
**PREVALENCE OF RISK FACTORS FOR TYPE
II DIABETES MELLITUS AMONG ADULTS- A
COMMUNITY BASED CROSS SECTIONAL
STUDY**

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LIST OF ABBREVIATIONS USED

AGR	–	Abnormal Glucose Regulation
AOR	–	Adjusted odds ratio
AUC	–	Area under Curve
BMI	–	Body Mass Index
BP	–	Blood Pressure
CF	–	Correction Factor
CAD	–	Coronary Artery Disease
CUPS	–	Chennai Urban Population Study
cm	–	Centimeter
DALY	–	Disability Adjusted Life Years
DBP	–	Diastolic Blood Pressure
DM	–	Diabetes Mellitus
EME	–	Established Market Economies
FBS	–	Fasting Blood Sugar
GBD	–	Global Burden of Disease
Hb A _{1c}	–	Glycated Hemoglobin
HC	–	Hip Circumference
IFG	–	Impaired Fasting Glucose
IDF	–	International Diabetes Federation
IDRS	–	Indian Diabetic Risk Score
ICMR- INDIAB	–	Indian Council of Medical Research-India DIAbetes
IGT	–	Impaired Glucose Tolerance
JNC	–	Joint National Committee

Kg	–	Kilograms
mg/dL	–	milligram per deciliter
MRC	–	Medical Research Council
NA	–	Not Applicable
NCD	–	Non – Communicable Disease
NFHS	–	National Family Health Survey
NIDDM	–	Non Insulin Dependent Diabetes Mellitus
NHANES	–	National Health and Nutrition Examination Survey
NHES	–	National Health Examination Survey
OR	–	Odds Ratio
PHC	–	Primary Health Centre
RR	–	Relative Risk
SBP	–	Systolic Blood Pressure
SEAR	–	South East Asia Region
SES	–	Socio Economic Status
SHIELD	–	Study to Help Improve Early evaluation and management of risk factors Leading to Diabetes
WC	–	Waist Circumference
WHO	–	World Health Organization
WHR	–	Waist Hip Ratio
²	–	Chi – square test

ABSTRACT

BACKGROUND AND OBJECTIVES

The burden of diabetes mellitus is expected to increase by 58%, from 51 million people in 2010 to 87 million in 2030. In rural India the prevalence rate has increased from 1% to 4-10% over last 20 years. Indian Diabetic Risk Score is a cost-effective & simple method for identifying people with higher risk of development of Diabetes Mellitus. If the disease has not yet developed, then some interventions could be undertaken to reduce the modifiable risk factors.

METHODOLOGY

A community based cross sectional study, conducted from January to December 2013 among rural adults aged between 30 to 60 years residing in Agasga village of Primary Health Center (PHC), Handignur which is a rural field practice area of Department of Community Medicine, Jawaharlal Nehru Medical College, Belgaum.. Total 855 participants were included in the study.

After obtaining the ethical clearance, pilot study was conducted. Written informed consent was obtained from every participant before collecting the data. Data was collected on the following aspects.

1. Socio Demographic Factors.
2. Risk Factors for Diabetes Mellitus [Abdominal Obesity, Physical Activity and Family History-Based on Indian Diabetic Risk Score.] and other risk factors like Alcohol consumption, , tobacco use, Diet (Fruits and Vegetables)and raised Blood Pressure were also included.

3. Estimation of Fasting blood sugar was done, using a standardized digital glucometer (Accu Check, Roche diagnostic, Germany), using capillary finger prick method. After collecting data on socio demographic variables and risk factors participants were given a date for estimation of fasting blood sugar. They were informed not to consume anything after 9 pm on the previous day of examination.

Risk prediction: Based on the Indian Diabetes Risk Score [IDRS]¹⁴, risk prediction for Diabetes Mellitus was done.

After the collection of data Health Education was given to those with more than two modifiable risk factors or those who have the chances of Diabetes Mellitus in next 10 years.

Statistical analysis was done using Pearson's Chi- Square test to find out the association between demographic variables and IDRS. A probability value (P value) of less than 0.05 was considered as significant. Multiple logistic regressions were used to know the risk factors associated with Diabetes Mellitus.

RESULTS

855 respondents comprising 51.54 % females and 48.53 % males were studied. 49.70 % were between age 35 – 49.71.8 % were agriculturist by occupation.77.1 % studied up to secondary school.69.3 % belonged to lower socio economic class. Most of the respondents 90.3 % indulged in moderate physical activity. 84.2 % had no family history of diabetes mellitus. 38.9 % individuals were in the overweight category and 10.3 % were obese according to Asian classification of BMI. 36.3 % % had high diabetic risk score. It is observed that chances of

high diabetic score increase with the increase in BMI. Prevalence of diabetes in studied population was 9.47 %; out of these, 3.3 % known cases of diabetes mellitus had high (>60) IDRS. Co-relation between BMI and IDRS shows that, if BMI increases from <18.50 to >25, chances of high risk for developing diabetes mellitus also significantly increase.

CONCLUSION AND INTERPRETATION

Our study showed even in rural area 1/3rd population is at higher risk of developing Diabetes Mellitus. Higher the risk score higher was the fasting blood sugar. Study estimates the usefulness of simplified Indian diabetes risk score for identifying undiagnosed high risk diabetic subjects in India. Use of the IDRS can make mass screening for undiagnosed diabetes in India more cost effective.

Implications: Early identification of risks will help in prevention and burden of disease.

KEY WORDS

Indian Diabetic Risk Score, Diabetes Mellitus, Risk factors, Rural area, Multiple logistic regressions.

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INTRODUCTION

The world today faces an epidemic of non communicable diseases (NCD), which will soon surpass communicable diseases both in developing and developed world. One among such diseases is Diabetes mellitus, which shows an ‘iceberg phenomena’. The prevalence of diabetes is rising at an alarming rate. The International Diabetes Federation had estimated that in 2010 the global population with diabetes between the ages of 20- 79 was 285 million (6.4%) and it had projected that this would grow to 439 million (7.7%) by 2030.¹ However the Diabetes Atlas, 6th edition figures shows that in 2013 there are 382 million people have diabetes in the world and by 2035 this will rise to 592 million.² Diabetes caused 5.1 million deaths in 2013; every six seconds a person dies from diabetes.² Diabetes caused at least 548 billion dollars in health expenditure in 2013 – 11% of total spending on adults.² The number of people with type 2 diabetes is increasing in every country. 80% of people with diabetes live in low-and middle-income countries and the socially disadvantaged in any country are the most vulnerable to the disease.¹

Today’s emerging diabetes hotspots include countries in the Middle East, Western Pacific, sub-Saharan Africa and South-East Asia where economic development has transformed lifestyles. The regional prevalence in South East Asian region in year 2013 is 72.1 million(8.2%) and is expected to scale up to 123 million (10.1%) by the year 2035.² 175 million people with diabetes are undiagnosed. The greatest number of people with diabetes is between 40 and 59 years of age.³

India is facing an epidemic of diabetes. The population of India is susceptible to diabetes mellitus. This propensity was demonstrated by multiple surveys of migrant Indians residing in Fiji, Singapore, South Africa, U.K. and USA.⁴ The rates of

diabetes in migrants from the Indian subcontinent have consistently shown to exceed those of the local population. At present, confirmed diabetes patients in India are 67 million, with another 30 million in pre diabetes group². By 2030, India will have the largest number of patients in the world. Every 5th patient visiting a consultant physician is a diabetic and every 7th patient visiting a family physician is a diabetic.⁵ The national prevalence of diabetes in India is estimated at 7.1%, although there is significant difference across geographical area and socioeconomic classes. The study done by Indian Council of Medical Research (ICMR) in the year 1970 reported a prevalence of 2.3% in urban areas, which had increased to 12-19% in the year 2000.⁶ ⁷ Correspondingly in rural areas, prevalence rates had increased from 1% to 4-10%, and in the other study it was reported to be 13.2%.⁸ Thus, it is clear that both in urban and rural India, prevalence rates of diabetes are increasing rapidly with estimation of 2:1 to 3:1.⁹ Keeping view of this alarming increase in incidence WHO has rightly declared India as “DIABETIC CAPITAL OF THE WORLD”.⁵

Although the prevalence is lower in rural areas, rural population is at risk of DM due to changing life styles, transition in diet similar to urban population, along with this ignorance, illiteracy and limited access to health care for non communicable diseases would make them more prone for DM. Indeed recent publications from rural populations report high diabetes prevalence rates. For example, 13.2% in Andhra Pradesh, 16% among villagers in costal Karnataka.^{8, 10}

With high genetic predisposition, increased susceptibility to environmental insults and risk factors like physical inactivity, high Body mass index, heavy consumption of tobacco & Alcohol, older age, as well as high social status are significantly associated with increased incidence of Diabetes Mellitus among Indians .

Due to silent manifestation of the disease which is usually detected accidentally when the patient comes to a doctor for some other ailments, there are quite a number of incidents where patient will have reached a stage where there might be damage to end organs like heart, kidneys, retina and brain. Hence early identification of patients not only with undiagnosed type 2 Diabetes but also identification of or those at an increased risk of developing type 2 Diabetes will help in tackling the problem of Diabetes Mellitus in long run.

Numerous studies have been conducted to estimate the prevalence of diabetes mellitus among the urban population of India.^{9,12} Very few data are available on the prevalence of diabetes mellitus among the rural population of India and so in Karnataka state. Data suggest that approximately 742 million people in India (70% of Indian population) live in rural area.¹³ It certainly becomes very important to estimate the prevalence of diabetes in rural Indian population to design various strategies to tackle the battle against diabetes mellitus.

Several prospective studies have shown that measures of lifestyle modification help in preventing the onset of diabetes. Early identification of the high risk individuals would help in taking appropriate intervention in the form of dietary changes and increasing physical activity, thus helping to prevent or at least delay the onset of diabetes. This means that identification of at risk individuals is extremely important if we are to prevent Diabetes Mellitus. Recently, risk scores based on simple anthropometric and demographic variables i.e.; Indian Diabetes Risk Score (IDRS) has been devised which can be used to detect at risk population.¹⁴ It is utmost important to create awareness among public about the risk factors of diabetes and thereby other non communicable diseases associated with it and reduce the associated

mortality and morbidity.¹⁵ With this background the present study designed to measure the risk factors for DM, and also to assess future risk of DM, by using IDRS, among rural adults. The study findings will further help in developing preventive strategies.

OBJECTIVES

The objectives of the present study were;

1. To know the prevalence of risk factors for type 2 diabetes mellitus among adults aged between 30 to 60 years residing in rural area.
2. To know the prevalence of type 2 Diabetes mellitus among them.
3. To assess the knowledge about Diabetes Mellitus among them.



INTRODUCTION



OBJECTIVES



**REVIEW OF
LITERATURE**



METHODOLOGY



RESULTS



DISCUSSION



CONCLUSION



LIMITATIONS



RECOMMENDATIONS



SUMMARY



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REVIEW OF LITERATURE

In 1998 the World Health Organization (WHO) predicted that the global diabetic epidemic would affect 154 million people by the year 2000. The actual rise in diabetes however surpassed the projection and most recent figures from the WHO suggest that, by the year 2030, more than 366 million or 4.4% of all adults worldwide will have diabetes.¹⁶ India is expected to have greatest number of all the individuals with diabetes (79.4 Million) followed by China, USA, Indonesia and Pakistan.¹⁷ The WHO estimates were conservatively lower than that of International Diabetes Federation (IDF) that anticipates a raise in diabetes to 439 million by the year 2030.¹⁸ It is conceivable that actual rise may surpass even projection due to aging population, the growing obesity epidemic, the increase rates of Type 2 Diabetes mellitus in adults and children, progressive urbanization and rise in prevalence of Diabetes in developing countries.

The new estimates show an increasing trend towards younger people developing diabetes, a trend that is very worrisome for future generations. Along with the increasing prevalence of diabetes the mortality prevalence due to it is also increasing, it increased from 5.2 % to 6.8 % from the year 2000 to 2010 and this is expected to rise further in next 10 years.¹⁸ In addition to increase in mortality, it is also associated with increase in morbidity. Diabetes is the leading cause of chronic kidney disease. Neuropathy affects 60-70 % of Diabetics and 60 % of non traumatic amputation is due to diabetes. Furthermore, people with diabetes are 2-4 times at more risk of heart disease and stroke than those without Diabetes. This complication can cost an individual his life expectancy and the quality of life and the nation cost of health expenses. Globally, diabetes related health care cost totally accounted for 11.6

% in year 2010. Global health expenditures to prevent and treat diabetes and its complications was about 376 billion US dollars in 2010.¹⁸ Therefore preventing or delaying the onset of diabetes has become the subject of many recent studies as well as focus of health care policies.

A Brief History of Time...

The earliest description of diabetes was documented in the writings of Hindu scholars as long as in 1500 BC. They had already described “a mysterious disease causing thirst, enormous

Urine output, and wasting away of the body with flies and ants attracted to the urine of people.” The term diabetes was probably coined by Apollonius of Memphis around 250 BC, which literally meant “to go through” or siphon as the disease drained more fluid than a person could consume. Later on, the Latin word “mellitus” was added because it made the urine sweet¹⁹.

The history of diabetes dates back to 1550 BC with the first reference of the disease in an Egyptian papyrus which mentions a rare condition of “too great emptying of urine” and causes the patient to lose weight rapidly.¹⁹

Sushruta, Arataeus, and Thomas Willis were the early pioneers of the treatment of diabetes. Greek physicians prescribed exercise, preferably on horseback, to “employ moderate friction” and alleviate excess urination. Wine, overfeeding to compensate for loss of fluid weight, starvation diet, potato therapy, and oat cure were some of the other curious forms of remedy suggested for the therapy of diabetes in olden days. Sir William Osler, in the year 1915, is said to have even recommended opium! Early research linked diabetes to glycogen metabolism, and the islet cells of

pancreas were discovered by Paul Langerhans, a young German medical student. In 1916, Sharpey-Shafer of Edinburgh suggested that a single chemical was missing from the pancreas and proposed its name as “insulin.” The term insulin originates from the word Insel, which is German for an islet or island.¹⁹

Diabetes²⁰

Diabetes is a chronic disease that occurs when the body cannot produce enough insulin or cannot use insulin effectively. Insulin is a hormone produced in the pancreas that allows glucose from food to enter the body’s cells where it is converted into energy needed by muscles and tissues to function. A person with diabetes does not absorb glucose properly, and glucose remains circulating in the blood (a condition known as hyperglycemia) damaging body tissues over time. This damage can lead to disabling and life-threatening health complications.

There are three main types of diabetes:

- Type 1 diabetes
- Type 2 diabetes
- Gestational diabetes

Type 1 diabetes:

Type 1 diabetes is a form of diabetes mellitus that results from the autoimmune destruction of the insulin-producing beta cells in the pancreas. Accounts for about 5% of all diagnosed cases of diabetes. Type 1 is usually first diagnosed in children and young adults, although it can occur at any time. To survive, people with type 1 diabetes use insulin from an injection or a pump. Risk factors for

type 1 diabetes can be autoimmune, genetic, or environmental. As of now, there are no known ways to prevent type 1 diabetes.

Type 2 diabetes

Type 2 diabetes is the most common type of diabetes. Accounts for about 95% of diagnosed diabetes in adults. It usually occurs in adults, but is increasingly seen in children and adolescents. In type 2 diabetes, the body is able to produce insulin but either this is not sufficient or the body is unable to respond to its effects (also known as insulin resistance), leading to a build-up of glucose in the blood. Many people with type 2 diabetes remain unaware of their illness for a long time because symptoms may take years to appear or be recognized, during which time the body is being damaged by excess blood glucose. They are often diagnosed only when complications of diabetes have already developed. Although the reasons for developing type 2 diabetes are still not known, there are several important risk factors.

Gestational diabetes:

Develops and is diagnosed as a result of pregnancy in 2%–10% of pregnant women. Gestational diabetes can cause health problems during pregnancy for both the child and mother. Children whose mothers have gestational diabetes have an increased risk of developing obesity and type 2 diabetes. Women who have gestational diabetes face a higher risk of developing type 2 diabetes in the future. Research has shown that 10–20 years after a woman has had gestational diabetes, she has a 35%–60% chance of developing type 2 diabetes.²¹

Diabetes Risk factors²

1. Genetic and acquired risk factors

- Familial aggregation
- Gene –Environmental interactions
- Ethnicity
- Low threshold for risk factors (age, BMI, central adiposity)
- Adverse intra uterine, maternal and perinatal conditions

2. Environmental Risk factors:

- Urbanization, modernization
- Rural –urban migration
- Globalization and Industrialization
- Sedentary lifestyle, consumption of energy dense food, smoking, tobacco chewing, excess Alcohol
- Sleep disturbances

3. Societal risk factors

- Low awareness about diabetes
- Several cultural and religious taboos
- Psycho-social factors affecting health
- Inadequate healthcare facilities
- Environment not congenial for physical activity
- Psychological stress.

Impaired glucose tolerance and impaired fasting glucose:

People whose blood glucose levels are high but not as high as those in people with diabetes are said to have impaired glucose tolerance (commonly referred to as IGT) or impaired fasting glucose (IFG). IGT is defined as high blood glucose levels after eating; whereas IFG is defined as high blood glucose after a period of fasting. The term 'pre diabetes' is also used to describe people with these conditions - a 'grey area' between normal glucose levels and diabetes. People with IGT are at high risk of developing type 2 diabetes¹⁸. Unsurprisingly, IGT shares many characteristics with type 2 diabetes and is associated with obesity, advancing age and the inability of the body to use the insulin it produces. Not everyone with IGT goes on to develop type 2 diabetes: a large bank of evidence supports the effectiveness of lifestyle interventions – healthy diet and physical exercise – to prevent the progression to diabetes.

Risk Factors: A risk factor is any attribute, characteristic or exposure of an individual that increases the likelihood of developing a disease or injury.

Risk assessment: Tool aims to promote vigilance in identifying risk and the ways in which risk can be minimized.

ASSESSMENT OF RISK FACTORS²²

The following non modifiable risk factors are included in the risk factor assessment:

- Age
- Gender
- Socioeconomic status
- Family history of Diabetes Mellitus.

The major (modifiable) behavioural and biological risk factors identified are

Major behavioural risk factors:

- Alcohol consumption
- Tobacco use
- Unhealthy diet (low fruit and vegetable consumption, type of oil used, fast food consumption)
- Physical inactivity

Major biological risk factor:

- Overweight and obesity
- Waist Circumference/ Waist Hip Ratio

RATIONALE FOR INCLUSION²²

The rationale for including these eight core modifiable risk factors in our study is that:

- They have the greatest impact on Diabetes mortality and morbidity.
- Modification is possible through effective prevention.
- Measurement of risk factors has been proven to be valid.

1. Age

Considering why Diabetes Type 2 is an Age-Related Condition

Type 2 diabetes is the foster child for an avoidable age- related condition: barring the worst of genetic bad luck, calorie restricted, well exercised people will not suffer from type 2 diabetes. But this is, undeniably, an age-related illness. Becoming more obese and sedentary will hasten onset of diabetes into earlier years of life, but

obese and sedentary life style among older are still far more likely to suffer type 2 diabetes than those who are equally overweight and sedentary younger counterparts.

Diabetes Mellitus in developing countries are characterized by early age of onset and greater mortality. About one fourth of global diabetes– related deaths take place before the age of 60 years of which in low and middle income countries 29% of diabetes deaths occur among people < 60 years, compared to 13% in high-income countries.²³

A prospective follow up study done in Canada among 69 494 participants aged 12 years and above ,the prevalence of diabetes mellitus was analyzed in relation to age, sex, body mass index, overweight status, energy expenditure, physical activity, smoking, drinking, income, marital status, education and rural or urban residence. The prevalence of diabetes increased with increased age in both males and females.²⁴

Gender and Type 2 DM

In the first half of the last century the prevalence of type 2 diabetes was higher among women than among men, but this trend has shifted, so more men than women are now diagnosed with type 2 diabetes. This change in the gender distribution of type 2 diabetes is mainly caused by a more sedentary lifestyle particularly among men, resulting in increased obesity. However, recent data have also shown that men develop diabetes at a lower degree of obesity than women – a finding which adds support to the view that the pathogenesis of type 2 diabetes differs between men and women. Observations of sex differences in body fat distribution, insulin resistance, sex hormones, and blood glucose levels further support this notion.²⁵

This study based on 2005–2008 National Health and Nutrition Examination Surveys among US adults to classify 3,627 adults aged 18 years. Age-adjusted prevalence as measured by Hb A1C5.7 or IGT did not vary significantly between men and women ($P = 0.87$ and $P = 0.14$, respectively). However, men were much more likely than women to have IFG100 ($P < 0.01$) and IFG110 ($P < 0.01$).²⁶

Socio-economic status

There has been considerable concern over the rising prevalence of diabetes in India, especially with studies on migrant Indian populations suggesting that South Asians may be more susceptible to the disease. In light of current findings, it appears that, at present, the more well-off segments of the Indian population are at greatest risk. This poses concerns on how to appropriately balance priorities to address the disease burden that afflicts the non-poor versus the poor in the context of India where >40% of the population continue to live in extreme poverty on <\$1.25/day.²⁷ It has been suggested that the prevalence of type 2 diabetes and other cardiovascular disease risk factors may increasingly become concentrated among low SES groups in India and other low- and middle-income countries.

The prevalence of diabetes is now rapidly increasing among the poor in the urban slum dwellers, the middle class and even in the rural areas. This is due to rapid changes in physical activity and dietary habits even among the poorer sections of the society. Unfortunately the poor diabetic subjects delay taking treatment leading to increased risk of complications. Moreover, as the epidemic matures and reaches the next stage of transition, the rich and the affluent will rapidly change their activity patterns and start making healthier food choices and ultimately the diabetes and heart disease will decrease in this section of the society. This has been demonstrated in the

developed world where the prevalence of diabetes and cardiovascular disease are higher among the lower socio-economic group and urban areas.

Family history:

Family history of type 2 diabetes mellitus is one of the major contributing factors in causing diabetes in next generation or it can act as one of the important preventing factor for those who are having positive family history and by this we can avoid the development of diabetes in early age.

A recent review concluded that having a parent with non-insulin-dependent diabetes mellitus (NIDDM) increases by two- to fourfold an offspring's chance of developing this condition, and that in this respect concordance between siblings appeared stronger than that between parent and child (5). In a study in northern Sudan, a family history of diabetes was 2.3 times more often reported among diabetics than non-diabetics.²⁸

Tobacco (Smoking and smokeless tobacco use)

Smokers are 30–40% more likely to develop type 2 diabetes than nonsmokers. And people with diabetes who smoke are more likely than nonsmokers to have trouble with insulin dosing and with controlling their disease.²⁹

The more cigarettes one smokes, the higher the risk for type 2 diabetes. No matter what type of diabetes one has, smoking makes diabetes harder to control.

Smokers with diabetes have higher risks for serious complications, including³⁰:

- Heart and kidney disease

- Poor blood flow in the legs and feet that can lead to infections, ulcers, and possible amputation (removal of a body part by surgery, such as toes or feet)
- Retinopathy (an eye disease that can cause blindness)
- Peripheral neuropathy (damaged nerves to the arms and legs that causes numbness, pain, weakness, and poor coordination)

If a smoker with diabetes, quitting smoking will benefit health right away.

People with diabetes who quit have better control of their blood sugar levels.

Alcohol consumption

A prospective study among 12,261 middle aged participants was conducted in US on Alcohol consumption and its risk on Diabetes Mellitus & atherosclerosis .Participants were followed for a period of 3 to 6 years. Alcohol consumption at baseline was characterized into lifetime abstainers, former drinkers, and current drinkers of various levels. Results of this study supported the hypothesis that high alcohol intake increases diabetes risk among middle-aged men.³¹

Alcohol consumption by diabetics can worsen blood sugar control in those patients. For example, long-term alcohol use in well-nourished diabetics can result in excessive blood sugar levels. Conversely, long-term alcohol ingestion in diabetics who are not adequately nourished can lead to dangerously low blood sugar levels. Heavy drinking, particularly in diabetics, also can cause the accumulation of certain acids in the blood that may result in severe health consequences. Finally, alcohol consumption can worsen diabetes-related medical complications, such as disturbances in fat metabolism, nerve damage, and eye disease.

Diet

An increased risk for developing type 2 diabetes is associated with overweight and obesity; abdominal obesity. It is probable that a high intake of saturated fats while non-starch polysaccharides are likely to be associated with a decreased risk. From existing evidence it is also possible that omega-3 fatty acids, low glycaemic index foods and exclusive breastfeeding may play a protective role.

A study on numerous clinical trials and cohort studies in low, middle and high income countries are evaluated regarding recommendations for dietary prevention of type 2 diabetes. These include, among others, the Finnish Diabetes Prevention Study, US Diabetes Prevention Program, Da Qing Study; Pima Indian Study; Iowa Women's Health Study; and the study of the US Male Physicians reports that in dietary practice exchanging non hydrogenated polyunsaturated fat for saturated and trans-fatty acids could appreciably reduce risk of type 2 diabetes mellitus. In addition, a low glycemic index with a higher amount of fiber and minimally processed whole grain products reduces glycaemic and insulinaemic response and lower the risk of type 2 diabetes mellitus. Dietary recommendations to prevent type 2 diabetes should focus more on the quality alone, in addition to balancing total energy intake with expenditure to avoid overweight and obesity.

Physical inactivity

Regular activity is a key part of managing .When active; cells become more sensitive to insulin so it can work more efficiently. Cells also remove glucose from the blood using a mechanism totally separate from insulin during exercise.

Physical inactivity and low physical fitness are independent predictors of mortality in people with type 2 diabetes, which in turn is a strong risk factor for CAD. Physically inactive lifestyle accounts in 3.3% of all deaths

Two randomized trials each found that lifestyle interventions including ~150 min/week of physical activity and diet-induced weight loss of 5–7% reduced the risk of progression from impaired glucose tolerance (IGT) to type 2 diabetes by 58%.³²

Physical activity improves endothelial function, which enhances vasodilatation and vasomotor function in the blood vessels. It contributes to weight loss, glycemic control, improved blood pressure, insulin sensitivity and lipid profile.

Overweight and obesity

Waist circumference and Waist: Hip ratio (WHR) is an approximate index of intra-abdominal fat mass (central obesity) and total body fat. Changes in waist circumference reflect changes in risk factors for CAD and Diabetes.

According to the Center for Disease Control, we are eating ourselves into a diabetes epidemic. The International Diabetes Federation (IDF) says that, “Diabetes and obesity are the biggest public health challenge of the 21st century.” The supporting statistics they cite are staggering: As of 1999, diabetes affected 16 million (six percent) of Americans – an increase of 40 percent in just ten years. During the same period, the obesity rate climbed from 12 percent to almost 20 percent. Last year the diabetes and obesity rates increased 6 percent and 57 percent.¹

The WHO projects that by 2015, approximately 2 – 3 billion adults will be overweight and more than 700 million will be obese.¹ In India, as per National Family

Health Survey (NFHS – III) conducted in 2005 – 06, the prevalence of overweight among men was 9.3% and women 12.3%.³³

Being overweight places extra stress on body in a variety of ways, including body's ability to maintain proper blood glucose levels. In fact, being overweight can cause body to become resistant to insulin. If a person already has diabetes, this means he /she will need to take even more insulin to get sugar into cells. And if a person doesn't have diabetes, the prolonged effects of the insulin resistance can eventually cause one to develop the disease.¹

Waist Hip ratio:

Waist circumference and Waist: Hip ratio (WHR) is an approximate index of intra-abdominal fat mass (central obesity) and total body fat.

Researchers have demonstrated a strong link between having a large waist circumference and an increased risk of developing Type 2 diabetes, independent of a person's body mass index (BMI).

In the largest study of its kind, a team led by the Medical Research Council (MRC) Epidemiology Unit, examined data from more than 340,000 people from eight European countries. They found that overweight people with a large waist (defined in this study as over 40 inches/102cm for men and over 34.5 inches/88cm for women) had a similar risk of developing diabetes to those who are clinically obese. This correlation was particularly strong in women.³⁴

Relevant studies:

According to World Health Organisation's Report on Global burden of Diabetes, the global mortality attributable to diabetes in the year 2000 was estimated to be 2.9 million deaths, equivalent to 5.2% of all deaths. Excess mortality attributable to diabetes accounted for 2–3% of deaths in poorest countries and over 8% in the U.S., Canada, and the Middle East. In people 35–64 years old, 6–27% of deaths were attributable to diabetes. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million by 2030. Unfortunately among the estimates in 2000 and 2030, India is ranked first with 31.7 million in 2000 and estimated to rise to 79.4 million by 2030, a huge leap of about 150%. The findings also indicate that the “diabetes epidemic” will continue even if other factors remain constant. Given the increasing prevalence of obesity, it is likely that these figures provide an underestimate of future diabetes prevalence.³

Global burden of diabetes, 1995-2025: prevalence, numerical estimates, and projections. Prevalence of diabetes in adults worldwide was estimated to be 4.0% in 1995 and to rise to 5.4% by the year 2025. It is higher in developed than in developing countries. The number of adults with diabetes in the world will rise from 135 million in 1995 to 300 million in the year 2025. The major part of this numerical increase will occur in developing countries. There will be a 42% increase, from 51 to 72 million, in the developed countries and a 170% increase, from 84 to 228 million, in the developing countries. Thus, by the year 2025, >75% of people with diabetes will reside in developing countries, as compared with 62% in 1995. The countries with the largest number of people with diabetes are, by the year 2025 are, India, China, and the U.S. In developing countries, the majority of people with diabetes are in the age range of 45-64 years. In the developed countries, the majority of people with diabetes are

aged 65 years. This pattern will be accentuated by the year 2025. There are more women than men with diabetes, especially in developed countries. In the future, diabetes will be increasingly concentrated in urban areas.³⁵

A cross sectional study on risk factors of diabetes was conducted in a Rural South African Community, samples were collected by random cluster sampling of adults aged >15 years. Totally 1,300 subjects were selected. The overall age-adjusted prevalence of diabetes was 3.9%, IGT 4.8%, and IFG 1.5%. The prevalence was almost similar in men and women for diabetes (men 3.5%; women 3.9%) and IGT (men 4.6%; women 4.7%) but higher in men for IFG (men 4.0%; women 0.8%). The prevalence of diabetes and IGT increased with age both in men and women, with peak prevalence in the 55- to 64-year age-group for diabetes and in the 65-year age-group for IGT. Of the cases of diabetes, 84.8% were discovered during the survey. In multivariate analysis, the significant independent risk factors associated with diabetes included family history (odds ratio 3.5), alcohol ingestion (2.8), waist circumference (1.1), systolic blood pressure (1.0), serum triglycerides (2.3), and total cholesterol (1.8); hip circumference was protective (0.9).³⁶

A community-wide prevalence survey using a 75-g oral glucose tolerance test (OGTT) was undertaken in the remote native reserve of Sandy Lake, Ontario, Canada. A total of 728 individuals were enrolled. The overall crude prevalence of NIDDM was 17.2% (18.1% females and 16.0% males) and increased to 26.1% overall (28.0% females and 24.2% males) when age-standardized. The prevalence of IGT was higher in females compared with males (age-standardized prevalence of 19.8 vs. 7.1%, respectively). Females had a higher prevalence of obesity, IGT, and NIDDM

occurring at younger ages. Measures of obesity and fasting insulin levels were significantly associated with NIDDM in the 18–49 age-group.³⁷

A cross sectional study on Type 2 diabetes in rural Uganda to assess prevalence, risk factors risk perceptions, and possible screening tools among people aged 35-60 years showed that About 18% of people aged 35-60 years were overweight, while 21% had hypertension. Women (OR 3.7; 95% CI 2.7-5.1), peri-urban dwellers (OR 2.5; 95% CI 1.5-3.0), and wealthier people (OR 4.1; 95% CI 2.4-7.0) were more likely to be overweight. Only 34% had adequate knowledge about lifestyle diseases. Prevalence of AGR was twice higher in obese people compared to those with a normal BMI (APRR 1.9, 95% CI 1.3-2.8) (II). Sufficient physical activity and diverse diet were associated with lower likelihood of AGR (II). The direct medical cost of screening one person was 0.53 US\$, translating to 2 US\$ per person detected with AGR. Agreement between FPG (the reference) and HbA1C in classifying diabetes was moderate (Kappa=22.9; AUC =75%), while that for AGR was low (Kappa=11.0; AUC=59%) (III). However, agreement was high (over 90%) among negative tests and in participants with risk factors for type 2 diabetes. FPG was more practical than HbA1C (III). Participants strong perceptions of diabetes as a very severe disease were incongruent with their perceived urgency for lifestyle change.³⁸

A cross – sectional study conducted in Brazil to evaluate the risk of type 2 diabetes mellitus and its association with clinical and sociodemographic variables with 419 users of the Estratégia Saúde da Família (Family Health Program).It was found that 25.3% of users were aged 45 years; 59.7% were overweight and 84.0% had abdominal obesity; 83.3% had a sedentary lifestyle; 53.7% did not eat fruits/vegetables daily; 12.9% took antihypertensive medication; 5.3% reported

previous history of high glucose and 47% family history of diabetes. Among users 24.6% were classified as low risk; 63.5% as moderate risk and 11.7% as high risk.³⁹

Data from the multistage cross-sectional National Health Examination Survey (NHES) IV of 18,629 Thai adults aged 20 years conducted in 2009 were used to analyze and compare with the data from NHES III in 2004. The prevalence of IFG and diabetes was 10.6 and 7.5%, respectively. Of all diabetes diagnoses, 35.4% were not previously diagnosed, and the proportion was higher in men than in women (47.3 vs. 23.4%, $P < 0.05$). Compared with those in year 2004, the proportions of individuals with diabetes and concomitant hypertension did not significantly decrease in 2009 in both sexes, but the proportions of women with diabetes who were abdominally obese or had high total cholesterol (5.2 mmol/L) significantly increased in 2009 by 18.0 and 23.5%, respectively (all $P < 0.01$). The rates of treatment and control of blood glucose, high blood pressure, and high total cholesterol were favorably improved in 2009. However, in substantial proportions of individuals with diabetes these concomitants were still controlled sub optimally.⁴⁰

To know the relationship of body mass index to diabetes mellitus, hypertension and dyslipidaemia: comparison of data from two national survey, one to help improve early evaluation and management of risk factors leading to Diabetes (SHIELD) 2004 screening questionnaire (mailed survey) and the National Health and Nutrition Examination Surveys (NHANES) 1999–2002 (interview, clinical and laboratory data) were conducted in nationally representative samples 18 years old. Responses were received from 127,420 of 200,000 households (64%, representing 211,097 adults) for SHIELD, and 4257 participants for NHANES. Prevalence of diabetes mellitus, hypertension and dyslipidaemia was estimated within BMI

categories, as was distribution of BMI levels among individuals with these diseases. Mean BMI was 27.8 kg/m² for SHIELD and 27.9 kg/m² for NHANES. Increased BMI was associated with increased prevalence of diabetes mellitus, hypertension and dyslipidaemia in both studies ($p < 0.001$). For each condition, more than 75% of patients had BMI ≥ 25 kg/m². Estimated prevalence of diabetes mellitus and hypertension was similar in both studies, while dyslipidaemia was substantially higher in NHANES than SHIELD. In both studies, prevalence of diabetes mellitus, hypertension and dyslipidaemia occurred across all ranges of BMI, but increased with higher BMI.⁴¹

A cross sectional study to know the prevalence of diagnosed and undiagnosed diabetes mellitus and its risk factors in a population-based in Qatar was done. The overall prevalence of diabetes mellitus among adult Qatari population was high (16.7%) with diagnosed DM (10.7%) and newly diagnosed DM (5.9%). The impaired glucose tolerance (IGT) was diagnosed in 12.5%, while impaired fasting glucose was in 1.3% with a total of (13.8%). The proportion of DM was higher in Qatari women than in Qatari men and it peaked in the age group 40-49 years (31.2%). The age-specific prevalence of total DM and IGT increased with age. Risk factors were significantly higher in diabetic adult Qatari population: central obesity ($p < 0.001$), hypertension ($p < 0.001$), triglyceride ($p < 0.001$), HDL ($p = 0.003$), metabolic syndrome ($p < 0.001$), heart diseases ($p < 0.001$). Smoking habits and family history of DM were the major contributors for diabetes disease. The central obesity was associated with higher prevalence of DM and IFG among Qatari men and women.⁴²

A Case-control study nested within a community-based survey was done in Porto Alegre. Total of 151 subjects with NIDDM and 301 non diabetic control

subjects were selected. Results showed Odds ratios for NIDDM, comparing a high WHR (> 0.926 for men, >0.83 for women) to a low WHR were 4.72 with a 95% confidence interval of 2.39-9.34, and 2.17 with a 95% confidence interval of 1.03-4.58, for women and men, respectively, controlling for age, overall obesity, and a family history of diabetes. Women with high WHRs in the presence of these risk factors are notably at risk for diabetes.⁴³

A systematic review and meta-analysis on prevalence and trends of the diabetes epidemic in South Asia: The most recent reported prevalence of pre-diabetes: diabetes in regional countries were; Bangladesh-4.7%:8.5% (2004-2005;Rural), India-4.6%:12.5% (2007;Rural); Maldives-3.0%:3.7% (2004;National), Nepal-19.5%:9.5% (2007;Urban), Pakistan-3.0%:7.2% (2002;Rural), Sri Lanka-11.5%:10.3% (2005-2006;National). Urban populations demonstrated a higher prevalence of diabetes. An increasing trend in prevalence of diabetes was observed in urban/rural India and rural Sri Lanka. The diabetes epidemicity index decreased with the increasing prevalence of diabetes in respective countries. A high epidemicity index was seen in Sri Lanka (2005/2006-52.8%), while for other countries, the epidemicity index was comparatively low (rural India 2007-26.9%; urban India 2002/2005-31.3%, and urban Bangladesh-33.1%). Family history, urban residency, age, higher BMI, sedentary lifestyle, hypertension and waist-hip ratio were associated with increased risks of diabetes.⁴⁴

A cross-sectional study was conducted between 2005 and 2006 to know Prevalence and projections of diabetes and pre-diabetes in adults in Sri Lanka. A nationally representative sample of 5000 adults aged 18 years and above was selected by a multi-stage random cluster sampling technique. Response rate was 91% (n =

4532), males 40%, age 46.1 +/- 15.1 years (mean +/- standard deviation). The age-sex standardized prevalence (95% confidence interval) of diabetes for Sri Lankans aged 20 years or more was 10.3% (9.4-11.2%) [males 9.8% (8.4-11.2%), females 10.9% (9.7-12.1%), P = 0.129]. Thirty-six per cent (31.9-40.1%) of all diabetic subjects were previously undiagnosed. Diabetes prevalence was higher in the urban population compared with rural [16.4% (13.8-19.0%) vs. 8.7% (7.8-9.6%); P < 0.001]. The prevalence of overall, urban and rural pre-diabetes was 11.5% (10.5-12.5%), 13.6% (11.2-16.0%) and 11.0% (10.0-12.0%), respectively. Overall, 21.8% (20.5-23.1%) had some form of dysglycaemia. The projected diabetes prevalence for the year 2030 is 13.9%. Those with diabetes and pre-diabetes compared with normal glucose tolerance were older, physically inactive, frequently lived in urban areas and had a family history of diabetes. They had higher body mass index, waist circumference, waist-hip ratio, systolic/diastolic blood pressure, low-density lipoprotein cholesterol and triglycerides. Insulin was prescribed to 4.4% (2.7-6.1%) of all diabetic subjects.⁴⁵

A study to know the prevalence of Diabetes Mellitus among representative population from all over India was done in the year 2001. The study was undertaken in 89 centers covering urban and rural area. The total numbers of subjects aged 25 and above were screened. The urban prevalence of Diabetes Mellitus found was 9.60% and 4.26% among rural population. The overall prevalence of Type2 DM was found to be 7.06% and also noted a positive association of prevalence of DM with increasing obesity and when BMI was used as defining criteria, more than half of the subjects had abdominal and truncal obesity (56.2 and 62.1%, respectively).⁴⁶

Prevalence of diabetes and prediabetes (impaired fasting glucose and/or impaired glucose tolerance) in urban and rural India: phase I results of the Indian

Council of Medical Research-India DIABetes (ICMR-INDIAB) study, of the 16,607 individuals selected for the study, 14,277 (86%) participated, of whom 13,055 gave blood samples. The weighted prevalence of diabetes (both known and newly diagnosed) was 10.4% in Tamilnadu, 8.4% in Maharashtra, 5.3% in Jharkhand, and 13.6% in Chandigarh. The prevalence of prediabetes (impaired fasting glucose and/or impaired glucose tolerance) was 8.3%, 12.8%, 8.1% and 14.6% respectively. Multiple logistic regression analysis showed that age, male sex, family history of diabetes, urban residence, abdominal obesity, generalized obesity, hypertension and income status were significantly associated with diabetes. Significant risk factors for pre diabetes were age, family history of diabetes, abdominal obesity, and hypertension and income status.⁴⁷

A community-based cross sectional study was conducted in Chandigarh, North India to know prevalence and risk factors of diabetes. A total of 349 subjects (15.7%, 95% CI: 13.9-16.9) were diabetic, comprising 210 (9.4%) with known diabetes and 139 (6.2%) with newly diagnosed diabetes, and 344 (15.4%, 95% CI: 14.3-17.1) subjects were prediabetic. The age-standardized prevalence of diabetes and prediabetes were 11.1% (95% CI: 9.7-12.4) and 13.2% (95% CI: 11.8-14.6), respectively. Age \geq 50 years, a family history of diabetes, BMI \geq 23 kg/m², abdominal obesity and hypertension were significantly and positively associated with the presence of diabetes, whereas educational status was negatively associated with diabetes (P<0.001 for all).⁴⁸

A study conducted on Diabetes prevalence and its risk factors in urban Pondicherry in 2007 to find out the risk of diabetes in general population by using Indian Diabetes Risk Score (IDRS). 53% females and 47% males were included in the

study. A large number of the subjects 68% were above 35 years of age. Most of the respondents 90.50% indulged in mild to moderate physical activity. Again, 68.50% had no family history of diabetes mellitus, 31.5% individuals were in the overweight category BMI >25, and 83% of high Diabetic Risk Score individuals were overweight. It is observed that chances of high diabetic score increase with the increase in BMI. Prevalence of diabetes in the studied population was 8.27%, out of that 76% had high >60 IDRS score.⁴⁹

A cross sectional study to know prevalence of diabetes mellitus amongst rural hilly population of North Eastern India and its relationship with associated risk factors and related co-morbidities. Diabetes mellitus was observed among 19.78% of the participants with additional 12.04% patients with impaired glucose tolerance (IGT). Diabetes mellitus was most prevalent among 50-59 years age group (32.10%). Hypertension was observed among participants with diabetes and IGT was 65.13% (hypertensive diabetics) and 53.94% (diabetics only). Mean body mass index and associated family history was added risk factors in prevalence of diabetes.⁵⁰

A cross sectional study was conducted to assess Diabetes Prevalence and its Risk Factors in Rural Area of Tamil Nadu. 1936 respondents comprising 1167 (60.27%) females and 769 (39.73%) males were studied. Majority 1203 (62.50%) were Hindus. 1220 (63. %) had studied up to higher secondary. 1200 (62%) belonged to lower and lower-middle socio-economic class. A large number of the subjects 948 (50%) were below 35 years of age. Most of the respondents 1411 (73%) indulged in mild to moderate physical activity. 1715 (87.91%) had no family history of diabetes mellitus. 750 (39.64%) individuals were in the overweight category (>25 BMI). Out of these overweight persons, 64% had high diabetic risk score. It is observed that

chances of high diabetic score increased with the increase in BMI. Prevalence of diabetes in studied population was 5.99%; out of these, 56% known cases of diabetes mellitus had high (>60) IDRS. Co-relation between BMI and IDRS shows that, if BMI increases from less than 18.50 to more than 30, chances of high risk for developing diabetes mellitus also significantly increase.⁵¹

A study was conducted among Chennai Urban Population on Glucose intolerance (diabetes and IGT) with special reference to family history, obesity and lifestyle factors. The overall prevalence of diabetes in the study population was 12.0%, (age-standardized -9.3%), which included 7.2% of known diabetic subjects and 4.8% undiagnosed diabetic subjects, while the prevalence of impaired glucose tolerance was 5.9% (age-standardized prevalence 5.0%). The prevalence of glucose intolerance (Diabetes + IGT) was significantly higher among subjects with both parents diabetic (55%) compared to those with one parent diabetic (22.1%, $p = 0.005$) and those with no family history (15.6%, $p < 0.0001$). Prevalence of glucose intolerance was significantly higher among subjects who had light grade physical activity (23.2%) compared to moderate (17.5%, $p = 0.04$) and heavy grade activity (8.1 % $p < 0.00001$). Subjects belonging to higher socio-economic status (SES) and who also had a positive family history of diabetes had five times greater prevalence of glucose intolerance compared to subjects from lower socioeconomic status and no family history ($p < 0.0001$). Regression analysis revealed age ($p < 0.0001$), waist circumference ($p < 0.0001$), body mass index ($p < 0.0001$), waist-hip ratio ($p < 0.0001$), systolic blood pressure ($p < 0.0001$), diastolic blood pressure ($p < 0.0001$), family history of diabetes ($p < 0.0001$), higher SES ($p < 0.0001$), moderate ($p = 0.001$) and light ($p < 0.001$) grade physical activity to be associated with glucose intolerance. Multiple logistic regression analysis showed that even after adjusting for

variables like age and family history of diabetes, physical activity showed a significant association with glucose intolerance.⁵²

A community based cross sectional study was conducted among 250 undiagnosed diabetic people aged 20 years in rural area of Kolkata .IDRS component, socio demographic factors and various anthropometric measurements were considered. 49.2 % were in moderate risk; 31.5% had high risk and 22.6% had low risk. By doing Multinomial Logistic Regression if low IDRS is compared with high IDRS female sex, hypertension & BMI were found to be statistically significant.⁵³

A study on the prevalence of type 2 diabetes in costal Karnataka, in 2007, showed the overall prevalence of type 2 diabetes was found to be 16 %.Self –reported was 11.2%, while 4.8% of previously normal people were found to have high fasting capillary blood glucose levels (new cases), based on the screening criteria employed. A sedentary lifestyle was observed in 11.1% of the subjects, while 41.8% were engaged in moderate physical activity. Positive family history of diabetes was present in 26% of the individuals. Over half (57.3%) of the study population had a normal BMI, while the overweight category included 14.6% , 28.1% of the individuals were found to be obese when BMI was used as the defining criteria, but over half of the subjects had abdominal and truncal obesity.¹⁰

A study was conducted to know the Knowledge and awareness of diabetes in urban and rural India by The Indian Council of Medical Research India Diabetes Study (Phase I): Indian Council of Medical Research India Diabetes 4. This study found that 43.2% of the overall study population had heard about a condition called diabetes. Overall urban residents had higher awareness rates 58.4% compared to rural

residents 36.8% ($p < 0.001$). About 46.7% of males and 39.6% of females reported that they knew about a condition called diabetes ($p < 0.001$). Of the general population, 41.5% knew about a condition called diabetes. 80.7% knew that the prevalence of diabetes was increasing, whereas 93 % diabetic subjects knew it. Among the general and diabetic population, 56.3% and 63.4% respectively, were aware that diabetes could be prevented. Regarding complications, 51.5% of the general population and 72.7% diabetic population knew that diabetes could affect other organs. Based on a composite knowledge score to assess knowledge among the general population, Tamil Nadu had the highest (31.7) and Jharkhand the lowest score (16.3). However among self-reported diabetic subjects, Maharashtra had the highest (70.1) and Tamil Nadu, the lowest score (56.5).⁵⁴

A study was conducted to assess awareness and knowledge of diabetes in Chennai--the Chennai Urban Rural Epidemiology Study, of the total 26,001 individuals, only 75.5% of the whole population reported that they knew about a condition called diabetes or conversely nearly 25% of the Chennai population was unaware of a condition called diabetes. 60.2% of all participants and 76.7% of the self reported diabetic subjects knew that the prevalence of diabetes was increasing in India. Only 22.2% of the whole population and 41.0% of the known diabetic subjects were aware that diabetes could be prevented. Knowledge of the role of obesity and physical inactivity in causing diabetes was very low, with only 11.9% of study subjects reporting these as risk factors for diabetes. Only 19.0% of whole population knew that diabetes could cause complications. Even among the self reported diabetic subjects, only 40.6% were aware that diabetes could produce some complications.⁵⁵

A study was conducted to assess awareness and attitude towards diabetes in the rural population of Arunachal Pradesh, Northeast India. The awareness of diabetes in the study population was found to be as low as 21%. Majority of subjects (58%) had a normal BMI and adequate physical activity (88%). The prevalence of smoking (72%) and alcohol consumption (49%) was found to be very high amongst the study population. Blood glucose screening revealed that 13% had impaired fasting glucose and 6% had impaired glucose tolerance.⁵⁷

METHODOLOGY

The present study was conducted at the Agasga village of Primary Health Center (PHC), Handignur which is a rural field practice area of Department of Community Medicine, Jawaharlal Nehru Medical College, Belgaum. The Handignur PHC has four sub-centers catering to 16 villages, having a total population of 27,509. The village is situated at a distance of 10 kilometers from Belgaum city towards South East (Figure 1).

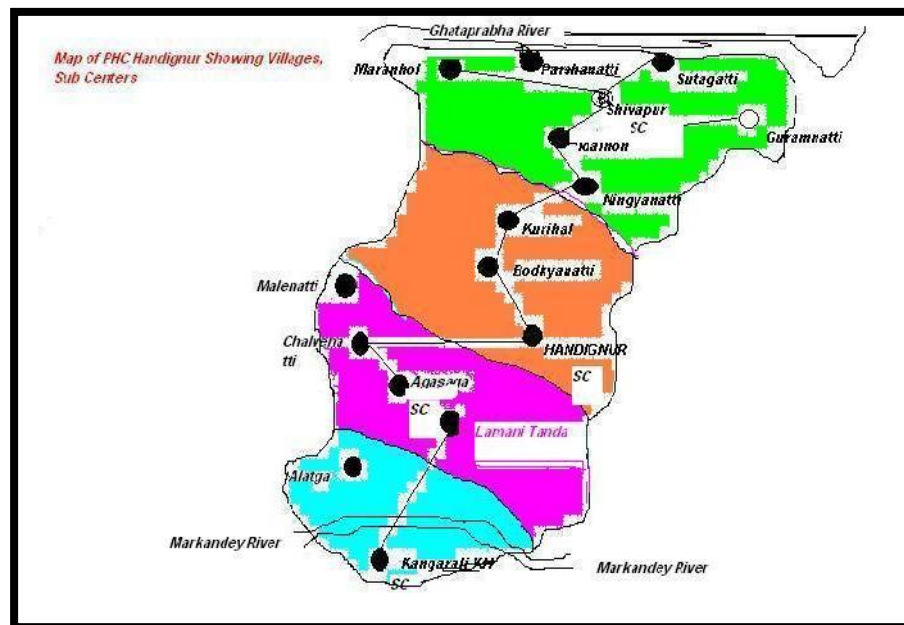


Figure1. Map of Handignur Primary Health Centre

Design

The study design was community based cross - sectional study.

Duration

One year – conducted from 1st January 2013 to 31st December 2013.

Participants

Adults aged between 30 years to 60 years residing in Agasga.

Selection criteria

Inclusion

1. Adults aged between 30 – 60 years.
2. Residents of Agasga village for one year.

Sample size

The required sample size was calculated using the formula: $N = 4 p q / d^2$ Where, **N** sample size

p prevalence of family history of Diabetes Mellitus (one of the risk factor for Diabetes Mellitus)

q (p – 100)

d absolute error.

p prevalence of family history¹⁰ = 26 %

q (100-p)

d absolute error = 3 %

Total sample (n) = 855.

Sampling method

Simple random sampling.

Sampling procedure

The total population of Agasga village is around 4000. As per voter's list the number of adults aged between 30 – 60 years residing in this area are

approximately 1900. Sampling frame was prepared. With help of Standard Random number table, 855 participants were identified and included in the study.

Ethical Clearance

The study was approved from Institutional Ethics Committee for Human Subject's Research, Jawaharlal Nehru Medical College, Belgaum. (Annexure I)

Informed consent

Based on the selection criteria, the study participants were selected and written informed consent (Annexure II) was obtained from all the participants, before collecting the data.

Data collection procedure

A Questionnaire was prepared and pilot study was conducted using the predesigned questionnaire and required modifications were made. (Annexure III)

Data was collected on the following aspects.

1. Socio Demographic Factors.
2. Risk Factors for Diabetes Mellitus [Includes - Age, Abdominal Obesity, Physical Activity and Family History- Based on Indian Diabetic Risk Score.]. Other factors like Alcohol consumption, Diet (Fruits and Vegetables), tobacco use, and raised Blood Pressure were also noted.
3. Estimation of Fasting blood sugar was done, using a standardized digital glucometer (Accu Check, Roche diagnostic, Germany), using capillary finger prick method at 7 a.m.. After collecting data on socio demographic variables and risk factors participants were given a date for estimation of fasting blood sugar. They were informed not to consume anything after 9 pm previous day.

Risk prediction: Based on the Indian Diabetes Risk Score [IDRS]¹⁴, risk prediction for Diabetes Mellitus was done.

After the collection of data Health Education was given to those with more than two modifiable risk factors or those who have the chances of Diabetes Mellitus in next 10 years.

Instruments used for data collection

The instruments included in the study were, stethoscope, mercury sphygmomanometer with standard adult cuff, weighing scale and non-stretchable measuring tape and digital glucometer. All the instruments were standardized.

Statistical analysis

The data was tabulated and master chart was prepared (Annexure IV). Data collected in the questionnaire was coded and entered in Microsoft excel sheet. Data was analyzed using Statistical Package for Social Sciences (SPSS), version 18.0 and the prevalence of each risk factor was expressed in terms of percentages. Pearson's Chi- Square test to find out the association between risk factors and IDRS. A probability value (P value) of less than 0.05 was considered as significant. Multiple logistic regressions were used to know the risk factors associated with Diabetes Mellitus.

DEFINITION OF STUDY VARIABLES

Step 1: Socio Demographic Factors.

Age: Age was recorded to the nearest completed year as per information given by the study subjects.

Religion: The subject's religion was noted and was grouped as "Hindu", "Muslim", "Christian" and "Others" (Jain, Buddhist, Parsi, etc).

Educational status: The subjects were asked about their highest level of completed education and were grouped into following categories.

Illiterate - A person who cannot read and write.

Primary school – Person who has studied up to 7th standard.

High school – Person who has studied up to 10th standard

Pre-university college / Diploma: A person who had studied up to pre university collegiate education and/or studied diploma.

Graduate: A person who has studied up to graduation and has obtained a degree.

Post graduate: A person who has completed post graduation and has obtained a post graduation degree.

Occupation:⁵⁷

Government employee: An individual who is hired by a government office or agency and paid a salary. This includes employees of: Central, State or Municipal governments and their agencies that are owned by the government.

Private employee: An individual who is hired to work and is paid a salary or wages. This includes any employees not working for the government.

Business: A person who had a shop or hotel (self employed)

Farmer :An individual engaged in agriculture, raising field crops for food or raw materials. A farmer might own the farmed land or might work as a labourer on land.

Coolie : A person who makes living on daily wage basis other than farm lands.

Skilled : A person who has acquired special skills like carpentry

Homemaker: An individual whose primary activity is in carrying out household tasks without being paid.

Marital Status: Marital status was classified as “Married”, “Unmarried” and “Widowhood or Divorced”

Socioeconomic status:

Information of total monthly income of the family in rupees was obtained as well as the family size. Per capita monthly income in rupees was calculated, and then the family was classified using modified B. G. Prasad’s classification.⁵⁸

Modified B. G. Prasad’s Classification

Socioeconomic class	Prasad's classification (1961) per capita income in Rs/ month⁵⁸	Modified Prasad's classification in the study period (2013) Per capita income in Rs/month⁵⁹
I	100 & above	5157 and above
II	50 to 99	2578 to 5156
III	30 to 49	1547 to 2577
IV	15 to 29	773 to 1546
V	below 15	below 733

Average Consumer Price Index for the year 2013 = 1046⁵⁹

Modification was done with the aid of Correction Factor (C.F), which was obtained as below:

$$\text{C. F.} = \frac{\text{Average Consumer Price Index for study period}}{100} \times 4.93$$

$$\begin{aligned} \text{C. F.} &= \frac{1046}{100} \times 4.93 \\ &= 51.56 \quad 52. \end{aligned}$$

Step 2: Risk Factors for Diabetes Mellitus

Alcohol Consumption: For the assessment of history of alcohol consumption period of recall was considered for the past one year.⁵⁷

Alcoholics: Subjects who had consumed any drink containing alcohol either in the past or consuming at present were categorized as “alcoholics”.

Present alcoholic: The person who consumed alcohol at least for the past one year.

Past alcoholic: The person who consumed alcohol earlier but left consuming alcohol for the last one year.

Non Alcoholics: Subjects who had never consumed alcohol.

Tobacco use: For the assessment of history of use of tobacco in any form (smoking or smokeless) period of recall was considered for the past one year and was based on WHO guidelines for tobacco use surveillance.⁵⁷

Smoking tobacco:

Smokers: Subjects those who had smoked in the past or smoking at present were considered as “smokers”.

Current smoker: The person who smoked beedis or cigarettes at least for the last one year.

Daily smoker: The person who smoked beedis or cigarettes daily for the last one year.

Past smoker: The person who smoked beedis or cigarettes earlier but left smoking for the last one year.

Non Smokers: Subjects who had never smoked any form of tobacco (Cigarettes/Beedi) were considered as “non smokers”.

Smokeless tobacco use:

Smokeless tobacco user: Subjects those who had used smokeless tobacco in the past or using at present were considered as “smokeless tobacco user”.

Current use of smokeless tobacco: The person who used any form of smokeless tobacco products (Snuff, Gutka, Chewing tobacco, etc.,) at least for the last one year.

Past user of smokeless tobacco: The person who used smokeless tobacco earlier but left using it for the last one year.

Non user of smokeless tobacco: Subjects who had never used any form of smokeless tobacco were considered as “non users of smokeless tobacco”.

Diet: Dietary assessment included frequency of fruits and vegetable consumption, predominant type of oil used for the cooking.

Fruits consumption: Fruit consumption pattern studied based on the days of fruit consumption on a typical week and were stratified as subjects who never consumed fruit, consumed 1 – 3 days, 4 – 6 days and on all the days of the week.⁶⁰

1 serving of fruit was defined as 1 medium size/ piece (80 grams) of Banana, Apple, orange, etc.^{57, 60}

Vegetable consumption: Vegetable consumption pattern studied based on the days of vegetable consumption on a typical week and were stratified as subjects who never consumed vegetables, consumed 1 – 3 days, 4 – 6 days and on all the days of the week.⁶⁰

1 serving of vegetable was defined as 1 medium size cup of raw green leafy vegetables or ½ cup of cooked vegetables like Carrot, pumpkin, corn, tomatoes, beans, etc., (80 grams)^{57, 60}

Oil / Fat consumption: Type of oil that was predominantly used for cooking purpose.

Physical Activity:

Physical activity was assessed by three domains: At work i.e., job related (paid and unpaid work, in and outside home), leisure time and travel related (to get to and fro from work places) physical activity and were classified as sedentary, moderate and vigorous activities at each domain.⁵⁷

Work related physical activity:

Work involving, mostly sitting or standing, with walking for not more than 10 minutes at a time was graded as sedentary work

Work involving moderate-intensity activity, like brisk walking, carrying light loads for at least 10 minutes at a time was graded as moderate work.

Work involving vigorous activity like heavy lifting, digging or other work for at least 10 minutes at a time was graded as vigorous work.

If an individual said yes for all the three, he / she were graded as vigorously active at work. If an individual said yes for both moderate and sedentary, he / she were graded as moderately active at work.

Leisure time physical activity:

Recreation, sport or leisure time involve mostly sitting, reclining, or standing, with no physical activity lasting more than 10 minutes at a time was graded as sedentary during leisure.

Any moderate intensity activities like brisk walking, cycling, playing games, for at least 10 minutes at a time was graded as moderately active during leisure.

Any vigorous activities like running or strenuous sports, weight lifting for at least 10 minutes at a time was graded vigorously active during leisure.

If an individual said yes for all the three, he / she were graded as vigorously active during leisure. If an individual said yes for both moderate and sedentary, he / she were graded as moderately active during leisure.

Travel related physical activity:

Walking or use of bicycle (pedal cycle) for at least 10 minutes continuously to and fro from work places.

History of Diabetes Mellitus

History of Diabetes Mellitus was assessed either by documentation by physician or if the person is on oral hypoglycemic agents or insulin or both.⁵⁷

Family History: Family history of Diabetes Mellitus and Hypertension was assessed among parents and siblings of the participants.

History of Raised Blood Pressure:

History of raised blood pressure was assessed either by documentation by physician or if the person is on blood pressure lowering drugs.⁵⁷

Family History:

Family history of Hypertension was assessed among parents and siblings of the participants.

Height:

The subject was asked to stand straight without footwear, with heels, buttocks and back straight and arms hanging by side. The height was measured from head to heel. The coinciding reading was measured to the nearest 0.1 cm using a metallic measuring tape.⁵⁷

Weight:

Body weight was measured without any foot wear and with minimal clothing to the nearest 0.1 kilogram using a standard portable adult weighing machine, which was standardized periodically during the study. The scale was adjusted to zero before each session and weight was recorded in kilograms.⁵⁷

Calculation of Body Mass Index (BMI in Kg/m²): Body mass index was calculated as;

$$\text{BMI} = \frac{\text{Weight in Kg}}{(\text{Height in Meter})^2}$$

Based on WHO and International obesity task force (IOTF) BMI cut-off standards for Asia and India, obesity was defined as below.⁶¹

Category	BMI range (Kg/m ²)
Underweight	<18.5
Normal	18.5-22.99
Overweight	23-25
Obesity	>25

As per the revised guidelines recommended by WHO, persons with BMI values of less than 18.5 were classified as “Underweight”, 18.5 to 24.99 were classified as “Normal weight”, 25.0 to 29.99 were classified as “overweight / pre-obese” and 30.0 to 34.99 were classified as “Obese class I”, 35.0 to 39.99 were classified as “Obese class II”, 40.0 were classified as “Obese class III”.⁶²

Category	BMI range (Kg/m ²)
Underweight	<18.5
Normal	18.5 – 24.99
Overweight	25 – 29.99
Obesity class I	30 – 34.99
Obesity class II	35 – 39.99
Obesity class III	40.0

Waist circumference (WC): The measurement was made at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest and the subject stands with arms at the sides, feet positioned close together, and weight evenly distributed across the feet.⁵⁸ Waist circumference > 80 centimeter for females and > 90 centimeter for males was considered to have abdominal obesity.¹⁴

Hip Circumference (HC): It is the maximum circumference in the horizontal plane measured over the buttocks at the level of greater tubercle.⁵⁷

Waist hip ratio (WHR): The ratio of waist circumference to the hip circumference less than 0.85 in females and less than 1.0 in male was considered normal.⁶³

Blood pressure measurement: During the course of interview, three measurements of blood pressure of each study participant were measured using mercury sphygmomanometer at an interval of 5 minutes in sitting position. The reading of blood pressure was obtained after the subject had rested for at least five minutes in the seated position. The first blood pressure measurement was recorded after obtaining

socio-demographic information from study subject, while second and third was recorded during clinical examination.

All blood pressure measurements were made on left arm of each subject, using a adult cuff of appropriate size covering 80% of the arm. The sphygmomanometer was kept at the level of the heart. The average of last two SBP and DBP reading in mm Hg were noted to describe the blood pressure of the participant.⁵⁷

Categorization of subjects by blood pressure levels:

The subjects were divided into “Normotensive”, “pre hypertensive “or “Hypertensive” on the basis of their blood pressure levels according to JNC VII criteria.⁶⁴

Category	SBP (in mmHg)	DBP (in mmHg)
Normotensives	120	and 80
Prehypertensive	121 – 139	or 81 – 89
Hypertension stage I	140 – 159	or 90 – 99
Hypertension stage II	160	or 100

Step 3:

The capillary blood samples were collected taking aseptic precautions and fasting blood sugar was measured. The values obtained were in mg/dL.

FBS < 110 was considered “normal”,

110 – 125 as “Impaired Fasting Glucose (IFG)”

126 was considered as “Diabetes”.⁶⁵

Assessment of knowledge:

Pretested Questionnaire was used to know the knowledge of the participants regarding Diabetes Mellitus. Total correct responses were 24. Each correct response was given a score each. Score less than mean -1 SD was classified as poor category (score <5), Mean -1SD to mean + 1SD was graded as average (score 5-10) and score more than mean + 1SD (score 11) was classified into good category of knowledge regarding Diabetes Mellitus.

RESULTS

The present study was conducted in the Agasga village under rural field practice area of Primary Health Centre, Handignur of Department of Community Medicine, Jawaharlal Nehru Medical College, Belgaum, on 855 subjects during the period of January 2013 to December 2013.

Most of the population could fluently speak and understand Kannada and Marathi languages. Many people were involved in agriculture and related activities for their living. The educational facilities that were available in the village was up to high school. The Anganwadi Workers, Health Assistants, Health workers, Private Practitioners and Medical Officer of PHC Handignur provided necessary health care facilities.

The data obtained was tabulated and analyzed under following headings as below:

- 1. Profile of study participants**
- 2. Prevalence of the risk factors among study participants and Prevalence of Diabetes Mellitus.**
- 3. Assessment of susceptibility of the participants to Diabetes Mellitus using Indian Diabetic Risk Score**
- 4. Association between various risk factors and Diabetes Mellitus.**
- 5. Assessment of Knowledge regarding Diabetes among the participants.**

I. PROFILE OF STUDY PARTICIPANTS**Table 1: Distribution of the study participants according to age (N=855)**

AGE (YEARS)	NUMBER	PERCENTAGE
30 -34	150	17.54
35 – 49	425	49.70
50-60	280	32.74
Total	855	100

In our study, 150(17.54 %) participants were between age group of 30 – 34 years, 425(49.7 %) between 35 to 49 years, 280(32.74%) between 50 to 60 years.

Table 2: Distribution of the study participants according to gender (N =855)

GENDER	NUMBER	PERCENTAGE
Male	415	48.53
Female	440	51.54
Total	855	100

Out of 855 study participants, 415 (48.53 %) were male and 440 (51.54 %) were female participants.

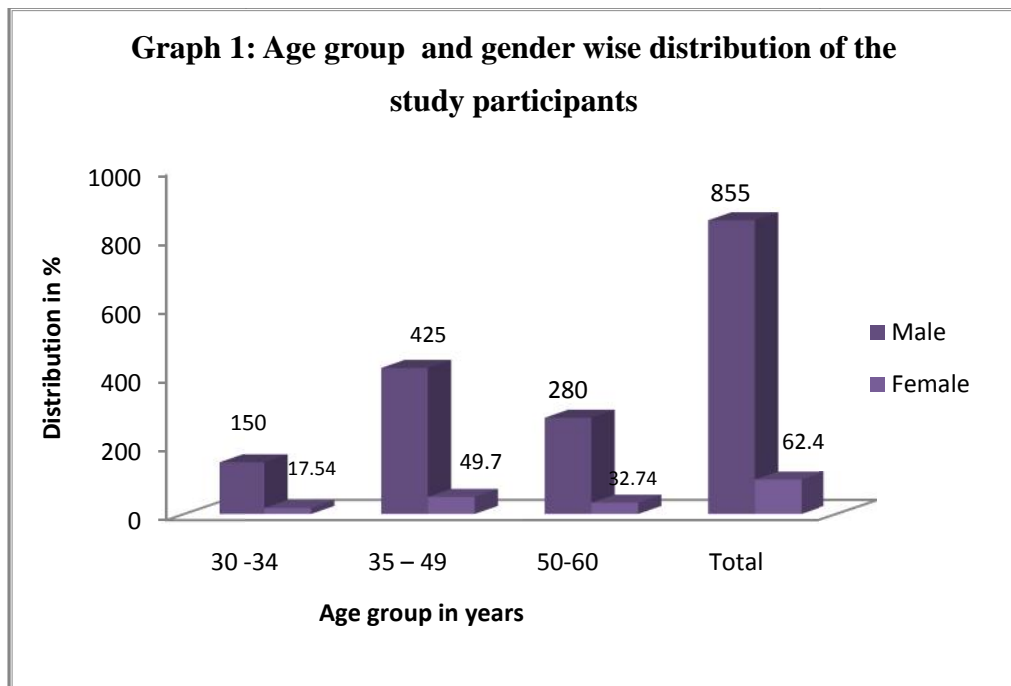


Table 3: Distribution of study participants according to marital status (N=855)

MARITAL STATUS	NUMBER	PERCENTAGE
Married	832	97.3
Unmarried	7	0.8
Widowed	16	1.9
Total	855	100

In the present study, 832 (97.3 %) were married, 7 (0.8 %) were unmarried and 16 (1.9 %) were widowed.

In the present study, all the 855 participants were Hindu by religion.

Table 4: Distribution of study participants according to their occupation status

(N =855)

OCCUPATION	NUMBER	PERCENTAGE
Government employee	03	0.4
Non - government employee	05	0.6
Business	7	0.8
Skilled Worker	9	1.1
Farmer	614	71.8
Coolie	69	8.1
Homemaker	144	16.5
Unemployed	4	0.5
Total	855	100

In the study, 614 (71.8 %) of the participants were farmers, 144 (16.5%) were homemakers, 69 (8.1%) were coolies, 9(1.1%) were skilled workers, 7(0.8%) were having business, 5(0.6%) were in private (clerical) job, 3(0.4%) were government employees and 4 (0.5%) were unemployed.

Table 5: Distribution of study participants according to type of family (N=855)

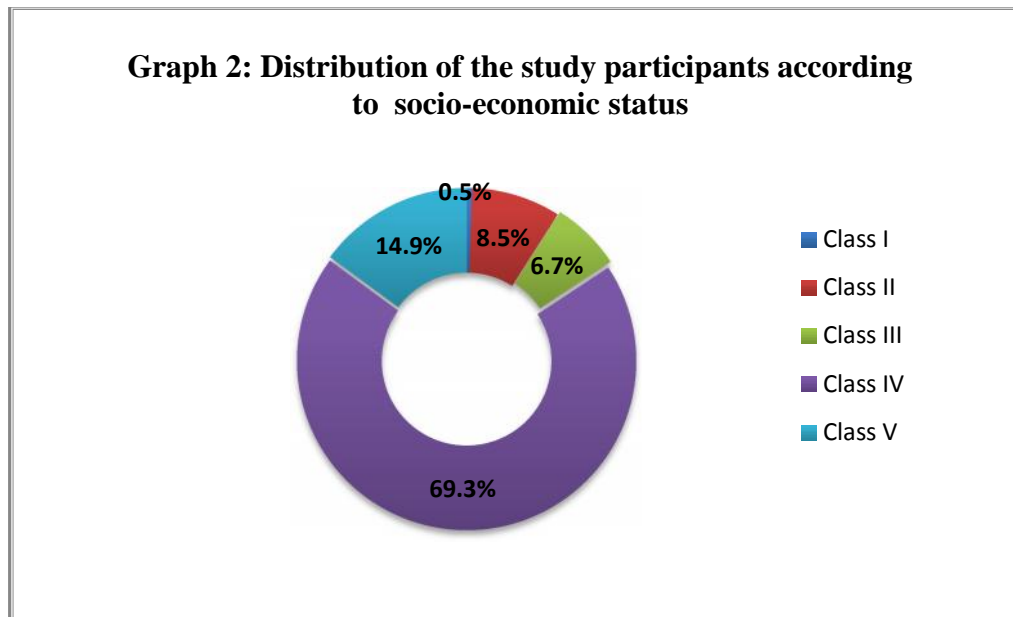
FAMILY TYPE	NUMBER	PERCENTAGE
Nuclear	723	84.6
Joint	132	15.4
Total	855	100

In this study, 84.6% (723) of the population had Nuclear family, 15.4% (132) had Joint family type.

Table 6: Distribution of study participants according to socio economic status

(Acc. to modified B.G. Prasad classification, 2013) (N = 855)

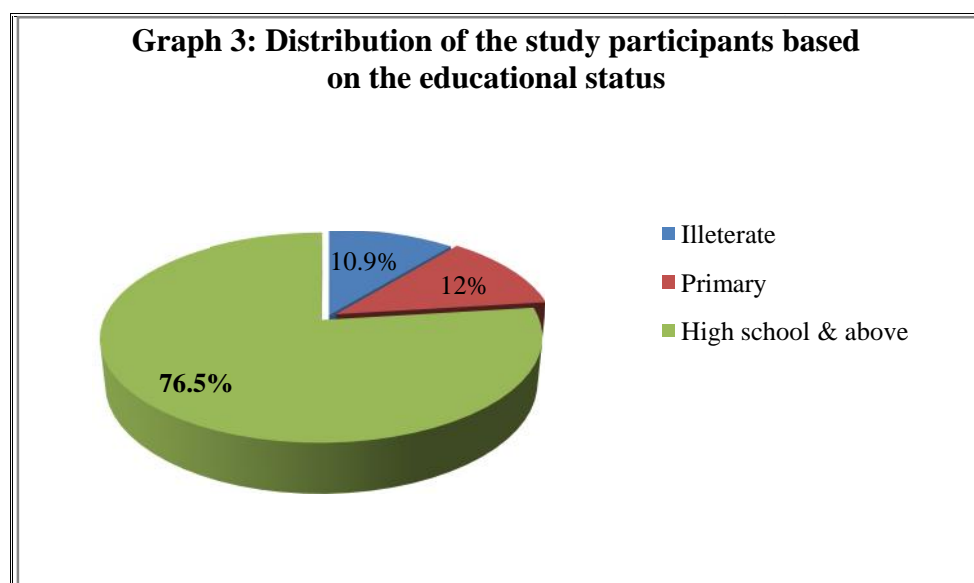
SOCIO ECONOMIC STATUS	NUMBER	PERCENTAGE
Class I	4	0.5
Class II	73	8.5
Class III	57	6.7
Class IV	593	69.3
Class V	128	14.9
Total	855	100



As per modified B.G. Prasad's classification, in the present study, 593 (69.3%) participants belonged to class IV SES, followed by 128 (15%) to class V, 73 (8.5 %) in class II, 57 (6.7 %) in class III, 132 (13.5%) and 4 (0.5 %) in class I.

Table 7: Distribution of study participants according to their educational status (N = 855)

EDUCATION	NUMBER	PERCENTAGE
Illiterate	93	10.9
Primary	103	12.0
High school and above	659	77.1
Total	855	100



In the present study, 93(10.9) were illiterate, 103 (12.0%) studied up to primary school level, 659(77.1%) high school and above.

Table 8: Distribution of study participants according to previous history of blood examination for diabetes (N =855).

BLOOD SUGAR EXAMINATION	MEN (%)	WOMEN (%)	TOTAL (%)
Yes	64(14.9)	92(20.9)	154(18)
No	353(85.1)	348(79.1)	701(82)
Total	415	440	855
$\chi^2 = 5.153$	Df = 1	p = 0.023	

The overall percentage of study participants who have got their blood examination done was 18 %. 82 % of population had not got tested their blood sugar level examined previously. More number of women got their blood sugar examined compared to men, the difference was statistically significant with $p = 0.023$.

Table 9: Distribution of study participants according to previous history of blood pressure examination (N =855).

BLOOD PRESSURE EXAMINATION	MEN (%)	WOMEN (%)	TOTAL (%)
Yes	181(43.6)	241(54.8)	422(49.4)
No	234(56.4)	199(45.2)	433(50.6)
Total	415	440	855(100)
$\chi^2 = 10.638$	Df = 1	p < 0.001	

The overall percentage of study participants who have got their blood pressure examination done was 49.4 %. 50.6 % of population had not got their blood pressure level examined previously. More number of women got their blood pressure examined compared to men, the difference was statistically significant with $p < 0.001$.

II. ASSESSMENT OF THE RISK FACTORS

a) *Behavioral Risk Factors.*

(i) ALCOHOL CONSUMPTION

Table 10 (a): Distribution of study participants according to history of use of alcohol (N=855)

ALCOHOL USE	MEN (%)	WOMEN (%)	TOTAL (%)
Yes	121(29.15)	0 (0)	121(14.1)
No	290(69.87)	440(100)	734 (85.8)
Total	415(100)	440(100)	855(100)

- a) In the present study, the overall prevalence of alcohol use was 14.1%. All the 14.1% were men. Zero percent among women.
- b) Among alcoholics, 15 (0.8%) had the history of duration of consumption less than 1 year, 20 (2.3%) for 1 to 5 years, 43(5%) for 6-10 years, 42(4.9%) for 11-20 years and 5(0.6%) of them had history of more than 20 years of alcohol consumption.

b) **Table 10(b):Distribution of study participants according frequency of alcohol consumption (N =121)**

FREQUENCY OF ALCOHOL	NUMBER	PERCENTAGE
5 days / week	8	9.6
1 – 4 days / week	15	12
1 – 3 days / month	48	38.4
Occasionally	50	40
Total	121	100

- i) Among alcoholics 40.0% consumed it occasionally, 38.4 % consumed it 1-3 days / month, 12 % consumed 1 to 4 days per week and 9.6 % consumed 5 days / week.
- ii) Among alcoholics, 63(53.6%) consumed 90 ml, 32 (25.6%) consumed 120 ml, 20(16%) consumed 60 ml and 6(4.8%) consumed more than 120 ml.
- iii) Among alcoholics, ‘country liquor’ was the predominant type of drink consumed 74 (62.4%) followed by ‘whiskey’ 27 (21.6%), ‘Rum’ 23 (18.4%), ‘Beer’ and ‘Gin’ 6 (4.8%) each.

(ii) SMOKING TOBACCO**SMOKING TOBACCO**

In the present study, 64 (%) were past smokers.

Table 11 (a): Distribution of study participants according to history of smoking tobacco (N=855)

SMOKING TOBACCO	MEN (%)	WOMEN (%)	TOTAL (%)
Yes	95(22.89)	-	95(11.11)
No	320(77.10)	440(100)	760(88.77)
Total	415(100)	440(100)	855 (100)

In the present study, 95 (11.22 %) participants smoked tobacco. Among men the prevalence of smoking was 22.89 % and among women smoking was not prevalent (0%).

SMOKELESS TOBACCO**Table 11 (b): Distribution of study participants according to history of using smokeless tobacco (N=855)**

SMOKELESS TOBACCO USE	MEN (%)	WOMEN (%)	TOTAL (%)
Yes	254(61.2)	257(58.4)	511(59.76)
No	161(38.8)	183(41.6)	344(40.23)
Total	415(100)	440(100)	855(100)
$\chi^2 = 0.694$			$p = 0.405$
Df = 1			

In the present study, (59.76%) used smokeless tobacco. Among men the prevalence of use was 254(61.2%) and women 257(58.4%).

Overall 'Chewing tobacco' was the predominant form of consumption i.e., 56.4 % followed by 'Tobacco plus Gutka' i.e., 2.6%.

Smokeless tobacco consumption was almost similar in men and women with $p=0.405$.

DIET

Table 12 (a): Distribution of study participants according to type of diet consumed (N =855)

DIET CONSUMPTION	MEN (%)	WOMEN (%)	TOTAL (%)
Vegetarian	42(10.1)	77(17.5)	119 (13.9)
Mixed	373(89.9)	363(82.5)	736 (86.1)
Total	415 (100)	440 (100)	855 (100)
$\chi^2 = 9.707$			Df = 1
			p = 0.002

Of the total participants, 119 (13.9%) were vegetarians and 736(86.1%) were mixed diet. More number of women consumed vegetarian diet compared to men. The difference was statistically significant with $p = 0.002$.

Staple food of the participants was Rice and Jowar.

Table 12 (b): Distribution of study participants according to frequency of consumption of fruits per week (N =855)

FRUITS CONSUMPTION	MEN (%)	WOMEN (%)	TOTAL (%)
Rarely	45(10.8)	60(13.6)	105(12.3)
1 – 3 days / week	343(82.7)	354(80.5)	697(81.5%)
4 – 6 days / week	27(6.5)	26(5.9)	53(6.2%)
Total	415 (100)	440 (100)	855(100)
$\chi^2 = 1.606$			$p = 0.448$

12.3 % of the participants rarely consumed any fruits. Most of the Participants (81.5%) consumed fruits 1-3 days / week. 6.2% of study population consumed fruits 4-6 days/week and no participant consumed fruits daily.

Table 12 (c): Distribution of study participants according to consumption of vegetables per week (N =855)

VEGETABLE CONSUMPTION	MEN (%)	WOMEN (%)	TOTAL (%)
1 – 3 days / week	5(1.2)	2(0.5)	7 (0.8)
4 – 6 days / week	52(12.5)	78(17.7)	130 (15.2)
On all days	358(86.3)	360(81.8)	718(84.3)
Total	415 (100)	440 (100)	855(100)
$\chi^2 = 5.765$			p = 0.056
Df = 2			

Majority of the study participants (84 %) consumed vegetables on all days. 15.2 % of them consumed vegetables 4 to 6 days a week and 0.8 % consumed 1 to 3 days a week.

In the present study, 639 (74.7%) participants used groundnut oil as their predominant oil for cooking, followed by Groundnut +sunflower oil 211 (24.7%) and 5 (0.5%) sunflower oil. None of them consumed coconut oil.

Junk food & Soft drinks History:

30 (3.5%) of the total study population eat junk food, of which most of them eat it occasionally. 94 (11%) of the study population consume soft drinks, of which 87(92.5%) of them have it occasionally.

PHYSICAL ACTIVITY**Table 13 (a): Distribution of study participants according to levels of physical activity at work (N = 855)**

PHYSICAL ACTIVITY AT WORK	MEN (%)	WOMEN (%)	TOTAL (%)
Sedentary	1(0.2)	4(0.9)	5(0.58)
Moderate	367(88.4)	405(92)	772(90.3)
Heavy	47(11.3)	31(7.0)	78 (9.1)
Total	415(100)	440(100)	855(100)
$\chi^2 = 6.227$	Df = 2	p = 0.044	

In the present study, 5(0.58%) participants were sedentary at work. 772 (90.3%) involved in moderate activity and 78(9.1%) were involved in vigorous physical activity at their work. More number of men were involved in heavy work than women, this difference was statistically significant with $p=0.044$.

Table 13 (b): Distribution of study participants according to levels of physical activity during leisure time (N =855)

PHYSICAL ACTIVITY DURING LEISURE	MEN (%)	WOMEN (%)	TOTAL (%)
Yes	2(0.5)	12(2.7)	14(1.6)
No	413(99.5)	428(97.3)	841(98.1)
Total	415 (100)	440(100)	855(100)
$\chi^2 = 6.685$	Df = 1	p = 0.01	

In the present study, most of the participants 98.1 % did not involve in physical activity during leisure time. Only 1.6% of the study population involved in physical activity during leisure time. (p=0.01).

Table 13 (c): Distribution of study participants according to physical activity during travel to work (N =855).

TRAVEL RELATED PHYSICAL ACTIVITY	MEN (%)	WOMEN (%)	TOTAL (%)
NA	1(0.2)	33(7.5)	34(3.97)
Sedentary	22(5.3)	2(0.5)	24(2.8)
Active	392(94.5)	405(92)	797(93.2)
Total	(100)	(100)	855 (100)
$\chi^2 = 46.305$			Df = 2
			p < 0.001

In the present study, 93.2 % involved in non sedentary type activity during their travel to work and 2.8 % of study population involved in sedentary type of physical activity during travel. More number of men spent energy through physical activity to reach work place compared to women, this difference was statistically significant. $p < 0.001$.

HISTORY OF DIABETES MELLITUS**Table 14 (a): Distribution of study participants according to self reported history of diabetes mellitus (N = 855).**

HISTORY OF DIABETES MELLITUS	MEN (%)	WOMEN (%)	TOTAL (%)
Present	14(3.4)	14(3.2)	28(3.3%)
Absent	401(96.6)	426(96.8)	827(96.7%)
Total	415 (100)	440(100)	855(100)
$\chi^2 = 0.025$	Df = 1	p = 0.875	

The overall prevalence of self reported history of diabetes mellitus in our study was 3.3%. There was no difference among men and women. (p=0.875).

All the self reported study subjects who were having diabetes mellitus were on treatment.

Table 14 (b): Distribution of study participants according to family history of Diabetes (N=855)

FAMILY HISTORY OF DIABETES MELLITUS	MEN (%)	WOMEN (%)	TOTAL (%)
Present	40(9.6)	30(6.8)	70(8.18)
Absent	347(83.6)	373(84.8)	720(84.21)
Don't know	28(6.7)	37(8.4)	65(7.60)
Total	415 (100)	440(100)	855(100)
$\chi^2 = 2.885$			p = 0.236
Df = 2			

In the present study, 70(8.18%) were having family history of diabetes. 65(7.60%) were not aware whether family history of diabetes was there or not and 720(84.21) were not having family history of Diabetes mellitus. There was no difference between men and a woman as far as history of diabetes Mellitus was concerned.(p=0.236)

Table 14 (c): Distribution of study participants according to family members with the history of Diabetes (N=855)

FAMILY HISTORY OF DIABETES	MEN (%)	WOMEN (%)	TOTAL (%)
No history	347(83.6)	373(84.8)	720(84.2)
Either Parent	35(8.4)	18(4.1)	53(6.1)
Both parents	4(1.0)	4(0.9)	08(0.93)
Brothers	-	4(0.9)	04(0.46)
Sisters	1(0.2)	4(0.9)	05(0.58)
Don't know	28(6.7)	37(8.4)	65(7.6)
Total	415 (100)	440(100)	855(100)
$\chi^2 = 12.718$	Df = 5	p = 0.026	

In the present study, 720(84.2%) did not have family history of diabetes, 53(6.1%) had either of parents having Diabetes, 8 (0.93%) had both parents having diabetes, 4 (0.46 %) and 5 (0.5%) had their brothers and sisters having diabetes respectively. 65(7.6%) of study population were not knowing their family history of diabetes. More number of men had history of either of the parents having Diabetes Mellitus compared to women, this difference was statistically significant with p = 0.026.

Table 15: Distribution of study participants according to self reported history of hypertension (N = 855).

HISTORY OF HYPERTENSION	MEN (%)	WOMEN (%)	TOTAL (%)
Present	27(6.5)	19(14.3)	46 (5.4)
Absent	388(93.5)	421(95.7)	809 (94.4)
Total	415 (100)	440(100)	855(100)
$\chi^2 = 2.008$	Df = 1	p = 0.156	

The overall prevalence of self reported history of hypertension in our study was 5.4%.

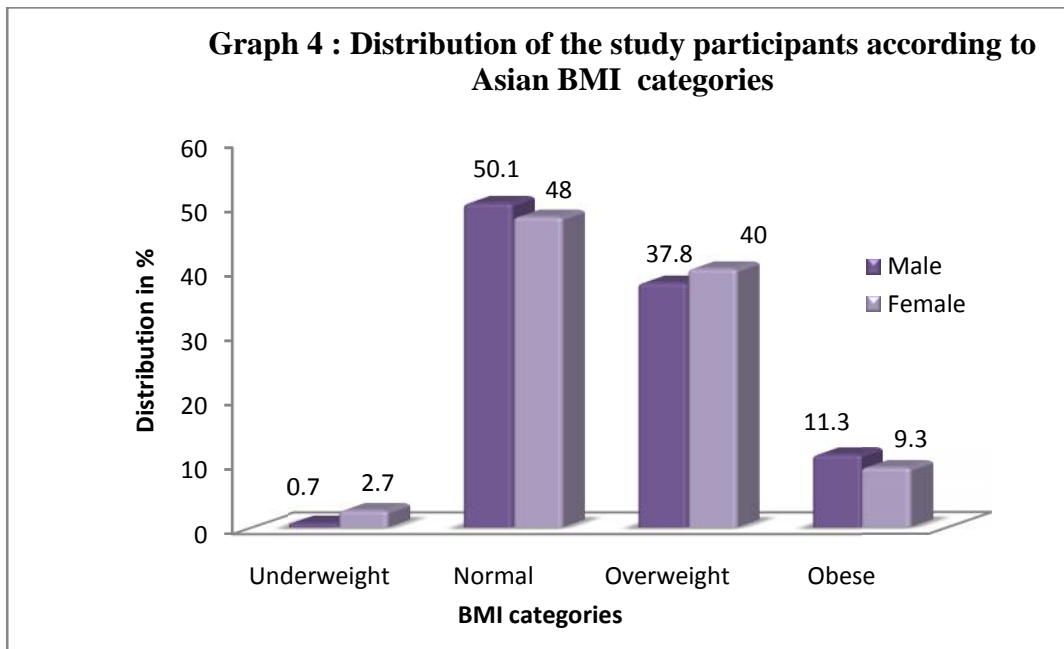
All the self reported study subjects who were having hypertension were on treatment.

In the present study, 49(5.73%) were having family history of hypertension.

806(94.26) were not having family history of hypertension. Among those having family history of hypertension, 39(4.56%) had either of parents having hypertension, 5 (0.58 %) had both parents having hypertension, 3 (0.35 %) and 2 (0.23%) had their brothers and sisters having hypertension respectively.

OVERWEIGHT AND OBESITY**Table 16 (a): Distribution of study participants according to Body Mass Index-Asian Criteria (Kg/m²) (N =855)**

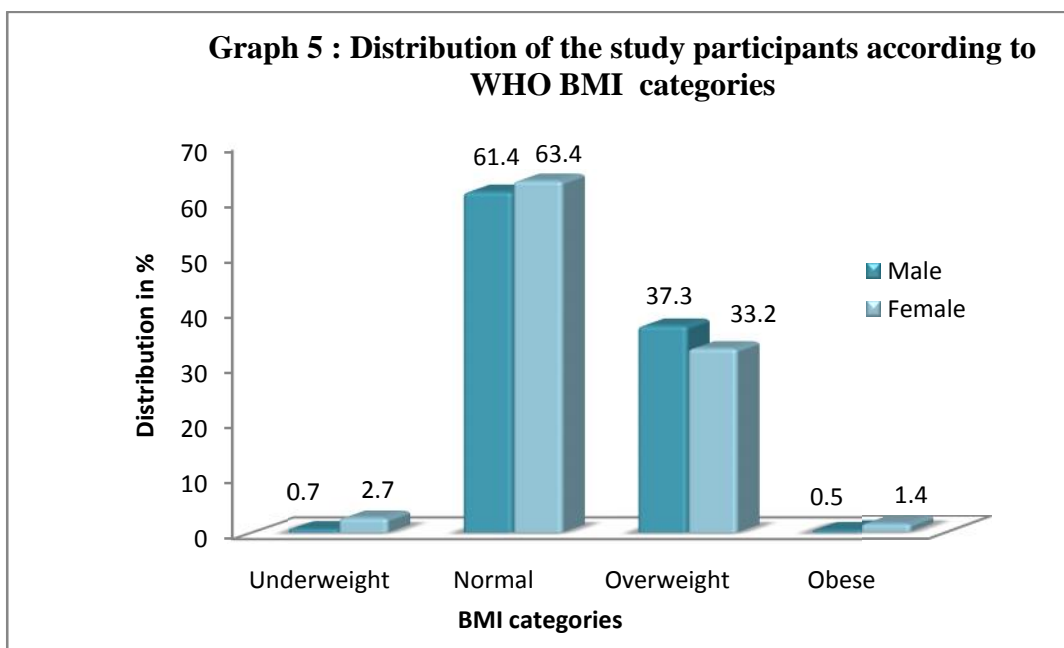
BMI CATEGORIES (KG/M²)	MEN (%)	WOMEN (%)	TOTAL (%)
Underweight (< 18.5)	3(0.7)	12(2.7)	15(1.8)
Normal (18.5 – 22.9)	208(50.1)	211(48)	419(49)
Overweight (23.0 – 24.9)	157(37.8)	176(40)	333(38.9)
Obese (25.0)	47(11.3)	41(9.3)	88(10.3)
Total	415 (100)	440(100)	855 (100)
$\chi^2 = 6.189$	Df = 3	p =0.103	



In the present study, under nutrition was more among women. The overall prevalence of overweight and obesity were 38.2% and 10.3 % respectively. The prevalence of overweight was more among women compared to men (40% vs. 37.8%); whereas among obese, men were more compared to women (11.3 vs. 9.3). The difference was not statistically significant ($P = 0.103$).

Table 16 (b): Distribution of study participants according to Body Mass Index (Kg/m²) (N =855) according to WHO criteria.

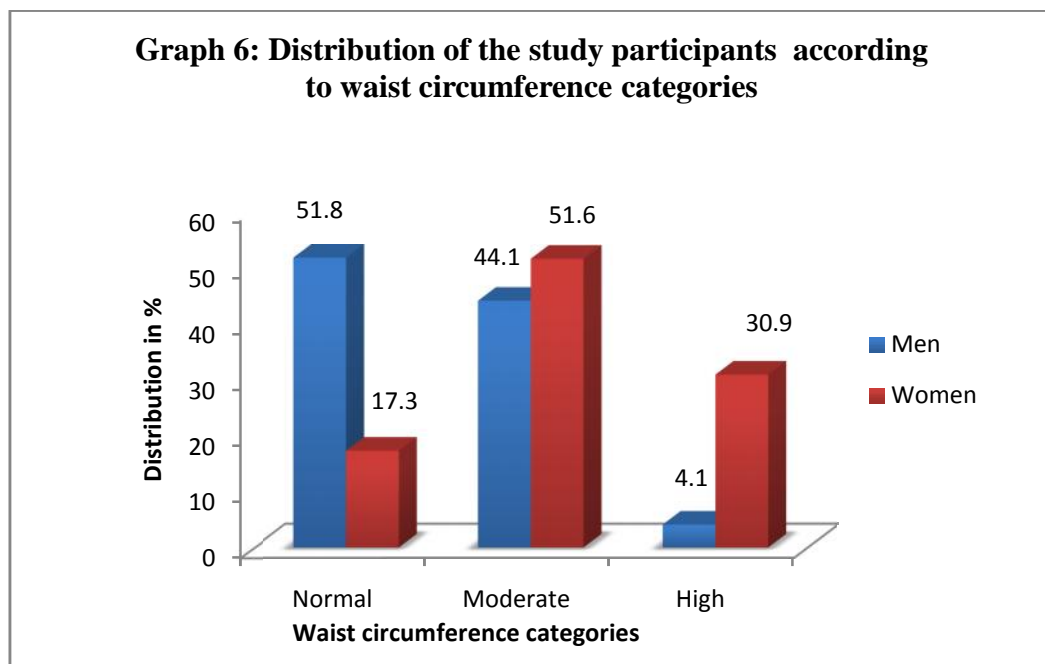
BMI CATEGORIES (KG/M²)	MEN (%)	WOMEN (%)	TOTAL (%)
Underweight (< 18.5)	3(0.7)	12(2.7)	15(1.8)
Normal (18.5 – 24.9)	255(61.4)	77(63.4)	532(62.4)
Overweight (25.0 – 29.9)	155(37.3)	145(33.2)	300(35.2)
Obese (30.0)	02(0.5)	06(1.4)	08(0.9)
Total	415 (100)	440(100)	855 (100)
$\chi^2 = 6.17$			Df = 3
			p =0.048



In the present study more women were undernourished while compared to men and the overall prevalence of overweight and obesity were 35.2% and 0.9 % respectively. The prevalence of overweight was more among men compared to women (37.3% vs. 33.2%); whereas among obese, women were more. The difference was statistically significant (p =0.048).

Table 17: Distribution of the study participants according to waist circumference (WC) (N =855)

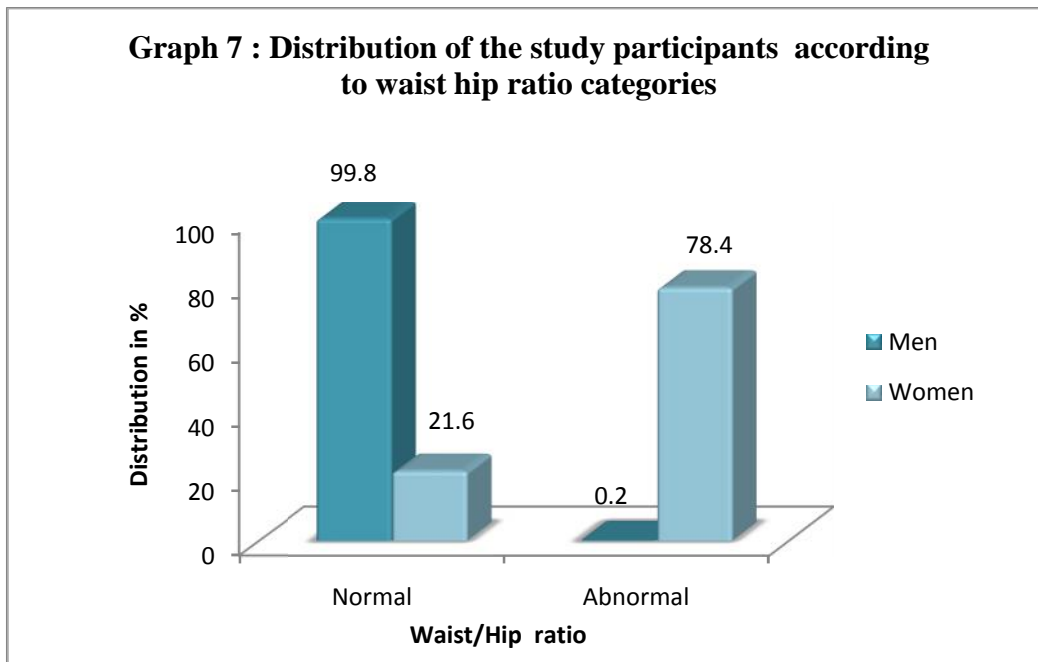
WC CATEGORIES (IN CMS)	MEN (%)	WOMEN (%)	TOTAL (%)
Normal M<90, F<80	215(51.8)	76(17.3)	291(34)
Abnormal -1 M 90-99 F 80-89	183(44.1)	228(51.6)	411(48)
Abnormal -2 M 100 F 90	17(4.1)	136(30.9)	153(17.9)
Total	415 (100)	440(100)	855(100)
$\chi^2 = 163.286$			Df = 2
			p < 0.001



In the present study, the overall prevalence of abdominal obesity based on waist circumference was 65.9 %. The prevalence among women was significantly high than that of men (82.4.0% vs. 48.0%). The difference was statistically significant ($p < 0.001$).

Table 18: Distribution of the study participants according to waist: hip ratio (WHR) (N =855)

WHR CATEGORIES	MEN (%)	WOMEN (%)	TOTAL (%)
Normal M<1 F <0.85	414(99.8)	95(21.6)	509(59.3)
Abnormal M>1 F > 0.85	1(0.2)	345(78.4)	346(40.46)
Total	415 (100)	440(100)	855(100)
$\chi^2 = 541.662$			Df = 1
			p < 0.001



In the present study, the overall prevalence of abdominal obesity based on waist:hip ratio criteria was 40.46 %. The prevalence among women was significantly high than that of men (78.0% vs. 0.2 %). The difference was statistically significant ($p < 0.001$).

Table 19 (a): Distribution of the participants according to systolic blood pressure (N =855)

SBP CATEGORIES	MEN (%)	WOMEN (%)	TOTAL (%)
Normal 120	217(52.3)	283(64.3)	550(58.5)
Pre – hypertension 121 – 139	166(40)	116(26.4)	282(33)
Hypertension grade I & II 140 – 159 & 160	32(7.7)	41(9.31)	73(8.6)
Total	440 (100)	440(100)	855(100)
$\chi^2 = 17.973$			Df = 2
			p =0.0001

In the present study the overall prevalence of hypertension was 8.6%; grade I and grade II being 8.1% and 0.5% respectively. Systolic hypertension prevalence was higher in females (9.31%) as compared to males (7.7%).

The overall prevalence of pre-hypertension was 33%; prevalence was more among males (40%) as compared to females (26.4%).

This gender wise difference in systolic blood pressure level was found statistically significant with more number of men with hypertension ($p = 0.001$).

Table 19 (b): Distribution of the participants according to diastolic blood pressure (N =855)

DBP CATEGORIES	MEN (%)	WOMEN (%)	TOTAL (%)
Normal 80	276(66.5)	329(74.8)	605(70.8)
Pre – hypertension 81 – 89	70(16.9)	60(13.6)	130(15.2)
Hypertension grade I 90 – 99	65(15.7)	47(10.7)	112(13.1)
Hypertension grade II 100	04(0.9)	04(0.9)	8(0.9)
Total	415 (100)	440 (100)	855(100)
$\chi^2 = 7.581$	Df = 3	p= 0.056	

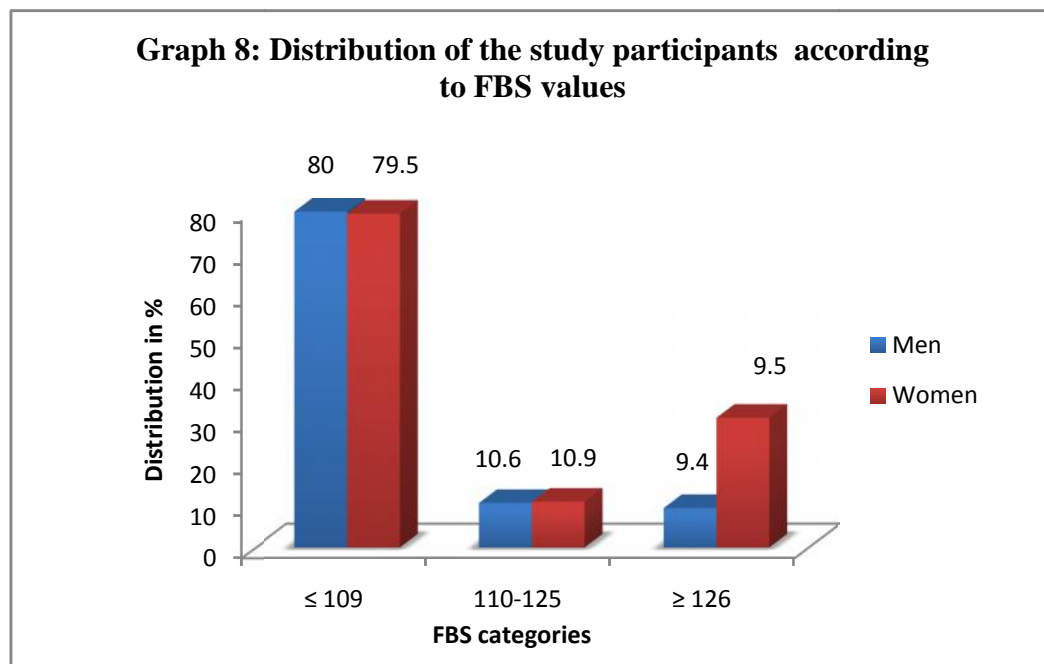
In the present study the prevalence of hypertension was 14.0%; grade I and grade II being 13.1% and 0.9 % respectively. Diastolic hypertension prevalence was higher in males (16.6%) as compared to females (11.6%).

The overall prevalence of pre-hypertension was 15.2%; prevalence was more among males (16.9%) as compared to females (13.6%).

This gender wise difference in systolic blood pressure level was found to be marginally significant (P = 0.056).

FASTING BLOOD SUGAR (FBS)**Table 20: Distribution of the selected participants according to FBS values (N =855)**

FBS VALUES (IN MG/DL)	MEN (%)	WOMEN (%)	TOTAL (%)
109(Normal)	332(80)	350(79.5)	682(79.8)
110 – 125(Impaired)	44(10.6)	48(10.9)	92(10.8)
126(High)	39(9.4)	42(9.5)	81(9.47)
Total	415 (100)	440 (100)	855(100)
$\chi^2 = 0.029$	Df = 2	p = 0.986	

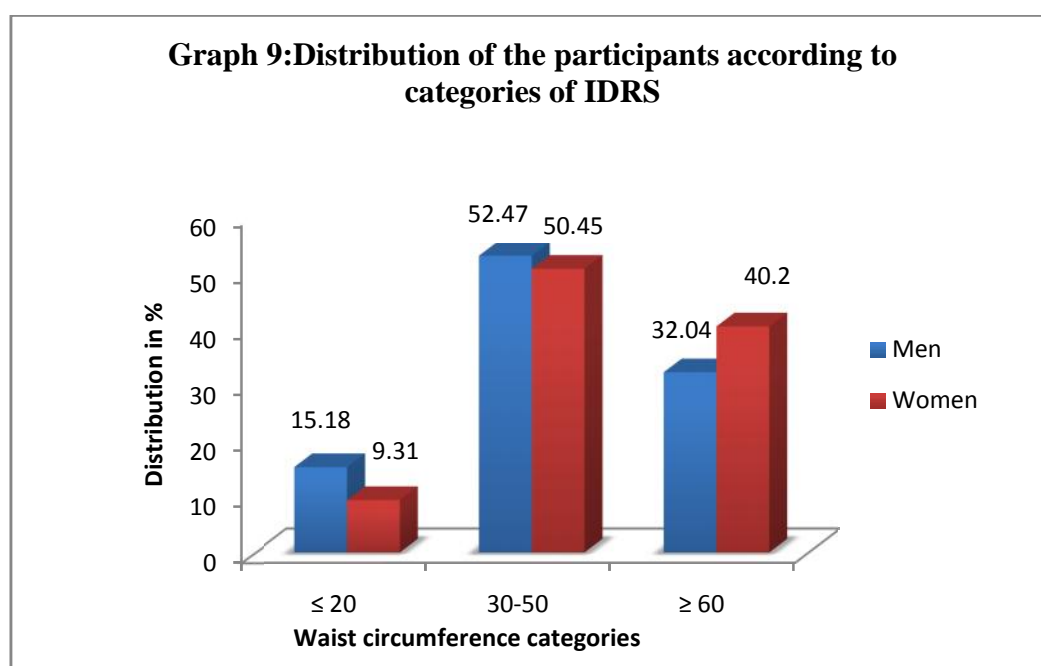


In the present study the prevalence of Diabetes was 9.5%; 10.8 % were at risk of getting Diabetes Mellitus.

This gender wise difference in diabetes Mellitus was not found to be statistically significant (P = 0.986).

IDRS RISK PREDICTION**Table 21: Distribution of participants according to categories of IDRS (N = 855)**

RISK SCORES	MEN (%)	WOMEN (%)	TOTAL (%)
<20(Low risk)	63(15.18)	41(9.31)	104(12.2)
30-50(Moderate risk)	219(52.77)	222(50.45)	441(51.6)
60(High risk)	133(32.04)	177(40.2)	310(36.3)
Total	415 (100)	440 (100)	855(100)
$\chi^2 = 10.197$			Df = 3
			p =0.006



In our study, 12.2% of the participants were under low risk category, 51.56 % were in moderate risk category and 36.3% were at high risk category. In high risk category females were more than males. (40.2% vs. 32.04 %)

This gender wise difference in risk factors of diabetes was found to be statistically significant ($p = 0.006$).

Table 22: Association between Type of family and IDRS

TYPE OF FAMILY	LOW RISK (%)	MODERATE RISK (%)	HIGH RISK (%)	TOTAL (%)
Nuclear	91(12.58)	381(52.69)	251(34.71)	723(84.6)
Joint	13(9.84)	60(45.45)	59(44.69)	132(15.4)
Total	104(12.16)	441(51.57)	310(36.25)	855(100)
$\chi^2 = 4.896$ Df =2 p =0.087				

In our study, there was no association found between type of family and IDRS score.(p=0.087)

Table 23: Association between SES and IDRS

SES	LOW RISK (%)	MODERATE RISK (%)	HIGH RISK (%)	TOTAL (%)
Class I	-	2(50)	2(50)	4(0.5)
Class II	5(6.8)	42(57.53)	26(35.61)	73(8.5)
Class III	3(5.26)	30(52.63)	24(42.10)	57(6.7)
Class IV	76(12.81)	312(52.61)	205(34.56)	593(69.3)
Class V	20(15.62)	55(42.96)	53(41.40)	128(14.9)
Total	104(12.16)	441(51.57)	310(36.25)	855(100)
$\chi^2 = 10.112$ Df = 6 p =0.120				

In our study there was no association between socio economic status and IDRS. The difference in the prevalence of risk factors among different SES classes was not statistically significant (P = 0.120).

Table 24: Association between Education status and IDRS

EDUCATION STATUS	LOW RISK (%)	MODERATE RISK (%)	HIGH RISK (%)	TOTAL (%)
Illiterate	–	55(59.13)	38(40.86)	93(10.9)
Primary	3(2.91)	52(50.48)	48(46.60)	103(12)
High school & above	101(15.32)	334(50.68)	224(33.99)	659(77.1)
Total	104(12.16)	441(51.57)	310(36.25)	855(100)
$\chi^2 = 29.562$ Df = 4 p < 0.001				

In our study there was association between education level and IDRS. Among illiterates none were in low risk category, 59.13 % were in moderate risk, 40.86 % were in high risk category. In participants who had their education up to primary 2.91 % were in low risk category, 50.48 % were in moderate risk and 46.60 were in high risk category. Among subjects who had education high school and above 12.16 % were in low risk category 50.68% were in moderate risk 33.99 % were in high risk category. The difference in the prevalence of risk factors among different education classes was statistically significant (p < 0.001).

Table 25: Association between Alcohol consumption and IDRS

ALCOHOL CONSUMPTION	LOW RISK (%)	MODERATE RISK (%)	HIGH RISK (%)	TOTAL (%)
Yes	14(11.6)	68(56.2)	39(32.2)	121(14.1)
No	90(12.3)	373(50.8)	271(36.9)	734 (85.8)
Total	104(12.16)	441(51.57)	310(36.25)	855(100)
$\chi^2 = 1.254$ Df = 2 p = 0.534				

In present study there was no association found between alcohol consumption and different IDRS risk scores.(p=0.534).

Table 26: Association between smoking tobacco and IDRS

SMOKING TOBACCO	LOW RISK (%)	MODERATE RISK (%)	HIGH RISK (%)	TOTAL (%)
Yes	9(9.5)	51(53.7)	35(36.8)	95(11.22)
No	95(12.5)	390(51.3)	275(36.2)	760(88.77)
Total	104(12.16)	441(51.57)	310(36.25)	855(100)
$\chi^2 = 0.738$ Df = 2 p = 0.692				

In present study there was no association found between smoking tobacco and different IDRS risk scores.(p=0.692).

Table 27: Association between Smokeless Tobacco consumption and IDRS

SMOKELESS TOBACCO	LOW RISK (%)	MODERATE RISK (%)	HIGH RISK (%)	TOTAL (%)
Yes	68(13.3)	266(52.1)	177(34.6)	511(59.76)
No	36(10.5)	175(50.9)	133(38.7)	344(40.23)
Total	104(12.16)	441(51.57)	310(36.25)	855(100)
$\chi^2 = 2.340$ Df = 2 p =0.310				

In present study there was no association found between chewing / smokeless tobacco consumption and different IDRS risk scores.(p=0.310)

Table 28: Association between type of diet and IDRS

DIET HABIT	LOW RISK (%)	MODERATE RISK (%)	HIGH RISK (%)	TOTAL (%)
Vegetarian	4(3.4)	69(58)	46(38.7)	119(13.9)
Mixed	100(13.6)	372(50.5)	264(35.9)	736(86.1)
Total	104(12.16)	441(51.57)	310(36.25)	855(100)
$\chi^2 = 10.124$ Df = 2 p =0.006				

In present study there was an association between type of diet and IDR Score. Risk was seen high among vegetarians than subjects who followed mixed type of diet.(p=0.006).

Table 29: Association between Asian BMI and IDRS

BMI	LOW RISK (%)	MODERATE RISK (%)	HIGH RISK (%)	TOTAL (%)
Underweight (< 18.5)	1(6.7)	12(80)	2(13.3)	15(1.8)
Normal (18.5 – 22.9)	75(17.9)	266(63.5)	78(18.6)	419(49)
Overweight (23.0 – 24.9)	27(8.1)	142(42.6)	164(49.2)	333(38.9)
Obese (≥ 25.0)	1(1.1)	21(23.9)	66(75)	88(10.3)
Total	104(12.16)	441(51.57)	310(36.25)	855(100)
$\chi^2 = 147.204$ Df = 6 p < 0.001				

In the present study, it was found that as the BMI increased high risk of getting diabetes Mellitus also increases high risk of getting Diabetes Mellitus also increases from 18.6 % among people with normal BMI to 75 % among with people with BMI 25. (p < 0.001).

Table 30: Association between WHO BMI and IDRS

BMI	LOW RISK (%)	MODERATE RISK (%)	HIGH RISK (%)	TOTAL (%)
Underweight & Normal weight	93(17)	345(63.07)	119(21.75)	547(63.97)
Overweight & Obese	11(3.57)	106(34.41)	191(62.01)	308(36.02)
Total	104(12.16)	441(51.57)	310(36.25)	855(100)
$\chi^2 = 144.796$				
Df = 2				
p < 0.001				

In present study high risk factor was found among subjects with overweight and obesity. Association found between BMI and IDRS. Higher the BMI higher the score (p < 0.001).

Table 31: Association between WHR and IDRS

WHR	LOW RISK (%)	MODERATE RISK (%)	HIGH RISK (%)	TOTAL (%)
Normal	80(16)	266(53.1)	155(30.9)	501(58.59)
Abnormal	24(6.8)	175(49.4)	155(43.8)	344(40.23)
Total	104(12.16)	441(51.57)	310(36.25)	855(100)
$\chi^2 = 24.379$ Df = 2 p < 0.001				

In present study association found between WHR and IDRS. Higher the WHR higher the score (p<0.001).

Table 32: Association between Systolic HTN and IDRS

SBP CATEGORIES	LOW RISK (%)	MODERATE RISK (%)	HIGH RISK (%)	TOTAL (%)
Normal	87(17.4)	326(65.2)	87(17.4)	500(58.5)
Pre – hypertension	17(6)	107(37.9)	158(56)	282(33)
Hypertension grade I&II	0	8(11)	65(89)	73(8.6)
Total	104(12.16)	441(51.57)	310(36.25)	855(100)
$\chi^2 = 215.917$ Df = 4 p < 0.000				

In present study association found between Systolic blood pressure and IDRS. Higher the SBP higher the score (p<0.000).

Table 33: Association between Diastolic HTN and IDRS

DBP CATEGORIES	LOW RISK (%)	MODERATE RISK (%)	HIGH RISK (%)	TOTAL (%)
Normal	86(14.2)	370(61.2)	149(24.6)	605(70.76)
Pre – hypertension	18(13.8)	51(39.2)	61(49.6)	130(15.20)
Hypertension grade I&II	0	20(16.7)	100(83.3)	120(14.03)
Total	104(12.16)	441(51.57)	310(36.25)	855(100)
$\chi^2 = 159.945$ Df = 4 p < 0.001				

In present study association found between Diastolic blood pressure and IDRS. Higher the DBP higher the IDR Score (p<0.001).

Table 34: Association between FBS and IDRS

FBS CATEGORIES (IN MG/DL)	LOW RISK (%)	MODERATE RISK (%)	HIGH RISK (%)	TOTAL (%)
109	104(15.2)	419(61.4)	159(23.3)	682(79.8)
110 – 125	0	17(18.5)	75(81.5)	92(10.8)
126	0	5(6.2)	76(93.8)	81(9.5)
Total	104(12.16)	441(51.57)	310(36.25)	855(100)
$\chi^2 = 248.695$ Df = 4 p < 0.001				

In present study association was found between Fasting blood sugar and IDRS. Higher the FBS higher the IDR Score .For normal FBS high risk of getting Diabetes Mellitus as per IDR Score was 23.3% ; for impaired reading 81.5 % and for frank Diabetes 93.8 %. (p <0.001)

Table 35: Association between age and Diabetes Mellitus:

AGE (YEARS)	DIABETES MELLITUS PRESENT (%)	DIABETES MELLITUS ABSENT (%)	TOTAL (%)
30 -49	13(2.3)	562(97.73)	575 (67.25)
50-60	68(24.3)	212(75.71)	280(32.74)
Total	81(9.47)	774(90.52)	855(100)
$\chi^2 = 107.112$			Df = 2
			p < 0.001

In the present study, among subjects who have been diagnosed with diabetes Mellitus, 24.3 % were in age group 50-60 years, 2.3 % were in age group between 30-49 .This study shows there is significant association of age with Diabetes Mellitus. As age advances more chances of getting Diabetes Mellitus. (p< 0.001)

Table 36: Association between gender and Diabetes Mellitus:

GENDER	DIABETES MELLITUS PRESENT (%)	DIABETES MELLITUS ABSENT (%)	TOTAL (%)
Male	39(9.4)	376(90.6)	415(48.53)
Female	42(9.23)	413(90.76)	455(51.54)
Total	81(9.47)	774(90.52)	855(100)
$\chi^2 = 0.005$			Df = 2
			p = 0.94

In this present study, among subjects diagnosed with Diabetes, 9.4 % were male and 9.23 % were females. Almost equal prevalence was seen among male and female, no significant association of gender with Diabetes Mellitus.(p=0.94).

Table 37: Association between literacy and Diabetes Mellitus:

EDUCATION	DIABETES MELLITUS PRESENT (%)	DIABETES MELLITUS ABSENT (%)	TOTAL (%)
Illiterate	16(17.2)	149(19.25)	150(17.54)
Primary	9(8.7)	413(53.35)	425(49.70)
High school and above	56 (8.5)	312(40.31)	280(32.74)
Total	81(9.47)	774(90.52)	855(100)
$\chi^2 = 7.278$			Df = 2
			p= 0.026

In this present study, among illiterates, 17.2 % were diabetics, among participants who had formal education up to primary 8.7 % were diagnosed with diabetes and participants who had education of high school and above, 8.5 % were diabetics. Significant association found with education level and prevalence of Diabetes Mellitus. Diabetes Mellitus was more associated with illiterates. ($p < 0.009$)

Table 38: Association between marital status and Diabetes Mellitus:

MARITAL STATUS	DIABETES MELLITUS PRESENT (%)	DIABETES MELLITUS ABSENT (%)	TOTAL (%)
Unmarried+ Widowed	11(47.8)	12 (52.2)	23(26.90)
Married	70(8.4)	762(91.58)	832(97.30)
Total	81(9.47)	774(90.52)	855(100)
$\chi^2 = 36.033$			Df = 1
			p < 0.001

In this present study, 47.8 % were Diabetic among unmarried & widowed. 8.4 % were diabetic among married. Significant association found with marital status and prevalence of Diabetes Mellitus. Diabetes Mellitus was more associated with unmarried and widowed.(p<0.001)

Table 39: Association between type of family and Diabetes Mellitus:

TYPE OF FAMILY	DIABETES MELLITUS PRESENT (%)	DIABETES MELLITUS ABSENT (%)	TOTAL (%)
Nuclear	67(9.3)	656(90.7)	723(84.56)
Joint	14(10.6)	118(89.4)	132(15.43)
Total	81(9.47)	774(90.52)	855(100)
$\chi^2 = 0.233$			Df = 1
			p =0.620

In this present study, 9.3 % were Diabetic among those lived in nuclear family type and 10.6 % were diabetic among those living in joint family type. No significant association found with family type and prevalence of Diabetes Mellitus (p=0.620).

Table 40: Association between SES and Diabetes Mellitus:

SOCIOECONOMIC STATUS	DIABETES MELLITUS PRESENT (%)	DIABETES MELLITUS ABSENT (%)	TOTAL (%)
Class I &II	11(14.3)	66(85.7)	77(9.00)
Class III	5 (8.8)	52 (91.2)	57(6.66)
Class IV	62(10.5)	531(1.11)	593(69.35)
Class V	3(2.3)	125(97.65)	128(14.97)
Total	81(9.47)	774(90.52)	855(100)
$\chi^2 = 10.365$			$p = 0.016$

In this present study, 14.3 % were Diabetic among class I & class II SES, 8.8 % were diabetic among class III SES, 10.5 % among class IV and 2.3 % among class V SES. Significant association found with SES and prevalence of Diabetes Mellitus. Diabetes Mellitus was more seen among class I& II SES and Class IV i.e. both upper class & lower middle class ($p = 0.016$).

Table 41: Association between Alcohol and Diabetes Mellitus:

ALCOHOL CONSUMPTION	DIABETES MELLITUS PRESENT (%)	DIABETES MELLITUS ABSENT (%)	TOTAL (%)
Yes	9(7.4)	112(92.56)	121(14.15)
No	72(9.8)	662(90.19)	734(85.84)
Total	81(9.47)	774(90.52)	855(100)
$\chi^2 = 0.681$			Df = 2
			p = 0.404

In this present study, 7.4 % were Diabetic among those consumed alcohol. 9.8 % were diabetic among those who didn't consume alcohol. Alcohol consumption was not found to be associated with Diabetes Mellitus (p=0.404).

Table 42: Association between Tobacco consumption and Diabetes Mellitus:

TOBACCO USE CATEGORY	DIABETES MELLITUS PRESENT (%)	DIABETES MELLITUS ABSENT (%)	TOTAL (%)
Smokers	5(16.1)	26(83.9)	31(3.62)
Chewers	44(9.8)	403(90.2)	447(52.2)
Both Smoker & Chewers	8(12.5)	56(87.5)	64(7.48)
Non users	24(7.7)	289(92.3)	313(36.60)
Total	81(9.47)	774(90.52)	855(100)
$\chi^2 = 3.546$			Df = 3
			p = 0.315

In this present study, 16.1 %, 9.8 % 12.5 % were Diabetic among smokers, chewers and both smokers & chewers of tobacco respectively. 7.7 % were diabetics among non users of tobacco. No significant association found with tobacco consumption and Diabetes Mellitus (p=0.315).

Table 43: Association between type of diet and Diabetes Mellitus:

TYPE OF DIET	DIABETES MELLITUS PRESENT (%)	DIABETES MELLITUS ABSENT (%)	TOTAL (%)
Vegetarian	11(9.2)	108(90.75)	119(13.91)
Mixed	70(9.5)	666(90.48)	736(86.08)
Total	81(9.47)	774(90.52)	855(100)
$\chi^2 = 0.681$			Df = 2
			p = 0.926

In this present study, 9.2 % were Diabetic among those consumed vegetarian type of diet. 9.5 % were diabetic among those who consumed mixed diet. Type of diet consumption was not found to be associated with Diabetes Mellitus (p=0.926).

Table 44: Association between Family history and Diabetes Mellitus:

FAMILY HISTORY	DIABETES MELLITUS PRESENT (%)	DIABETES MELLITUS ABSENT (%)	TOTAL (%)
Yes	9(12.9)	61(87.14)	70(8.18)
No	65(9)	655(90.97)	720(88.88)
Don't Know	7(10.8)	58(89.23)	65(7.6)
Total	81(9.47)	774(90.52)	855(100)
$\chi^2 = 1.229$			Df = 2
			p = 0.541

In this present study, 12.9 % gave family history of Diabetes Mellitus and were diagnosed with it. 9 % of the subjects diagnosed with Diabetes Mellitus gave no family history. 10.8 % were unaware of the family history. No Significant association was found with family history and Diabetes Mellitus. (p =0.541).

Table 45: Association between Physical activity and Diabetes Mellitus:

PHYSICAL ACTIVITY	DIABETES MELLITUS PRESENT (%)	DIABETES MELLITUS ABSENT (%)	TOTAL (%)
Sedentary	2(40)	3(60)	5(0.58)
Moderate	71(9.2)	701(81.98)	772(90.29)
Heavy	8(10.3)	70(89.74)	78(9.12)
Total	81(9.47)	774(90.52)	855(100)
Fischer exact test		p = 0.98	

In this present study, in sedentary type of physical activity 40 %, in moderate type of physical activity 9.2 % in 10.3 % heavy activity were diagnosed with Diabetes Mellitus. No Significant association was found with physical activity and Diabetes Mellitus. (p= 0.98).

Table 46: Association between Waist circumference and Diabetes Mellitus:

WAIST CIRCUMFERENCE	DIABETES MELLITUS PRESENT (%)	DIABETES MELLITUS ABSENT (%)	TOTAL (%)
Normal M<90 F<80	8(2.7)	283(97.25)	291(34.03)
Abnormal -1 M 90-99 F 80-89	29(7.1)	382(92.94)	411(48.07)
Abnormal -2 M 100 F 90	44(28.8)	109(71.24)	153(17.89)
Total	81(9.47)	774(90.52)	855(100)
$\chi^2 = 84.491$			$Df = 2$
			$p < 0.001$

In this present study, among normal waist circumference 2.7 %, among Medium waist circumference 7.1% and among high 28.8 % were diagnosed with Diabetes Mellitus. Significant association was found with waist circumference and Diabetes Mellitus. ($p < 0.001$).

Table 47: Association between BMI (Asian criteria) and Diabetes Mellitus:

BMI(ASIAN CRITERIA)	DIABETES MELLITUS PRESENT (%)	DIABETES MELLITUS ABSENT (%)	TOTAL (%)
Under weight + Normal weight	15(3.5)	419(96.54)	434(50.76)
Overweight + Obese	66(15.7)	355(84.32)	421(49.23)
Total	81(9.47)	774(90.52)	855(100)
$\chi^2 = 37.214$			Df = 2
			p < 0.001

In this present study, among subjects diagnosed with Diabetes, 3.5 % were under weight and normal category. 15.7 % were under overweight and obese category. Significant association was found with BMI. More Diabetic patients were found to be in overweight and obese category. (p < 0.001).

Table 48: Association between BMI (WHO criteria) and Diabetes Mellitus:

BMI(WHO CRITERIA)	DIABETES MELLITUS PRESENT (%)	DIABETES MELLITUS ABSENT (%)	TOTAL (%)
Under weight + Normal weight	27(4.9)	520(95.06)	547(63.97)
Overweight + Obese	54(17.5)	254(82.46)	308(36.02)
Total	81(9.47)	774(90.52)	855(100)
$\chi^2 = 36.456$			Df = 2
			p < 0.001

In this present study, among subjects diagnosed with Diabetes, 4.9 % were under weight and normal category.17.5 % were under overweight and obese category. Significant association was found with BMI and Diabetes Mellitus.(p <0.001).

Table 49: Association between SBP and Diabetes Mellitus:

SBP	DIABETES MELLITUS PRESENT (%)	DIABETES MELLITUS ABSENT (%)	TOTAL (%)
140	25(34.2)	48(65.75)	73(8.53)
<140	56(7.2)	726(92.83)	782(91.46)
Total	81(9.47)	774(90.52)	855(100)
$\chi^2 = 57.114$			Df = 2
			p < 0.001

In this present study, among subjects diagnosed with Diabetes, 34.2 % were having SBP 140 mm Hg and 7.2 % with <140 mm Hg. Significant association was found with SBP and those diagnosed with Diabetes Mellitus. (p <0.001).

Table 50: Association between DBP and Diabetes Mellitus:

DBP	DIABETES MELLITUS PRESENT (%)	DIABETES MELLITUS ABSENT (%)	TOTAL (%)
90	40(33.33)	80(66.66)	120(14.03)
<90	41(5.6)	694(94.42)	735(90.76)
Total	81(9.47)	774(90.52)	855(100)
$\chi^2 = 92.660$			Df = 2
			p < 0.001

In this present study, among subjects diagnosed with Diabetes, 33.33 % were having DBP 90 mm Hg and 5.6 % with < 90 mm Hg. Significant association was found with DBP and those diagnosed with Diabetes Mellitus. (p <0.001).

Table 51: Multiple Logistic Regressions for risk factors associated with Diabetes Mellitus:

VARIABLES	UNIVARIATE				MULTIVARIATE		
	PREVAL ENCE (%)	UNADJU STED OR	95 % CI	P VALUE	ADJ UST ED OR	95% CI	P VALUE
<u>Age</u>							
30-49	13(2.3)	13.86	7.51- 25.62	<0.001	5.92	2.98- 11.87	<0.001
50	68(24.3)						
<u>Literacy</u>							
Illiterate	16(17.2)	2.24	1.22- 4.09	0.009	0.99	0.39- 2.51	0.992
Primary	9(8.7)	1.03	0.49- 2.15	0.935	0.95	0.42- 2.17	0.921
High school & above	56(8.5)	1*			1*		
<u>Marital status</u>							
Unmarried+ Widow	11(47.8)	9.98	4.25- 23.44	<0.001	5.38	1.83- 15.81	0.002
Married	70(8.4)						

<u>Socio Economic Status</u>							
Class I&II	11(4.3)	6.62	1.76- 25	0.005	11.17	2.68- 52.63	0.001
Class III	5(8.8)	4.00	0.92- 17.84	0.064	3.89	0.64- 18.18	0.155
Class IV	62(10.5)	4.85	1.5- 15.87	0.008	6.09	1.71- 21.73	0.005
Class V	3(2.3)	1*					
<u>Asian BMI</u>							
Under weight +Normal weight	15 (3.5)						
Over weight + Obese	66(15.7)	5.19	2.91- 9.26	<0.001	2.45	0.98- 6.08	0.053
<u>WHO BMI</u>							
Under weight +Normal weight	27(4.9)						
Over weight + Obese	54(17.5)	4.09	2.25- 6.65	<0.001	1.04	0.46- 2.36	0.921

<u>Waist circumference</u>							
Low	8(2.7)	1*			1*		
Medium	29(7.1)	5.31	3.18-8.89	<0.001	2.07	1.11-3.85	0.022
High	44(28.8)	14.28	6.51-31.31	<0.001	3.46	1.33-9.03	0.002
<u>Hypertension</u>							
SBP							
>140	25(34.2)						
<140	56(7.2)						
DBP		8.84	5.41-14.45	<0.001	2.59	142-4.73	0.002
>90							
<90	40(33.3)						
	41(5.6)						

*Referral category

In this present study the overall prevalence of diabetes in the study population was 9.47%, which included 3.3 % of known diabetic subjects and 6.17 % undiagnosed diabetic subjects, while the prevalence of impaired glucose tolerance was 10.8 %. The prevalence of Diabetes Mellitus was higher among subjects with family history, who had sedentary or light grade physical activity compared to moderate and heavy activity, even though statistically not significant. Subjects >50 years of age, unmarried & widowed, belonging to higher socio-economic status (SES)

, and class IV, higher BMI(Asian & WHO classification), Hypertension, higher waist circumference were more associated with Diabetes Mellitus. Multiple logistic regression analysis showed that even after adjusting for variables like age, literacy, marital status, socio economic status waist circumference, Systolic & Diastolic Hypertension showed a significant association with Diabetes Mellitus.

Table 52: Knowledge of Diabetes Mellitus (N =855)

GENDER	POOR (%)	AVERAGE (%)	GOOD (%)	TOTAL (%)
Male	83(20)	298(71.8)	341(8.2)	415(48.53)
Female	78(17.7)	326(74.10)	361(8.2)	440(51.46)
Total	161(18.8)	624(73)	70(8.2)	855(100)
$\chi^2 = 0.738$ Df = 2 p = 0.691				

In the present study, 73% had average knowledge about Diabetes mellitus, 18.8% had poor knowledge and 8.2% had good knowledge about it. There was no significant difference in knowledge about it between male and female participants. (p=0.691)

Table 53: Association between Knowledge level and IDRS (N =855)

KNOWLEDGE	LOW RISK (%)	MODERATE RISK (%)	HIGH RISK (%)	TOTAL (%)
Poor	16(9.9)	84(52.2)	61(37.9)	161(18.8)
Average	79(12.7)	328(52.6)	217(34.8)	624(73)
Good	9(12.9)	32(45.7)	32(45.7)	70(8.18)
Total	104(12.16)	441(51.57)	310(36.25)	855(100)
$\chi^2 = 4.559$ Df = 4 p =0.336				

In our study, participants who had poor knowledge about diabetes Mellitus, 37.9% were under high risk, 52.2% were moderate risk and 9.9% were at low risk. Among participants who had average knowledge 34.8% had high risk, 52.6 % had medium risk 12.7% had low risk. Among participants who had good knowledge about Diabetes Mellitus 45.7 % were under high risk and an equal number of them were in moderate risk and 12.9 % were under low risk.

There was no significant association between Knowledge and IDRS categories. (p=0.336)

DISCUSSION

The present cross sectional study was conducted at Agasga village under Primary Health Center, Handignur which is a rural field practice area of Department of Community Medicine, Jawaharlal Nehru Medical College, Belgaum, during the period January 2013 to December 2013.

I. PROFILE OF STUDY PARTICIPANTS

In the present study, 48.53 % were men with mean age 44.1 ± 9.63 years and 51.54 % were women with mean age 44.3 ± 8.92 years. Overall mean age of participants was 44.2 ± 9.26 years. Maximum number (49.2 %) of male participants was in age group of 35–50 years and minimum (18.3%) in 34 years. Maximum number of female participants was (49.7%) in the age group of 35-50 years and minimum (17.5%) were 34 years.

In the present study all the participants were Hindus by religion. 71.8% were agriculturist by occupation and 16.5 % were home makers. 10.9 % did not have any formal education, 12 % studied up to primary, 77.1 % were educated up to high school and above. 86.1% of the study population consumed mixed type of diet. Majority of study participants belonged to class IV SES (69.3%) followed by class V (14.9 %) and the least belonged to class I (0.5 %) of B.G.Prasad's modified classification.

A study conducted to assess prevalence of Diabetes and its risk factors in rural area of Tamil Nadu showed that, a total of 1936 respondents were interviewed, among them, 40% were males and 60% were females. 49 % of study participants were in age group 20-34, 27 % between age 35-49 and 24 % above the age of 50. Majority participants i.e.; 62 % were Hindus by religion. 25 % of study population were illiterate, 45 % had

education up to primary, 30 % up to secondary level and above. 48 % of study population were house wives, 40 % were agriculturists , laborers & others and rest 12 % were either in service, Business, retired or students.32.8 % belonged to V, 20 % each in class III and class IV.Most of the respondents 90% consumed mixed type of diet.⁵¹ (Table 1- 7)

PREVALENCE AND DISCRIPTION OF THE RISK FACTORS

In the present study, prevalence of alcohol use was 14.1 %. All the 14.1 % alcohol users were men. Among users of alcohol, 9.6%of men consumed alcohol more or equal to 5 drinks on any day in the last week. Study conducted in rural Nagpur also showed that none of the women reported consuming alcohol. The prevalence of alcohol consumption among men was higher i.e.; 37.7% compared to our study. Total, 1.7 % men had consumed more than or equal to 5 drinks on any day, in the last week.⁶⁷ But frequency of consumption was lesser compared to our study, this could be due to difference in culture.

In the present study, the prevalence of smoking tobacco and smokeless tobacco was 11.11% and 59.76 % respectively. All smokers being men, women in our study used smokeless tobacco equally as men and there was no significant difference between men and women in using smokeless tobacco .(61.2%, 58.4 % respectively with $p=0.405$). Nagpur study showed that prevalence of daily smoked and smokeless tobacco user in men was 20.5 % and 62.6 % respectively, which was more compared to our study. But similar to our study none of the women smoked while the prevalence of smokeless tobacco use was 32.8 %.⁶⁷ which was less compared to our study. This could be due to social cultural difference. (Table 11 a & 11 b)

In our study 81.5 % of participants consumed less than five servings of fruits per week was 81.5 % which is comparable to a study conducted by Shah and Mathur in the year 2010 in India based on ICMR reports done in different parts of country, showed that 82.1% men and 87.2% of women consumed less than five servings of fruit and vegetables per week.⁶⁸ According to report of ICMR- WHO six site study profile on assessment of burden of Non communicable diseases, in rural areas , subjects consuming fruits and vegetables <5 servings per week was 82.1 & 87 .1 % among men and women respectively.⁶⁹ (Table 12 a-c)

In our study, most of the participants (90.3%) were involved in moderate type of physical activity and 9.1% involved in heavy activity at work. 98.1 % of the participants did not involve themselves in any type of activity during leisure time.93.2% of study population either walked or cycled to reach the work place.

According to study conducted in rural Tamil Nadu, 73% of the participants involved in mild to moderate the physical activity and higher proportion of the participants i.e.; 98.6% involved in sedentary activity during leisure time.⁵¹

A study conducted in Kerala found that 23.7% of the participants were engaged in high level of physical activity while 69.5% of the respondents were engaged in moderate level of activity .⁷⁰(Tables 13.a – c)

In our study, 18% of study population had their blood sugar examination done previously and out of them 3.3% knew that they had diabetes mellitus; of the total participants, 8.18 % had family history of diabetes Mellitus and 7.6 % were unaware about family history. 6.1 % had either of their parents having Diabetes Mellitus and 0.93 % with both parents having it and 1% of them had either of their siblings having Diabetes Mellitus.

In a study conducted in Rural Tamil Nadu, majority i.e.; 88.58% of the respondents had no family history of Diabetes Mellitus.⁵¹ According to the study conducted by Ramachandran *et al.* in an urban area of south India,¹¹ 47% of the people who had diabetes had a positive family history and the other study conducted in urban area of Pondicherry had 31.50% positive family history.⁵ This difference may be due to different life-styles and socio-economic status of the respondents.(Table 14 a-c)

In our study, 49.4 % of study population had got their blood pressure examination done previously, 5.4 % of them knew that they were having hypertension, self reported having hypertension; the prevalence of hypertension was 8.6% among study population. Prevalence of systolic hypertension was higher in females i.e.; 8.4% as compared to males 7.7%. 5.73% had family history of hypertension out of it 4.56 % had either of their parents having hypertension 0.58 % with both parents having it and 0.58 % of them had either of their siblings having hypertension.

A study conducted in Nagpur showed the prevalence of self- reported hypertension was 2.3% in men and 2.8% in women, whereas the actual prevalence of hypertension was 14.8 % in men and 15.9 % in women.⁶⁷ According to another study which was re viewed across different parts of India, the prevalence of hypertension had been reported to range between 20–40% and 12–17% among the urban adults and rural adults respectively (Reddy et al 2005).⁷¹ (Table 15, 19a, b)

In the present study age standardized prevalence of generalized obesity as per Asian criteria for BMI, the overall prevalence of overweight and obesity were 38.9 %

and 10.3 % respectively. While using WHO criteria for BMI prevalence of overweight and obesity were 35.2 % and 0.9 % respectively.

According to study conducted among Chennai urban population showed the overall age-standardized prevalence of obesity using the Asian criteria for BMI, it was 26.5%; while using WHO criteria for BMI it was 4.0%.⁷² The Chinese National Nutrition Survey showed that the prevalence of obesity (BMI \geq 25) was 17.2% in Shanghai, 26.5% in Tianjin and 32.8% in Beijing .Using (BMI \geq 30), the prevalence of obesity among Hong Kong Chinese population was 2.2% in men and 4.8% in women.⁷³ (Table 16a &b)

The overall prevalence of moderate and high central obesity in our study assessed by WC using Asia Pacific definition was 48 % and 17.9 % respectively. 82.5% women were having WC $>$ 80 cm, while among men 48.2 % had their WC $>$ 90 cm. According to study conducted among Chennai urban population shows prevalence of central obesity of 46.6 %.⁷²

In the present study, the overall prevalence of abdominal obesity based on waist: hip ratio criteria showed that 40.46 % were obese. The prevalence among women was significantly higher than that of men (78.0% vs. 0.2 %). The difference was statistically significant ($p < 0.001$).

In a study conducted in rural community of Tamil Nadu prevalence of waist hip ratio $>$ 1 among males in general population was 3.56% and among females ($>$ 0.85) 32%. Difference between male and female waist hip ratio was significantly high ($P < 0.05$).⁵¹(Table 17, 18)

In our study the overall prevalence of fasting blood sugar ≥ 126 mg /dl was seen in 9.47 % of participants. It was in 9.5 % men and 9.4 % in women. 10.8 % had impaired glucose tolerance. There was no significant difference between men and women as far as blood sugar level were concerned.

In contrast to our study, Tamil Nadu study conducted in rural area showed that prevalence of diabetes was 5.99% which was less compared to our study. Out of these 56% were known cases of diabetes mellitus.

A study was conducted in year 2004, in 77 centers (urban & rural) to determine the prevalence of diabetes mellitus (DM) and impaired glucose tolerance (IGT) in subjects aged 25 years and above in India. The standardized prevalence rate for DM in the total Indian, urban and rural populations was 4.3, 5.9 and 2.7%, respectively. The corresponding IGT rates in the three populations were 5.2, 6.3 and 3.7%, respectively.¹² This was less compared to our study.

Another study conducted by ICMR- INDIAB showed the prevalence of diabetes (both known and newly diagnosed) was 10.4% in Tamilnadu, 8.4% in Maharashtra, 5.3% in Jharkhand, and 13.6% in Chandigarh. The prevalence of prediabetes (impaired fasting glucose and/or impaired glucose tolerance) were 8.3%, 12.8%, 8.1% and 14.6% respectively.⁴⁷ (Table 20)

In our study, the behavioral and biological risk factors measured were assessed and depending on the number of risk factors present among each individual they were further stratified into 3 groups according to Indian diabetic risk Scores. Risk < 20 as low risk, Risk 30 -50 as moderate risk and >60 as High risk. 12.2%, 51.6 % and 36.3 % respectively had low, moderate and high risk factors when compared to men.

Women were having more risk factors when compared to men. This could be attributed to higher prevalence of Overweight and Obesity among them.

A study conducted in rural Tamil Nadu showed that 18.66 % had high risk, 50 % had moderate risk and 31.34 % had low risk by IDRS.⁵¹ In a similar study conducted at Chennai by Mohan *et al.* 43% of the population were found in high risk category⁹ and another study done in urban area of Pondicherry 31.2% had high risk score.⁵ (Table 21)

There was no association between type of family, socio economic status, alcohol consumption, tobacco (smoking and smokeless) use with IDRS. With $p > 0.05$.

Significant association was observed between increased BMI, , waist hip ratio, those whose blood pressure greater than or equal to 140/90 mm Hg and who had blood sugar ≥ 126 mg /dl.

Among obese 75 % were in high risk group and among overweight 49 % were in high risk group. Among underweight and normal BMI 13 & 18 % were in high risk group respectively. In study conducted in rural Tamil Nadu showed that in underweight category only 14.6% had high IDRS whereas in obese category 40% had high IDRS and 39.64% had high IDRS in overweight category.⁵¹ (Table 28 & 29)

In this present study the overall prevalence of diabetes in the study population was 9.47%, which included 3.3 % of known diabetic subjects and 6.17 % undiagnosed diabetic subjects who were detected during the study, while the prevalence of impaired glucose tolerance was 10.8 %. The prevalence of Diabetes Mellitus was higher among subjects with family history of Diabetes Mellitus, who had sedentary or light grade physical activity compared to moderate and heavy

activity, even though statistically not significant. Subjects >50 years of age, unmarried & widowed, belonging to higher socio-economic status (SES), and class IV, higher BMI (Asian & WHO classification), Hypertension, higher waist circumference. Multiple logistic regression analysis showed that after adjusting for variables age, literacy, marital status, socio economic status, waist circumference, raised Systolic & Diastolic blood pressure showed a significant association with Diabetes Mellitus.

In study conducted in a Selected South Indian Population With Special reference to family history, obesity and lifestyle factors – The Chennai Urban Population Study (CUPS 14); the overall prevalence of diabetes was 12.0%, which included 7.2% of known diabetic subjects and 4.8% detected at the time of study, while the prevalence of impaired glucose tolerance was 5.9%. The prevalence of glucose intolerance (Diabetes + IGT) was significantly higher among subjects with both parents diabetic (55%) compared to those with one parent diabetic (22.1%, $p=0.005$) and those with no family history (15.6%, $p<0.0001$). Prevalence of glucose intolerance was significantly higher among subjects who had light grade physical activity (23.2%) compared to moderate (17.5%, $p = 0.04$) and heavy grade activity (8.1% $p < 0.00001$). Subjects belonging to higher socio-economic status (SES) and who also had a positive family history of diabetes had five times greater prevalence of glucose intolerance compared to subjects from lower socioeconomic status and no family history ($p < 0.0001$). Regression analysis revealed age ($p<0.0001$), waist circumference ($p<0.0001$), body mass index ($p<0.0001$), waist-hip ratio ($p< 0.0001$), systolic blood pressure ($p<0.0001$), diastolic blood pressure ($p<0.0001$), family history of diabetes ($p<0.0001$), higher SES ($p<0.0001$), moderate ($p = 0.001$) and light ($p < 0.001$) grade physical activity to be associated with glucose intolerance. Multiple

logistic regression analysis showed that even after adjusting for variables like age and family history of diabetes, physical activity showed a significant association with glucose intolerance.⁵² (Table 35-51)

In the present study, 73% had average knowledge about Diabetes mellitus, 18.8% had poor knowledge and 8.2% had good knowledge about it. There was no significant difference in knowledge between male and female participants. Among participants who had poor knowledge about diabetes Mellitus, 37.9% were under high risk, 52.2% were moderate risk and 9.9% were at low risk. Among participants who had average knowledge 34.8% had high risk, 52.6 % had medium risk 12.7% had low risk. Among participants who had good knowledge about Diabetes Mellitus 45.7 % was under high risk and an equal number of them were in moderate risk and 12.9 % were under low risk. There was no significant association between Knowledge and IDRS categories

A study was conducted to know the Knowledge and awareness of diabetes in urban and rural India by The Indian Council of Medical Research India Diabetes Study (Phase I): Indian Council of Medical Research India Diabetes 4. This study found that only 43.2% of the overall study population had heard about a condition called diabetes. Overall urban residents had higher awareness rates (58.4%) compared to rural residents (36.8%) ($p < 0.001$). About 46.7% of males and 39.6% of females reported that they knew about a condition called diabetes ($p < 0.001$). Of the general population, 41.5% knew about a condition called diabetes, 80.7% knew that the prevalence of diabetes was increasing, whereas among diabetic subjects, 93.0% knew it .Among the general and diabetic population, 56.3% and 63.4% respectively were aware that diabetes could be prevented. Regarding complications, 51.5% of the general population and 72.7% diabetic population knew that diabetes could affect

other organs. Based on a composite knowledge score to assess knowledge among the general population, Tamil Nadu had the highest (31.7) and Jharkhand the lowest score (16.3). However among self-reported diabetic subjects, Maharashtra had the highest (70.1) and Tamil Nadu, the lowest score (56.5).⁵⁴ (Table 52-53)

CONCLUSION

The present community based study conducted to know the prevalence of risk factors for Diabetes Mellitus and its prevalence done in rural setup reports that there is increase in the prevalence of DM and impaired glucose tolerance as compared to rural population in Tamil Nadu.

In this study, with the help of Indian Diabetic Risk Score (IDRS) the susceptibility of participants to Diabetes Mellitus were classified into low risk, moderate risk and high risk. 2.2%, 51.6 % and 36.3 % of the study population came under low, moderate and high risk scores respectively. Apart from risk factors included in IDRS, significant association was observed between gender(women), literacy level (illiterates) , type of diet (more among vegetarians) increased BMI, increased waist hip ratio, those whose blood pressure greater than or equal to 140/90 mm Hg and who had blood sugar 126 mg /dl.

In this study the overall prevalence of diabetes in the study population was 9.47%, which included 6.17 % undiagnosed diabetic subjects who were detected during the study, while the prevalence of impaired glucose tolerance was 10.8 %. The prevalence of Diabetes Mellitus was higher among subjects with family history of Diabetes Mellitus, who had sedentary or light grade physical activity (but statistically not significant), subjects >50 years of age, unmarried & widowed, belonging to higher socio-economic status (SES), and class IV, higher BMI (Asian & WHO classification), Hypertension, higher waist circumference.

With high degree of heritability, life style factor diabetes could become a major health hazard in India and this underscores the fact that prevention of diabetes

must be one of the important health targets for the nation in this century. It is utmost important to create awareness among public about the risk factors of diabetes and thereby other non communicable diseases associated with it, reduce the associated mortality and morbidity and also to educate them about need for screening to detect Diabetes Mellitus.

LIMITATIONS

The limitations of the study are:

1. Those who showed FBS value of 126 mg/dl were not subjected to Oral Glucose Tolerance Test (OGTT).
2. HbA1c (Glycosylated hemoglobin) could not be done in DM patients to know their previous glycemic status.
3. Recall bias could have occurred while assessing some of the behavioral risk factors for Diabetes Mellitus.

RECOMMENDATIONS

On the basis of this study, the following recommendations have been made for the improvement of health of adults in the rural community.

1. Mandatory screening for risk factors for Diabetes Mellitus and other NCDs among individuals aged 30 years and above residing in rural area.
2. Use of simple Indian Diabetic Risk Score at primary care level for identification of individuals with high risk of developing Diabetes Mellitus, so that interventions can be undertaken.
3. Health education on modifiable risk factors like
 - Alcohol and tobacco consumption
 - Increase in physical activity
 - Maintenance of ideal body weight.
4. Creating awareness regarding risk factors for Diabetes Mellitus and educate regarding prevention of disease.

SUMMARY

The present study was a community based cross sectional study undertaken to assess the risk factors for Diabetes Mellitus among rural adults aged between 30 to 60 years and also to predict the future risk Diabetes Mellitus based on the Indian Diabetes Risk Score (IDRS). To assess the prevalence of Diabetes mellitus among them and to assess the knowledge about it.

The study included 855 participants aged between 30 to 60 years residing in Agasga village under Handignur PHC, which is a rural field practice area of Department of Community Medicine, J. N. Medical College, Belgaum. The duration of study was one year from 1st January 2013 to 31st December 2013. A pre-designed and pre-tested questionnaire was used to collect the data from the participants. Screening for diabetes was done by estimating the Fasting Blood Glucose (FBG) in capillary blood, using glucose-oxidase strips read in a glucometer (Accu check glucometer system).

In the present study, 48.8% were men with mean age 44.1 ± 8.92 years and 51.54% were women with mean age 44.2 ± 9.26 years. Majority were in between 35 – 49 years (49.7%).

All the participants were Hindu by religion. Most of them were married (97.3%). 84.6 % were living in nuclear family type. Majority of the study participants were farmers (71.8%) and home makers (16.5%). 77.1 % had formal education of secondary and above; 12 % of them studied up to primary; 10.9% were illiterate. Majority of study participants belonged to SES class IV (69.3%);

The prevalence of alcohol consumption was 14.1 % and all were men. Majority of them (38.4%) consumed 1 – 3 days per month. The prevalence of smoking was 11.22 % and use of smokeless tobacco was 59.76 %. Majority were daily users of smokeless tobacco.

Among the participants 81.6% followed mixed type of diet. 81.5 % of them did not consume any fruits regularly and 12.3 % of them rarely consumed fruits. Vegetable consumption was noted on all days among 84.3% participants. Groundnut oil was the most common type of oil used.

Most of the participants were having moderate type of physical activity during work (90.3%). Majority did not involve in physical activity during leisure time (98.1%). Majority involved in same activity during travelling to work place. (93.2%).

3.3% of the participants self reported the history of Diabetes. 84.21% of the participants had no family history of Diabetes; 8 % of study population had family history of Diabetes and almost equal percent were not aware of it.

5.4 % of the participants self reported the history of hypertension. 94.26 % of the participants had no family history of hypertension.

According to BMI for Asian Criteria, the overall prevalence of overweight and obesity was 38.9 % and 10.3 % respectively. The prevalence of overweight was more among women compared to men (40 % vs.37.8 %); whereas among obese, men were more than women (11.3% vs. 9.3 %).Even though it was not statistically significant.

According to WHO criteria for BMI, the overall prevalence of overweight and obesity was 35.2 % and 0.9 % respectively. The prevalence of overweight was more

among men compared to women (37.3 % vs.33.2 %); whereas among obese, women outnumbered men (1.4% vs. 0.5 %).

Prevalence of central obesity assessed by WC and WHR were 65.9% and 40.6% respectively. This prevalence among women outnumbered that of men (82.5 % vs. 48.2 %).

The prevalence of systolic pre-hypertension (33%) was nearly four times to that of systolic hypertension (8.6%) among the participants. The prevalence diastolic pre-hypertension and hypertension was 15.2 % and 14.0%. Men were relatively at higher risk of being pre-hypertensive and hypertensive in both systolic and diastolic blood pressure categories.

The prevalence of fasting blood sugar level ≥ 126 mg/dl was seen among 9.5 % of the study population. There was no significant difference among men and women.

The risk of having diabetes Mellitus was predicted using Indian Diabetes risk score. High risk Score i.e. ≥ 60 was seen among 36.3 % of the study participants, 40.2 % among males and 32.04% among females. Females were more than males. Higher score was associated with increasing age, illiterates, overweight and obese, increased waist circumference, hypertensive and with fasting sugar level ≥ 126 mg/dl.

In this present study the overall prevalence of diabetes in the study population was 9.47%, while the prevalence of impaired glucose tolerance was 10.8 %. The prevalence of Diabetes Mellitus was associated with family history, sedentary lifestyle, age >50 years , unmarried & widowed, belonging to higher socio-economic status (SES) , and class IV, higher BMI(Asian & WHO classification), Hypertension,

higher waist circumference. Multiple logistic regression analysis showed that even after adjusting for variables like age, literacy, marital status, socio economic status, waist circumference, Systolic & Diastolic Hypertension showed a significant association with Diabetes Mellitus.

73% of study population had average knowledge about Diabetes Mellitus. 18.8% of study population had poor knowledge and 8.2% had good knowledge about Diabetes Mellitus. There was no significant difference between knowledge about diabetes mellitus and its reduction of risk associated with it.

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ANNEXURE- I
ETHICAL CLEARANCE LETTER



K.L.E.SOCIETY'S
JAWAHARLAL NEHRU MEDICAL COLLEGE,
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Date: 11/10/2012

To,

REG. NO.BD0112003

PG student in Community Medicine,
J.N.Medical College,
BELGAUM.

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled "PREVALENCE OF RISK FACTORS FOR TYPE II DIABETES MELLITUS AMONG ADULTS – A COMMUNITY BASED CROSS SECTIONAL STUDY" is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

(Dr.Hema Dhumale)
Member Secretary
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belgaum.

(Dr.Ganga Pilli)
Chairman,
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belgaum.

ANNEXURE II – CONSENT FORM

“PREVALENCE OF RISK FACTORS FOR TYPE II DIABETES MELLITUS AMONG ADULTS- A COMMUNITY BASED CROSS SECTIONAL STUDY”

GUIDE: Dr._____

INVESTIGATOR: Dr._____

Introduction (Purpose of the Study):

The present study is conducted among people aged between 30 to 60 years residing in the Agasga sub centre to know the risk factors associated with Diabetes Mellitus. Rural population are at risk of DM due to changing life styles, due to ignorance, illiteracy and limited access to health care for non-communicable diseases, would make them more prone for DM. Hence the present study will be undertaken to measure the risk factors for DM, and also to assess future risk of DM, by using IDRS, among rural adults. The study findings will further help in developing preventive strategies.

You are being invited to participate in this study. Participation is completely voluntary.

Methodology (Explanation of Procedures):

In this study you will have to answer a few prepared questions about your age occupation, income, general health information and socio other details. Few questions regarding habits like tobacco and alcohol consumption, diet, physical activity will be asked.

You would also undergo measurement of Fasting blood sugar, Blood pressure for 2 times along with measurements of weight, height, waist and hip circumference. Participation in this study is voluntary, you are free to withdraw your consent at any time you wish.

Possible benefits:

By participating in this study you will help us by providing a valuable data regarding the prevalence of risk factors for coronary artery disease which will benefit the whole community when possible intervention can be taken up to reduce risk factors.

Possible risks:

Methods applied to do the study are safe. The physical measurement tools are safe and not likely to harm anyone.

Cost of participation:

The cost of the study will be borne by the researcher. You will not have any additional costs to you for participating in the study. Neither will you be paid any amount for participating in the study.

Privacy and Confidentiality:

Your identity will not be revealed. All information collected will be coded so that no one other than the investigator will know your identity.

Withdrawal from the study:

Your participation in this study is voluntary. You can withdraw from the study at any time if you wish to do so. However you will not lose benefits to which you are entitled.

Authorization to publish the results:

The researcher may use the information gathered from this study for presentation in scientific journals. However your identity will not be revealed.

Questions:

If you have any queries regarding the study, you can contact Dr. _____ on mobile no _____ or Dr _____ on mobile no _____. If you have any questions about rights as a research participant you can contact Dr. _____, HOD and Professor of Pathology. J.N.M.C Institutional Ethics Committee on human subject's research on _____.

Legal rights:

By signing this consent form you are not waiving any of your legal rights.

Consent summary:

I have read/ have been explained all the contents of this consent form in my local language and having understood and clarified all my queries about the study to the best of my knowledge, I hereby give my voluntary consent for participation in the study.

Name of the participant Signature/

Left thumb impression of the participant:

Name of the interviewer

Signature of the interviewer:

Name of the eyewitness

Signature/ left thumb impression of the eyewitness:

Signature of the guide: _____ Date: _____

ANNEXURE III – PROFORMA

K.L.E. UNIVERSITY's

J.N.MEDICAL COLLEGE, BELGAUM

DEPARTMENT OF COMMUNITY MEDICINE

RESEARCH QUESTIONNAIRE

Investigator: Dr. _____ Guide: Dr. _____

**“PREVALENCE OF RISK FACTORS FOR TYPE II DIABETES
MELLITUS AMONG ADULTS– A COMMUNITY BASED CROSS
SECTIONAL STUDY”**

[Note: All the personal information provided during this study will be kept confidential. Only aggregated data will be published.]

I] GENERAL INFORMATION:

Sl. No. _____ Date of survey. _____

Name: _____ Age: _____ years

Address: _____

Sex: Male / Female

Marital Status: Married/Un married/Divorced/Separated

Religion: Hindu/ Muslim/Others specify: _____

Occupation: Govt. Employee/ Private Job (clerical)/ Business/
Skilled worker/Farmer/Coolie/Housewife/ Others
specify: _____

Type of family: Nuclear /Joint/ Broken

Family size: _____

Total income: Rs _____ / month

Per capita income: _____

Socio Economic Status (Modified BG Prasad's classification): - I \ II \ III \ IV \ V

Education: Illiterate /Primary/Secondary/PUC/Graduation/Post graduation

II. QUESTIONS TO ASSESS RISK FACTORS

1. Alcohol consumption:

Do you consume alcohol YES / NO

IF YES,

- a. Since when:
- b. How many times per week:
- c. How much quantity:
- d. Type of alcohol: Beer/Whiskey/Rum/Gin/Country liquor/Others
specify:_____

2. Tobacco use:

a. Are you a smoker? YES / NO

IF NO,

a) Did you smoke in the past? YES / NO

b)If yes,

- i. For how many years?
- ii. When did you stop?

IF YES,

- a. Since when you are smoking?
- b. How many cigarettes or beedis per day?
- c. Do you other form of tobacco? YES / NO

If yes,

- i. What you use?

ii. Since when?

iii. How many?

3. DIETARY PRACTICES

a. Type of diet – Vegetarian/Non vegetarian

b. Staple diet – Rice/Ragi/Wheat/Maize/Jowar

Diet Chart

	Item	Calories	Proteins
Breakfast			
Lunch			
Evening snacks			
Dinner			
Total			

c. How many times do you eat fried food per week?

i. Once/ Twice/thrice/All days

ii. Any other specify: _____

d. Fruit and vegetable consumption

i. The number of days fruit is eaten in a week

ii. The number of servings on one of these days

iii. The number of days vegetables is eaten in a week

iv. The number of servings on one of those days.

d. Type of oil or fat most often used for cooking

i. Groundnut/Sunflower/Safflower/Coconut/Don't know/Others

specify: _____

f.

i. Do you eat outside junk food YES/ NO

ii. How many times per week

iii. Specify items you eat

g.

i. Do you consume soft drinks YES/ NO

ii. How many times per week

4. Physical activity

a. Does your job require physical activity? YES/ NO

b. If yes, is it moderate/heavy

c. How many hours per day such activity takes place?

Less than 1hr/1-3hrs/more than 3hrs

d. Do you involve in physical exercise in leisure time apart from your occupation?

YES/ NO

If yes,

e. How many days per week?

f. How many hours per day?

G. Mention type of activity_____

h. How do you go for your workplace?

Walking/Cycling/Two wheeler/Public transport/Others

specify:_____

i. How long will it take to reach your workplace?

Less than 30 min/30 to 60 min/more than 60 min

5. History of diabetes

- a. Have you ever got your blood sugar measured? YES / NO
- b. Are you a diabetic? YES / NO
- c. If yes are you taking any treatment for raised blood sugar?
- d. If yes, what drugs? Specify: _____
- e. Is there family history of Diabetes Mellitus
YES / NO
- f. If yes, who is having diabetes mellitus? Either Parent /Both
parents/Brothers/Sisters/Don't know

6. History of raised blood pressure

- a. Have you ever got your blood pressure measured? YES / NO
- b. Are you hypertensive? YES / NO
- c. If yes, are you on treatment for raised blood pressure? YES / NO
- d. If yes, which tablet? Mention: _____
- e. Is there family history of high blood pressure? YES / NO
- f. If yes, who is having increased blood pressure?
Either Parent /Both parents/Brothers/Sisters/Don't know

STEP II -GENERAL PHYSICALEXAMINATION -

PHYSICAL MEASUREMENTS

Height in cm

Weight in kg

BMI (body mass index) in Kg/m²

Waist circumference in cm

Hip circumference in cm

Waist: Hip Ratio

Systolic blood pressure (SBP) mmHg

Diastolic blood pressure (DBP) mmHg

STEP III – SYSTEMIC EXAMINATION

Cardio Vascular System -

Respiratory system -

Per Abdominal Examination -

Central Nervous system -

STEP IV

FASTING BLOOD SUGAR LEVEL -

V. IDRS risk prediction

Particulars	Scores
Age [years]	
< 35 [reference]	00
35 – 49	20
50	30
Abdominal obesity	
Waist <80 cm [female] ,<90 [male] [reference]	00
Waist 80 – 89 cm [female], 90 – 99 cm [male]	10
Waist 90 cm [female], 100 cm [male]	20
Physical activity	
Exercise [regular] + strenuous work [reference]	00
Exercise [regular] or strenuous work	20
No exercise and sedentary work	30

Family history	
No family history [reference]	00
Either parent	10
Both parents	20
Minimum score	00
Maximum score	100

TOTAL SCORE According to IDRS:

Score 60 Significant YES/ NO

VI. KNOWLEDGE ABOUT DIABETES:

1. What is Diabetes?

2. It is correctly detected by examining?

- a. Urine
- b. Blood
- c. Clinical examination
- d. X ray

3. What are the symptoms of Diabetes Mellitus?

- a. Increase in thirst
- b. Increase in hunger
- c. Increase in frequency of urination
- d. Delayed wound healing
- e. All of the above
- f. Don't know

4. What are the risk factors for Diabetes Mellitus?

- a. Obesity
- b. Alcohol consumption
- c. Eating sweets
- d. Family history
- e. Decreased physical activity
- f. Don't know

5. Which type of food should be avoided by diabetics?

- a. Sweets
- b. Rice
- c. Fried foods, junk food, refined food (maida)
- d. Ghee / Butter
- e. Don't know

Any other specify _____

6. Which type of food to be consumed by Diabetics?

- a. Vegetables
- b. All Fruits
- c. Whole Grains
- d. Refined food
- e. Selected fruits

7. How long medicine to be taken by Diabetics?

- a. Few years
- b. Till it is cured
- c. Life long
- d. Don't know

8. What are the organs affected by Diabetes?

- a. Eye
- b. Heart
- c. Kidney
- d. Nerves
- e. others -
- f. Don't know

9. Whether Diabetes is hereditary?

- a. Yes
- b. No
- c. Don't know

10. Is it possible to prevent Diabetes?

- a. Yes
- b. No
- c. Don't know

If yes, how? -

ANNEXURE IV – KEY TO MASTER CHART

- A) Serial No
- B) Age
- C) Sex
1. Male
 2. Female
- D) Marital Status:
1. Unmarried
 2. Married
 3. Divorced
 4. Separated
 5. Widowed/Widower
- E) Religion
1. Hindu
 2. Muslim
 3. Christian
- F) Occupation:
1. Govt. Employee
 2. Private Job (clerical)
 3. Business
 4. Skilled worker
 5. Farmer
 6. Coolie
 7. Housewife
 8. Others
- G) Type of family:
1. Nuclear
 2. Joint

3. Broken

H) Family size: _____

I) Socio Economic Status (Modified BG Prasad's classification): -

1. I

2. II

3. III

4. IV

5. V

J) Education:

1. Illiterate

2. Primary

3. Secondary

4. PUC

5. Graduation

6. Post graduation

II. QUESTIONS TO ASSESS RISK FACTORS

1. Alcohol consumption:

K) Do you consume alcohol?

1. YES

2. NO

IF YES,

L) Since when:

0. NA

1. < 1yr

2. 1-5yrs

3. 6-10 yrs

4. 11-20 yrs

5. > 20 yrs

M) How many times per week :

0. NA

1. 5 or more days in a week

2. 1 – 4 days per week

3. 1 – 3 days a month

4. Occasionally

N) How much quantity:

0. NA

1. 30 ml

2. 60 ml

3. 90 ml

4. 120 ml

5. > 120 ml

O) Type of alcohol:

0. NA

1. Beer

2. Whiskey

3. Rum

4. Gin

5. Country liquor

6. Others

IF YES,

T) Since when you are smoking?

0. NA
1. < 1yr
2. 1-5 yr
3. 5-10 yrs
4. 10-20 yrs
5. >20yrs

U) How many cigarettes or beedis per day?

0. NA
1. 1
2. 2-3
3. 4-5
4. > 10

V) Do you use other form of tobacco?

1. YES
2. NO

If yes,

W) What you use?

0. NA
1. Tobacco
2. Jarda
3. Gutka
4. Tobacco+ Gutka
5. Tobacco + Jarda

6. Others
- X) Since when?
- 0. NA
 - 1. < 1yr
 - 2. 1-5 yr
 - 3. 5-10 yrs
 - 4. 10-20 yrs
 - 5. >20yrs

- Y) How many?
- 0. NA
 - 1. 1 pack
 - 2. 2-3
 - 3. 4-5
 - 4. > 5

3. DIETARY PRACTICES

- Z). Type of diet –
- 1. Vegetarian
 - 2. Non vegetarian

- AA) Staple diet –
- 1. Rice
 - 2. Ragi
 - 3. Wheat
 - 4. Maize
 - 5. Jowar
 - 6. Rice + Jowar

- AB) Diet Chart
- 1. Adequate
 - 2. Less
 - 3. More

AC) How many times do you eat fried food per week?

1. All days
2. 4-5 days
3. 2-3
4. Once
5. No

Fruit and vegetable consumption

AD) The number of days fruits are eaten in a week

1. All the days of the week
2. 4 – 6 days per week
3. 1 – 3 days per week
4. Never

AE) The number of servings on those days.

0. NA
1. Once
2. Twice
3. 3-4 times

AF) The number of days vegetables are eaten in a week

1. All the days of the week
2. 4 – 6 days per week
3. 1 – 3 days per week
4. Never

AG) The number of servings on those days.

0. NA
1. Once
2. Twice
3. 3-4 times

AH) Type of oil or fat most often used for cooking

1. Groundnut
2. Sunflower
3. Safflower
4. Coconut
5. Groundnut + Sunflower
6. Others

AI) Do you eat outside junk food

1. YES
2. NO

AJ) How many times per week

0. NA
1. All the days of the week
2. 4 – 6 days per week
3. 1 – 3 days per week
4. Occasionally

AK) Do you consume soft drinks?

1. YES

2. NO

AL) How many times per week?

0. NA

1. All days of the week

2. 4-6 days per week

3. 1-3 days per week

4. Occasionally

4. Physical activity

AM) Does your job require physical activity?

1. YES

2. NO

AN) If yes, is it

0. Sedentary

1. Moderate

2. Heavy

AO) How many hours per day such activity takes place?

0. NA

1. < 1hr

2. 1-3hrs

3. > 3hrs

AP) Do you involve in physical exercise in leisure time apart from your occupation?

1 YES

2. No

If yes,

AQ) How many days per week?

0. NA
1. All days
2. 4-6 days
3. 1-3

AR) How many hours per day?

0. NA
1. > 1hr
2. 30 min
3. < 30 min

AS) Mention type of activity

0. NA
1. Walking
2. Jogging
3. Cycling
4. Swimming

AT) How do you go for your workplace?

0. NA
1. Walking
2. Cycling
3. Two wheeler
4. Public transport
5. Walking Cycling

6. Others specify

AU) How long will it take to reach your workplace?

0. NA
1. < 30 min
2. 30 to 60 min
3. > 60 min

5. History of diabetes

AV) Have you ever got your blood sugar measured?

1. YES
2. NO

AW) Are you a diabetic?

1. YES
2. NO

AX) If yes are you taking any treatment for raised blood sugar?

0. NA
1. YES
2. NO

AY) Is there family history of Diabetes Mellitus?

1. YES
2. NO
3. Don't know

AZ) If yes, who is having diabetes mellitus?

0. NA
1. Either Parent

2. Both parents

3. Brothers

4. Sisters

5. Don't know

6. History of raised blood pressure

BA) Have you ever got your blood pressure measured?

1. YES

2. NO

BB) Are you hypertensive?

1. YES

2. NO

BC) If yes, are you on treatment for raised blood pressure?

0. NA

1. YES

2. NO

BD) Is there family history of high blood pressure?

1. YES

2. NO

3. Don't know

BE) If yes, who is having increased blood pressure?

0. NA

1. Either Parent

2. Both parents

3. Brothers

4. Sisters

5. Don't know

STEP II -GENERAL PHYSICALEXAMINATION -

PHYSICAL MEASUREMENTS

BF) Height in cm

BG) Weight in kg

BH) BMI (body mass index) in Kg/m²

BI) Waist circumference in cm

BJ) Hip circumference in cm

BK) Waist: Hip Ratio

BL) Systolic blood pressure (SBP) mmHg

BM) Diastolic blood pressure (DBP) mmHg

STEP III – SYSTEMIC EXAMINATION

BN) 1. Normal

2. Cardio Vascular System

3. Respiratory system

4. Per Abdominal Examination

5. Central Nervous system

STEP IV

BO) FASTING BLOOD SUGAR LEVEL -

V. IDRS risk prediction

BP) TOTAL SCORE According to IDRS:

BQ) Score 60 Significant

1. YES

2. NO

BR) VI. KNOWLEDGE ABOUT DIABETES:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR		
1	38	1	2	1	5	1	4	3	2	2	0	0	0	2	2	0	0	0	0	2	0	0	0	1	6	1	4	2	1	2	2	1	2	0	2	0	1	1	2	2	0	0	0	1	1	2	2	0	2	0	2	0	164	55	20.45	85	95	0.89	120	80	1	93	50	2	4						
2	35	2	2	1	5	2	6	3	2	2	0	0	0	2	2	0	0	0	0	2	0	0	0	1	6	1	4	2	1	2	2	1	2	0	2	0	1	1	3	2	0	0	0	1	2	1	2	0	2	0	2	0	153	45	19.22	69	91	0.76	120	80	1	88	20	2	5						
3	38	1	2	1	5	1	5	3	2	2	0	0	0	0	2	2	0	0	0	0	2	0	0	1	6	1	4	2	1	2	2	1	2	0	2	0	2	2	3	2	0	0	0	3	1	2	2	0	2	0	2	0	163	62	23.34	92	95	0.97	120	80	1	75	30	2	6						
4	41	1	2	1	5	1	6	3	2	2	0	0	0	2	2	0	0	0	0	1	1	1	2	1	6	1	4	2	1	2	2	1	2	0	2	0	2	2	3	2	0	0	0	1	1	2	2	0	2	0	2	0	165	52	19.10	81	85	0.95	130	80	1	84	40	2	3						
5	60	1	2	1	5	2	5	2	2	2	0	0	0	2	2	0	0	0	0	2	0	0	2	1	6	1	3	2	1	2	2	1	2	0	2	0	2	1	2	2	0	0	1	1	2	2	0	1	1	2	0	2	0	168	64	22.68	90	90	1.00	140	90	1	88	70	1	7					
6	55	2	2	1	5	1	5	2	2	2	0	0	0	2	2	0	0	0	0	2	0	0	0	1	6	1	3	2	1	4	2	1	2	0	2	0	2	1	2	2	0	0	0	1	1	2	2	0	1	1	2	0	2	0	152	43	18.61	80	90	0.89	130	80	1	120	70	1	4				
7	35	1	2	1	6	1	4	3	2	2	0	0	0	2	1	2	1	0	0	1	1	3	3	1	6	1	3	4	0	4	2	1	2	0	2	0	2	1	2	2	0	0	0	1	1	2	2	0	1	1	1	2	0	2	0	165	60	22.04	89	98	0.91	120	80	1	78	40	2	9			
8	60	2	2	1	7	1	2	3	1	2	0	0	0	2	2	0	0	0	0	1	1	5	1	1	6	1	3	2	1	2	2	1	2	0	2	0	2	1	2	1	3	3	1	0	0	1	2	0	2	0	2	0	152	70	30.30	104	118	0.88	150	90	1	103	70	1	2						
9	32	1	2	1	6	1	4	3	3	1	2	3	1	2	2	0	0	0	0	2	0	0	0	1	6	1	3	2	1	2	2	1	1	4	1	3	1	2	3	2	0	0	0	4	1	2	2	0	3	5	1	2	0	2	0	175	62	20.24	84	94	0.89	120	80	1	93	20	2	3			
10	54	2	2	1	7	1	5	3	1	2	0	0	0	2	2	0	0	0	0	2	0	0	0	1	6	1	4	3	1	2	2	1	2	0	2	0	1	1	2	1	3	1	1	0	0	2	2	0	3	5	2	2	0	2	0	157	63	25.56	88	108	0.81	134	88	1	100	60	1	9			
11	35	2	2	1	4	1	4	3	2	2	0	0	0	2	2	0	0	0	0	1	1	3	1	1	6	1	4	2	1	1	2	5	1	3	2	0	1	1	3	2	0	0	0	2	2	0	2	0	2	0	2	0	146	44	20.64	68	120	0.57	120	80	1	80	20	2	5						
12	59	2	2	1	7	2	7	4	1	2	0	0	0	2	2	0	0	0	0	1	1	2	1	1	6	1	4	3	1	2	2	1	2	0	2	0	1	1	2	2	0	0	0	1	1	1	2	0	1	1	1	2	0	156	63	25.89	102	123	0.83	146	92	1	89	70	2	2					
13	52	1	2	1	5	1	5	4	2	1	4	3	2	1	3	2	0	0	1	4	3	1	2	6	1	3	2	1	2	2	1	2	0	2	0	1	1	2	2	0	0	1	1	2	2	0	2	0	1	1	1	2	0	172	68	22.99	94	104	0.90	128	90	1	83	60	1	7					
14	50	1	2	1	5	2	7	4	2	2	0	0	0	2	2	0	0	0	0	2	0	0	0	1	6	1	4	3	1	1	2	1	1	4	1	4	1	4	1	2	3	2	0	0	3	1	2	2	0	2	0	2	0	168	48	17.01	74	92	0.80	110	70	1	72	50	2	7					
15	60	1	2	1	5	1	5	2	2	1	5	1	4	5	1	0	0	0	5	4	2	0	0	1	6	1	3	3	1	2	2	1	1	4	1	4	1	1	1	2	0	0	0	1	2	2	2	0	3	5	2	2	0	2	0	150	45	20.00	81	88	0.92	140	90	3	140	70	1	3			
16	45	2	2	1	7	2	6	2	2	2	0	0	0	2	2	0	0	0	0	2	0	0	0	1	6	1	3	3	1	2	1	2	1	2	0	2	0	1	2	3	2	0	0	0	0	2	2	0	3	5	1	2	0	2	0	150	50	22.22	93	107	0.87	150	90	1	113	70	1	6			
17	60	2	2	1	7	1	4	4	2	2	0	0	0	2	2	0	0	0	0	2	0	0	0	1	6	1	3	3	1	2	2	5	1	4	2	0	1	1	2	1	2	2	1	2	2	1	0	0	1	2	0	3	5	1	2	0	2	0	150	49	21.78	83	99	0.84	120	70	1	86	60	1	11
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24	41	2	2	1	5	2	5	4	2	2	0	0	0	2	2	0	0	0	0	2	0	0	0	1	6	2	4	3	1	1	2	1	2	0	2	0	1	2	3	2	0	0	0	1	2	1	2	0	2	0	1	2	0	150	54	24.00	94	100	0.94	140	80	1	92	60	1	12					
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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	
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59	40	1	2	1	5	2	5	3	3	1	3	4	4	2	2	1	2	2	0	0	1	1	2	1	1	6	1	4	2	2	2	2	1	1	3	2	0	1	1	2	2	0	0	1	1	2	2	0	1	2	0	1	2	175	80	26.12	94	102	0.92	136	86	1	112	50	2	8				
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61	52	2	2	1	7	1	5	3	2	2	0	0	0	0	2	2	0	0	0	0	1	1	2	1	1	6	2	4	4	1	2	2	1	2	0	2	0	1	0	0	2	0	0	0	0	2	2	0	1	3	156	68	27.94	98	104	0.94	136	86	1	112	80	1	6							
62	40	2	2	1	5	2	5	3	2	2	0	0	0	0	2	2	0	0	0	0	2	0	0	0	1	6	1	3	2	1	2	2	1	2	0	2	0	1	1	2	2	0	0	1	1	2	2	0	1	3	1	2	0	1	157	64	25.96	98	105	0.93	130	80	1	94	70	1	9			
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66	45	2	2	1	7	1	4	4	2	2	0	0	0	0	2	2	0	0	0	0	1	1	1	1	6	1	4	3	1	1	2	1	2	0	2	0	1	1	3	2	0	0	0	0	2	2	0	2	0	1	2	0	2	0	155	48	19.98	78	86	0.91	130	80	1	76	40	2	3			
67	42	2	2	1	7	2	5	4	2	2	0	0	0	0	2	2	0	0	0	0	1	1	1	1	6	1	4	3	1	1	2	1	2	0	2	0	1	1	3	2	0	0	0	0	0	1	2	0	2	0	1	2	0	1	157	49	19.88	80	88	0.91	110	70	1	78	60	1	8			
68	40	2	2	1	5	1	4	4	2	2	0	0	0	0	2	2	0	0	0	0	2	0	0	0	1	6	2	3	3	1	2	1	2	0	2	0	1	1	3	2	0	0	0	1	1	2	2	0	2	0	2	2	162	57	21.72	83	90	0.92	110	70	1	83	50	2	6					
69	40	2	2	1	5	1	4	4	2	2	0	0	0	0	2	2	0	0	0	0	1	1	1	1	6	2	4	3	1	2	2	1	2	0	2	0	1	4	1	1	3	2	0	0	0	1	1	2	1	0	1	3	1	2	0	2	0	154	46	19.40	77	84	0.92	106	68	1	82	50	2	9
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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	
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137	42	2	2	1	5	1	5	4	2	2	0	0	0	0	2	2	0	0	0</																																																			

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	
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180	37	2	2	1	5	1	4	2	3	2	0	0	0	0	2	2	0	0	0	0	0	2	0	0	2	6	1	4	4	1	1	2	5	2	0	2	0	1	1	3	2	0	0	0	1	1	2	2	0	2	0	1	2	0	2	0	154	55	23.19	83	102	0.81	120	80	1	87	50	2	6	
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192	51	1	2	1	5	1	4																																																															

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR		
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224	60	1	2	1	5	1	2	4	3	1	4	4	3	2	2	1	2	4	0	0	1	1	1	3	3	6	1	5	3	1	1	2	5	2	0	2	0	1	1	3	2	0	0	0	1	1	1	1	1	2	0	1	1	1	2	0	0	167	72	25.82	94	102	0.92	120	80	1	98	60	1	6	
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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR
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276	34	1	2	1	5	1	4	4	3	1	2	4	4	3	2	0	0	0	0	0	2	0	0	0	2	6	2	4	4	1	1	2	5	2	0	2	0	1	1	3	2	0	0	0	1	1	2	2	0	2	0	2	0	2	0	167	70	25.10	90	100	0.90	120	80	1	87	30	2	4	
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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR							
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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	
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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	
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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR				
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687	38	1	2	1	5	1	5	4	3	2	0	0	0	0	2	2</																																																									

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR			
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716	33	1	2	1	5	1	5	4	3	2	0	0	0	0	2	1	2	2	2	1	2	0	0	2	6	1	5	3	1	1	2	1	2	0	2	0	1	1	3	2	0	0	0	1	1	2	2	0	2	0	1	2	0	2	0	173	69	23.05	84	96	0.88	110	70	1	98	40	2	6				
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742	48	1	2	1	5	1	5	4	3	2	0</																																																													

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR
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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR
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