Prevalence of metabolic syndrome and its association with type 2 diabetes in south Indian patients

http://manuscript.advancejournals.org/uploads/f94c4e761f336736fd72b71f3051eb4d15b13dba69689f

October 14, 2019 · Volume 32 Issue 1

admin

. Prevalence of metabolic syndrome and its association with type 2 diabetes in south Indian patients: http://manuscript.advancejournals.org/uploads/f94c4e761f336736fd72b71f3051eb4d15b13dba69689f3e5ee755b3dae77ae3/Manuscrip Journal of Recent Advances in Applied Sciences. 2019 Oct 14 [last modified: 2020 Apr 28]. Edition 1.

Abstract

Metabolic syndrome is describes as a clustering of cardiovascular risk factors, such as, abdominal obesity, dyslipidemia, hyperglycaemia and hypertension. There are so many risk factors are common in Type 2 diabetes and cardiovascular disease, and many of these risk factors are highly correlated with one another. The risk factors of the metabolic syndrome are of metabolic origin and composed of atherogenic dyslipidemia, high plasma glucose level, elevated blood pressure, a prothrombotic state, and a pro inflammatory state. The management of persons with metabolic syndrome should have to focus not only on blood glucose control but also includes approaches for reduction of other cardiovascular disease risk factors. The present study aims to understand the prevalence of metabolic syndrome and its association with type 2 diabetes. The study group included 150 type 2 diabetes patients in the age group ranging between 20-80 years. Waist and hip circumference, BMI, Blood pressure, fasting blood glucose and Cholesterol tests like HDL and Triglycerides was determined. Prevalence of individual risk factor for metabolic syndrome was determined out of 150 patients and 97 patients were observed with high blood pressure, 85 patients were observed with low levels of HDL, 60 patients were observed with central obesity, 45 patients were observed with high triglycerides and all 150 patients were observed with diabetes.

Key words

Metabolic Syndrome, insulin resistance, Abdominal obesity , cytokines, type 2 diabetes.

Introduction

Metabolic syndrome (MS) is describes as a clustering of key cardiovascular risk factors, such as, abdominal obesity, dyslipidemia, hyperglycaemia and hypertension and obesity (particularly central adiposity). The MS has drew increased attention in the last few years. The World Health Organization (WHO), has defined the syndrome to include a combination of impaired glucose regulation or diabetes, insulin resistance, raised arterial blood pressure, raised plasma triglycerides and/or low HDL-cholesterol, central obesity and/or BMI >30 kg m-2 and micro albuminuria (Hanson RL et. al; 2002: Ginsberg HN et al., 2009; Manjunath CN et al. 2013 and Cornier MA et. al; 2008). The increased prevalence of metabolic syndrome in all over the world appears to be driven largely by more obesity exacerbated by luxurious and inactive of lifestyles (Alberti et al., 2005). Different metabolic pathways have also been showed to link insulin resistance and hyperinsulinemia (Reaven G, 2004, Eckel RH et al; 2005). There are so many risk factors are common in Type 2 diabetes and cardiovascular disease, and many of these risk factors are highly correlated with one another. (Hamman et al., 1992; Castelli et al., 1984 and Stern et al., 1995). Person with these indications generally manifest a prothrombotic state which is a proinflammatory state and also represent a big risk of cardiovascular disease (Kaur J. 2014; and Hanson et. al., 2002).

The management of individual with metabolic syndrome should have to focus not only on the regulation of blood glucose level but also includes approaches for reduction of other cardiovascular disease threats. This has been variously reported that insulin resistance is supposed to be the common etiological factor for this syndrome. Intense and early management of the syndrome may have a prominent effect on the prevention of diabetes and as well as cardiovascular disease (Magkos F, et al; 2009). Abdominal obesity is most strongly linked with the metabolic syndrome among the all form of obesity. It is measured clinically as an increased waist circumference. Obesity is one of the main risk factors associated with the development of type 2 diabetes mellites. (Han TS and Lean ME, 2016). Austin and his colleagues first reported that the Atherogenic Dyslipidemia (AD) as a clinical condition which is characterized by high levels of serum triglyceride (TG) and small-dense low-density lipoprotein (sdLDL) particles with low levels of high-density lipoprotein cholesterol (HDL-C) (Manjunath CN, et al; 2013). Generally high blood pressure is highly linked with the obesity and commonly found in individual with insulin-resistant. Hypertension is linked with the metabolic risk factors. Insulin resistance is found in the most of the people with the metabolic syndrome (Ivanova EA et al; 2017, Hirano T, 2005). It strongly linked with the other metabolic risk factors and correlates with cardiovascular disease. A proinflammatory state which is identified clinically by presence of high level of C-reactive protein (CRP) that is generally found in

those persons who have metabolic syndrome. A prothrombotic state which is characterized by presence of high level of plasma plasminogen activator inhibitor (PAI-1) and fibrinogen which also linked with the metabolic syndrome.

This is reported that Pro-thrombotic and proinflammatory states may be metabolically interlinked (National Cholesterol Education Program, 2002). There is no any specific drug that cure metabolic syndrome. It have been suggested that drugs such as Metformin, glitazones and acarbose either improve the syndrome or delay in the progression of type 2 diabetes (Pfeiffer AF and Klein HH, 2014) although, there is a safety concerns which do not favour for glitazones. Among the diabetes, type 2 is the most common form that counts approximately 90% of person with diabetes around the world which is characterized by insulin resistance (IDF 2006, American Diabetes Association, 2014).

The peoples with type 2 diabetes are increasing in almost all countries with 80% of people are belong to type 2 diabetes which are living in low- and middle-income countries (Olokoba AB et al., 2012). The occurrence of type 2 DM greatly varies particularly from one geographical region to the other as a result of environmental and lifestyle risk factors (Zimmet P et al; 2012). It is reported that the occurrence of DM in adults with type 2 DM is increasing and will rise in developing countries among the patients that are aged between 45 and 64 years (Wild S et al; 2004).

The present is focus and narrate the beneficiary factors for this study to understand properly the occurence of MS and its link with type 2 diabetes. The objectives of this study was to assess the risk stratified by obesity, hypertension, hyperglycemia , identification of metabolic syndrome (MS) among patients with type-2 diabetes, to find predictors /markers for type-2 diabetes, and to identify the strongest predictors of metabolic syndrome in newly detected type-2 diabetic individuals.

Materials And Methods

Samples

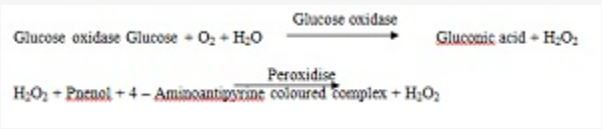
It is a population based study among the subjects with type-2 diabetes, including obesity, cardiovascular risk factors, abdominal obesity, dyslipidemia, hyperglycaemia and hypertension and its association with type 2 diabetes. The study was conducted in the Aruna Diabetes Centre, Chennai on the patients who were registered for type-2 diabetes treatment in the age (years) group of 20 to 80. The study has been conducted over a period of three months (January 2015 – March 2015). the number of samples 150 samples from registered, 20 to 80 years of age at baseline, randomly selected, presentation of relative risk at end points of metabolic syndrome or type 2 diabetes.

Collections of blood samples

The blood samples were collected through phlebotomy the NABL protocol was followed for the collection of samples. The patient was made to sit and asked to place the arm on the table. The tourniquet was tied and the vein was felt to introduce the needle. The puncture site was slightly rubbed with cotton dipped in 70% alcohol (Lippi G et. al; 2017). The syringe was then removed from the warp and the needle was inserted in the midcubital vein. Around 2ml of blood was collected and the needle was withdrawn by applying pressure with sterile cotton in order to stop bleeding from the punctured site. The tourniquet was removed and the patient was asked to fold his hand for few minutes. After removing the needle from the syringe, the collected blood was dispensed into the respective labelled test tubes (Fujii C, 2013).

Estimation of fasting plasma glucose

The estimation of fasting plasma glucose level was done according to Glucose oxidase is an enzyme that catalyse the oxidation of Beta D- glucose which is present in the blood plasma to D glucono -1, 5 – lactone with the formation of hydrogen peroxide; then this lactone is then slowly hydrolysed to D-gluconic acid. The hydrogen peroxide then produced is broken down to oxygen and water by the peroxidase enzyme and finally converted to a coloured compound which can be measured colorimetrically. The red coloured complex formed and O.D measured at 505 nm with referred by Juaristi et. al; 1995.



Estimation of triglycerides

The experiments have been carried out according to Philip, D. Mayne et al., 1994. Sample triglycerides were incubated

lipoprotein lipase (L.P.L.) which liberates glycerol and free fatty acids. Glycerol is converted to giycarol-3 phosphate (G3P) and adenosine-5-diphosphate (ADP) by glycerolkinase and ATP. Glycerol-3-phosphate (G3P) is then converted by glycerol phosphate dehydrogenase (GPO) to dihydroxyacetone phosphate (DAP) and hydrogen peroxide (H_2O_2).

Estimation of hdl – cholesterol

The estimation of low density lipoprotein (LDL) cholesterol, very low density lipoproteins (VLDL) cholesterol and chylomicron fractions are precipitated upon adding the methylene Glycol 6000 (PEG). After centrifugation, the high density lipoprotein (HDL) fraction remains in the supernatant and is determined according to Richmond, N et al., 1974.

Measurement of Waist Circumference

Measuring tape was placed, holding it parallel to the floor around abdomen at the level of the iliac crest. Hold tape snug but do not compress the abdominal skin and measure circumference by measuring tape (Anuradha, R., & Hemachandran, S. (2012). This is a simple method for assessing the abdominal obesity which is calculated by Anuradha R and Hemachandran S, 2012.

Hip Circumference Measurement Technique

Measuring tape was placed, holding it parallel to the floor, around the hip at the level of greater trochanter of femur. Hold tape snug but do not compress the skin and measured circumference according to Taylor RW et al; 2000.

Measurement of the blood pressure

The patient sits on a chair with the lower arm supported ahead. The blood pressure cuff is placed on the patients' right arm, allowing 1 inch between the bottom of the cuff and the crease of the elbow. The diaphragm is placed over the brachial artery in the space between the bottom of the cuff and the crease of the elbow and the blood pressure is measured according to Ogedegbe G, 2010.

Results

Samples were collected from positive type 2 diabetes patients and processed in Aruna Diabetes Center, Choolaimedu, Chennai. The study group included 150 type 2 diabetes patients in the age group ranging between 20-80 years. Waist and hip circumference, BMI, Blood pressure, fasting blood glucose and Cholesterol tests like HDL and Triglycerides was determined. Patient's age and sex information was taken for the present study. Distribution of type2 diabetes was determined according to age group in the present study 20-40 years group 25 patients have type 2 diabetes, 41 – 60 years 40 patients with type 2 diabetes and in 61-80 years 85 patients having type 2 diabetes. Prevalence of individual risk factor for metabolic syndrome was determined out of 150 patients and 97 patients were observed with high blood pressure, 85 patients were observed with low levels of HDL, 60 patients were observed with central obesity, 45 patients were observed with high triglycerides and all 150 patients were observed with diabetes. Correlation of metabolic syndrome and type 2 diabetes was determined out of 150 diabetic patients 60 patients were observed with metabolic syndrome. Distribution of metabolic syndrome was identified in 150 patients. 32 patients having cluster of risk factors such as in group fasting blood glucose, high blood pressure, central obesity in second group 20 patients has fasting blood glucose, low HDL, central obesity and the final group 8 patients has fasting blood glucose, central obesity high triglycerides.The group stratified by obesity and hypertension along with hyperglycemia had highest risk associated with type-2 diabetes All the registered type-2 diabetes were identified with metabolic syndrome. Therefore, we can propose that the risk cluster (FBS+CENTRAL OBESITY+HIGH BP) could be a predictor for type -2 diabetes in the non-diagnosed group of individuals and among these the strongest predictor is high blood pressure and low HDL-C. There is a strong inheritable genetical association in type 2 Diabetes Mellitus (Olokoba et al., 2012). The hall mark of Type 2 DM is insulin insensitivity as a result of insulin resistance, declining insulin production, and possibility of pancreatic beta-cell failure (Kahn et al., 1994). This causes the decrease in glucose transport into the liver, muscle cells, and fat cells. Olokoba et al., 2012). The present study was conducted from January 2014 to march 2015 at Aruna diabetes centre, Chennai. The total 150 participants were included in this study. One fifty respondents aged form 20 to 80 of age at baseline was screened for Metabolic Syndrome (MS) with registered type II diabetic patients. Table 5.1/Fig 3.1 shows the sample of 150 participants were included in this study, of which 43.4% were females, 56.6% were male.

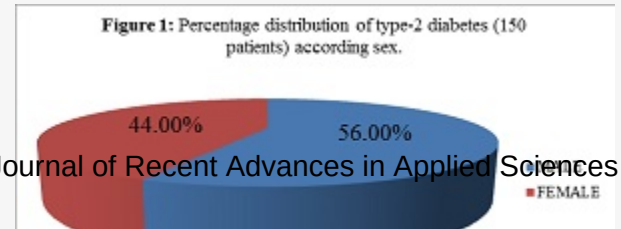


Figure 1: Percentage distribution of type-2 diabetes (150 patients) according sex.

Age distribution

Table 3.2/ Fig 3.2 show the age distribution of type-2 diabetes. Based on age group, patients were divided into three groups, 20-40 years and 41-60 and 61-80 years. Out of 150 patients , 25 patients (16%) under age group (20-40 years) and under age group (41-60 years) 85 patients (56%) under age group (61-80 years) 40 patients (26%) (Table 3.2 and Fig 3.2). Table 3.3 shows the Prevalence of individual risk factor for metabolic syndrome. The most prevalent metabolic risk observed was the Fasting plasma glucose and it was present in 135 (90%); high blood pressure values recorded high in 97 (64%) subjects ;low levels of HDL-C, present in 85 (53%) participants. and 45(30%) had raised triglyceride levels ,Central Obesity (W/H ratio:>102/99) was noted in 60(40%) participants (Fig 3.3). The most common risk factors found in this study were high blood pressure (64%) and HDL-C (53%), Central obesity (40%) (Table 3.3/Fig 3.2). Table 3.4/ Fig 3.4 shows 40% metabolic syndrome were identified in 150 type -2 diabetic patients. Table 3.5/Fig 3.5 shows the 32 patients having cluster of risk factors such as in group fasting blood glucose , central obesity , high blood pressure in second group 20 patients has fasting blood glucose, central obesity, low HDL and the final group 8 patients has fasting blood glucose, central obesity, high triglycerides.

Many peoples suffering from type 2 DM are obese, with central visceral adiposity, therefore, adipose tissue also plays a significant role in the cause of type 2 DM (Olokoba et al; 2012).

Table 1: Percentage distribution of Type-2 Diabetes (150 patients) according sex.

S.No	SEX	Number of patients	Percent (%) Distribution
1	MALE	85	56.60%
2	FEMALE	65	44%

The percentage distribution according the age it shows the mails have 56% and females have 44% of type 2 diabetes among the 150 patients.

Table:2 Distribution of type-2 diabetes (150patients) according to Age group.

S.No	Age Group(Years)	Number of patients	Percentage (%)
Distribution			
1	(20-40)	25	16%
2	(41-60)	85	56%
3	(61-80)	40	26%

According to the age group the distribution the percentage of type 2 diabetes in different age such as 20-40 age group the number of patient 25 the distribution in 16%. The group 2 age between 41-60 the number of patients 85 the distribution percent 56%. The III group was 61-80 the number of patients 40 the distribution was 26%. According to this table the percentage of distribution of type 2 diabetes higher in II group aged between 41-60 years. It was representing the higher distribution rate in adult age between 40-60. The age people were more risk of type 2 diabetes.

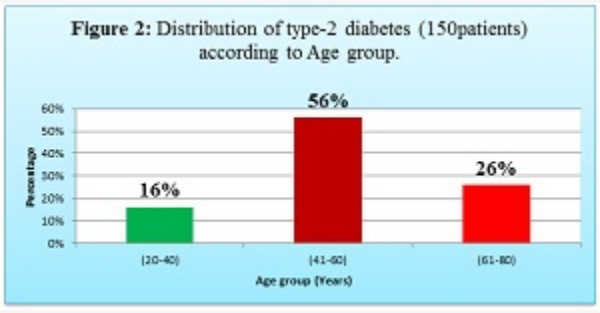


Figure 2: Distribution of type-2 diabetes (150patients) according to Age group.

Table: 3 Prevalence of individual risk factors of metabolic syndrome among type-2 diabetic patients.

S.No	Cluster of risk factors	Number of Patients	Percentage distribution
1	FBS	135	90%
2	HIGH BP	97	64%
3	LOW HDL	85	53%
4	CENTRAL OBESITY	60	40%
5	HIGH TGL	45	30%

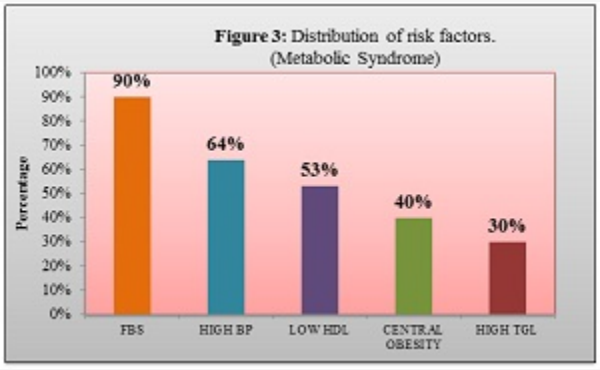


Table :4 Correlation of metabolic syndrome and type-2 diabetes .

S.No	Clinical condition	Number of Patients	Percentage Distribution
1	Type-2 Diabetes	150	100%
2	MS associated with Diabetes	60	40%

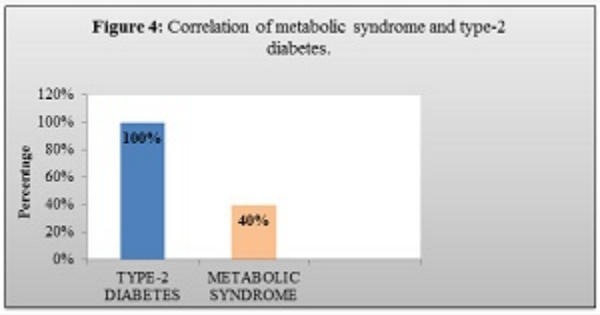
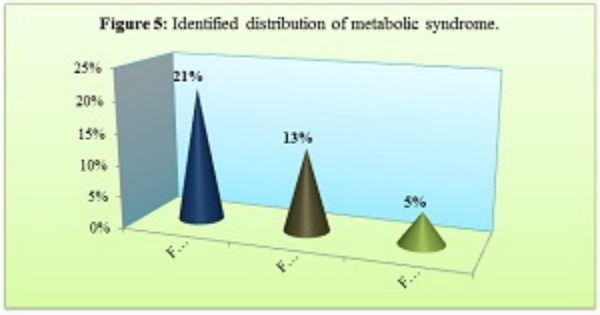


Table 5: Identified distribution of metabolic syndrome.

S.No	Identified MS Cluster	Number of Patients	Percentage
1	FBS+CENTRAL OBESITY+HIGH BP	32	21%
2	FBS+CENTRAL OBESITY+LOW HDL	20	13%
3	FBS+CENTRAL OBESITY+HIGH TGL	8	5%



Discussion

In present study 100% of the diabetic patients (n=150), aged >20 years (females: 44% and males: 56%) under the criteria diagnosed for metabolic syndrome according to ATP III guidelines (Kaur J, 2014). As per the WHO the occurence of metabolic syndrome in T2DM among males and females was approximately 84% and 78%, respectively. The data showed that cardiovascular disease was generally increased in patients with metabolic syndrome (Isomaa et. al; 2001). The percentage of T2DM patients with age more than 40 years those with metabolic syndrome in both the findings are comparable. Botnia study was classified using BMI or Waist-hip ratios for the obesity. There is a higher occurrence of obesity in Botnia study as compared to present study used the ATP III criteria for central obesity (i.e., waist circumference >88 cm in females and >102 cm in males) (Elsayed et al., 2008). In our study, 60% diabetic patients had three components satisfying criteria for metabolic syndrome. It has been suggested by Cruz et al., 1998 that number of criteria for metabolic syndrome may be inversely proportional to insulin sensitivity (Bahijri et al., 2013). By knowing the cluster of individuals at high-risk for metabolic syndrome there can be delay in the emergence of DM, dyslipidemia, CVD, heart stroke and obesity. The populations with family history of DM have increased risk for both cardiovascular disease and T2DM (Kaur et al., 2014). Metabolic syndrome is a cardiovascular risk factor as per the ATP III lifestyle modification, therapeutic intervention is vital in the prevention of both T2DM and premature Cardio Vascular Disease in those population who are at risk (Lorber et al., 2014).

There are multiple risk factors linked with CVD in patients with diabetes, including hypertension, obesity, hyperlipidemia and microalbuminuria (Jager et al., 1998) which is the main factor of Metabolic Syndrome (MS). There is a threat of death due to CVD that causes two-to six times more among peoples without diabetes. Among white americans, the age-relatd prevalence of coronary heart disease (CHD) is twice as among those with type-2 diabetes as among those without diabetes (Mensah et al., 2017). People living with type 2 DM are at high risk to various forms of complixities, which is generally causes early death (Olokoba et al., 2012). The present study has concluded that Metabolic Syndrme found generally among the local peoples with type-2 diabetes who are at high risk of peripheral vascular disease and heart complications. A prolonged, intensive targeted intervention that involves various cardiovascular risk components are suggested to reduce the risk of cardiovascular incidents which is already reported among Caucasians (Gaede P et al; 2003).

Metabolic syndrome is a intricate combination which includes abdominal obesity, atherogenic dyslipidaemia, elevated blood pressure, insulin resistance along with glucose intolerance and a prothrombotic and proinflammatory state which affects all stage of ages. This syndrome also known as “syndrome X” , “ insulin resistance syndrome” , the deadly quartet”, “cardiometabolic syndrome”, “Reaven’s syndrome” (NIH-2001). The criteria for diagnosis of the metabolic syndrome have been

published by various organizations including the World Health Organization (WHO), the National Cholesterol Education Programme (NCEP) and the American Association of Clinical Endocrinologists (AACE). Primarily called syndrome X in 1988 by Reaven, in which each component of the syndrome has been linked with an increased risk of cardiovascular disease (Reaven et al.,1988).

People with metabolic syndrome are at high risk for prone to diabetes mellitus and cardiovascular disease, as well as increased mortality from cardiovascular disease. The present study aims to understand the prevalence of metabolic syndrome and its association with type 2 diabetes. The study group included 150 type 2 diabetes patients in the age group ranging between 20-80 years. It has been reported that metabolic syndrome promotes the renal disease. It is reported that in the patients with MS, hypertension should be managed with angiotensin-converting enzyme inhibitors or angiotensin-receptor blockers, which is reported to lower the proteinuria, slow down the progression of renal diseases and lower the blood pressure level, (Alebiosu et al.,2004).

The prevalence of metabolic syndrome increases with the increase in age of the individuals. The findings of present study are tantamount to that of Adediran in which mostly the patience with metabolic syndrome were above 60 years with a means age of 59 +12years, while in the Saudi Arabian research findings, the mean age was 60+13 years assuring the fact that metabolic syndrome is very common among the elderly people (Mansour AA et al., 2007). 64% of the patients had hypertension which is very common metabolic abnormality. Hypertension is a crucial cardiovascular risk component in its own, and in combination along with insulin resistance in these patients causes a synergistic effect (Cheung et al., 2012). Adediran et. al; showed that 59% of the patients had hypertension, while Mansour found a rate of 76% with metabolic syndrome in his study (Adediran et al., 2012).

The clinical significance of the MS is linked to this putative effect on cardiovascular morbidity and mortality (Obunai et al; 2007). In a Scandinavian study it has been reported that the prevalence of coronary heart disease, myocardial infarction and stroke was generally threefold higher in patients with the metabolic syndrome than in those without the MS (Sanchis-Gomar et al., 2016). Management of the metabolic syndrome includes dietary modification, exercise and medications which reduce insulin resistance and in turn this will reduces the morbidity and mortality linked with this syndrome (Liberopoulos EN et al., 2005). The research finding have been reported that there was prominent reduction in the incidence of type 2 DM when the maintenance of body mass index up to 25 kg/m2, eating high fibre and unsaturated fat and diet with low in saturated and trans-fats and glycemic index, regular exercise, free from smoking and reducing the intake of alcohol (Chen et al., 2012).