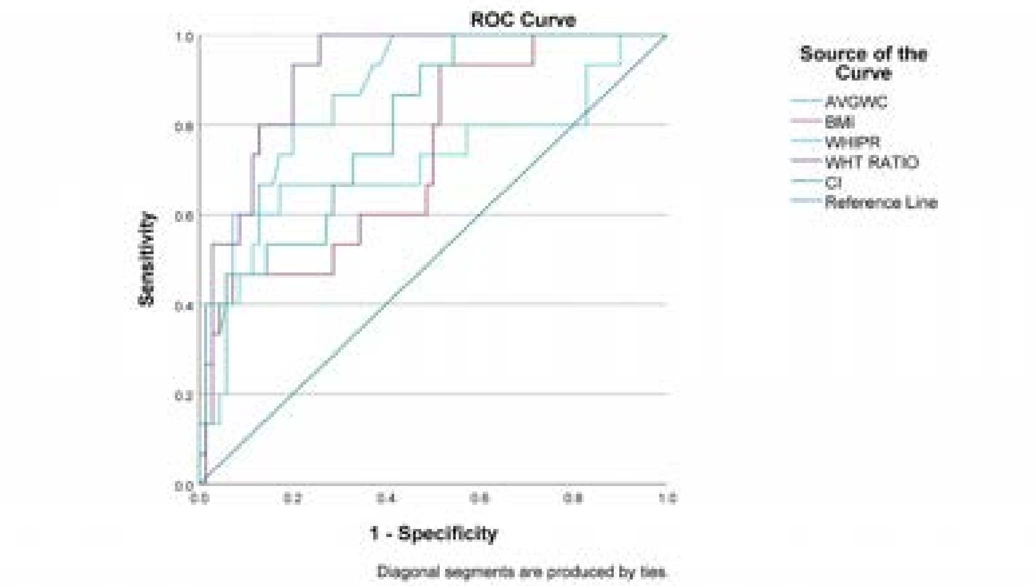
- AUC is 0.695, p = 0.047, sensitivity is 80.5% and specificity is 57.2%. Cut off 0.978

Graph 11: ROC Curve of Waist to Height Ratio



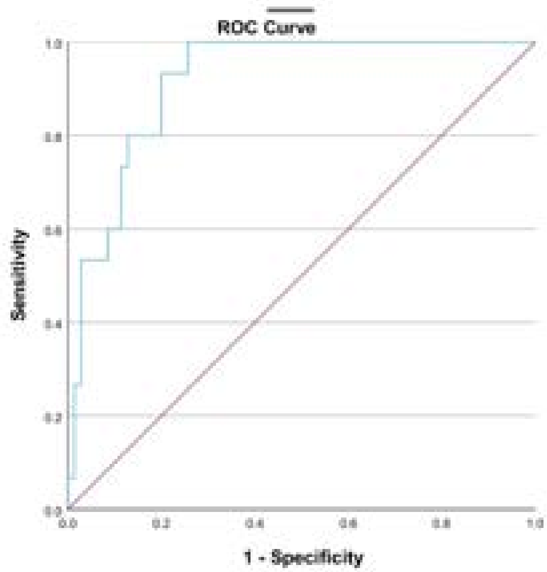
- AUC is 0.755, p = 0.045, sensitivity is 75.6% and specificity is 59%. Cut off 0.573

Graph 12: ROC Curve of CI,BMI,WC,WHRamd WHtR for women



- Best AUCS were obtained for WHtR, followed by WC, followed by CI.
- WHtR is a better screening tool for CV risk than BMI, WC,WHR and CI in women.

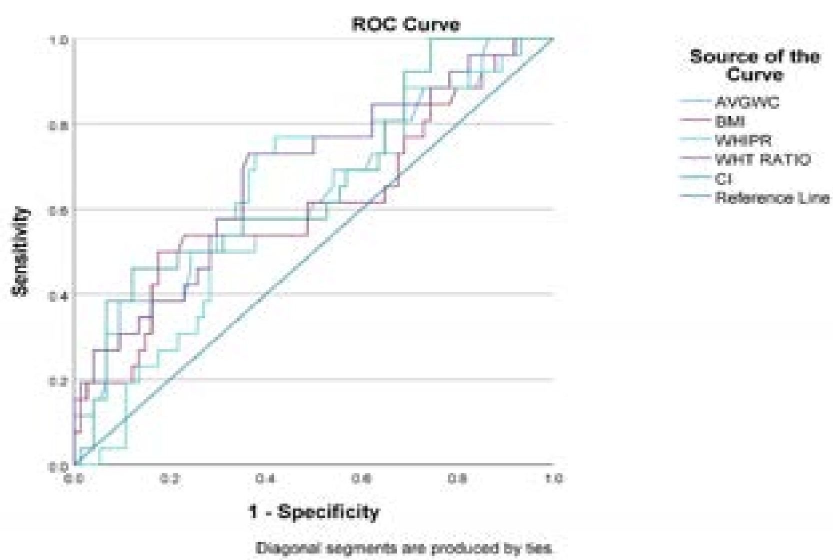
Graph 13 : ROC Curve for WHtR in women



- Cut -off value is 0.61. Sensitivity is 93% and specificity is 80%

Graph 14 : ROC curve for CI, BMI,WC,WHR,WHtR for men

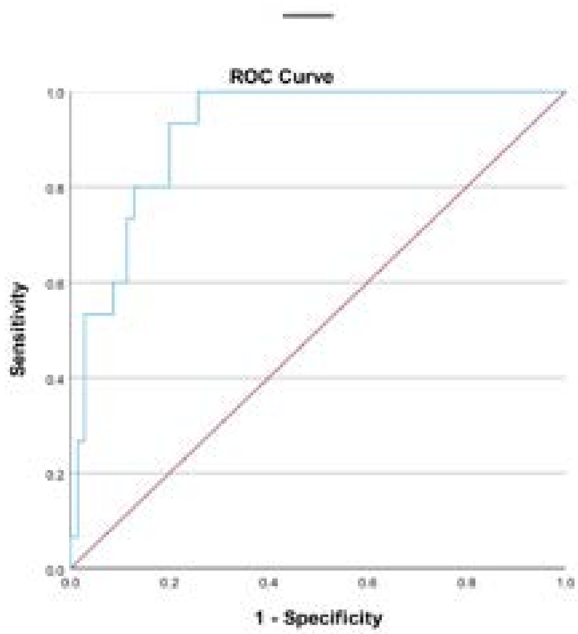
- Best AUC obtained for WHtR, followed by CI, WHR,WC,BMI.



- WHtR is a better screening tool for CV risk in men.

Graph 15: ROC Curve for WHtR for men

- WHtR is a better screening tool for CV risk than CI, WC and BMI in men.



- Cut-off value is 0.57, sensitivity is 73.1% and specificity is 63.5%.

DISCUSSION

DISCUSSION

Conicity Index is an anthropometric index examining the abdominal obesity of the subjectIncreasingwaist obesity is associated with a higher cardiovascular risk and mortality.[45]The risk assessment toolscannot assess the abdominal obesity directly.In this study, we studied the usage and importance of Conicity Index as a screening tool for the presence of Cardiovascular risk using a PROCAM score. We have also tried to establish the correlation of ConicityIndex with other anthropometric indices such as BMI, WC, WHtR. We have arrived at a cut-off value ofCI (1.23) (table 15) to enable action levels in Indian population to preventcardiovascular mortality.

- Mean age of the subject population was 45.98 years with a SD of 12.74 (table 9).as compared to another study done by Venkataramanan 47 et al, in Andhra Pradeshwhere they comparedassociation of obesity indices with CHD risk factors inurban vs rural Indian men where the meanage was 47.4 years with a SD of 9.1.
- Males (54%) are higher than females (46%) in this study (table 4) comparable toanother study done by Nadeem [48] et al in Pakistan on anthropometric indices todetermine insulin resistancewheremales constituted 65% and females 35% ofthe study population.

- The mean BMI (table 9) calculated was 28.13 kg/m2, belonging in theoverweight range as per the Asian population cutoffs given byWHO The prevalence ofoverweight subjects was 53.6% and the prevalence of obesity was 35.1% (table5) Only 11.4% of subject were of normal BMI category of18.5 – 22.9 kg/m2. Inurban north Indian study[49]the overall prevalence of generalizedobesity was 50.1 per cent, wherethe criterion for generalised obesity was defined as a BMI >25kg/m2. Almost all of the subjects inour study were from urban areas and this can explain the highprevalence of obesity as urban dwellers are more of sedentary lifestyle. These statisticssuggests the dangerous prevalence of obesity and actually enhance the importance of such studies.
- The 10-year cardio vascular risk calculated by PROCAM score was less than 10% in 77% of the subjects. PROCAM score was selected in our study as we did not excludediabetics or elderlyindividuals.
- The mean Conicity index was calculated to be 1.25 (table 9),which is slightly above the cut-off value calculated in this study (1.23). (table15).Around 60% subjects had a CI higher than thecalculated cut-off of 1.23 (table 17).The mean CI of men and women in our study was 1.281 witha SD of0.09 and 1.22 with a SD of 0.09 respectively (table 10). These are similar to the resultsobtained by Adithi[61] et al where the mean CI among

women in was 1.22 ± 0.1 and similar to Venkatramana [48] et al where the mean CI among men was 1.3±0.1.

- Conicity index positively correlated with CV risk calculated by PROCAM (r = 0.344, p<0.001(table 14) however the strength of correlation was higher as compared to the study performed by Adithi 61 et al. Strong correlation wasfound between CI and some of modifiable risk factors like PPBS, SBP and DBP (table 14). CI also correlated strongly withWC and WHtR.
- The cut-off value for CI as calculated in thisstudy is 1.23 with AUC being 0.729and a sensitivity of 70.7% and a specificity of 50% with no statistically significant difference in the discriminatory power of CI as a screening toolbetween men and women (table 16). This is similar to the studyconducted in south India by Adithi[61]et al which suggested similar sensitivity (73%)andstatistically significant difference in Conicity Index. A study conducted at Brazil, South Americautility of Conicity Index as a coronary event where the best cut-off points to discriminate highcoronary risk in men and women were, respectively, 1.25 (73.91% sensitivityand 74.92%specificity) and 1.18 (73.39% sensitivity and 61.15% specificity) by Pitanga[50] et al.In Pakistan, Nadeem[48]et alstudy suggested 1.39 to be the best cut-off of CI for determining insulin resistance. This variance in the cut-offobtained between these studies across geographical regions can be

explained by variousfactors like ethnicity and diversity in physical activity,eating patternsand standard of living.

- In our study, CI had a weak correlation with SBP (r= 0.356) (table 14). But this correlation was stronger as compared various studies likeMantzoros[51] et al on CI as a predictor of blood pressurelevels where CIcorrelated with systolic blood pressure (r = 0.14, p = 0.02). Shidfar[52] et al studyof post-menopausal women showed that BMI and CIwere significantly correlated with SBP. (r = 0.212, p = 0.009). This shows thatBMI and CI could be an important determining factor of SBP.
- CI was weakly but positivelycorrelated with FBS (r = 0.114) and with PPBS (r = 0.183)(table 14). Our results shows a similar result to the study by Ghosh53 etal where CI was positivelycorrelated with PPBS with r= 0.244.(table 14) Considering that insulin resistance is by itself acardiovascular risk, these findings are appropriately similar in our study.
- There was a very strong correlation between CI and WC with r= 0.784 and a good correlationbetween CI and WHtR with r = 0.702 (table 14), both of these achieving statistical significance.Hence this proves that CI can be used as an alternative index for assessing abdominal obesity.Interestingly, it was found that overall, WHtR was a better screening tool forcardiovascular risk with an AUC of 0.755 with a p value of 0.045, a sensitivityof 75.6% and a

specificity of 59% (table 15). The meta-analysis study[54] of 88000 individuals,suggested the statistical superiority of WHtR over other anthropometric indices in detecting the CV risk.The risk of atherosclerosis and its complications determined by ideal WHtRin ROC analysis was ≥0.53 with a prevalence of 55.8% in a Chinese study[55] done on elderly individuals,

- In women, WC was found to be a better screening tool for cardiovascular riskthan CI, WHR or BMI with an AUC of 0.873, p <0.042, and a sensitivity of86.7% and a specificity of 71.4% (table 21). The cut-off value of WC forwomen was 90.38 cm(table 18). In men, the AUC forWC did not achievestatistical significance (table 18). Overall, WC had an AUC of 0.730, with p=0.043, sensitivity of 73.2% and specificity of 54.9%.(table 15).
- BMI was not found to be related to any MACE (Major Adverse Cardiac Event and Waist circumference was inferred to be a very good predictor of the same in a study by Tarastchuk[56]reinforcing the emphasis on central adiposity and its effect on CV risk.In ourstudy too, BMI didnot prove to be good screening tools forcardiovascular risk (table 15). In an Iranian study [57], WC proved to be a betterpredictor of modifiable risk factor of CVD like diabetes and hypertension than BMI, in women. The cut-off valuefor WC for women (90.37cm) in our study was found to be higher than the WHOcut –

off for Asians in women, i.e, less than 80cm. Further studies arerequired to ascertain region specific cut offs to provide an improved tool for screening.

- Comparative analyses between all the anthropometric indices for men showed WHtR to be a better screening tool withan AUC of 0.682, sensitivity of 73.1% and specificity of 63.5%.
- Abdominal obesity majorly increases the weight of the individual and in turn BMI was suggested in our study because Waist Circumference increased with BMI at a statistical significance ofp<0.001. Increase in waist circumference seems to be the major contributor to weight as the BMIincreases in our study the WHtR also correspondinglyincreases with a p=0.001 suggesting tracking waist circumference along with weight is of utmost importancefor central obesity.Ina study done in China [58] with increasing BMI, therisk of hypertension increased substantially for both genders (p<0.001) , which was inferred in our study as well.
- This study infers a weak but positive correlation between CI and Cardiovascular risk prediction score . Nevertheless it has strong correlations between CI and some individual riskfactors likeSBP and DBPand anthropometric measures like WC and WHtR.WHtR provedto be good screening tool for cardiovascular risk in women and men irrespectively.

- In the Framingham heart study [59]with 5209 participants, it was concluded that BMI was a better marker for cardiovascularmorbidity as compared to CI. In astudy by Fontela[60] et al, on none of the anthropometric measures were found to beindependent factors for a diagnosis ofCAD or its mortality.
- The fact that the pathogenic mechanisms of interplay between central adiposity and atherosclerosis are not fully understood yet is being proved by these findings. Further studies onConicity Index and other anthropometric measures are the need of the hour due to the alarmingrate this undervalued pandemic that is obesity so that an action level cut-off can be established toprevent further disease progression and mortality.

CONCLUSION

CONCLUSION

This was a cross-sectional study done on 185 subjects attending the general OPD in a teritiary care setup in a urban city in South Indiato study the utility of conicity index as a screening tool for cardiovascular risk factors in Indians. The study was done betweenApril 2021 and June 2022.

Complete clinical profile with history and examination followed by anthropometric measures diabetic and lipid profile was assessed. Statistical analyses were done to arrive at a cut-off of CI as nostandard values have yet been derived for Indian population.

- The mean CI calculated in this study was 1.25 and the cut-off of CI calculated to identifyan increased cardiovascular risk was 1.23. CI had a positive but weak correlation with cardiovascular risk. However, strong correlations were obtained between CI and individual cardiovascular risk factors like PPBS, SBP, DBP. Strong correlations were also found between CI and other anthropometric indices like WC and WHtR. WHtR can be used as a screening tool for cardiovascular risk in males as well as females
- Along with traditional risk factors of cardiovascular risk like total cholesterol, triglycerides or blood pressure , the measures of abdominal obesity need to be considered as well in the riskanalysis.

- Primary prevention strategies should be initiatedfor preventing the cardiometabolic risk for individuals at early age using both cardiovascular risk factors and metabolic risk factors in orderto give a comprehensive direction.
- Anthropometric measures are the need of the hour in tackling this global epidemic that is obesity,hence it imperative that frequent montioring and its imbibation in the reular clinical practice is imperative.

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GOVERNMENT STANLEY MEDICAL COLLEGE & HOSPITAL,CHENN

INSTITUTIONAL ETHICS COMMITTEE

TITLE OF THE WORK	:	"CONICITY INDEX AS A SCREENING TOOL FOR CARDIOVASCULAR RISK FACTORS IN INDIANS"
PRINCIPAL INVESTIGATOR	:	DR. V. ANIRUDH SRINIVAS,
DESIGNATION	:	PG IN GENERAL MEDICINE,
DEPARTMENT	:	DEPARTMENT OF GENERAL MEDICINE

The request for an approval from the Institutional Ethical Committee considered on the IEC meeting held on 24.03.2021 at the Council Hall, Stan College, Chennai-1 at 11 am.

The members of the Committee, the secretary and the Chairman ar approve the proposed work mentioned above, submitted by the principal

The Principal investigator and their team are directed to adhere to th given below:

1. You should inform the IEC in case of changes in study procedure, site i investigation or guide or any other changes.
2. You should not deviate from the area of the work for which you appli clearance.
3. You should inform the IEC immediately, in case of any adverse events serious adverse reaction.
4. You should abide to the rules and regulation of the institution(s).
5. You should complete the work within the specified period and if any time is required, you should apply for permission again and do the w
6. You should submit the summary of the work to the ethical committee completion of the work.

CONSENT FORM

INFORMATION TO THE PARTICIPANT:
This study 'Conicity Index as a screening tool for cardiovascular risk factors in Indians' has been designed to study the relationship between certain anthropometric (body) measures and indices like waist circumference, hip circumference and conicity index with cardiovascular risk factors (Blood pressure, blood sugars, blood lipids.) If you are willing to let the investigator use your information for this study, you will have to permit the investigator, Dr V ANIRUDH SRINIVAS, to take certain body measurements when you are at the hospital for an executive health check and allow the investigator to use the results of your Executive health check blood tests. All the required measurements will be taken in a professional manner in complete privacy in a comfortable environment. Should you feel uncomfortable during any part of the process, you are free to withhold consent. Names and identifying information will be kept confidential and will not be used anywhere in the study.

UNDERTAKING BY THE INVESTIGATOR:
Your consent to participate in the above study is sought. You have the right to refuse consent or withdraw the same during the study without giving any reason. If you have any questions about the study, you are free to contact Dr. V ANIRUDH SRINIVAS Junior Resident Government Stanley Medical College Chennai for any clarification if you so desire. If you withdraw from the study, all your information will be destroyed.

CONFIDENTIALITY:
All the information/data collected from you and the results of the study shall be kept in strict confidence. The information provided/obtained by the study shall be kept separate from your medical records. A serial number will indicate your identity on records. The results will not be provided to your relatives, personal physician, insurance companies or any other third party unless you give a written consent for this to be done.
Information about you will be available to the investigators & the research associates.
No person or family will be identified in any report or publications from the study.
RESULT OF THE STUDY:The results will not be disclosed to you.
Patient consent form
I ________________ aged_____ with M.R.D. no- _______ have understood the information given in the information sheet regarding the study "CONICITY INDEX AS A SCREENING TOOL FOR CARDIOVASCULAR RISK FACTORS IN INDIANS" being conducted by Dr. V. Anirudh Srinivas, under the guidance of Dr. I Rohini Dr. G. Vijayalakshmi Dr . B Uma Maheshwari .The nature, objective, duration and expected effects of the study have been explained to me in a language in which I am conversant. I am ready to participate in this study voluntarily. I agree to cooperate with the research staff. I understand that I am at the liberty to withdraw from the study at any point of time without giving a reason and will not be prosecuted for doing the same.
By signing this consent form I have not given up any legal rights which I am otherwise entitled to.

Signature of patient Date	Signature of investigator Date

PROFORMA

Participant's name:
Age/Sex:
MRD no:
Occupation:
Place of residence: Co-morbidities and duration: Medications used –

Anthropometric measures	Measurement 1	Measurement 2	Average
Waist circumference (cm)			
Hip circumference(cm)			
Height (cm)			
Weight (kg)			
Blood Pressure(mmhg)			

FBS (mg/dl)	PPBS (mg/dl)	LDL (mg/dl)	HDL (mg/dl)	CHOL (mg/dl)	TGL (mg/dl)

PROCAM SCORE					
AGE	SCORE	LDL	SCORE	SBP	SCORE
35-39	0	<100	0	<120	0
40-44	6	100-129	5	120-129	2
45-49	11	130-159	10	130-139	3
50-54	16	160-189	14	140-159	5
55-59	21	>189	20	>=160	8
60-65	26				
TRIGLYCERIDE	SCORE	HDL	SCORE	SMOKER	SCORE
<100	0	<35	11	NO	0
100-149	2	35-44	8	YES	8
150-199	3	45-54	5		
>199	4	>54	0	TOTAL SCORE	
DIABETIC	SCORE	FAMILYHISTORYOFMI	SCORE		
NO	0	NO	0		
YES	6	YES	4		

1	HC2	AVGHC	HT	WT1	WT2	AVGWT	BMI	BMI RANGE	WHIPR	WHIPCLASS	WHT RATIO	CI	SBP/DBP	FBS	PPBS	LDL	HDL	CHOL	TGL	LDL/HDL	CHO/HDL	TSH	T2DM	SHTN	HYPOTHY	CV RISK
120	120.5	120.25	1.58	87	88	87.5	35.05	5	0.85	2	0.64	1.25	110/70	78	87	103	45	178	152	2.29	3.96	1.4	N	N	N	23
92	92.5	92.25	1.75	87	87	87	28.41	4	0.97	2	0.51	1.17	140/95	73	95	109	35	190	282	3.11	5.43	1.3	N	N	N	29
00.5	101	100.75	1.57	77	77	77	31.24	5	0.89	3	0.57	1.18	130/90	137	254	158	57	241	128	2.77	4.23	5.5	Y	N	N	31
92.5	93	92.75	1.5	61	61	61	27.11	4	0.91	3	0.56	1.21	120/70	121	257	105	49	205	195	2.14	4.18	1.1	Y	N	N	21
96.5	96	96.25	1.58	72	71.5	71.75	28.74	4	0.97	2	0.59	1.27	130/85	84	236	91	53	165	105	1.72	3.11	4	Y	N	N	42
80.5	80	80.25	1.49	53	54	53.5	24.10	3	0.93	3	0.50	1.14	110/75	147	157	73	21	109	77	3.48	5.19	1.3	Y	Y	N	37
92	93	92.5	1.49	63	62	62.5	28.15	4	0.92	3	0.57	1.21	125/85	89	93	117	41	184	130	2.85	4.49	1	N	N	N	21
87	86	86.5	1.71	83	82	82.5	28.21	4	1.05	3	0.53	1.20	120/90	66	106	71	42	139	132	1.69	3.31	2.6	N	N	N	24
97	97.5	97.25	1.71	85	85.5	85.25	29.15	4	1.04	3	0.59	1.32	130/90	93	106	115	43	193	177	2.67	4.49	3.7	N	N	N	19
80.5	80.5	80.5	1.55	45	45	45	18.73	2	0.92	3	0.48	1.26	100/70	86	105	95	57	172	100	1.67	3.02	3.2	N	N	N	22
97	97	97	1.5	61	60	60.5	26.89	4	0.93	3	0.60	1.30	120/75	85	89	120	51	203	162	2.35	3.98	3.2	N	N	N	15
96	96.5	96.25	1.61	78	78.5	78.25	30.19	5	1.02	3	0.61	1.29	135/80	88	94	110	68	203	128	1.62	2.99	2.9	N	N	N	20
84	84.5	84.25	1.53	62	62.5	62.25	26.59	4	0.98	3	0.54	1.19	110/65	102	106	86	41	142	75	2.10	3.46	3	N	N	N	8
88	88.5	88.25	1.47	56	56	56	25.92	4	0.97	3	0.58	1.27	147/95	89	127	44	50	121	133	0.88	2.42	6.5	N	N	N	38
107	107.5	107.25	1.6	75	75	75	29.30	4	1.05	3	0.70	1.51	150/80	118	219	40	46	112	130	0.87	2.43	2.9	Y	Y	N	38
72	72.5	72.25	1.56	40	40	40	16.44	1	0.90	3	0.42	1.17	145/10(	74	81	89	56	158	65	1.59	2.82	1.9	N	Y	N	31
97	96.5	96.75	1.69	68	68	68	23.81	3	1.03	3	0.59	1.45	155/95	120	153	103	47	182	159	2.19	3.87	4.2	Y	Y	N	58
09.5	109.5	109.5	1.54	72.5	72.5	72.5	30.57	5	0.88	3	0.62	1.28	120/80	240	298	39	60	120	106	0.65	2.00	2.6	Y	N	N	30
83.5	84	83.75	1.64	64	65	64.5	23.98	3	1.07	3	0.55	1.31	110/60	87	104	136	48	220	179	2.83	4.58	2.7	N	N	N	30
103	102.5	102.75	1.68	82	82	82	29.05	4	1.02	3	0.62	1.37	135/95	88	141	119	44	218	274	2.70	4.95	2.4	Y	Y	N	38
107	106.5	106.75	1.67	85	86	85.5	30.66	5	1.03	3	0.66	1.41	145/95	150	241	144	43	212	126	3.35	4.93	1.2	Y	Y	N	60
95	95.5	95.25	1.5	66	66	66	29.33	4	0.85	2	0.54	1.12	110/70	86	90	89	50	154	76	1.78	3.08	2.6	N	N	N	5
91	91	91	1.47	65	65	65	30.08	5	0.96	3	0.59	1.20	110/70	77	93	84	47	144	63	1.79	3.06	2.3	N	N	N	5
05.5	105.5	105.5	1.56	76	77	76.5	31.43	5	0.93	3	0.63	1.28	140/90	91	113	130	41	203	158	3.17	4.95	3.1	N	N	N	37
94.5	95	94.75	1.64	79	78.5	78.75	29.28	4	0.96	2	0.55	1.20	110/80	86	94	90	36	144	89	2.50	4.00	1.9	N	N	N	34
108	108.5	108.25	1.57	80	80	80	32.46	5	0.89	3	0.61	1.24	110/80	86	96	79	39	135	83	2.03	3.46	25.4	N	N	Y	8
97.5	97	97.25	1.55	70	70	70	29.14	4	0.96	3	0.60	1.27	140/80	229	349	181	55	287	254	3.29	5.22	15.5	Y	N	Y	39
89.5	90	89.75	1.46	70	70.5	70.25	32.96	5	0.91	3	0.56	1.07	120/80	149	306	160	51	251	198	3.14	4.92	4.4	Y	N	N	34
117	118	117.5	1.51	92	92	92	40.35	6	0.89	3	0.69	1.23	140/80	140	176	151	40	218	133	3.78	5.45	4	Y	Y	N	47
82.5	82	82.25	1.52	55	55	55	23.81	3	0.93	3	0.50	1.16	120/80	97	114	170	46	238	114	3.70	5.17	4.9	N	N	N	33
77	77	77	1.41	50	50	50	25.15	3	0.95	3	0.52	1.13	120/80	92	131	118	36	172	91	3.28	4.78	2.5	N	N	N	35
79.5	79	79.25	1.54	49	49	49	20.66	2	0.80	2	0.41	1.04	120/80	94	120	77	47	179	276	1.64	3.81	2.7	N	N	N	31
95	95.5	95.25	1.58	72	73	72.5	29.04	4	0.99	3	0.60	1.28	130/90	95	103	142	55	228	156	2.58	4.15	1.2	N	Y	N	28
01.5	101.8	101.65	1.68	93	93.5	93.25	33.04	5	0.97	3	0.59	1.22	110/60	80	106	102	46	171	114	2.22	3.72	1.8	N	N	N	18
90	91.5	90.75	1.41	52	52.5	52.25	26.28	4	0.92	3	0.59	1.26	130/95	118	254	100	49	167	92	2.04	3.41	10.2	Y	N	N	35
87.5	87	87.25	1.58	65	65	65	26.04	4	0.92	2	0.51	1.15	110/80	87	164	90	44	187	264	2.05	4.25	3	N	N	N	12
91	91	91	1.5	68	68	68	30.22	5	0.98	2	0.59	1.21	110/70	98	153	165	38	226	115	4.34	5.95	0.84	Y	N	N	68
76.5	76.5	76.5	1.66	53	54	53.5	19.42	2	0.94	1	0.44	1.17	110/60	84	110	113	36	172	115	3.14	4.78	1.4	N	N	N	29
81.5	81.5	81.5	1.62	61	61	61	23.24	3	0.95	2	0.48	1.16	130/80	89	161	115	42	179	111	2.74	4.26	2.1	N	N	N	43
88	88.5	88.25	1.48	64	64	64	29.22	4	0.94	3	0.56	1.15	110/70	101	127	185	40	256	153	4.63	6.40	3.7	N	N	N	25
90.5	90	90.25	1.54	76	76	76	32.05	5	0.97	3	0.57	1.15	120/80	90	110	118	42	179	93	2.81	4.26	6	N	N	N	26
96.5	96	96.25	1.62	83	83	83	31.63	5	0.89	3	0.53	1.09	140/90	101	107	60	48	140	159	1.25	2.92	11.4	N	N	N	19
96.5	96.8	96.65	1.75	93	93	93	30.37	5	1.03	3	0.57	1.25	170/12(	88	114	104	37	182	203	2.81	4.92	4.4	N	N	N	41
02.5	102	102.25	1.73	95	95	95	31.74	5	0.97	2	0.57	1.22	135/85	97	102	123	39	182	101	3.15	4.67	1.1	N	Y	N	31
99.5	99.5	99.5	1.56	76	76	76	31.23	5	0.95	3	0.61	1.25	110/70	78	101	82	48	152	111	1.71	3.17	3.4	N	N	N	7
102	102.5	102.25	1.46	74	74	74	34.72	5	1.06	3	0.74	1.40	180/10(	110	182	129	41	227	287	3.15	5.54	1.6	N	Y	N	56
126	125.5	125.75	1.53	103	103	103	44.00	6	0.88	3	0.72	1.24	150/10(	251	384	102	60	196	171	1.70	3.27	4.5	Y	Y	Y	29
00.5	100.2	100.35	1.53	65	65	65	27.77	4	0.85	3	0.56	1.20	120/80	187	235	72	39	158	236	1.85	4.05	2.6	Y	N	N	20
92	92.5	92.25	1.7	70	70	70	24.22	3	0.95	2	0.51	1.25	135/85	315	509	193	41	277	216	4.71	6.76	1.1	Y	N	N	57
99.5	99	99.25	1.57	65	65	65	26.37	4	0.95	2	0.60	1.35	160/80	103	182	101	56	185	142	1.80	3.30	2.8	Y	Y	N	42
87.5	87	87.25	1.41	60	60	60	30.18	5	1.01	3	0.63	1.24	170/90	125	229	102	39	180	195	2.62	4.62	3.1	Y	Y	N	54

1	HC2	AVGHC	HT	WT1	WT2	AVGWT	BMI	BMI RANGE	WHIPR	WHIPCLASS	WHT RATIO	CI	SBP/DBP	FBS	PPBS	LDL	HDL	CHOL	TGL	LDL/HDL	CHO/HDL	TSH	T2DM	SHTN	HYPOTHY	CV RISK
91.5	92	91.75	1.67	70	70	70	25.10	4	1.04	3	0.57	1.35	120/70	82	104	99	32	153	112	3.09	4.78	3.8	N	N	N	15
96	96.5	96.25	1.71	86	86	86	29.41	4	1.04	3	0.59	1.30	120/80	107	254	61	39	118	88	1.56	3.03	2.4	Y	Y	N	34
96	96.5	96.25	1.73	88	88	88	29.40	4	1.01	3	0.56	1.25	120/80	92	114	122	39	203	210	3.13	5.21	4.2	N	N	N	19
70.5	70	70.25	1.61	53	55	54	20.83	2	0.94	1	0.41	1.04	100/70	189	246	96	27	163	202	3.56	6.04	2.6	N	N	N	15
97.5	98	97.75	1.56	86	86	86	35.34	6	1.06	3	0.67	1.28	120/80	69	81	122	50	213	204	2.44	4.26	3.6	N	N	N	44
96	95.5	95.75	1.6	77	77	77	30.08	5	1.03	3	0.62	1.31	120/80	83	106	50	49	141	215	1.02	2.88	1.8	N	N	N	21
95	95.5	95.25	1.73	78	78	78	26.06	4	1.03	3	0.57	1.34	120/80	95	128	129	44	189	80	2.93	4.30	1.4	N	N	N	27
99.5	99	99.25	1.77	97	97	97	30.96	5	0.97	2	0.54	1.19	150/11	87	91	54	26	118	192	2.08	4.54	1.3	N	Y	N	27
98	98.5	98.25	1.46	61	61	61	28.62	4	0.98	3	0.66	1.37	160/10	108	172	168	45	252	194	3.73	5.60	2.4	N	Y	N	60
75.5	76.5	76	1.56	55	55	55	22.60	3	1.04	3	0.51	1.22	150/90	198	332	184	20	226	109	9.20	11.30	4.3	Y	Y	N	49
103.5	103	103.25	1.74	97	97	97	32.04	5	1.04	3	0.62	1.32	130/90	168	353	82	40	154	159	2.05	3.85	2.5	Y	Y	N	39
86.5	87	86.75	1.58	63	63	63	25.24	4	1.04	3	0.57	1.31	130/90	159	426	86	51	164	133	1.69	3.22	7.6	Y	N	N	50
96.5	96	96.25	1.59	83	83	83	32.83	5	0.96	3	0.58	1.17	120/70	138	265	98	43	175	171	2.28	4.07	2.2	Y	N	N	35
100.5	100	100.25	1.71	94	94	94	32.15	5	1.10	3	0.65	1.37	130/80	109	126	93	43	159	117	2.16	3.70	3.1	N	N	N	37
80.55	80	80.275	1.45	53	53	53	25.21	4	1.01	3	0.56	1.23	130/80	126	200	146	59	256	254	2.47	4.34	1.3	Y	N	N	43
81.5	81	81.25	1.67	61	61	61	21.87	3	0.99	2	0.48	1.22	100/60	91	104	105	40	167	111	2.63	4.18	0.5	N	N	N	48
90	90	90	1.77	81	81	81	25.85	4	1.07	3	0.55	1.31	120/70	100	139	132	48	203	117	2.75	4.23	1.7	N	N	N	27
80.5	80.5	80.5	1.59	66	66	66	26.11	4	1.00	3	0.51	1.15	120/80	90	111	122	49	205	169	2.49	4.18	1	N	N	N	35
73	73	73	1.43	45	45	45	22.01	3	0.94	3	0.48	1.12	120/80	86	132	109	49	179	106	2.22	3.65	6.9	N	N	N	44
91	91.5	91.25	1.7	74	74	74	25.61	4	0.98	2	0.53	1.24	140/90	90	103	76	37	162	244	2.05	4.38	3.8	N	N	N	17
70	70.5	70.25	1.48	44	44	44	20.09	2	0.91	1	0.43	1.07	100/60	77	93	79	39	145	135	2.03	3.72	1.6	N	N	N	10
72.5	73	72.75	1.73	59	59	59	19.71	2	1.02	3	0.43	1.17	110/70	92	122	80	38	145	137	2.11	3.82	2.6	N	N	N	14
86.5	86	86.25	1.75	80	80	80	26.12	4	0.99	2	0.49	1.16	120/80	141	357	78	40	157	193	1.95	3.93	0.9	Y	N	N	25
78.5	78	78.25	1.45	51	51	51	24.26	3	0.97	3	0.53	1.18	130/80	276	442	167	57	290	331	2.93	5.09	1.9	Y	Y	N	38
90	90	90	1.57	60	60	60	24.34	3	0.98	3	0.56	1.31	130/90	88	137	120	49	198	147	2.45	4.04	0.71	N	N	N	41
83	83	83	1.68	75	75	75	26.57	4	0.97	2	0.48	1.10	130/90	233	315	71	47	135	84	1.51	2.87	1.7	Y	N	N	40
98	97	97.5	1.6	85	85	85	33.20	5	1.03	3	0.63	1.26	160/10	375	606	191	54	274	144	3.54	5.07	5.3	Y	Y	N	56
98.5	98	98.25	1.72	98	98	98	33.13	5	1.02	3	0.58	1.22	140/11	363	511	161	44	243	192	3.66	5.52	6.9	Y	Y	N	71
89.5	89	89.25	1.55	70	70	70	29.14	4	1.06	3	0.61	1.29	140/10	155	253	78	39	196	396	2.00	5.03	3.5	Y	Y	N	34
91	91	91	1.51	69	69	69	30.26	5	1.06	3	0.64	1.31	120/80	196	260	199	42	312	638	4.74	7.43	43.8	Y	Y	Y	44
99.5	99	99.25	1.78	95	95	95	29.98	4	1.02	3	0.57	1.27	120/80	96	104	141	53	222	138	2.66	4.19	1.4	N	N	N	27
88	87	87.5	1.61	65	65	65	25.08	4	0.97	3	0.53	1.23	120/80	159	279	110	44	181	138	2.50	4.11	3	Y	N	N	39
97	97.5	97.25	1.68	72	72	72	25.51	4	0.96	2	0.56	1.31	120/80	159	274	81	44	143	92	1.84	3.25	1.2	Y	N	N	46
92	92	92	1.68	75	75	75	26.57	4	0.98	2	0.54	1.24	120/80	85	98	121	42	202	195	2.88	4.81	3.5	N	N	N	32
105	105.5	105.25	1.53	87	87	87	37.17	6	1.06	3	0.73	1.35	150/11	330	577	133	55	218	148	2.42	3.96	2.3	Y	Y	N	49
99	99.5	99.25	1.54	60	60	60	25.30	4	1.04	3	0.67	1.52	150/10	119	273	144	50	220	132	2.88	4.40	5.2	Y	Y	N	58
108	107	107.5	1.75	89	89	89	29.06	4	1.05	3	0.64	1.45	130/90	86	103	151	59	250	201	2.56	4.24	2.7	N	N	N	27
105	105.5	105.25	1.71	86	86	86	29.41	4	1.02	3	0.63	1.39	130/90	113	187	145	47	220	138	3.09	4.68	10.4	Y	N	Y	64
88	88.5	88.25	1.68	78	78	78	27.64	4	1.03	3	0.54	1.23	140/90	106	130	110	42	194	212	2.62	4.62	4.2	N	Y	N	48
102	103	102.5	1.56	81	81	81	33.28	5	1.03	3	0.67	1.34	130/90	75	82	298	70	415	233	4.26	5.93	7.3	N	N	N	31
94.5	94	94.25	1.69	68	68	68	23.81	3	1.01	3	0.56	1.38	120/80	358	477	108	45	179	132	2.40	3.98	0.87	Y	Y	N	31
109.5	109	109.25	1.51	80	80	80	35.09	6	1.03	3	0.74	1.41	130/90	158	318	115	42	225	338	2.74	5.36	3.7	Y	N	N	47
93	93.5	93.25	1.55	60	60	60	24.97	3	0.96	3	0.58	1.32	110/70	90	135	89	54	172	146	1.65	3.19	3.4	N	N	N	18
105.5	105.5	105.5	1.65	80	80	80	29.38	4	1.02	3	0.65	1.41	130/90	116	228	111	48	221	312	2.31	4.60	2.7	Y	N	N	37
98	98.5	98.25	1.7	65	65	65	22.49	2	0.97	2	0.56	1.41	120/80	95	99	117	48	188	113	2.44	3.92	2.9	N	N	N	14
96	96.5	96.25	1.56	75	75	75	30.82	5	1.05	3	0.65	1.34	130/90	300	495	121	44	215	252	2.75	4.89	0.48	Y	N	N	37
93	93.5	93.25	1.55	58	58	58	24.14	3	0.96	3	0.58	1.34	120/80	202	229	79	68	158	56	1.16	2.32	3.1	Y	N	N	23
98	97.5	97.75	1.75	98	98	98	32.00	5	1.03	3	0.57	1.23	140/10	73	172	185	60	299	268	3.08	4.98	3	N	Y	N	45
90	90.5	90.25	1.65	60	60	60	22.04	2	0.98	2	0.53	1.34	100/60	101	106	96	41	162	123	2.34	3.95	2.4	N	N	N	10
105.5	106	105.75	1.68	79	79	79	27.99	4	1.04	3	0.65	1.46	130/90	141	257	146	52	245	233	2.81	4.71	1.7	Y	N	N	28
92	93	92.5	1.56	65	65	65	26.71	4	0.95	3	0.56	1.24	110/70	87	107	149	49	217	97	3.04	4.43	1.5	N	N	N	15
85	85.5	85.25	1.63	68	68	68	25.59	4	1.04	3	0.54	1.25	110/70	145	232	49	32	123	210	1.53	3.84	4.1	Y	N	N	50

	HC2	AVGHC	HT	WT1	WT2	AVGWT	BMI	BMI RANGE	WHIPR	WHIPC LASS	WHT RATIO	CI	SBP/D BP	FBS	PPBS	LDL	HDL	CHOL	TGL	LDL/ HDL	CHO/ HDL	TSH	T2DM	SHTN	HYPOTHY	CV RISK
.5	85.5	85.5	1.65	64	64	64	23.51	3	0.99	2	0.52	1.25	140/70	241	431	107	46	228	374	2.33	4.96	4.9	Y	Y	N	40
72	72.5	72.25	1.61	52.5	53	52.75	20.35	2	0.92	1	0.41	1.06	120/80	78	97	108	76	207	116	1.42	2.72	4.1	N	N	N	34
79	79	79	1.7	55	55	55	19.03	2	1.00	2	0.46	1.27	110/70	77	90	57	43	130	148	1.33	3.02	1.5	N	N	N	22
84	84	84	1.74	60	60	60	19.82	2	0.94	1	0.46	1.24	140/90	78	145	85	31	153	185	2.74	4.94	9.3	Y	Y	Y	53
.5	84	84.25	1.61	74	74	74	28.55	4	1.09	3	0.57	1.24	140/80	79	117	90	40	146	87	2.25	3.65	1.7	N	Y	N	41
.5	87.5	87.5	1.7	79	79	79	27.34	4	1.03	3	0.53	1.22	120/80	83	89	118	40	187	143	2.95	4.68	5.1	N	N	N	27
.5	84	84.25	1.77	72	72	72	22.98	2	1.02	3	0.49	1.24	130/80	96	116	111	50	195	169	2.22	3.90	4.4	N	N	N	16
.5	73	72.75	1.53	43	43	43	18.37	1	0.95	2	0.45	1.19	100/60	99	109	105	39	191	234	2.69	4.90	1.5	N	N	N	41
.5	87.5	87.5	1.51	60	60	60	26.31	4	0.99	2	0.57	1.26	120/70	96	108	113	42	179	119	2.69	4.26	5.6	N	N	N	17
.5	89.5	89.5	1.71	73	73	73	24.96	3	1.03	3	0.54	1.29	120/70	78	130	106	85	214	115	1.25	2.52	2.8	N	N	N	15
.5	90.5	90.5	1.79	79	79	79	24.66	3	0.98	2	0.50	1.23	120/80	76	93	109	38	172	123	2.87	4.53	0.87	N	N	N	17
00	100	100	1.5	73	73	73	32.44	5	0.90	2	0.60	1.18	100/60	72	95	156	49	225	102	3.18	4.59	2.4	N	N	N	25
99	99.5	99.25	1.67	92	92	92	32.99	5	1.10	3	0.65	1.35	150/10(	121	200	149	47	230	169	3.17	4.89	2	Y	Y	N	40
.5	98	98.25	1.56	77	77	77	31.64	5	0.94	3	0.59	1.21	140/90	85	96	176	61	262	126	2.89	4.30	2.66	N	N	N	41
.5	104	103.75	1.73	99	99	99	33.08	5	1.07	3	0.64	1.35	160/10(	98	125	87	48	160	126	1.81	3.33	1.7	N	Y	N	31
.5	84	84.25	1.8	81	81	81	25.00	4	0.98	2	0.46	1.13	120/80	71	100	121	51	192	102	2.37	3.76	1.4	N	N	N	14
91	91.5	91.25	1.71	70	70	70	23.94	3	0.90	2	0.48	1.18	100/60	82	95	148	45	211	91	3.29	4.69	5.1	N	N	N	15
.5	90.5	90.5	1.49	65	65	65	29.28	4	0.93	2	0.56	1.17	110/60	87	98	107	48	184	146	2.23	3.83	1	N	N	N	12
.5	100	100.25	1.59	80	80	80	31.64	5	1.02	3	0.64	1.32	120/70	90	119	121	36	197	201	3.36	5.47	2	N	N	N	34
.5	85	85.25	1.51	60	60	60	26.31	4	0.89	2	0.50	1.11	120/80	101	108	88	39	167	201	2.26	4.28	1.6	N	N	N	14
.5	96	96.25	1.51	72	72	72	31.58	5	0.97	3	0.62	1.24	120/70	90	98	103	40	175	159	2.58	4.38	2.4	N	N	N	18
91	91	91	1.57	68	68	68	27.59	4	0.91	3	0.53	1.15	110/70	98	114	133	42	213	192	3.17	5.07	8.5	N	N	N	21
88	88.5	88.25	1.7	74	74	74	25.61	4	1.03	3	0.53	1.26	110/70	100	115	100	36	152	78	2.78	4.22	1	N	N	N	13
.5	101	101.25	1.56	82	82	82	33.69	5	0.93	3	0.60	1.19	180/10(	190	276	166	53	245	130	3.13	4.62	2.2	Y	Y	N	45
99	99	99	1.7	84	84	84	29.07	4	1.04	3	0.61	1.34	110/70	95	118	98	34	154	106	2.88	4.53	1.6	N	N	N	21
05	105	105	1.65	83	83	83	30.49	5	1.05	3	0.67	1.43	130/80	84	234	86	39	158	167	2.21	4.05	1.3	Y	N	Y	46
84	84	84	1.62	60	60	60	22.86	3	0.93	3	0.48	1.18	110/70	92	130	62	54	132	78	1.15	2.44	2.1	N	N	N	21
.5	97	97.25	1.5	63	63	63	28.00	4	1.03	3	0.67	1.42	170/70	177	347	91	54	201	281	1.69	3.72	2.4	Y	N	Y	53
.5	95.5	95	1.54	71	71	71	29.94	4	0.96	3	0.59	1.24	140/90	106	119	125	50	200	125	2.50	4.00	1.8	N	N	N	32
87	88	87.5	1.54	61	61	61	25.72	4	1.07	3	0.61	1.36	130/80	155	295	130	45	197	112	2.89	4.38	3.5	Y	Y	N	52
13	113	113	1.65	97	97	97	35.63	5	1.03	3	0.71	1.39	140/10(	106	149	133	37	242	360	3.59	6.54	2.8	N	N	N	60
95	95	95	1.58	66	66	66	26.44	4	1.02	3	0.61	1.38	100/70	83	95	130	53	197	69	2.45	3.72	2.3	N	N	N	15
.5	84.5	84.5	1.48	62	62	62	28.31	4	1.07	3	0.61	1.28	180/10(	106	119	166	49	243	140	3.39	4.96	4.5	N	Y	N	45
.5	86.5	86.5	1.59	61	61	61	24.13	3	1.01	3	0.55	1.30	130/80	202	465	61	44	149	220	1.39	3.39	2.8	Y	N	N	37
93	93	93	1.73	86	86	86	28.73	4	1.03	3	0.55	1.24	130/80	100	115	100	36	152	78	2.78	4.22	1	N	Y	N	13
93	93	93	1.6	80	80	80	31.25	5	1.03	3	0.60	1.25	130/10(	190	276	166	53	245	130	3.13	4.62	2	Y	N	Y	45
.5	84	83.75	1.64	64	65	64.5	23.98	3	1.07	3	0.55	1.31	110/60	87	104	136	48	220	179	2.83	4.58	2.7	N	N	N	30
03	102.5	102.75	1.68	82	82	82	29.05	4	1.02	3	0.62	1.37	135/95	88	141	119	44	218	274	2.70	4.95	2.4	Y	Y	N	38
07	106.5	106.75	1.67	85	86	85.5	30.66	5	1.03	3	0.66	1.41	145/95	150	241	144	43	212	126	3.35	4.93	1.2	Y	Y	N	60
95	95.5	95.25	1.5	66	66	66	29.33	4	0.85	2	0.54	1.12	110/70	86	90	89	50	154	76	1.78	3.08	2.6	N	N	N	5
91	91	91	1.47	65	65	65	30.08	5	0.96	3	0.59	1.20	110/70	77	93	84	47	144	63	1.79	3.06	2.3	N	N	N	5
.5	105.5	105.5	1.56	76	77	76.5	31.43	5	0.93	3	0.63	1.28	140/90	91	113	130	41	203	158	3.17	4.95	3.1	N	N	N	37
.5	95	94.75	1.64	79	78.5	78.75	29.28	4	0.96	2	0.55	1.20	110/80	86	94	90	36	144	89	2.50	4.00	1.9	N	N	N	34
08	108.5	108.25	1.57	80	80	80	32.46	5	0.89	3	0.61	1.24	110/80	86	96	79	39	135	83	2.03	3.46	25.4	N	N	Y	8
.5	97	97.25	1.55	70	70	70	29.14	4	0.96	3	0.60	1.27	140/80	229	349	181	55	287	254	3.29	5.22	15.5	Y	N	Y	39
.5	90	89.75	1.46	70	70.5	70.25	32.96	5	0.91	3	0.56	1.07	120/80	149	306	160	51	251	198	3.14	4.92	4.4	Y	N	N	34