ASSESSMENT OF RISK FACTORS FOR CORONARY ARTERY DISEASE AMONG ADULTS RESIDING IN RURAL AREA – A CROSS SECTIONAL STUDY

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This is to certify that the dissertation entitled **"ASSESSMENT OF THE RISK FACTORS FOR CORONARY ARTERY DISEASE AMONG ADULTS RESIDING IN RURAL AREA – A CROSS SECTIONAL STUDY"** is a bonafide and genuine research work done by **Reg.No:BD0111001.**

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LIST OF ABBREVIATIONS USED

BMI	–	Body Mass Index
BP	–	Blood Pressure
CAD	–	Coronary Artery Disease
CF	–	Correction Factor
cm	–	Centimeter
CVD	–	Cardiovascular Disease
CVE	–	Cardiovascular Events
DALY	–	Disability Adjusted Life Years
DBP	–	Diastolic Blood Pressure
DM	–	Diabetes Mellitus
EME	–	Established Market Economies
FAO	–	Food and Agriculture Organization
FBS	–	Fasting Blood Sugar
GBD	–	Global Burden of Disease
HC	–	Hip Circumference
HCE	–	High Caloric expenditure
HDL	–	High Density Lipoprotein
IFG	–	Impaired Fasting Glucose
IHD	–	Ischemic Heart Disease
ISH	–	International Society of Hypertension
JNC	–	Joint National Committee
Kg	–	Kilograms
LDL	–	Low Density Lipoprotein
LMIC	–	Low and Middle Income Countries

mg/dL	–	milligram per deciliter
MI	–	Myocardial Infarction
MONICA	–	Multinational monitoring of trends and determinants in cardiovascular diseases
NCD	–	Non – Communicable Disease
NHANES	–	National Health and Nutrition Examination Survey
PAR	–	Population Attributable Risk
PHC	–	Primary Health Centre
RR	–	Relative Risk
SBP	–	Systolic Blood Pressure
SEAR	–	South East Asia Region
SES	–	Socio Economic Status
TC	–	Total Cholesterol
TGL	–	Tri-glycerides
VLDL	–	Very Low Density Lipoprotein
WC	–	Waist Circumference
WHO	–	World Health Organization
WHR	–	Waist Hip Ratio
χ^2	–	Chi – square test

ABSTRACT

BACKGROUND AND OBJECTIVES

The globe is witnessing a rapid epidemiological transition. Cardiovascular diseases which include coronary artery disease (CAD) account for 60% of all deaths and 47% of burden of diseases which is progressively increasing in rural population in terms of absolute numbers. The majority of the individuals who experience coronary events have one or more cardiovascular risk factors. Most of these events are preventable if meaningful intervention is taken against the risk factors which reduce the mortality by 35 – 60%. Hence this study was undertaken to assess the risk factors for coronary artery disease among adults residing in rural area and also to predict the future risk of cardio vascular events.

METHODOLOGY

A community based cross sectional study, conducted from January to December 2012 among rural adults aged between 20 to 60 years residing in Kakati – A sub centre under PHC, Vantamuri, Belgaum. Total 980 participants were included in study.

After obtaining the ethical clearance, pilot study was conducted. Written informed consent was obtained from every participant. Data was collected by house to house visit using a predesigned questionnaire, which included socio demographic variables; behavioral risk factors (tobacco and alcohol use, decreased fruits and vegetable consumption and physical inactivity); the biological risk factors (self reported hypertension and diabetes mellitus, over weight and obesity); and family history of CAD. Statistical analysis was done using chi square test and ‘P’ value less than 0.05 was considered significant.

RESULTS

In the present study, 48.8% were men and 51.2% were women. The prevalence of behavioral risk factors which included; smoking tobacco (10.9%), smokeless tobacco (35.7%), alcohol consumption (21.4%); non-consumption of fruits (8.0%); work, leisure time and travel related sedentary activity among 18.3%, 50.4% and 22.8% of the participants respectively. These risk factors were in higher proportion among men ($P < 0.0001$). Biological risk factors which included; self reported hypertension (20.2%), diabetes mellitus (6.3%); overweight (26.7%), obesity (7.0%) reported a significant gender difference ($P < 0.0001$). About half of the participants had 1 to 2 risk factors (51.3%) and One fourth of the participants had 3 or more coronary risk factors (25.9%). Bio-chemical risk factors viz., FBS, TC and TGL levels showed a significant increase in their mean values with increase in number of risk factors. HDL was more in those with lesser number of risk factors. Advancing age, lesser or no formal education, sedentary work status and lower socio economic status were significantly associated with majority of behavioral and biological risk factors for coronary artery disease ($P < 0.001$)

CONCLUSION AND INTERPRETATION

Our study demonstrated a significant higher prevalence of behavioral and biological risk factors for CAD in rural population in south India, with a significant gender difference. Three fourth of the participants had one or more risk factors for CAD. Men had higher prevalence of CAD risk factors; whereas women exhibited a significant higher risk of CAD as predicted by charts. Burden of CAD risk factors in this population reflects epidemiological transition which requires an immediate attention.

KEY WORDS

Coronary Artery Disease, Risk factors, Rural area, Non-communicable disease.

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INTRODUCTION

The globe is witnessing a rapid epidemiological transition. Infectious and nutritional diseases are receding among adults while non - communicable diseases (NCD's) are becoming increasingly common as the cause of morbidity and mortality.[1] They are projected to exceed communicable, maternal, perinatal, and nutritional diseases, as the most common causes of death by 2030.[2] As the global burden of NCD's continues to grow; tackling it constitutes one of the major challenges for development in the 21st century.[3] In recent years most of the developing countries including India are facing this challenge.

Non-communicable or chronic diseases are diseases of long duration and generally slow in progression such as cardiovascular diseases (CVD), stroke, cancer, chronic respiratory diseases and diabetes. In 2008, five out of the top ten causes for mortality worldwide, other than injuries, were NCD's; this will go up to seven out of ten by the year 2030. By then, about 76% of the deaths in the world will be due to NCD's.[4] Out of the 36 million people who died from chronic diseases in 2008, 9 million were under 60 years and 90% of these premature deaths occurred in low and middle income countries (LMIC).[5]

Cardiovascular diseases which include Coronary Artery Disease (CAD) and stroke account for the large proportion of all premature deaths and disability worldwide. They are responsible for 60% of all deaths and 47% of burden of diseases.[6] According to the World Health Report – 2002, CVD's will be the largest cause of death and disability in India by 2020.[7] It has been estimated that,

2 % reduction in chronic diseases death rates per year globally could result in saving about 36 million premature deaths by the year 2015.[4]

The Global Burden of Disease (GBD) study reported that in India in year 2000, a total number of deaths due to CVD's were 3.1million and that due to CAD was 1.6 million. It has been predicted that by 2020, there would be 111% increase in CVD death in India. This increase is much more than 77% for china, 106% for other Asian countries and 15% for economically developed countries.[8] Currently Indians experience CVD deaths at least a decade earlier than their counterparts in countries with established market economies (EME). The GBD study estimates that 52% of CVD deaths occur in young and middle aged people in India as compared to 23% in EME, resulting in a profound adverse impact on the economy.[6, 9.]

The prevalence of the CVD's especially the Coronary Artery Disease, which forms the single largest killer disease among the group is showing upward trend in most countries and for several reasons this trend is likely to increase rapidly and will have a significant social, economic and health consequences.

The World Health Organization (WHO) has drawn attention to the fact that CAD is our 'modern epidemic' i.e., a disease that affects populations, not an unavoidable attribute of ageing.[10] Demographic projections indicates a major increase in CAD mortality in India due to epidemiological transition, with increase in life expectancy and change in the age profile, combined with increased lifestyle related risk factors which is accelerating CAD among the growing population.[11, 12.]

The CAD has assumed the 'epidemic' proportion in India and many other developing countries. The prevalence rates can be estimated from several studies over the past several decades which have ranged from 1.6% to 7.4% in rural population and 1% to 13.2% in urban population.[13] Though the disease is more prevalent in urban population it is progressively increasing in rural population in terms of absolute numbers, the burden of CAD in these subjects is large. The disease occurs at younger age in rural subjects as compared to those in urban populations which deserves a special attention.[8]

The term "Risk Factor" specifically for CAD was used first time in Framingham Study, which refers to an attribute or characteristic or exposure of an individual whose presence or absence raises the probability of an adverse outcome.[7] The majority of the 32 million individuals who develop heart attacks and strokes every year have one or more cardiovascular risk factors. Most of these cardiovascular events (CVE) are preventable if meaningful action is taken against the risk factors.[14] Early detection of CAD risk factors and appropriate intervention reduces the mortality by 35 – 60%.[15]

According to a WHO report, the impact of many of the risk factors can be reversed quickly, and most benefits will accrue within a decade. Even modest changes in risk factor levels could bring about large benefits.[9]

There is a strong positive correlation of increase in CAD in rural subjects with primordial risk factors of faulty diet, tobacco consumption, and sedentary lifestyle.[8] Major coronary risk factors – high blood pressure, high cholesterol levels and diabetes are also found to be escalating in rural population and

correlate positively with the increase in CAD and most often have more than one CAD risk factor. These risk factors are interrelated so much so that occurrence of one risk factor paves the way for the other and moderate elevation of any risk factors have multiplicative effect, there by leading to the development of CAD. It is therefore necessary to take into account the overall risk of an individual in order to predict the future incidence of CAD. Risk prediction charts have been developed using simple variables so that they can be applied even in low resource-settings.

Retrospective analysis of Indian CAD burden and risk factors studies show increasing prevalence in both urban and rural population.[11] The policy makers and health planners do not have sufficient data on the risk factors of CAD in the country, due to paucity of population based studies.

The key to controlling the global epidemic of CAD is primary prevention based on comprehensive population – wide programmes. The basis of CAD prevention is the identification of the major common risk factors and their prevention and control. The risk factors of today are the diseases of tomorrow.[16] Once the individual's risk is predicted with some degree of certainty, the management can be tailored accordingly to intensify preventive intervention to control risk factors. This is extremely important because we need to identify those who will benefit most from preventive intervention, especially with limited resources. Thus there is a felt need to establish coronary artery disease risk factors surveillance in the country. Once we have such data interventions could be done to minimize modifiable risk factors and hence combat the problem of increasing CAD related mortality and morbidity.

Studies on prevalence of risk factors for CAD are routinely carried in developed countries. However few studies on prevalence of risk factors have been carried out in India and in Karnataka state. Hence a community based study on the prevalence of risk factors for coronary artery disease among adults residing in rural field practice area was taken up. The results of this study will provide necessary inputs to categorize patients with risk factors and to predict the incidence of CAD in the next 10 years for those aged 40 years and above. Also pave the way for health education for lifestyle modification to those with more than two modifiable risk factors or those who have the chances of developing CAD in next 10 years.

OBJECTIVES

1. To assess the risk factors for coronary artery disease among adults residing in rural area.

2. To predict the future risk of major cardiovascular event based on the World Health Organisation – International Society of Hypertension risk prediction charts.

REVIEW OF LITERATURE

THE CHANGING WORLD – TOWARDS NCD's

Non–communicable diseases principally cardiovascular diseases, diabetes, cancers and chronic respiratory diseases contribute to 60% of all deaths globally, with 90% of deaths are occurring in low-and middle-income countries (LMIC). The rapidly increasing burden of these diseases is affecting poor and disadvantaged populations disproportionately, contributing to widening health gaps between and within countries. Moreover these deaths are largely preventable and the number of premature deaths can be greatly reduced.[2, 3]

Cardiovascular diseases account for a large proportion of all deaths and disability worldwide. The GBD study reported that in 1990 there were 5.2 million deaths from CVD's in economically developed countries and 9.1 million deaths in developing countries.[17] However, premature deaths accounted about one-quarter of all CVD deaths in the developed world, whereas more than about half of these deaths occurred in the developing world.[18] It has been predicted that by the year 2020 there will be an increase by almost 75% in the global CVD burden; most of it will occur in developing countries. Several studies reported that mortality from CVD's was projected to decline in developed countries from 1970 to 2015 while it was projected to almost double in the developing countries.[19]

The second half of the twentieth century witnessed major health transitions in the world, propelled by socio-economic and technological changes which profoundly altered life expectancy and ways of living while creating an unprecedented human capacity to use science to prolong and enhance life.

Among these health transitions, the most globally pervasive change has been the rising burden of CVD's in epidemic proportions; and tackling it constitutes one of the major challenges for development in the 21st century. [18, 20]

HEALTH TRANSITION IN INDIA

Demographic transition

It is characterised by the drop in fertility rate, decrease in mortality and increase in life expectancy. Along with demographic factors, there are changes in economic factors and social factors. The Indian economy is growing at 7% per year. With increasing life expectancy, the proportion of the population older than 35years is expected to rise from 28% in 1981 to 42% in 2021. During the decade 1991 – 2001, the population grew by 18% in the rural areas and 31% in urban regions. Urbanisation and industrialisation are changing the patterns of living in ways that increase behavioural and biological risk factor levels in the population.[21]

Epidemiological transition

The increasing burden of CVD's, particularly in developing countries including India, threatens to overwhelm the health services. At the beginning of 20th century, communicable diseases including maternal and perinatal causes were the leading killers. While infectious and malnutrition-related illnesses continue to be a major problem, in many parts of India the additional burden of CVD will severely strain an overstretched, ill-prepared and resource constrained health infrastructure. The scenario at the onset of 21st century has changed

drastically, making CVDs the major killer all over the world. This whole process of shift in disease pattern is levelled as 'epidemiological transition'.[21]

Five Stages of the Epidemiologic Transition[21]			
Stage	**Description**	**% CVD Deaths**	**Predominant CVD type**
Pestilence and famine	Predominance of malnutrition and infectious diseases as causes of death; high rates of infant and child mortality; low mean life expectancy	**< 10**	Rheumatic heart disease (RHD), Cardiomyopathies caused by infection and malnutrition
Receding pandemics	Improvements in nutrition and public health lead to decrease in rates of deaths related to malnutrition and infection; precipitous decline in infant and child mortality rates	**10 – 35**	Rheumatic valvular disease, hypertension, CAD, and stroke (predominantly hemorrhagic)
Degenerative and human-made diseases	Increased fat and caloric intake and decrease in physical activity lead to emergence of atherosclerosis; with increase in life expectancy, mortality from chronic, NCD's exceeds mortality from malnutrition and infectious disease	**35 – 65**	CAD and stroke (ischemic and hemorrhagic)
Delayed degenerative diseases	CVD and cancer are the major causes of morbidity and mortality; better treatment and prevention efforts help avoid deaths among those with disease and delay primary events; age-adjusted CVD morality rate declines; CVD affecting older individuals	**40 – 50**	CAD, stroke, and congestive heart failure
Inactivity and obesity	Overweight and obesity increase at alarming rate; diabetes and hypertension increase; decline in smoking rates levels off; a minority of the population meets physical activity recommendations	Possible reversal of age-adjusted declines in mortality	CAD, stroke, and congestive heart failure, peripheral vascular disease

The economic impact of these transformations was estimated as 9 billion dollars in national income from premature deaths due to heart disease, stroke and diabetes in 2005 alone, with the projected estimates of 237 billion dollars by 2015. The out-of-pocket health expenses incurred by households increased from 31.6 per cent in 1995 to 47.3 per cent in 2004.[4] Rural India is currently in phase I and II of the epidemiological transition with predominant cardiovascular disease being nutrition related, rheumatic heart disease and hypertension with a low prevalence of CAD. However, the urban India has progressed to stage II – III of this transition and there is a massive CAD epidemic. In some parts of rural India, such as Kerala, transition to stage IV has already occurred.[8]

Cardiovascular diseases are major and growing contributors for mortality and disability in South India. Most people in South Asia live in rural India. CVD accounted for 32% of all deaths in 2000, and an estimated 2 million deaths were expected to occur due to CVD by 2010, representing a 30% increase over the preceding decade. The transition appears to be in the Western style with CAD as the predominant form of CVD. In 1960, CAD represented 4% of all CVD deaths in India, whereas in 1990 the proportion was >50%. In certain rural areas, the prevalence of CAD and its risk factors is approaching urban rates.[22]

DEFINITION – CAD

Coronary Artery Disease (Syn: Ischemic heart disease) has been defined as the impairment of the heart function due to inadequate blood supply to the heart compared to its needs, caused by obstructive changes in the coronary circulation.[23] The most common cause of myocardial ischemia is atherosclerotic

disease of an epicardial coronary artery (or arteries) sufficient to cause a regional reduction in myocardial blood flow and inadequate perfusion of the myocardium supplied by the involved coronary artery.[22]

SOCIO-ECONOMIC IMPACT OF CAD

CAD derives its importance for a variety of medical and socioeconomic reasons, as follows: [24]

- The disease has a very high "killing power" – even in developed countries with well established treatment and ambulance services, 25% of those who suffer from acute Myocardial Infarction (MI) would die within one hour and would never reach the hospital; another 8 to 10% would die in the next 24 hours in the hospital and yet another 10% would die in the next one year.
- Even for those who survive, the quality of life in terms of physical capabilities is compromised, along with constant apprehension about the future.
- The treatment is costly and available at few selected centres.
- Most of the persons affected with clinical disease are in their middle age, and are in the maximal productive phase of their life; they also have the maximum family and social obligations to fulfil. Getting affected by the disease at this age therefore leads to tremendous loss to the organization and much suffering for the family.

BURDEN OF CAD

"Epidemics" of CAD began at different times in different countries starting from early 1920's. Countries where the epidemic began earlier are now showing a decline. The reasons for the changing trends in CAD are not precisely known.[10] The WHO has completed a project known as MONICA (multinational monitoring of trends and determinants in cardiovascular diseases) which measured the trends in CAD and stroke mortality and morbidity and assessed the extent of these trends were related to changes in the known risk factors, daily living habits, health care and various socioeconomic features in the defined communities and different countries.[25] When CAD emerged, it was called as "disease of affluence" i.e., the disease of the higher social classes. 50 years later the situation is changing; there is a strong inverse relation between social class and CAD in developed countries. The highest coronary mortality is seen at present in the European Region followed by South-East Asia Region (SEAR).[10]

CAD prevalence appears to be worsening in India. The rates are predicted to increase by 120% in women and 137% in men from 1990 to 2020.[17] Among adults over 20 years the estimated prevalence of the CAD is around 3 – 4% in rural areas and 8 – 10% in urban areas, representing two fold rise in rural area and six fold rise in urban areas between 1960 – 2000 thus the estimated CAD cases in India are 30 million (15 million each in rural and urban areas).[26, 27] CAD affects Indians with greater frequency and at an younger age than counterparts in developed countries, as well as many other developing countries.[28] It has been predicted that the CAD will increase rapidly in India and will host more than half the cases in the world within 15 years.[26]

The key to control the global epidemics of CAD and other chronic diseases is primary prevention based on comprehensive population wide programmes and avert these epidemics wherever possible. The basis of this mode of prevention is the identification of the major risk factors and their prevention and control, as the risk factors of today are the diseases of tomorrow.[16]

RISK FACTORS OF CAD

"Risk" is a probability of an adverse outcome, or a factor that raises this probability. A **'risk factor'** refers to any attribute, characteristic and /or exposure of an individual which increases the likelihood of developing a disease.[7, 16]. Common, preventable risk factors underlie most chronic diseases. These chronic disease risk factors are a leading cause of the death and disability burden in all countries, regardless of their economic development status.[29]

The objective of health care is not just to identify the people suffering from disease and treat them, but preventing disease by systematic assessment and reduction of their causes. Much scientific effort and most health resources are directed towards treating disease – the "rule of rescue" still dominates.[30] Assessments of burden resulting from risk factors will estimate the potential of prevention. Even when the focus is on causes as well as disease outcomes, much scientific activity should be directed at assessing whether a risk exists at all.

'**Risk assessment'** can be defined as, a systematic approach to estimate and compare the burden of disease resulting from different risks.[7] It will give an overview of risk factors and its determinants, each of which may be altered by

many different strategies; it can provide an overall picture of the relative roles of different risks to human health.

Coronary Artery Disease is an "iceberg disease", and moreover the aetiology is 'multifactorial' in origin. Hence mere prevalence of the disease will not estimate the true burden of the disease and this underestimated burden may result in inadequate focus on the issue and inefficient preventive strategies implementation. Therefore, focusing on risk factors for CAD is the key for primary prevention.

Over 300 risk factors have been associated with CAD. The major established risk factors meet three criteria:

a. A high prevalence in many populations;
b. A significant independent impact on the risk of CAD
c. Their treatment and control result in reduced risk.

They can be enumerated as follows: [31]

A. <u>Major modifiable risk factors</u>

1. High blood pressure:
2. Abnormal blood lipids – High total cholesterol, LDL cholesterol and triglyceride levels, and low levels of HDL cholesterol
3. Tobacco use
4. Physical inactivity
5. Obesity
6. Unhealthy diets – Low fruit and vegetable intake
7. Diabetes Mellitus

B. Other modifiable risk factors

1. Low socioeconomic status
2. Mental ill-health
3. Psychosocial stress
4. Alcohol use
5. Use of certain medication – Oral contraceptives and hormone replacement therapy
6. Lipoprotein (a)

C. Non-modifiable risk factors

1. Advancing age
2. Heredity or family history
3. Gender
4. Ethnicity or race

D. Novel risk factors

1. Excess homocysteine in blood
2. Inflammation / raised inflammatory markers
3. Abnormal blood coagulation

Risk factors for CAD are now significant in all populations. In the developed countries, at least one-third of all CAD is attributable to five risk factors: tobacco use, alcohol use, high blood pressure, high cholesterol and obesity. In developing countries face a 'triple burden' of risks, grappling with the problems of under nutrition and communicable diseases, while also contending with the same risks of CAD as developed nations.

LANDMARK STUDIES ON THE RISK FACTORS

The Framingham Study (1951), one of the best known large prospective study at Framingham, Massachusetts, became a model for many other studies examined for certain personal factors, suspected and subsequently showed through many years of follow up, to be powerful and consistent indicators of CAD. It played a major role in establishing the concept and nature of CAD risk factors and their relative importance.[32]

Soon after the initiation of Framingham study, an international collaboration led from Minneapolis, United States, **The Seven Countries Study** was launched. It sought to explain the large variation in death rates from CAD in different countries. Countries included were: Finland, United States of America, Netherlands, Italy, Yugoslavia, Greece and Japan. This study demonstrated the classical Framingham risk factors deferred with region and determined variation in coronary risk factors between whole populations in different countries.[25]

In early 1970's **The North Karelia Project**, in the eastern part of Finland, a multiple risk factor intervention trial was conducted, which demonstrated the reduction in the major risk factors resulted in decline in CAD mortality by 24% in men and 51% in women in North Karelia, compared to 12% reduction in men and 26% in women in rest of Finland. It estimated that only 50% of risk of CAD could be explained by conventional risk factors.[10, 32]

The INTERHEART Study, an international case-control study, carried out in 52 countries involving 15,152 cases of acute MI and 14,820 controls, estimated the hazard ratios and population-attributable fractions for multiple

well-established physiological and behavioural risk factors for incident myocardial infarction in several regions of the world.[33] This study concluded that abnormal lipids, smoking, hypertension, diabetes, abdominal obesity, psychosocial stress, decreased consumption of fruits and vegetables, moderate consumption of alcohol and physical inactivity accounted for most of the risk of CAD worldwide. Collectively, these nine risk factors accounted for 90% of the population attributable risk (PAR) in men and 94 % in women. The risk of CAD imposed by these risk factors was similar in both sexes, for all the population groups studied at all ages in all regions emphasizing the role of environmental origin of cardiovascular risk factors for all the ethnicities of the world. The only difference observed for South Asian population was the earlier occurrence of CAD.[24, 33]

The higher risk for CAD in South Asians in their younger age is largely determined by the higher levels of risk factors and the nine conventional risk factors (abnormal lipid levels, smoking, alcohol consumption, hypertension, diabetes, abdominal obesity, psycho-social factors, decreased consumption of fruits & vegetables and physical inactivity) collectively explain 86% of the CAD risk in South Asians.[33]

CAD RISK IN INDIA

Epidemiological studies from various parts of India have reported the rising trends and a high burden in the levels of conventional risk factors such as diabetes, hypertension and metabolic syndrome which are largely determined by urbanization as evident from the urban – rural difference in the risk factors

observed in India.[34, 35] The long-term case fatality following acute coronary syndrome is considerably higher among Indians as compared to other populations.[36] In addition, a reversal of socio-economic gradients for CAD risk factors has emerged in the Indian population.[37]

Several factors appear likely to have contributed to the acceleration of CAD epidemic in India in recent times. These are: (i) Demographic transition to an older population, as a result of increasing life expectancy (ii) Confluence of both conventional risk factors and non-conventional risk factors in Indians.[38] Conventional factors like hypertension, diabetes, hypercholesterolemia, smoking, etc., owe their origin to growing urbanization and western 'acculturation' amongst Indians. Non-conventional risk factors like hyperinsulinaemia, insulin resistance, lipoprotein-(a), etc., are determined by genes or other 'programming' factors and their high prevalence probably explain the malignant, precocious nature of CAD that typically affects Indians. (iii) Recently indicated relationship between low birth-weight which is widely prevalent amongst Indian newborns and enhanced susceptibility to CAD in adult life ('Barker hypothesis'). These multiplicative effects of conventional and emerging risk factors appear to provide a plausible explanation for the excess burden of CAD risk among Indians.[39]

ASSESSMENT OF RISK FACTORS

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

- Age
- Gender

- Socioeconomic status
- Family history of CAD

The major (modifiable) behavioural and biological risk factors identified are[7]:

Major behavioural risk factors:

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

Major biological risk factors:

- Overweight and obesity
- Raised blood pressure
- Raised blood glucose
- Abnormal blood lipids and its subset raised total cholesterol.

RATIONALE FOR INCLUSION

The rationale for including these eight core modifiable risk factors in our study is that[16, 40]:

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

Age

Cardiovascular diseases in developing countries are characterized by early age of onset and greater mortality. About one fourth of global CAD – related deaths take place before the age of 60 years of which in low and middle income countries 29% of CAD deaths occur among people < 60 years, compared to 13% in high-income countries.[2]

Age > 45 years for males and > 55 years for females increases the risk of CAD.[24] A prospective follow – up study of 14,786 middle-aged men and women in Finland, an increase in risk factor levels was associated with the age-related increase in CAD incidence and mortality in both sexes but to a larger extent in women.[41]

Coronary Artery Disease affects Indians with greater frequency and at a younger age than counterparts in developed countries, as well as many other developing countries. Age-standardized CVD death rates in people 30 – 69 years old are 180, 280 and 405 per lakh in Britain, China and India respectively. 50% of CAD – related deaths in India occurs in people aged < 60 years, whereas only 22% of them occur in Western countries in this age group.[28, 42]

Ageing is also associated with increasing number of risk factors. More than 75% of women aged 40 to 60 have one or more risk factors for CAD. Many risk factors start during childhood; some even develop within the first 10 years of life. A progressive of the major biological risk factors of CAD was associated with increasing age was observed.[43]

Gender

Male sex is at a higher risk. However, after menopause, the risk for females increases and equalizes that of males by the age 50 to 55 years.[24] There is a marked difference in CAD risk between sexes.[44] In both sexes, the risk of CAD increases markedly with age.[45] Among the middle-aged people, CAD is 2 to 5 times more common in men than in women.[46]

Cardiovascular disease develops 7 to 10 years later in women than in men and is still the major cause of death in women over the age of 65 years. The risk of heart disease in women is often underestimated due to the misperception that females are 'protected' against CVD's. Recent data from the National Health and Nutrition Examination Surveys (NHANES - III) have shown that over the past two decades the prevalence of CAD has increased in women in midlife (35 to 54 years), while declining in similarly aged men.[47]

Menopause transition is associated with worsening CAD risk profile.[48] Although women and men share most classic risk factors, the significance and the relative weighting of these factors are different.[49]

Socio-economic status

Epidemiological transition had led the CAD, from affluent sections of society to trickle down the social scale to become higher among people of lower socio-economic status (SES). In 'developing' world populations, those of higher socio-economic position are currently thought to be at highest risk of CAD.[50]

In rural India, where 70% of India's population lives, recent studies indicate that CVDs especially CAD is the leading cause of death and CAD risk factor levels are higher than previously assumed.[51] A shift in CAD risk factors to the more disadvantaged in rural area is a major challenge. Evidence now shows that the poor may begin life with increased vulnerability to CAD and are then exposed to additional risks throughout life.[2]

Family history of CAD

Coronary Artery Disease aggregates in families. Family history of coronary heart disease significantly increases risk of the disease in all first degree relatives. Risk is higher if more than one first degree relative is affected.[52]

Risk varies according to age at presentation, number of relatives affected, and degree of genetic concordance. Premature CAD; before 55 years in men and 60 years in women, is more likely to reflect a genetic predisposition. High levels of cardiovascular risk factors have been noted in siblings, children, and even partners of patients with CAD.[53] Therefore family history could be an independent risk factor for CAD.

Tobacco (Smoking and smokeless tobacco use)

Tobacco use is the fourth most common risk factor for disease and the second major cause of death worldwide. It is currently responsible for the death of one in ten adults' worldwide (about 4.9 million deaths each year). If the

current smoking pattern continues, it is estimated that deaths from tobacco consumption will be about 10 million people per year by 2020.[7, 54]

Smoking has been identified as a major CAD risk factor with several possible mechanisms: Carbon monoxide induced Atherogenesis; Nicotine stimulation of adrenergic drive raising both blood pressure and myocardial oxygen demand; Lipid metabolism with fall in "protective" high-density lipoproteins, etc.[10]

Tobacco use is responsible for 25 % of CAD deaths under 65 years of age in men and particularly causes sudden cardiac death among less than 50 years of age. There is evidence that the influence of smoking is not only independent, but also synergistic with other risk factors such as hypertension and elevated serum cholesterol. The risk of death from CAD declines substantially within one year of stopping smoking and more gradually thereafter until, after 10 – 20 years; it is the same as that of non-smokers.[55]

Alcohol consumption

The harmful use of alcohol is a major risk factor for premature deaths and disabilities in the world. High alcohol intake is an independent risk factor for CAD, hypertension and other CVDs, obesity, diabetes mellitus and cancers. Hazardous and harmful drinking was responsible for 2.3 million deaths worldwide in 2004 which amounts to 3.8% of all deaths in the world. More than half of these deaths occurred as a result of CAD.[6, 10] The relationship between

alcohol consumption and ischemic heart and cerebrovascular diseases is complex. It depends on the amount and the pattern of alcohol consumption.[2, 56]

Unhealthy diet

Unhealthy diet includes low fruit and vegetable consumption and extra added salt consumption. Consumption of fruits and vegetables plays a vital role in providing a diversified and nutritious diet. Adequate consumption of fruit and vegetables reduces the risk for CAD.[16] Low consumption of fruits and vegetables in many regions of the developing world is however, a persistent phenomenon, confirmed by the food consumption surveys.[57]

26.7 million (1.8%) DALYs worldwide are attributable to low fruit and vegetable intake. Of the burden attributable to low fruit and vegetable intake, about 85% was from cardiovascular diseases. Low intake of fruits and vegetables is estimated to cause 31% of CAD and 11% of stroke worldwide.[7]

WHO and the Food and Agriculture Organization of the United Nations (FAO) recommends consumption of less than 5 g sodium chloride (or 2 g sodium) per day as a population nutrient intake goal, while ensuring that the salt is iodized.[57] The expert consultation of WHO stressed that dietary intake of sodium from all sources influences blood pressure levels in the population and should be limited so as to reduce the risk of CAD and stroke. Many epidemiological studies have demonstrated that high salt intake is associated with an increased risk of high blood pressure, and thereby CAD and stroke.[58]

Physical inactivity

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. Physically inactive persons have a 20% to 30% increased risk of all-cause mortality as compared to those who adhere to 30 minutes of moderate intensity physical activity on most days of the week.[16]

Worldwide estimates as per a recent WHO report indicate that, on a long term average, physical inactivity carries an increased relative risk (RR) of 1.05 to 2.63 for CAD, 1.2 to 2.89 for hypertension and stroke, 1.08 to 4.31 times for type – 2 diabetes. Physical inactivity is a major risk factor in promoting obesity, thereby adding the risk of CAD.[16]

Evidence from observational studies suggests that leisure-time physical activity is associated with reduced cardiovascular risk and mortality in both men and women and in middle-aged and older individuals.[24]

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. The possible beneficial effects of physical activity on CAD risk may be mediated, at least in part, through these effects on intermediate risk factors.[24]

Overweight and obesity

Overweight and obesity are the most prevalent malnutrition all over the world. It has lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance. Risks of CAD, ischemic stroke and type 2 diabetes mellitus increase steadily with increasing body mass index (BMI), a measure of obesity.[7]

Prospective epidemiological studies have shown a relationship between overweight or obesity and cardiovascular morbidity, CAD mortality and total mortality. Obesity is strongly related to other major CAD risk factors, such as raised blood pressure, glucose intolerance, type 2 diabetes and dyslipidaemia.[24]

The WHO projects that by 2015, approximately 2 – 3 billion adults will be overweight and more than 700 million will be obese.[59] 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%.[59, 60, 61]

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.[59] The appropriate upper limits of measures of overweight and obesity have been recently redefined by various expert bodies, for South Asian populations, including Indians, as they constitute a 'high risk' population for CAD because of higher proportion of central obesity.[62, 63, 64]

Raised blood pressure

Raised blood pressure is a major risk factor for CAD and ischemic as well as hemorrhagic stroke.[59] Blood pressure levels have been shown to be positively and continuously related to the risk of CAD and stroke.[65] Raised blood pressure is estimated to cause 7.1 million deaths, about 13% of the total deaths, 4.5% of disease burden accounting for 64.3 million DALYs.[7]

The risk of cardiovascular disease doubles for each increment of 20/10 mmHg of blood pressure, starting as low as 115/75 mmHg. Treating raised blood pressure has been associated with a 16% reduction in the risk of CAD. [66]

Raised blood pressure often coexists with other cardiovascular risk factors, such as tobacco use, overweight or obesity, dyslipidemia and dysglycaemia, which increase the cardiovascular risk attributable to any level of blood pressure. Evidence suggest that it is not only the diastolic level but that systolic BP level is also independently related to CAD risk; in fact, as age advances, the level of systolic BP may be more important for CAD risk than diastolic level.[24]

Raised blood glucose

It is predicted that there will be at least 366 million people in the world with diabetes by the year 2030. Impaired glucose tolerance and impaired fasting glycaemia are risk categories for future development of diabetes and CAD. The age-adjusted mortality, mostly due to CAD in many populations, is 2 – 4 times higher among diabetics than in the non-diabetic population.[67]

Cardiovascular disease accounts for about 60% of all mortality in people with diabetes. The risk of cardiovascular events is 2 – 3 times higher in people with type 2 diabetes and the risk is disproportionately higher in women. Diabetics also have a poorer prognosis after a CVE compared with non-diabetics.[68]

Epidemiological evidence also suggests that the association between blood glucose and CAD begins before diabetes manifests itself. The CAD risk increases as glucose tolerance becomes impaired and then progresses to diabetes. Further, abnormal glucose regulation tends to occur together with other known CAD risk factors such as; central obesity, elevated blood pressure, low HDL-cholesterol and high triglyceride level. Each 1% increase in HbA1c level was associated with a 14% increase in the incidence of fatal or nonfatal CAD.[24]

Abnormal blood lipids

Raised total cholesterol is a major cause of disease burden in both the developed and developing world as a risk factor for CAD. Raised cholesterol is estimated to cause 56% of global CAD. Overall this amounts to about 4.4 million deaths (7.9% of total) and 40.4 million DALYs (2.8% of total).[7]

In 2008, the global prevalence of raised total cholesterol among adults was 39% (37% for males and 40% for females).[2] 10% reduction in serum cholesterol in men aged 40 can result in a 50% reduction in CAD within 5 years. Levels of plasma high density lipoprotein (HDL) cholesterol are inversely related to CAD

incidence, and the relationship is independent of total cholesterol, low density lipoprotein (LDL) cholesterol and triglyceride (TGL) levels.[16]

CAD RISK PREDICTION

Primary prevention in terms of risk stratification is pivotal in order to accurately determine and intervene early in the natural history of CAD. One goal in risk factor research is to move ever closer to the proximal direct causes of disease. A complementary goal is to improve prediction to identify individuals who are more likely to develop CAD and who therefore should be receiving more intensive interventions where possible.[69]

The WHO / ISH risk prediction charts have been developed from best available mortality and risk factor data of the low and middle income country (LMIC) populations which do not have individual refined risk prediction charts. These charts provide an approximate estimate of CVD risk in people who do not have an established CAD, stroke or other atherosclerotic disease. They have been designed using a 'modeling approach'. The risk factor profiles included: age, sex, tobacco smoking, systolic blood pressure, total cholesterol, and the presence or absence of type - 2 diabetes have been combined with information on the relative risk of each factor, along with the population - level estimate of absolute risk.[70]

These charts are simple and can be used at the primary health care level and identify people at high-risk and, if necessary can be referred for appropriate

management to the next level of care. Due to the paucity of data, 28 different charts have been compiled for 14 epidemiological sub-regions of WHO; one set includes cholesterol levels and one set without cholesterol levels. Thus, the WHO/ISH risk prediction charts will improve the effectiveness of cardiovascular risk management, even in settings which do not have sophisticated technology.

REVIEW OF STUDIES

A cross-sectional population based study of CAD risk factors among 858 individuals aged 40 – 70 years. The prevalence of the different risk factors were as follows: hypertension in 46.4%, overweight and obesity in 30%, abdominal obesity 31%, dysglycaemia in 4.4% and hypercholesterolemia 3.7%. Prevalence of hypertension and dysglycaemia was higher in men while the others were higher in women. Only hypertension (P = 0.117) and hypercholesterolemia (P = 0.183) did not reveal any significant association with gender.[71] In this study, there was less representation of male gender (71.2% women and 28.8% men), hence the results cannot be extrapolated.

A cross-sectional study was carried out in rural community of Cavunge, in the Brazilian state of Bahia with randomly chosen sample of 160 individuals (age > 19 years). The prevalence of the risk factors were: hypertension 36.5%; hypercholesterolemia 20.4%; high LDL-C level 31.1%; 4% were diabetic; and 39.7% had a high-risk Framingham score. Abdominal obesity was the most prevalent risk factor observed among 41.3% individuals. High caloric-

expenditure (HCE) physical activities were performed by 56.5% of the individuals. The HCE group had a greater frequency of normal triglyceride levels (63% vs. 44%; P=0.05), no diabetes, and WHR tending towards normal (46% vs. 27%, P=0.08) as compared with those in the low caloric-expenditure group.[72] The sample size being very less, the results cannot be generalized.

Study carried out at Mukim Dengkil, Selangor, a rural community setting in Malaysia, to determine the prevalence CAD risk factors and identify their associated factors, among residents aged 15 years and above with the sample of 570 subjects. Prevalence of hypertension was 26.8%, with the highest prevalence among those aged 60 years and above (57.3%). Age and male gender were associated significantly (P<0.01). Prevalence of obesity was 11.4%, with the highest prevalence among those aged 40 to 49 years (22.7%). Female gender, age and ethnicity were significantly associated (P<0.05) However, there was no significant association between hypertension and obesity (OR=1.14, 95% CI=0.65, 2.02).[73]

In a cross sectional study conducted at South West Thogbah, Saudi Arabia assessed the prevalence of CAD risk factors among persons attending primary health care centre in a random sample of 227 individuals aged 18 years and above. The prevalent risk factors were diabetes mellitus (28.2%), obesity (37.9%) and lack of physical exercise (68.3%). Diabetes mellitus was the most prevalent risk factor among males (55.6%), while obesity was the main one among females

(42.3%).[74] Since this was a facility based study and small sample size the results cannot be generalized.

CAD risk factor assessment was undertaken at Dhahran, located in foothills of Eastern Nepal, where randomly selected 140 adult subjects aged 35 to 86 (mean 54.1± 10.5) years. The prevalence of various risk factors for CAD was found to be: hypertension – 35.3%, diabetes mellitus – 15.9%, history of current smoking – 38.7%, hypercholesterolemia – 12.6%, sedentary life style – 47.1%, BMI > 25 kg/m2 – 33.6% and central obesity – 42.1%. Approximately one third of the subjects (30.3%) had more than one risk factor.[75] Higher prevalence of risk factors was due to inclusion of population up to 85 years.

The cross sectional survey was conducted in a rural Vietnamese sample using the WHO STEPwise approach to NCD risk factor surveillance (STEPS). 1978 participants were selected by multi-stage sampling. The prevalence of smoking and alcohol consumption were much higher in men than in women. Additionally, 80.8% of men and 50.6% of women reported being exposed daily to tobacco smoke either from them or through passive smoking. 8.8% of men and 12.6% of women were overweight (BMI ≥ 25 kg/m2) and 2.3% of men and 1.5% of women were obese (BMI ≥ 30 kg/m2). The prevalence of hypertension was 27.3% in men and 16.2% in women. About 1% of men and women had raised blood glucose. Blood pressure was significantly associated with age and BMI for both men and women ($p < 0.05$).[76]

A study to assess preventable risk factors for NCD's was conducted in rural Indonesia using the WHO STEPwise approach NCD risk factor surveillance (STEPS). 2600 participants aged 15 – 74 years were selected using cluster sampling. The prevalence of smoking was high among men at all ages and almost negligible among women (53.9% vs. 1.7%). Hypertension prevalence was almost similar among men and women (22.4% vs. 21.9%). Men had higher mean blood pressure. Women had higher mean BMI. The trend of risk factors increases across socio-economic groups. The study showed that rural population are not spared from emergence of risk factors for chronic diseases.[77]

In a cross sectional study at rural Bangladesh risk factors for CAD was assessed among 238 men and 272 women aged 18 years or more. Men and women had a similar mean BMI, waist circumference, systolic blood pressure, diastolic blood pressure, total cholesterol and blood glucose level. The prevalence of obesity (BMI ≥ 30; 0.8 vs. 1.1%), hypertension (9.8 vs. 15.6%), hypercholesterolemia (2.8 vs. 3.0%) and diabetes mellitus (2.9 vs. 0.7%) remained similar between the sexes. However, central obesity was less frequent (2.9 vs. 16.8%; P = 0.001) in men. Overall, tobacco consumption (57.1 vs. 23.2%; P = 0.001) and smoking (50.3% vs. 2.9%; P = 0.001) were more frequent in men, but chewing tobacco consumption was similar (16.3 vs. 21.4%; P = 0.095).[78]

A community-based cross-sectional study was undertaken in the Feroz Shah Kotla (FSK) area of Central District of Delhi in 2008 with a sample size of 619,

the prevalence of various risk factors were; the past smoking rate was observed to be 31%, only 17.6% were currently smoking. 2.45% consumed alcohol daily. The daily intake of fruits in a typical week was only 1%. The overall prevalence of known cases of hypertension was 36.9% and that of diabetes was 10.53%. The mean BMI among women was higher (23.6 kg/m^2) than men (22.7 kg/m^2). Gender difference was conspicuous in their waist: hip ratios too.[79]

A cross sectional survey was conducted to know the prevalence of cardiovascular risk factors in 11 villages of Kancheepuram and Thiruvallur districts of Tamil Nadu. Study population included 10,500 subjects aged 25 – 64 years. Tobacco consumption was prevalent among 60.7% males and 15.1% females. Among males smoking was prevalent in 46.9% and chewing of tobacco in 11.7%. Prevalence of current smoking and regular alcohol use among males was more in the age group of 25 – 34 years to 35 - 44 years and declined thereafter. Alcohol consumption was prevalent among 69.8% males and 1.3% females. Overweight was seen in about 26.0 % males and 12% females. Hypertension was present is 21.7% males and 21.3% females. Among the subjects with hypertension, 74.9% were newly detected during the survey which is one of the important risk factor for CAD could be detected due to such study.[80]

A cross sectional study of coronary risk factors in a rural area of Pune was carried out among 406 people of 30 years and above. The prevalence of smoking and tobacco was 16%, alcohol intake 9.4%, daily salt intake of ≥ 5 grams was 34.2%, daily saturated fat intake was seen in 47%, physical inactivity in 18.5%, BMI ≥ 25 was seen in 18% and ≥ 30 was seen in 3.2% Truncal obesity was found to be18.5% more in males, abdominal obesity was 15.7% more in case of males.

18.5% were suffering from systolic hypertension and 15% with diastolic hypertension. Differences in prevalence in males and females were statistically significant for risk factors like smoking, alcohol and abdominal obesity. This study also showed that there was increased prevalence of modifiable risk factors for CAD.[81]

Prevalence of risk factors for NCD's in a rural area of Faridabad district of Haryana among 15 – 64 year population using WHO STEP–wise tool to estimate behavioral risk factors and physical measurements. The prevalence of tobacco smoking was 41% for men and 13% for women. Alcohol consumption was seen in 24.35% of males and none among the females. The mean number of servings of fruits and vegetables per day was 3.7% for men and 2.7% for women. The percentage of people undertaking at least 150 minutes of physical activity in a week was 77.8% for men and 54.5% for women. Among men 9.0% had BMI ≥ 25 compared to 15.2% among women. The prevalence of hypertension or on anti hypertensive drugs was 10.7% among men and 7.9% among women. This study showed a high burden of tobacco and alcohol use among men, physical inactivity and overweight among women and low fruit and vegetable consumption among both sexes.[82]

A large multi-centric cross sectional study was conducted to investigate the socio-demographic patterning of NCD risk factors in 1600 villages from 18 states in India among 1963 subjects aged between 20 – 69 years. Prevalence of most risk factors increased with age. The prevalence of risk factors among men and women were: tobacco use (40% and 4%); low fruit and vegetable intake (69% and 75%); obesity (19% and 28%); dyslipidemia (33% and 35%); hypertension

(20% and 22%); diabetes (6% and 5%) and underweight (21% and 18%). Tobacco and alcohol use, low intake of fruit and vegetables, and underweight were more common in lower socioeconomic positions; whereas obesity, dyslipidemia, and diabetes (men only) and hypertension (women only) were more prevalent in higher socioeconomic positions. Risk factors were generally more prevalent in South Indians compared with North Indians.[83]

A cross-sectional study was carried out in a rural area of Nellore district of Andhra Pradesh among 500 participants to assess the prevalence of traditional cardiovascular risk factors using cluster sampling technique. 83.3 % of males were smokers and alcoholics. The overall prevalence of pre-hypertension, hypertension, diabetes, pre-diabetes and hypercholestremia were 24%, 22.4%, 5.8%, 5.2% and 20.8% respectively. Most of the personnel undertook moderate or heavy exercise. A higher proportion of individuals with pre-hypertension had clinical and behavioral risk factors such as hyperglycemia, hypercholesterolemia and adverse dietary practices like saturated fat and added salt intake. The pre-hypertension was associated with hypercholesterolemia and hyperglycemia among moderately physically active population.[84]

In the cross sectional study conducted in rural population block of Doiwala, Dehradun among 707 participants of more than 15 years of age to assess the conventional risk factors of NCD. 14.8% study population was found to be overweight and obese wherein the prevalence was two times more in females than males. As per the weight hip ratio 44.8% population was in the moderate to high risk category. Overall 6.7 % population was found to be hypertensive. About 3.7% of the subjects were in frank diabetic status. High cholesterol levels were

seen in 7.4% subjects. The overall prevalence of CAD risk factors were comparatively lower in men compared to women.[85]

A cross sectional study was conducted to assess the prevalence of CAD risk factors in a semi-urban population of Andhra Pradesh, India, in different socio-economic status (SES) groups among a healthy sample of 440 men and 210 women with an age range of 20 –70 years. Mean levels of serum total cholesterol (TC), HDL-C, and LDL-C were found to be higher among women, whereas triglycerides (TGL), systolic BP and diastolic BP were higher in men. No statistically significant differences in BMI were observed between the sexes. In men, a significant positive rank correlation (rho = $P < 0.05$) was observed between SES and TC, TG, systolic and diastolic BP and BMI, but in women, the same trend was found only with TC, TG and age. The prevalence of obesity was 14.4%, hypertension 13.1%, hypercholesterolemia 18.6%, hypertriglyceridemia 45.9% and low HDL 31.0%. In both sexes, the prevalence of hypercholesterolemia, hypertriglyceridemia and sedentary life style increased among higher SES groups ($P < 0.05$). The results demonstrate that higher SES groups have greater prevalence of CAD risk factors than lower SES groups.[86]

A cross sectional study to assess risk factors for CAD was conducted in rural area of Thiruvanantapuram district, Kerala using the WHO STEP-wise approach to surveillance of CAD approach. A total of 7449 individuals (51% women) stratified by age group, sex and place of residence were selected. The prevalence of smoking among men was 42.0%. The prevalence of overweight among men and women was 23.9% and 37.5% respectively. One fifth of the sample used tobacco products, and a tenth consumed alcohol and two-fifths

consumed a diet low in fruit and vegetable content but physical inactivity was uncommon. High blood pressure was observed in nearly 30 % of individuals. The burden of CAD risk factors was high. Prevalence of behavioral and each of the biochemical risk factors increased with age, adjusting for other factors including sex and the place of residence.[87]

A prevalence study of cardiovascular risk factors was conducted among 4535 individuals from 20 villages in the rural East and West Godavari regions of Andhra Pradesh. SES was measured by assessment of education, income and occupation. Lower fruit intake and higher tobacco and alcohol use were found in those with lower SES. Overweight, physical inactivity, diabetes, hypertension, family history of CAD and previous CAD (men only) were greater in higher SES participants. Lower SES participants had less blood pressure, glucose or cholesterol screening.[88]

All the above studies showed higher prevalence of modifiable risk factors, but prevalence of certain risk factors varied in different geographical area. Hence the knowledge of risk factors for CAD in specific area would help to plan intervention.

METHODOLOGY

The present study was conducted at the Kakati – A sub centre of the Primary Health Center (PHC), Vantamuri which is a rural field practice area of Department of Community Medicine, Jawaharlal Nehru Medical College, Belgaum. The Vantamuri PHC has five sub-centers catering to 17 villages, having total population of 34,512. The sub centre is situated at a distance of 6 kilometers from Belgaum city towards North East (Figure 1).

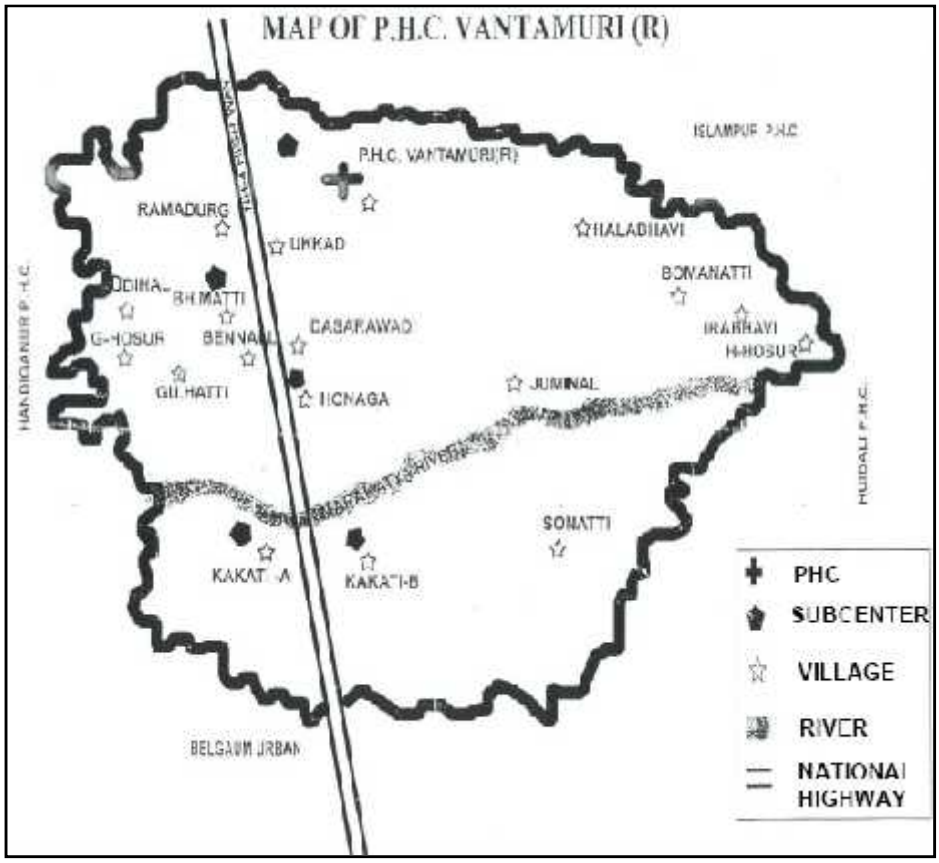


Figure1. Map of Vantamuri Primary Health Centre

Design

The study design was community based cross - sectional study.

Duration

One year – conducted from 1st January 2012 to 31st December 2012.

Participants

Adults aged between 20 years to 60 years residing in Kakati – A sub centre of Primary Health Centre, Vantamuri which is a rural field practice area of Department of Community Medicine, Jawaharlal Nehru Medical College, Belgaum.

Selection criteria

Inclusion

- Adults aged between 20 years to 60 years.
- Residents of the study area and who were staying in that area for at least one year.

Exclusion

- Persons already diagnosed with Coronary Artery Disease (Myocardial Infarction, Angina, Heart failure) in the past**.**

Sample size

The required sample size is calculated using the formula**: $N = 4pq / d^2$**

Where, **N** → sample size

p → prevalence of overweight (one of the risk factor for CAD)

q → (p – 100)

d → absolute error.

By taking prevalence of overweight as 11%[60], and absolute error as 2 % the sample size obtained was 978 approximated to **980**. Considering 10% drop outs from the study, the total sample size obtained was 1078.

Sampling method

Simple random sampling.

Sampling procedure

The total population of Kakati (A) sub centre is 8072. Voter's list of the year 2011 was obtained from gram panchayat office of Kakati, to identify all the adults aged between 20 years to 60 years. Total numbers of adults satisfying the inclusion criteria were approximately 3800. Sampling frame was prepared. With the help of standard random number table, 1078 participants were identified. A total of 980 individuals participated 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 based on WHO STEP wise approach for CAD Surveillance.[16] A pilot study was conducted using the predesigned questionnaire and required modifications were made. (Annexure III)

Data was collected from the participants through interview. Data regarding socio demographic variables like age, sex, address, educational status, main work status (occupation), marital status, socio-economic status were collected.

The risk factors of CAD were assessed in 3 steps.

1. Behavioral measurements
2. Physical measurements
3. Biochemical measurements

STEP 1 (Behavioral measurements) which included details of health behaviors like Tobacco use (smoking and smokeless tobacco); Alcohol consumption, Diet (Fruits and vegetables consumption, type of oil used, extra salt and salted food intake, taking meals outside home); Physical activity (type of work / occupation, recreation, travel related activities); Family history of CAD, Diabetes Mellitus (DM) and Hypertension; History of raised Blood Pressure and History of Diabetes Mellitus documented by a physician.

STEP 2 (Physical measurement) which included Height (in meters), Weight (in kilograms), Waist and Hip circumference (in centimeter) were recorded with minimal clothing using standardized instruments and Body Mass Index (BMI, in Kg/m^2), Waist: Hip Ratio was calculated. Blood Pressure (BP)

was measured in sitting position using Mercury Sphygmomanometer. **Three** readings were obtained of which average of last **two** readings was documented.[16]

STEP 1 and 2 were applied to all the study participants and the risk factors were assessed and the subjects are stratified into 3 groups based on presence of Risk Factors as; [65]

1. No risk factor
2. 1 - 2 risk factors
3. 3 or more risk factors

STEP 3 (Biochemical measurements) included Serum Fasting Blood Sugar (FBS, in mg/dl), Serum Total Cholesterol (TC in mg/dl), Serum Triglyceride (TGL in mg/dl) and Serum High Density Lipoproteins (HDL in mg/dl) and Serum Low Density Lipoproteins (LDL in mg/dl). This step was carried out on 10 percent of the participants among each of the above three groups classified based on risk stratification.

Risk prediction of CAD

The risk of getting CAD was predicted using the WHO/ International Society of Hypertension colour coded risk prediction charts applicable to South East Asia Region –D, India[70] (Figure 2). A 10 year risk of fatal or non-fatal cardiovascular event (CAD and stroke) was predicted into five levels of risk categories and this was applicable for age group of 40 years and above only. The variables used in the risk prediction included gender, age, systolic blood pressure, smoking or tobacco consumption status and presence or absence of diabetes mellitus. Categories of risk prediction included;

1. <10%
2. 10% to <20%
3. 20% to <30%
4. 30% to <40%
5. ≥ 40%

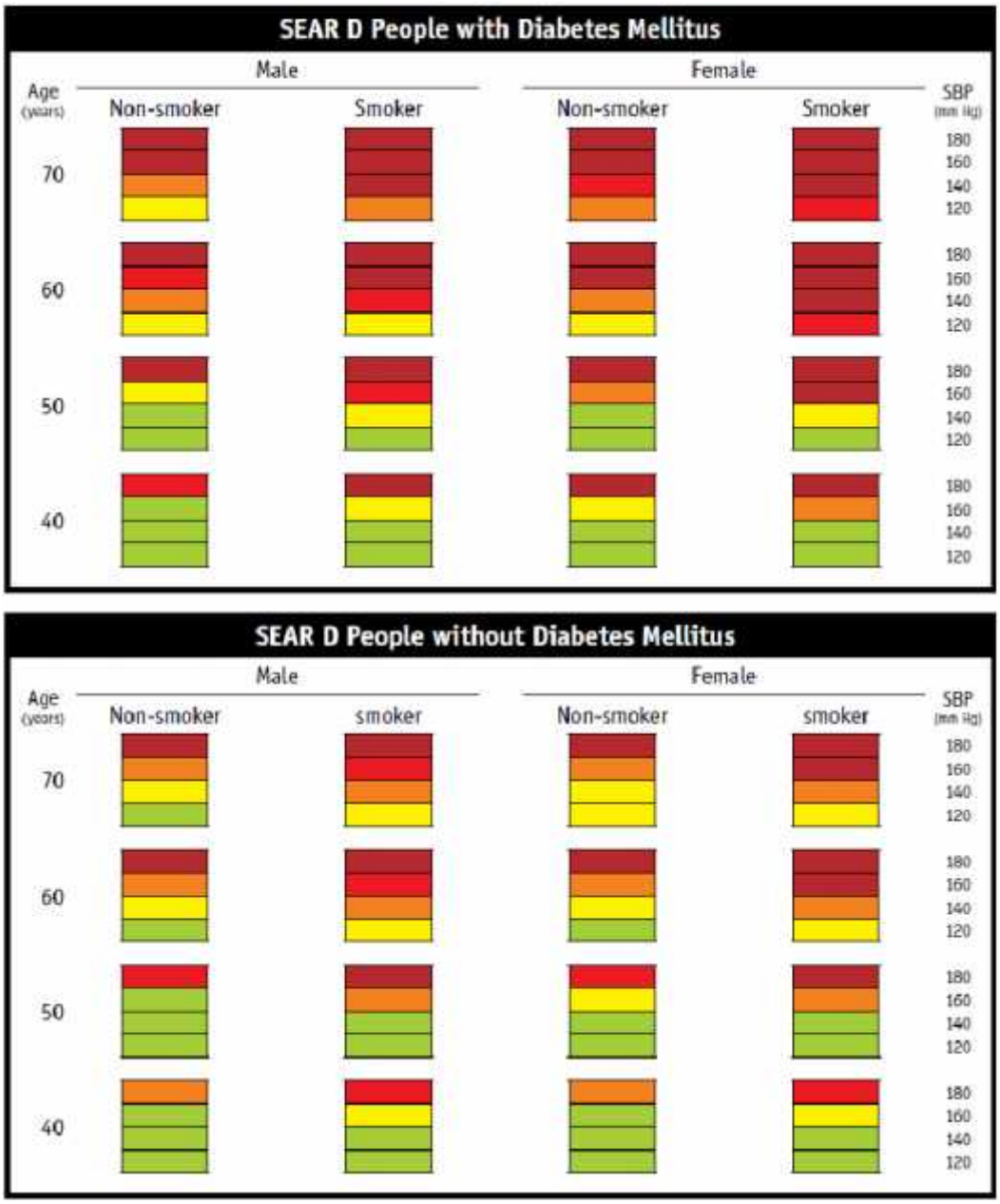


Figure 2: WHO/ISH risk prediction chart for SEAR D. 10-year risk of a fatal or non-fatal cardiovascular event. [70]

Health Education was also given to those with more than two modifiable risk factors or those who have the chances of developing CAD 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. 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 16.0 and the prevalence of each risk factor was expressed in terms of percentages. Statistical analysis was done using Pearson's Chi- Square test to find out the association between demographic variables and risk factors of CAD. A probability value (P value) of less than 0.05 was considered as significant.

DEFINITION OF STUDY VARIABLES

***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.

No formal education: A person has not received or attended any formal school.

Primary school: A person who had studied till or less than fifth standard.

Higher Primary school: A person who had studied from fifth to seventh standard.

High School: A person who had studied from eighth to tenth 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.

Main work status: [16]

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.

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

Self-employed: An individual who produces goods for sale or earns an income through provision of services to different people and/or who spends significant amount of time working for family business, farming or other similar activity.

Student: An individual whose primary activity is engaging in studies at, pre-university or university schools.

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

Retired: An individual who has earned income during some period in the workforce or as an employer and who is no longer working due to age.

Unemployed: An individual who could work but does not currently have a job or business (excluding homemaker)

***Marital Status*:** Marital status was classified as "Married", "Unmarried" and "Widow 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.[89]

Modified B. G. Prasad's Classification

Socioeconomic class	Prasad's classification (1961) per capita income in Rs/ month[89]	Modified Prasad's classification in the study period (2012) Per capita income in Rs/month[90]
I	100 & above	4800 and above
II	50 to 99	2400 to 4799
III	30 to 49	1440 to 2399
IV	15 to 29	720 to 1439
V	below 15	below 720

Average Consumer Price Index for the year 2012 = 969.21[90]

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

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

$$\text{C. F.} = \frac{969.21}{100} \text{ X } 4.93$$

$$= 47.78 \approx 48.$$

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

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.[16]

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".

Alcohol Consumption: For the assessment of history of alcohol consumption period of recall was considered for the past one year.[16]

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.

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

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.[91]

1 serving of fruit was defined as 1 medium size piece (≈ 80 grams) of Banana, Apple, orange, etc., [16, 91]

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.[91]

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)[16, 91]

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

Extra salt consumption: Extra Salt consumption was assessed either by habit of taking extra salt in the plate other than which has been already added in the food or consumption of salted food items such as pickles, papad, etc., Salt added during cooking and invisible salt in food and vegetable was not taken into consideration.[58]

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.[16]

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 get to and fro from work places.

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.[16]

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.[16]

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 heal. The coinciding reading was measured to the nearest 0.1 cm using a metallic measuring tape.[16]

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.[16]

Calculation of Body Mass Index (BMI in Kg/m^2): Body mass index was calculated as;

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

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”.[10]

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

Based on WHO and International obesity task force (IOTF) BMI cut-off standards for Asia and India, obesity was defined as below.[62]

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

***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.[16] Waist circumference > 80 centimeter for females and > 90 centimeter for males was considered to have abdominal obesity.[63]

Hip Circumference (HC): It is the maximum circumference in the horizontal plane measured over the buttocks at the level of greater tubercle.[16]

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.[92]

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.[16]

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.[66]

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

Biochemical measurements:

Biochemical measurements were applied to only 10 % of the study sample who were stratified based on the number of risk factors from each group.

As house to house collection of blood samples was logistically inconvenient, hence the investigator gave appointments to the selected respondents for reporting at the nearest Anganwadi centre at each street which was convenient to the participants. Since fasting samples were to be collected, the selected respondents were advised in writing about the instructions and the time in early morning to assemble.

The sequence of events at the camp followed mostly was: arrival at the place by the respondent and the informed consent was obtained. The venous samples were collected taking aseptic precautions and transferred to container bulb without any anticoagulant.

The blood samples were allowed to clot and then were placed in carriers with ice packs for transportation to the laboratories for further processing and

testing. The laboratory analysis of all the samples was done at the Department of Biochemistry, J. N. Medical College, Belgaum.

The results of the tests were communicated to the subjects by the investigators through valid laboratory reports. Those individuals whose biochemical test results were not within normal limits were referred by the investigators for further evaluation to appropriate health facilities.

Serum Fasting Blood Sugar (FBS)

FBS was estimated by Trinder's method using enzymatic reagent containing glucose peroxidase and oxidase. (Manufacturing company; Transasia Bio-Medicals Ltd., Solan (HP), India) The principle of estimation of blood glucose involves enzyme catalyzed reaction with the reagent with formation of gluconic acid. The coupling reaction yields the final product Quinoineimine complex with absorbance proportional to the glucose concentration of the sample when measured at 505nm wavelength. The values obtained were in mg/dL. Sr. FBS < 110 was considered "normal", 110 – 125 as "Impaired Fasting Glucose (IFG)" and ≥ 126 was considered as "Diabetes".[93]

Serum Total Cholesterol (TC)

TC was estimated by Modified Roeschlau's method using cholesterol reagent (Manufacturing company; Transasia Bio-Medicals Ltd., Solan (HP), India). The principle of estimation of cholesterol involves enzyme catalyzed reaction with the reagent. The absorbance of the final product Quinoineimine which formed at the end point is directly proportional to the Cholesterol concentration of the sample when measured at 505nm wavelength. The reference

values of normal range were 140 – 240 mg/dL. Values > 240 mg/dL was considered as impaired serum TC.[94]

Serum Triglyceride (TGL)

TGL was estimated by reagent based GPO – Trinder method of Wako and modifications by McGowan, et al and Fossati, et al. (Manufacturing company; Transasia Bio-Medicals Ltd., Solan (HP), India). The principle of estimation of TGL involves enzyme catalyzed reaction with the reagent. The intensity of the chromogen (Quinoineimine) formed at the end is directly proportional to the triglyceride concentration of the sample when measured at 505nm wavelength. The normal fasting values ranges from 25 – 150 mg/dL. Values > 150 mg/dL was considered as impaired serum TGL.[94]

Serum High Density Lipoprotein (HDL)

HDL was estimated by reagent based Phosphotungstic acid method described by Burstein, et al. (Manufacturing company; Transasia Bio-Medicals Ltd., Solan (HP), India). The principle of estimation of HDL involves enzyme catalyzed reaction where chylomicrons, LDL and VLDL (low and very low density lipoproteins) are precipitated by phosphotungstic acid in presence of magnesium ions. The HDL cholesterol remains unaffected in the supernatant and is estimated using ERBA Cholesterol reagent at 505nm wavelength. The normal fasting values ranges from 40 – 80 mg/dL. Values < 40 mg/dL was considered as impaired serum HDL.[94]

RESULTS

The present study was conducted in the Kakati (A) sub centre under rural field practice area of Primary Health Centre, Vantamuri of Department of Community Medicine, Jawaharlal Nehru Medical College, Belgaum on 980 subjects during the period of January 2012 to December 2012.

Most of the population can fluently speak and understand Kannada and Marathi languages. Many people are involved in agriculture and related activities for their living. The educational facilities are available in the village up to high school and Industrial Training Institute. The Anganwadi Workers, Health Assistants, Health workers, Private Practitioners and Medical Officer of PHC Vantamuri provide necessary health care facilities.

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

1. **Profile of study participants**

2. **Prevalence and description of the risk factors for CAD**

    A. **STEP 1: Behavioral risk factors**

    B. **STEP 2: Biological risk factors**

    C. **STEP 3: Biochemical risk factors**

3. **Risk prediction for CAD**

4. **Association between various socio-demographic variables and risk factors.**

I. PROFILE OF STUDY PARTICIPANTS

Table 1: Age wise distribution of the study participants (N=980)

Age (Years)	Number	Percentage
20 – 29	234	23.9
30 – 39	250	25.5
40 – 49	262	26.7
≥ 50	234	23.9
Total	**980**	**100**

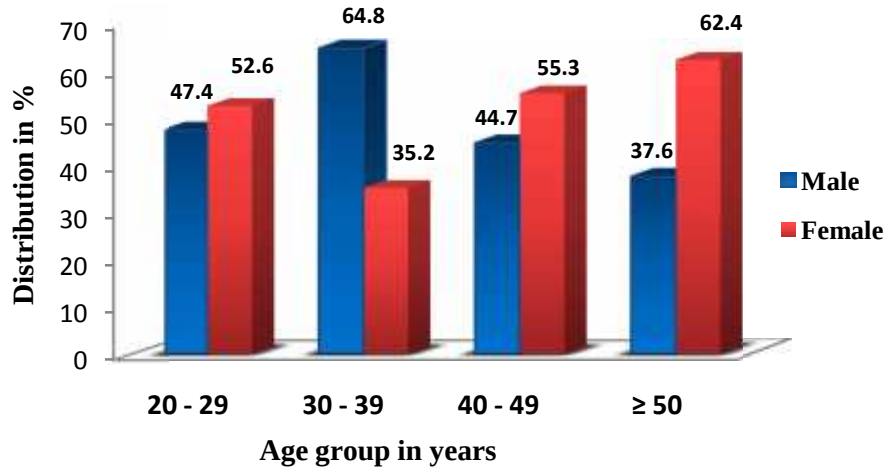
In our study, 234 (23.88%) participants were between age group of 20 – 29 years, 250 (25.51%) between 30 to 39 years, 262 (26.73%) between 40 to 49 years and 234 (23.88%) were more than or equal to 50 years.

Table 2: Distribution of the study participants according to gender (N = 980)

Gender	Number	Percentage
Male	478	48.8
Female	502	51.2
Total	**980**	**100**

Out of 980 study participants, male participants were 478 (48.78 %) and female participants were 502 (51.22 %).

Graph 1: Age group and gender wise distribution of the study participants

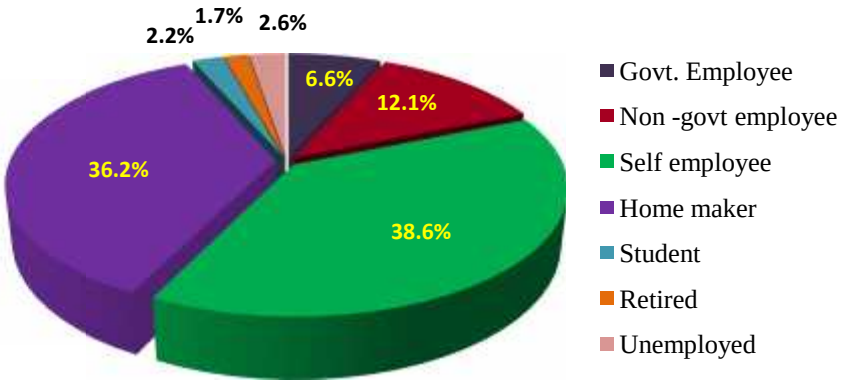


Maximum number of male participants 162 (64.8%) were in age group of 30 – 39 years and minimum 88 (37.6%) in ≥ 50 years age group. Maximum number of female participants 146 (62.4%) were in ≥ 50 years age group and minimum 88 (35.2%) were in 30 – 39 years age group. The mean age of male participants was 38.2 ± 10.66 years and mean age of female participants was 40.4 ± 11.32 years.

Table 3: Distribution of study participants according to their main work status (N = 980)

Occupation	Number	Percentage
Government employee	65	6.6
Non - government employee	119	12.1
Self employee	378	38.6
Home maker	355	36.2
Student	21	2.2
Retired	17	1.7
Unemployed	25	2.6
Total	**980**	**100**

Graph 2: Distribution of the study participants according to their main work status

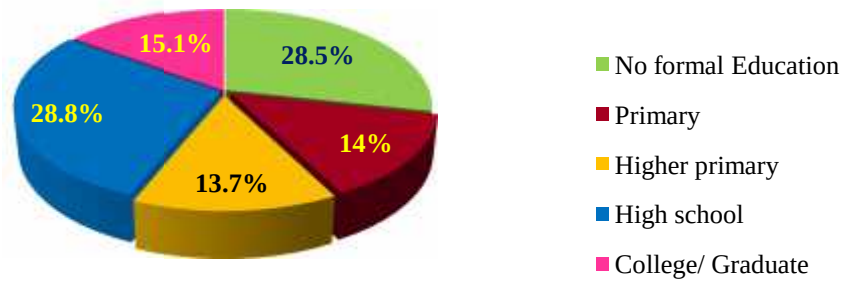


In the study 65 (6.6%) of the participants were government employees, 119 (12.1%) were non-government employees, 378 (38.6%) were self employed, 355 (36.2%) were homemakers, 21 (2.2%) were students, 17 (1.7%) were retired and 25 (2.6%) were unemployed.

Table 4: Distribution of study participants according to their educational status (N = 980)

Education	Number	Percentage
No formal education	279	28.5
Primary	137	14.0
Higher primary	134	13.6
High school	282	28.8
Pre-university + Graduate	148	15.1
Total	**980**	**100**

Graph 3: Distribution of the study participants based on the educational status



In the present study, 279 (28.5%) did not have any formal education, 137 (14.0%) studied up to primary school level, 134 (13.7%) up to higher primary level, 282 (28.8%) up to high school level, 148 (15.1%) above high school level

Table 5: Distribution of study participants according to their religion (N=980)

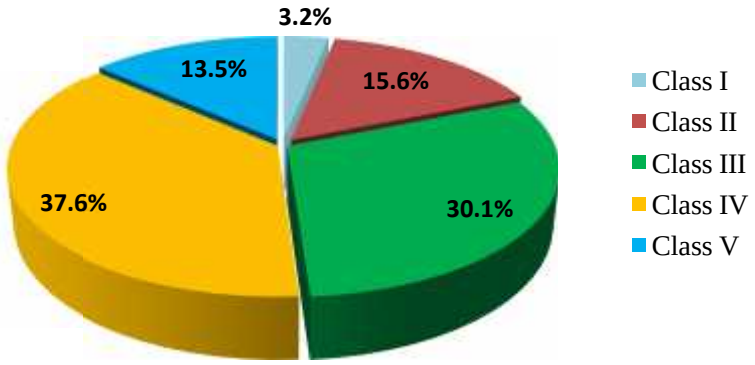
Type of work	Number	Percentage
Hindu	811	82.8
Muslim	160	16.3
Christian	09	0.9
Total	**1472**	**100**

In the present study, 811 (82.8 %) were Hindu by religion, 160 (16.3 %) were Muslims and 9 (0.9 %) were Christians.

Table 6: Distribution of study participants according to socio economic status (Acc. to modified B.G. Prasad classification, 2012) (N = 980)

Socio economic status	Number	Percentage
Class I	31	3.2
Class II	153	15.6
Class III	295	30.1
Class IV	369	37.6
Class V	132	13.5
Total	**980**	**100**

Graph 4: Distribution of the study participants according to socio-economic status



In the present study, majority of study participants, 369 (37.6%) belonged to class IV SES as per modified B.G. Prasad's classification; followed by 295 (30.1%) in class III; 153 (15.6%) in class II, 132 (13.5%) in and least in class I i.e., 31 (3.2%).

Table 7: Distribution of study participants according to marital status (N=980)

Marital status	Number	Percentage
Married	865	88.2
Unmarried	82	8.4
Widowed / Divorced	33	3.4
Total	**980**	**100**

In the present study, 865 (88.2%) were married, 82 (8.4%) were unmarried and 33 (3.4%) were widowed or divorced.

Table 8: Distribution of study participants according to family history of CAD (N=980)

Family history of CAD	Number	Percentage
No history	883	90.1
Father	73	7.5
Mother	22	2.2
Both parents	02	0.2
Total	**1472**	**100**

In the present study, 883 (90.1%) did not have family history of CAD, 97 (9.9%) had; out of it 73 (7.5%) of father had CAD, 22 (2.2%) mother and in 02 (0.2%) both had CAD.

II. PREVALENCE AND DESCRIPTION OF THE RISK FACTORS

A. *STEP 1*: *Behavioral Risk Factors*.

SMOKING TOBACCO

Table 9 (a): Distribution of study participants according to history of smoking tobacco (N=980)

Smoking tobacco	Men (%)	Women (%)	Total (%)
Yes	105 (22.0)	02 (0.4)	107 (10.9)
No	373 (78.0)	500 (99.6)	873 (89.1)
Total	**478 (100)**	**502 (100)**	**980 (100)**
χ^2 = 117.10	**Df = 1**		**P < 0.0001**

In the present study, 10.9% of the participants smoked tobacco. Among men the prevalence of smoking was higher (22.0%) compared with women (0.4%) (P < 0.0001)

The mean age of initiation of smoking among smokers was 22.15 ± 5.9 years with a range of 14 to 45 years. The youngest age of onset of smoking noted was **14** years.

The average duration of smoking among smokers was 18.4 ± 10.31 years with a range of 1 to 42 years.

Table 9 (b): Distribution of smokers according frequency of smoking (N=980)

Frequency of Smoking tobacco	Men (%)	Women (%)	Total (%)
Daily	96 (91.4)	2 (100)	98 (91.5)
Occasionally	04 (3.8)	0 (0)	04 (3.7)
Past smoker	05 (4.8)	0 (0)	05 (4.8)
Total	**105 (100)**	**2 (100)**	**107 (100)**
χ^2 = 121.58	**Df = 2**		**P < 0.0001**

In the present study, among the smokers most of the subjects were daily smokers, 04 (3.7%) were occasional and 05 (4.8%) were past smokers. Overall 'Beedi' was the predominant form consumed by 53.3% of smokers followed by 'Cigarette' 46.7% of them.

SMOKELESS TOBACCO

Table 10 (a): Distribution of study participants according to history of using smokeless tobacco (N=980)

Smokeless tobacco use	Men (%)	Women (%)	Total (%)
Yes	223 (46.7)	127 (25.3)	350 (35.7)
No	255 (53.3)	375 (74.7)	630 (64.3)
Total	**478 (100)**	**502 (100)**	**980 (100)**
χ^2 = 48.63	**Df = 1**		**P < 0.0001**

In the present study, (35.7%) used smokeless tobacco. Among men the prevalence of use was 46.7% and among women it was 25.3%. The difference was statistically significant (P < 0.0001)

The mean age of initiation of smoking among smokers was 22.4 ± 7.01 years with a range of 7 to 50 years. The youngest age of smokeless tobacco use noted was **7** years.

The average year of consumption of smokeless tobacco among users was 18.9 ± 9.47 years with a range of 1 to 45 years.

Table 10 (b): Distribution of study participants according frequency of use of smokeless tobacco (N = 350)

Frequency of Smokeless tobacco	Men (%)	Women (%)	Total (%)
Daily	207 (92.8)	99 (78.0)	306 (87.4)
Occasionally	07 (3.2)	20 (15.7)	27 (7.7)
Past user	09 (4.0)	08 (6.3)	17 (4.9)
Total	**223 (100)**	**127 (100)**	**350 (100)**
χ^2 = 67.328	**Df = 2**		**P < 0.0001**

In the present study, among the users of smokeless tobacco, most of the subjects were daily users. 92.8% of men and 78.0% of women used it daily; 3.2% of men and 15.7% of women used it occasionally. About 4.9% of them were past users. Majority of them i.e., 64.3% of the participants did not consume tobacco.

Overall 'Chewing tobacco' was the predominant form of consumption i.e., 66.0% followed by 'Gutka' i.e., 30.6%.

ALCOHOL CONSUMPTION

Table 11 (a): Distribution of study participants according to history of use of alcohol (N = 980)

Alcohol use	Men (%)	Women (%)	Total (%)
Yes	200 (41.8)	10 (2.0)	210 (21.4)
No	278 (58.2)	492 (98.0)	770 (78.6)
Total	**478 (100)**	**502 (100)**	**980 (100)**
χ^2 = 230.93		**Df = 1**	**P < 0.0001**

In the present study, the overall prevalence of alcohol use was 21.4%. Among men 41.8% of them consumed it as compared to women 2.0%. This difference was statistically significant (P < 0.0001)

Among alcoholics, 'whisky was the predominant type of drink consumed 96 (45.7%) followed by 'brandy' 63 (30.0%), 'beer' 23 (11.0%), 'rum' 19 (9.0%) and others 09 (4.3%).

'Whisky' was the predominant type of drink consumed among men (47.0%) whereas 'brandy' was the predominant type among women (60.0%).

Table 11 (b): Distribution of study participants according frequency of alcohol consumption (N = 210)

Frequency of Alcohol	Number	Percentage
≥ 5 days / week	41	19.5
1 – 4 days / week	126	60.0
1 – 3 days / month	35	16.7
< 1 day / month	08	3.8
Total	**210**	**100**

Among the alcoholics 60.0% consumed it 1 to 4 days a week, 19.5% consumed it more than or equal to 5 days per week; 16.7% consumed occasionally i.e., 1 to 3 days per month and 3.8% consumed less than once per month.

DIET

Table 12 (a): Distribution of study participants according to consumption of fruits per week (N = 980)

Fruits consumption	Men (%)	Women (%)	Total (%)
Never	40 (8.4)	39 (7.8)	79 (8.0)
1 – 3 days / week	276 (57.7)	323 (64.3)	599 (61.1)
4 – 6 days / week	126 (26.4)	96 (19.1)	222 (22.7)
On all days	36 (7.5)	44 (8.8)	80 (8.2)
Total	**478 (100)**	**502 (100)**	**980 (100)**
$\chi^2 = 7.972$	**Df = 3**		**P = 0.047**

Participants who consumed fruits every day were 8.2%. Most of them (61.1%) consumed 1 to 3 days per week and some (22.7%) consumed in a frequency of 4 to 6 days a week. 8.0% of the participants never consumed any fruits. Men consumed fruits more than women, this difference was statistically significant (P = 0.047).

Table 12 (b): Distribution of study participants according to consumption of vegetables per week (N = 980)

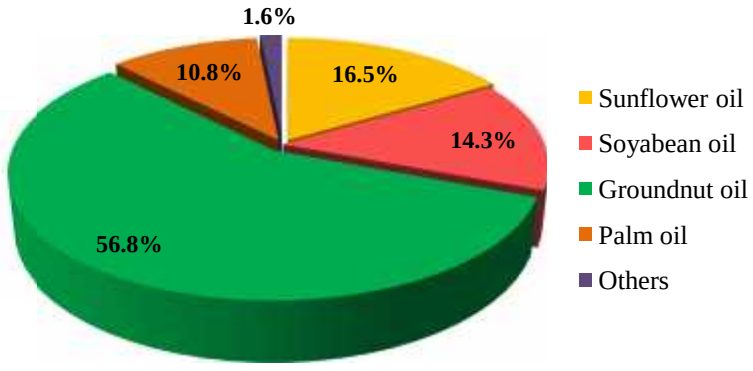
Vegetable consumption	Men (%)	Women (%)	Total (%)
1 – 3 days / week	8 (1.7)	11 (2.2)	19 (1.9)
4 – 6 days / week	74 (15.5)	80 (15.9)	154 (15.7)
On all days	396 (82.8)	411 (81.9)	807 (82.3)
Total	**478 (100)**	**502 (100)**	**980 (100)**
$\chi^2 = 0.399$	**Df = 2**		**P = 0.819**

Majority of the study participants (82.3%) consumed vegetables on all days. 15.7% of them consumed vegetables 4 to 6 days a week and 1.9% consumed 1 to 3 days a week. There was no difference between men and women in frequency of vegetable consumption (P = 0.819).

Table 12 (c): Distribution of study participants according to predominant type of oil used (N = 980)

Type of oil	Number	Percentage
Sunflower	164	16.5
Soya bean	139	14.3
Groundnut	556	56.8
Palm	106	10.8
Other	15	1.6
Total	**980**	**100**

Graph 5: Distribution of the study participants according to predominant type of oil used



In the present study, 556 (56.8%) participants used groundnut oil as their predominant oil for cooking, followed by sunflower oil 164 (16.5%), soya bean oil 139 (14.3%), palm oil 106 (10.8%) and others 15 (1.6%).

Table 12 (d): Distribution of study participants according to consumption of extra salt (N = 980)

Extra salt consumption	Men	Women	Total
Yes	119 (24.9)	81 (16.1)	200 (20.4)
No	359 (75.1)	421 (83.9)	780 (79.6)
Total	**478 (100)**	**502 (100)**	**980 (100)**
χ^2 = 11.56	**Df = 1**		**P = 0.001**

In the present study 200 (20.4%) participants consumed extra salt other than that added to the cooked food. More men consumed extra salt compared to women; this difference was statistically significant between the genders. (24.9% vs. 16.1%) (P = 0.001)

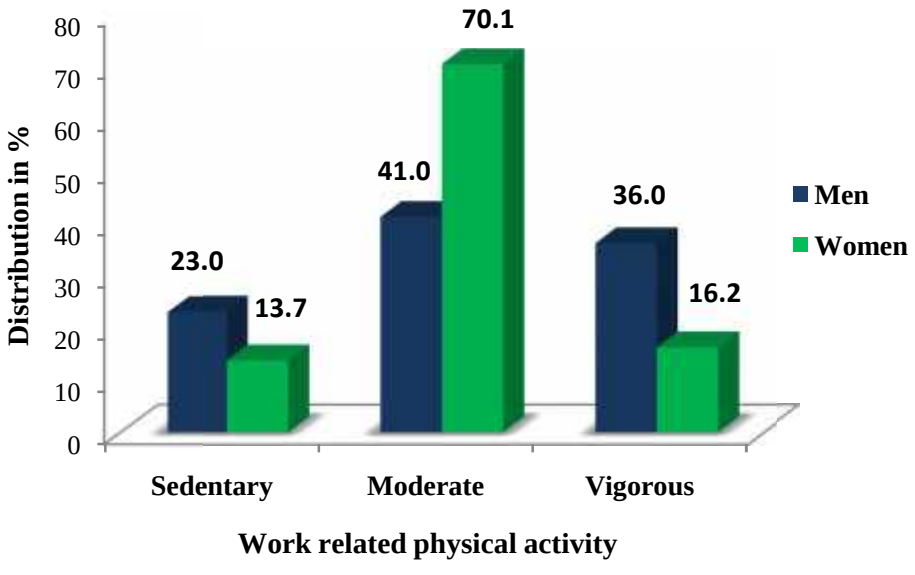
The proportion of the participants who reported consuming salted food items were 612 (62.6%) and pickle was the most common type salted food item consumed (87.2%).

PHYSICAL ACTIVITY

Table 13 (a): Distribution of study participants according to levels of physical activity at work (N = 980)

Physical activity at work	Men (%)	Women (%)	Total (%)
Sedentary	110 (23.0)	69 (13.7)	179 (18.3)
Moderate	196 (41.0)	352 (70.1)	548 (55.9)
Vigorous	172 (36.0)	81 (16.2)	253 (25.8)
Total	**478 (100)**	**502 (100)**	**980 (100)**
χ^2 = 85.99	**Df = 2**	**P < 0.0001**	

Graph 6 : Distribution of the study participants according to work related physical activity

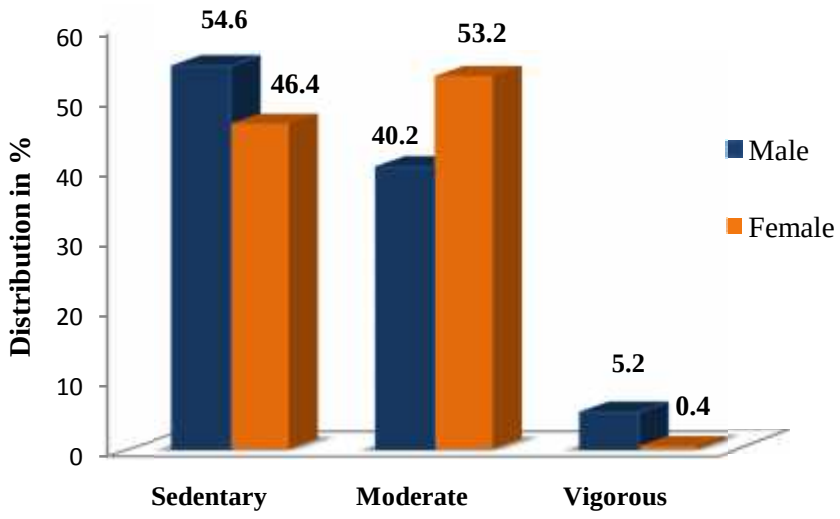


In the present study, 179 (18.3%) participants were sedentary at work. 548 (55.9%) and 253 (25.8%) were involved in moderate and vigorous physical activity at their work. Men were more sedentary at work (23.0%) as compared to women (13.7%). The difference was found to be statistically significant ($P < 0.0001$).

Table 13 (b): Distribution of study participants according to levels of physical activity during leisure time (N = 980)

Physical activity during leisure	Men (%)	Women (%)	Total (%)
Sedentary	261 (54.6)	233 (46.4)	494 (50.4)
Moderate	192 (40.2)	267 (53.2)	459 (46.8)
Vigorous	25 (5.2)	2 (0.4)	27 (2.8)
Total	**478 (100)**	**502 (100)**	**980 (100)**
χ^2 = 32.87	**Df = 2**	**P < 0.00001**	

Graph 7: Distribution of the participants according to leisure time physical activity



In our study, 494 (50.4%) participants were sedentary during leisure time, 459 (46.8%) were doing moderate physical activity and 27 (2.8%) were involved in vigorous physical activity during leisure time. Men were more sedentary during leisure time (54.6%) as compared to women (46.4%) and this difference between genders was statistically significant ($P < 0.0001$).

Table 13 (c): Distribution of study participants according to physical activity during travel to work (N = 980).

Travel related physical activity	Men (%)	Women (%)	Total (%)
Sedentary	111 (23.2)	112 (22.3)	223 (22.8)
Non-sedentary	367 (76.8)	390 (77.7)	757 (77.7)
Total	**478 (100)**	**502 (100)**	**980 (100)**
χ^2 = 0.116	**Df = 1**		**P = 0.734**

In our study, 223 (22.8%) participants were found to be sedentary during travel to work. There was no significant difference between genders in travel related physical activity (P = 0.734).

SELF REPORTED HYPERTENSION AND DIABETES MELLITUS

Table 14 (a): Distribution of study participants according to self reported history of hypertension (N = 980).

History of Hypertension	Men (%)	Women (%)	Total (%)
Present	83 (17.4)	115 (22.9)	198 (20.2)
Absent	395 (82.6)	387 (77.1)	782 (79.8)
Total	**478 (100)**	**502 (100)**	**980 (100)**
χ^2 = 4.669	**Df = 1**		**P = 0.031**

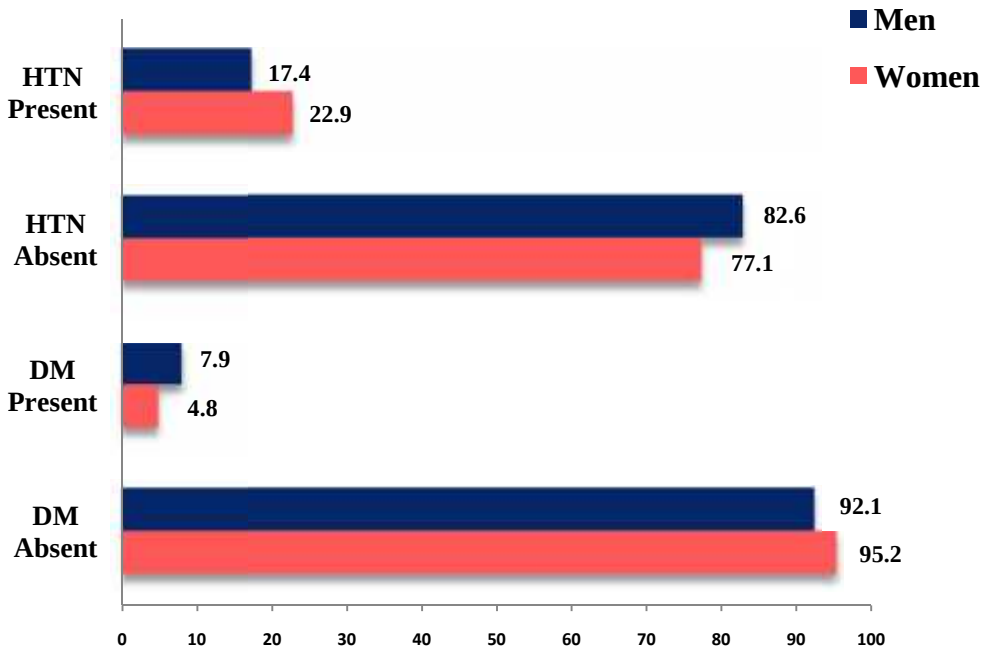
The overall prevalence of self reported hypertension in our study was 20.2%. The prevalence among women was higher (22.9%) compared to men (17.4%). This difference was found to be statistically significant (P = 0.031)

Table 14 (b): Distribution of study participants according to self reported history of diabetes mellitus (N = 980).

History of Diabetes Mellitus	Men (%)	Women (%)	Total (%)
Present	38 (7.9)	24 (4.8)	62 (6.3)
Absent	440 (92.1)	478 (95.2)	918 (93.7)
Total	**478 (100)**	**502 (100)**	**980 (100)**
X^2 = 4.419	**Df = 1**		**P = 0.042**

The overall prevalence of self reported history of diabetes mellitus in our study was 6.3%. The prevalence among men was higher (7.9%) compared to women (4.8%). This difference was found to be statistically significant (P = 0.042)

Graph 8: Distribution of the study participants according to self reported historyof hypertension and history of diabetes mellitus



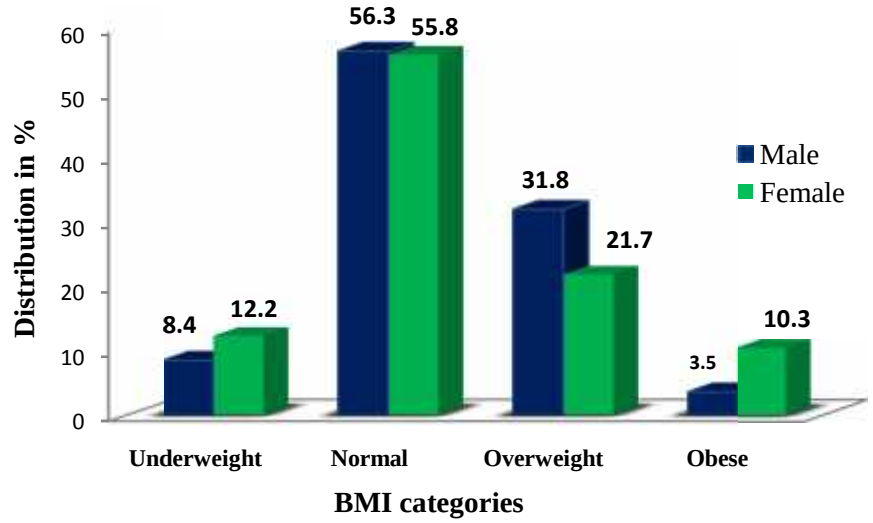
B. *STEP 2*: *Biological Risk Factors.*

OVERWEIGHT AND OBESITY

Table 15 (a): Distribution of the study participants according to Body Mass Index (Kg/m^2) (N = 980)

BMI Categories (Kg/m^2)	Men (%)	Women (%)	Total (%)
Underweight (< 18.5)	40 (8.4)	61 (12.2)	101 (10.3)
Normal (18.5 – 24.9)	269 (56.3)	280 (55.8)	549 (56.0)
Overweight (25.0 – 29.9)	152 (31.8)	109 (21.7)	261 (26.7)
Obese (≥ 30.0)	17 (3.5)	52 (10.3)	69 (7.0)
Total	**478 (100)**	**502 (100)**	**980 (100)**
χ^2 = 28.854	**Df = 3**		**P < 0.0001**

Graph 9 : Distribution of the study participants according to BMI categories

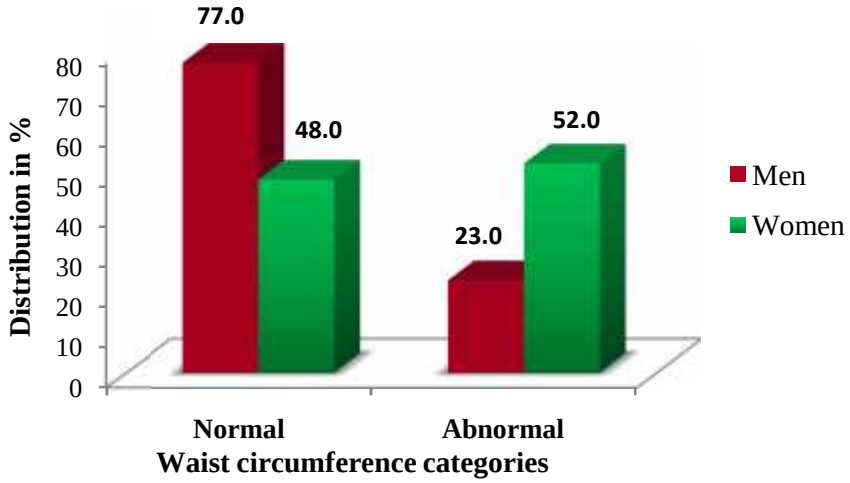


In the present study the overall prevalence of overweight and obesity were 26.7% and 7.0% respectively. The prevalence of overweight was more among men compared to women (31.8% vs. 21.7%); whereas among obese, women outnumbered men (10.3% vs. 3.5%). This difference was statistically significant (P < 0.0001)

Table 15 (b): Distribution of the study participants according to waist circumference (WC) (N = 980)

WC categories	Men (%)	Women (%)	Total (%)
Normal	368 (77.0)	241 (48.0)	609 (62.1)
Abnormal	110 (23.0)	261 (52.0)	371 (37.9)
Total	**478 (100)**	**502 (100)**	**980 (100)**
χ^2 = 87.407	**Df = 1**		**P < 0.0001**

Graph 10: Distribution of the study participants according to waist circumference categories



In the present study, the overall prevalence of abdominal obesity based on waist circumference criteria was 37.9%. The prevalence among women was double than that of men (52.0% vs. 23.0%). The difference was statistically significant ($P < 0.0001$).

Table 15 (c): Distribution of the study participants according to waist: hip ratio (WHR) (N = 980)

WHR categories	Men (%)	Women (%)	Total (%)
Normal	282 (59.0)	20 (4.0)	302 (30.8)
Abnormal	196 (41.0)	482 (96.0)	678 (69.2)
Total	**478 (100)**	**502 (100)**	**980 (100)**
χ^2 = 347.562	**Df = 1**		**P < 0.0001**

In the present study, the overall prevalence of abdominal obesity based on waist : hip ratio criteria was 69.2%. The prevalence among women was significantly high than that of men (96.0% vs. 41.0%). The difference was statistically significant ($P < 0.0001$).

HYPERTENSION

Table 16 (a): Distribution of the participants according to systolic blood pressure (N = 980)

SBP categories	Men (%)	Women (%)	Total (%)
Normal	119 (24.9)	178 (35.5)	297 (30.3)
Pre – hypertension	226 (47.3)	196 (39.0)	422 (43.1)
Hypertension grade I	100 (20.9)	93 (18.5)	193 (19.7)
Hypertension grade II	33 (6.9)	35 (7.0)	68 (6.9)
Total	**478 (100)**	**502 (100)**	**980 (100)**
χ^2 = 13.588	**Df = 3**		**P = 0.004**

In the present study the overall prevalence of hypertension was 26.6%; grade I and grade II being 19.7% and 6.9% respectively. Systolic hypertension prevalence was higher in males (27.8%) as compared to females (25.5%).

The overall prevalence of pre-hypertension was 43.1%; prevalence was more among males (47.3%) as compared to females (39.0%).

This gender wise difference in systolic blood pressure level was found statistically significant (P = 0.004).

Table 16 (b): Distribution of the participants according to diastolic blood pressure (N = 980)

DBP categories	Men (%)	Women (%)	Total (%)
Normal	188 (39.3)	227 (45.2)	415 (41.3)
Pre – hypertension	145 (30.3)	136 (27.1)	281 (28.7)
Hypertension grade I	116 (24.3)	95 (18.9)	211 (21.5)
Hypertension grade II	29 (6.1)	44 (8.8)	73 (7.5)
Total	**478 (100)**	**502 (100)**	**980 (100)**
χ^2 = 8.543	**Df = 3**	**P = 0.036**	

In the present study the prevalence of hypertension was 29.0%; grade I and grade II being 21.5% and 7.5% respectively. Diastolic hypertension prevalence was higher in males (30.4%) as compared to females (27.7%).

The overall prevalence of pre-hypertension was 28.7%; prevalence was more among males (30.3%) as compared to females (27.1%).

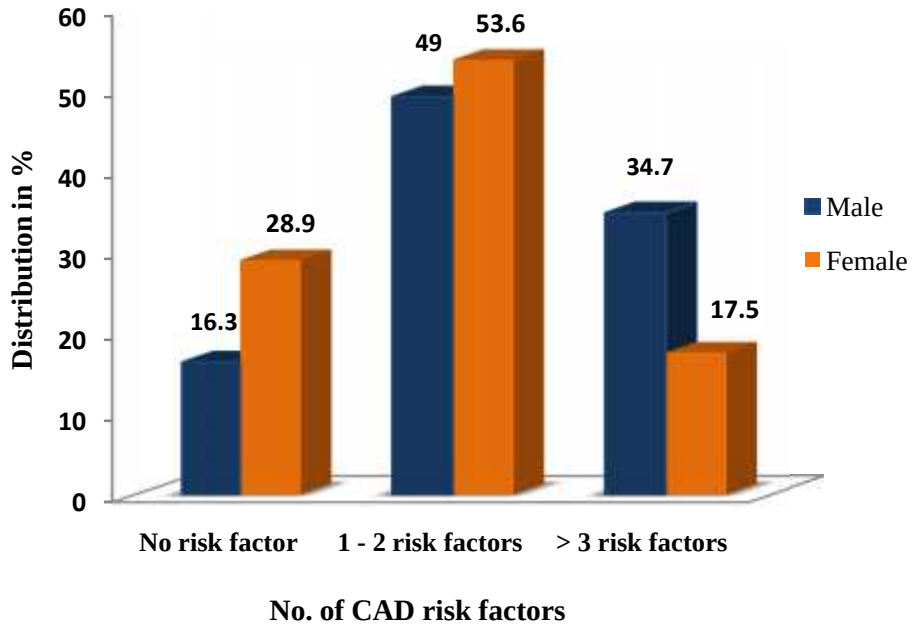
This gender wise difference in systolic blood pressure level was found statistically significant (P = 0.036).

RISK STRATIFICATION

Table 17: Distribution of the participants according to the number of risk factors for CAD (N = 980)

Risk categories	Men (%)	Women (%)	Total (%)
No risk factors	78 (16.3)	145 (28.9)	**223 (22.8)**
1 – 2 risk factors	234 (49.0)	269 (53.6)	**503 (51.3)**
3 or more risk factors	166 (34.7)	88 (17.5)	**254 (25.9)**
Total	**478 (100)**	**502 (100)**	**980 (100)**
χ^2 = 45.958	**Df = 2**	**P < 0.0001**	

Graph 11: Distribution of the study participants according to number of CAD risk factors



In our study, 22.8% of the participants were free from any of the risk factors for CAD, 503 (51.3%) had 1 – 2 risk factors and 254 (25.9%) had 3 or more risk factors for CAD. 757 (77.2%) had at least one or more risk factors.

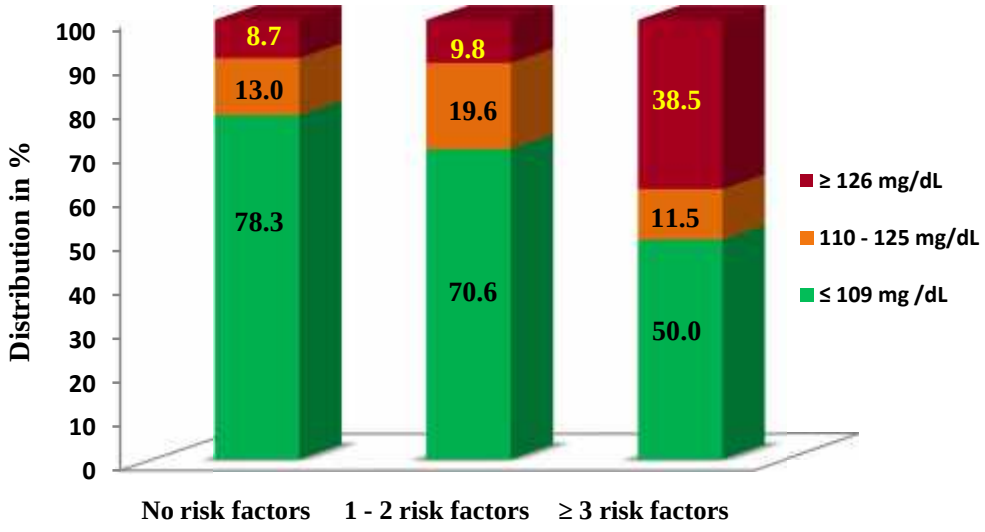
C. *STEP 3*: *Biochemical Risk Factors*

SERUM FASTING BLOOD SUGAR (FBS)

Table 18: Distribution of the selected participants according to Serum FBS and risk categories (N = 100)

Risk categories	Serum FBS categories (in mg/dL)			Total (%)
	≤ 109	110 – 125	≥ 126	
No risk factors	18 (78.3)	03 (13.0)	02 (8.7)	23 (100)
1 – 2 risk factors	36 (70.6)	10 (19.6)	05 (9.8)	51 (100)
3 or more risk factors	13 (50.0)	03 (11.5)	10 (38.5)	26 (100)
Total	**67 (67.0)**	**16 (16.0)**	**17 (100)**	**100 (100)**
χ^2 = 12.050	**Df = 4**		**P = 0.017**	

Graph 12: Distribution of the selected study participants according to serum FBS values and no. of CAD risk factors



Among study participants who were subjected to fasting blood sugar examination 67.0% had normal blood glucose; 16.0% had impaired fasting glucose levels and 17.0% were having high fasting blood sugar levels. This difference was statistically significant when compared with the risk categories (P = 0.017).

Among the participants having impaired fasting glucose levels only 04 (25.0%) were known case of DM. Among the participants who had high fasting blood sugar levels only 06 (35.3%) were known case of DM.

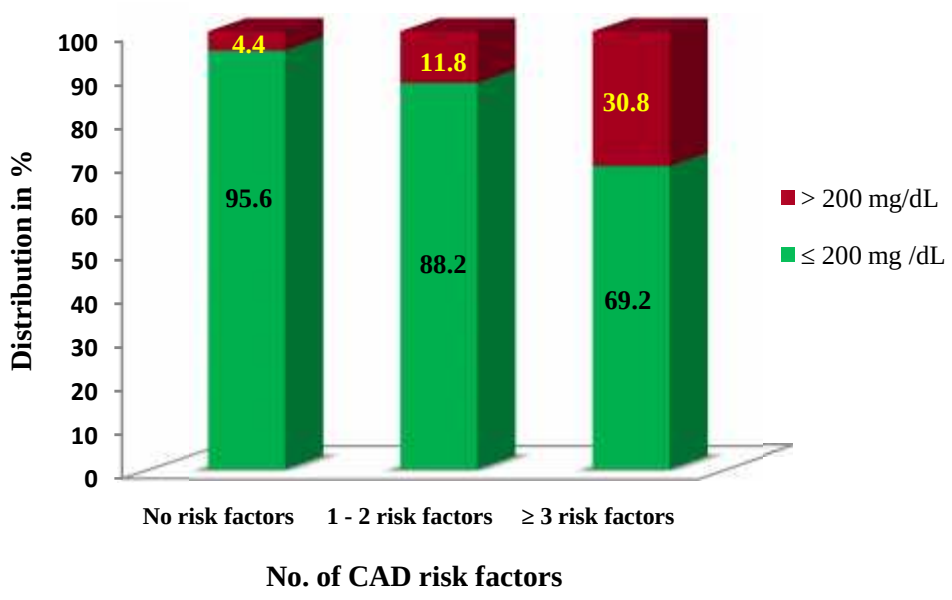
The mean ± SD values of FBS was found to be increasing with the number of risk factors i.e., 101.0 ± 25.2 in no risk category, 103.4 ± 20.1 in 1 to 2 risk category and 128.1 ± 64.6 in more than or equal to 3 risk factor categories.

SERUM TOTAL CHOLESTEROL (TC)

Table 19: Distribution of the selected participants according to Serum TC and risk categories (N = 100)

Risk categories	Serum TC categories (in mg/dL)		Total (%)
	≤ 200	> 200	
No risk factors	22 (95.6)	01 (4.4)	23 (100)
1 – 2 risk factors	45 (88.2)	06 (11.8)	51 (100)
3 or more risk factors	18 (69.2)	08 (30.8)	26 (100)
Total	**85 (85.0)**	**15 (15.0)**	**100 (100)**
χ^2 = 7.536	**Df = 2**	**P = 0.023**	

Graph 13: Distribution of the selected study participants according to serum TC values and no. of CAD risk factors



Among study participants who were subjected to fasting total cholesterol examination 85.0% had normal cholesterol levels and 15.0% had high cholesterol levels. This difference was statistically significant when compared with the risk categories (P = 0.023).

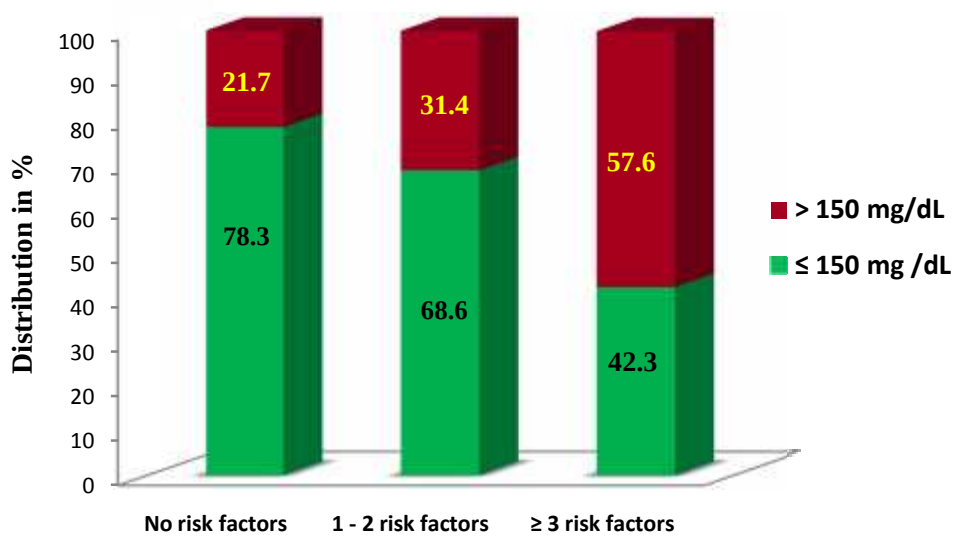
The mean ± SD values of TC was found to be increasing with the number of risk factors i.e., 160.2 ± 73.4 in no risk category, 171.9 ± 28.4 in 1 to 2 risk category and 183.8 ± 28.2 in more than or equal to 3 risk factor categories.

SERUM TRIGLYCERIDE (TGL)

Table 20: Distribution of the selected participants according to Serum TGL and risk categories (N = 100)

Risk categories	Serum TGL categories (in mg/dL)		Total (%)
	≤ 150	> 150	
No risk factors	18 (78.3)	05 (21.7)	23 (100)
1 – 2 risk factors	35 (68.6)	16 (31.4)	51 (100)
3 or more risk factors	11 (42.3)	15 (57.6)	26 (100)
Total	**64 (64.0)**	**36 (36.0)**	**100 (100)**
χ^2 = 7.814	**Df = 2**	**P = 0.020**	

Graph 14 : Distribution of the selected study participants according to serum TGL values and no. of CAD risk factors



Among study participants who were subjected to fasting triglyceride level examination 64.0% had normal triglyceride levels and 36.0% had high triglyceride levels. This difference was statistically significant when compared with the risk categories (P = 0.020).

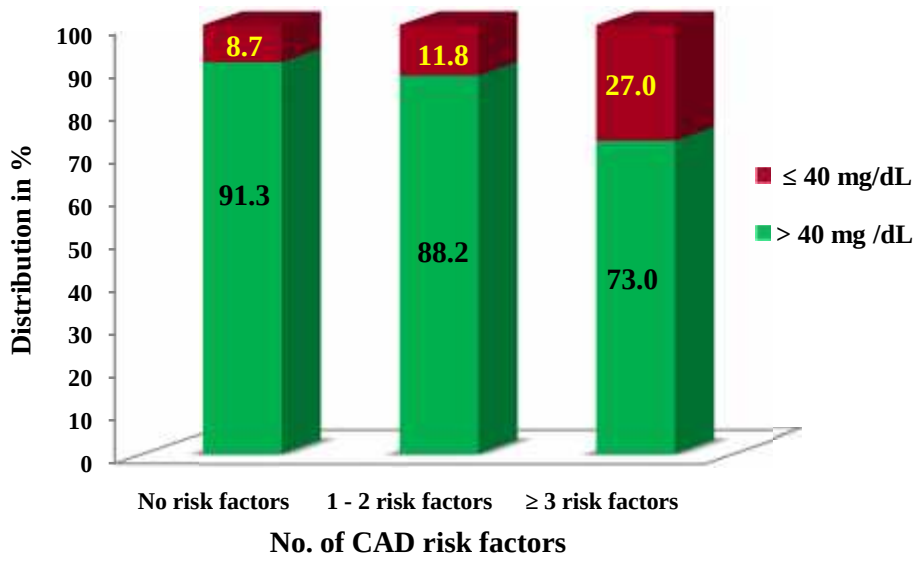
The mean ± SD values of TGL was found to be increasing with the number of risk factors i.e., 128.7 ± 71.9 in no risk category, 138.5 ± 52.1 in 1 to 2 risk category and 163.2 ± 63.0 in more than or equal to 3 risk factor categories.

SERUM HIGH DENSITY LIPOPROTEIN (HDL)

Table 21: Distribution of the selected participants according to Serum HDL and risk categories (N = 100)

Risk categories	Serum HDL categories (in mg/dL)		Total (%)
	≥ 40	< 40	
No risk factors	21 (91.3)	02 (8.7)	23 (100)
1 – 2 risk factors	45 (88.2)	06 (11.8)	51 (100)
3 or more risk factors	19 (73.0)	07 (27.0)	26 (100)
Total	**85 (85.0)**	**15 (15.0)**	**100 (100)**
χ^2 = 4.035	**Df = 2**	**P = 0.133**	

Graph 15: Distribution of the selected study participants according to serum HDL values and no. of CAD risk factors



Among study participants who were subjected to fasting HDL cholesterol examination 85.0% had normal HDL cholesterol levels and 15.0% had high cholesterol levels. However, this difference was not statistically significant when compared with the risk categories (P = 0.133).

The mean ± SD values of HDL was found to be decreasing with the number of risk factors i.e., 45.7 ± 4.1 in no risk category, 42.8 ± 3.3 in 1 to 2 risk category and 41.6 ± 3.4 in more than or equal to 3 risk factor categories.

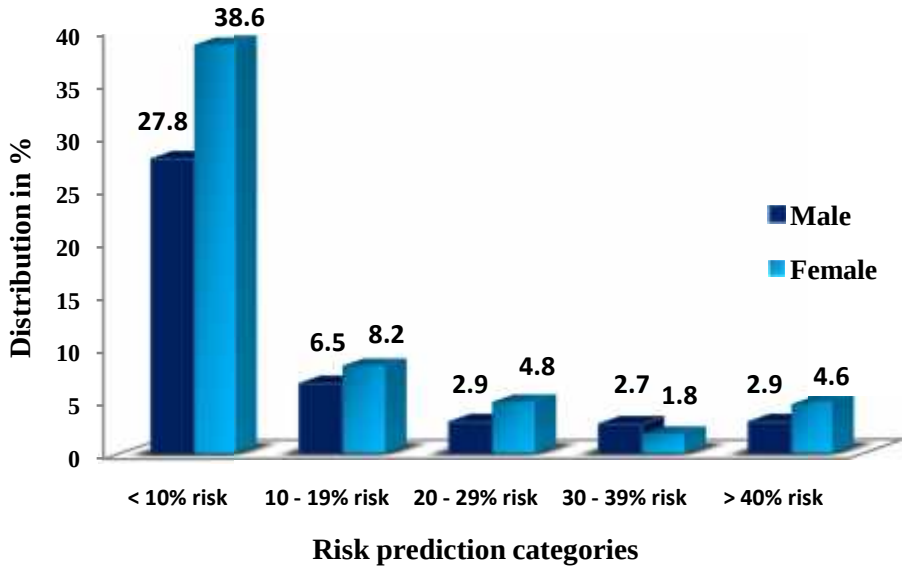
III. RISK PREDICTION FOR CAD

Table 22: Prediction of 10 year risk of fatal or non fatal cardiovascular event among the participants (N = 980)

Risk Prediction Categories	Men (%)	Women (%)	Total (%)
Not assessed*	273 (57.1)	211 (42.0)	484 (49.4)
< 10 % risk	133 (27.8)	194 (38.6)	327 (33.4)
10 – 19 % risk	31 (6.5)	41 (8.2)	72 (7.3)
20 – 29 % risk	14 (2.9)	24 (4.8)	38 (3.9)
30 – 39 % risk	13 (2.7)	9 (1.8)	22 (2.2)
≥ 40 % risk	14 (2.9)	23 (4.6)	37 (3.8)
Total	**478 (100)**	**502 (100)**	**980 (100)**
χ^2 = 25.686	**Df = 5**		**P < 0.0001**

[* Risk prediction was carried out in participants aged 40 years and above only as it is available only for those aged > 40 years]

Graph 16 : Distribution of the study participants according to predicted risk of CAD



In our study 496 (50.6%) had some risk of fatal or non-fatal cardio vascular event in their near future decade. Based on the WHO / ISH risk prediction chart category; majority i.e., 327 (33.4%) had < 10% risk; 72 (7.3%) had 10 – 19% risk; 38 (3.9%) had 20 – 29 % risk; 22 (2.2%) had 30 – 39% risk and 37 (3.8%) had ≥ 40% risk of fatal or non-fatal cardio vascular event in next 10 years.

Among the gender, women had significant higher risk of CAD as compared to men in near future decade ($P < 0.0001$).

IV. ASSOCIATION BETWEEN RISK FACTORS AND DEMOGRAPHIC VARIABLES.

A. Age and Risk factors for CAD.

Table 23 (a): Association between age and risk factors for CAD (N = 980)

Age group in years	No.	Smoking (%)	Tobacco use (%)	Alcohol use (%)	Sedentary at work (%)	Sedentary during Leisure (%)	Sedentary during Travel (%)
20 – 29	234	22 (9.4)	54 (23.1)	37 (15.8)	45 (19.2)	140 (59.8)	86 (36.8)
30 – 39	250	24 (9.6)	87 (34.8)	63 (25.2)	41(16.4)	105 (42.0)	47 (18.8)
40 – 49	262	28 (10.7)	105 (40.1)	68 (26.0)	46 (17.6)	110 (42.0)	50 (19.1)
≥ 50	234	33 (14.1)	104 (44.4)	42 (17.9)	47 (20.1)	139 (59.4)	40 (17.1)
Total	**980**	**107 (10.7)**	**350 (35.7)**	**210 (21.4)**	**179 (18.3)**	**494 (50.4)**	**223 (22.8)**
X^2 value **Degrees of freedom** **P value**		3.454 3 0.327	26.307 3 **< 0.0001**	11.366 3 **0.010**	1.336 3 0.721	30.386 3 **< 0.0001**	34.582 3 **< 0.0001**

The prevalence of tobacco use (smoking and smokeless) was more among participants in the age group ≥ 50 years, while both form of tobacco use was least in the younger age group 20 – 29 years.

Current alcohol consumption was more prevalent in middle age viz. 30 – 39 years (25.2%) and 40 – 49 years (26.0%)

Leisure time sedentary activities were more prevalent among all ages; as compared to work and travel related sedentary activities. Participants of extreme age were more sedentary at work and during leisure i.e., 19.6% and 59.6% respectively. Participants in 20 – 29 years group were more sedentary during travel to work (36.8%).

Association between age and tobacco use, alcohol use and sedentary activities at leisure time and travel were statistically significant with $P < 0.001$.

Table 23 (b): Association between age and risk factors for CAD (N = 980)

Age group in years	Number	Self reported Hypertension (%)	Self reported Diabetes (%)	Overweight (%)	Obese (%)
20 – 29	234	14 (6.0)	03 (1.3)	30 (12.8)	02 (0.9)
30 – 39	250	29 (11.6)	08 (3.2)	64 (25.6)	13 (5.2)
40 – 49	262	56 (21.4)	21 (8.0)	103 (40.1)	25 (9.5)
≥ 50	234	99 (42.3)	30 (12.8)	62 (26.5)	29 (12.4)
Total	**980**	**198 (20.2)**	**62 (6.3)**	**261 (26.6)**	**69 (7.0)**
χ^2 value		111.969	32.084	85.837	
Degrees of freedom		3	3	6	
P value		**< 0.0001**	**< 0.0001**	**< 0.0001**	

Self reported hypertension and diabetes were higher in age group ≥ 50 years i.e., 42.3% and 12.8% respectively. As the age increased prevalence of hypertension and diabetes also increased, this difference was statistically significant (P < 0.0001).

Prevalence of overweight and obesity increased significantly with age with the maximum prevalence of overweight was in 40 – 49 years group (40.1%) and that of obesity in ≥ 50 years group (12.4%) (P < 0.0001).

Table 23 (c): Association between age and risk factors for CAD (N = 980)

Age group in years	Number	Systolic hypertension (%)	Diastolic hypertension (%)	WC category (%)	WHR category (%)
20 – 29	234	17 (7.3)	23 (9.8)	47 (20.1)	145 (62.0)
30 – 39	250	48 (19.2)	61 (24.4)	69 (27.6)	145 (58.0)
40 – 49	262	88 (33.6)	98 (37.4)	139 (53.1)	201(76.6)
≥ 50	234	108 (46.2)	102 (43.6)	116 (49.6)	187 (79.9)
Total	**980**	**261 (26.6)**	**284 (29.0)**	**371 (37.9)**	**678 (69.2)**
χ^2 value		104.112	77.549	81.965	39.998
Degrees of freedom		3	3	3	3
P value		**< 0.0001**	**< 0.0001**	**< 0.0001**	**< 0.0001**

Both systolic and diastolic hypertension was found to be increasing with age and the maximum was in ≥ 50 years group (46.2% and 43.6% respectively) with statistical association (P < 0.0001).

Similarly abdominal obesity using WC and WHR criteria was significantly higher in 40 – 49 and ≥ 50 years group respectively. (P < 0.0001)

B. Educational status and Risk factors for CAD.

Table 24 (a): Association between educational status and risk factors for CAD (N = 980)

Educational status	No.	Smoking (%)	Tobacco use (%)	Alcohol (%)	Sedentary at work (%)	Sedentary during Leisure (%)	Sedentary during Travel (%)
No formal education	279	25 (9.0)	141(50.5)	48 (17.2)	30 (10.8)	132 (47.3)	42 (15.1)
Primary	137	21 (15.3)	58 (42.3)	35 (25.5)	20 (14.6)	68 (49.6)	37 (27.0)
Higher primary	134	17 (12.7)	44 (32.8)	34 (25.4)	18 (13.4)	62 (46.3)	27 (20.1)
High school	282	28 (9.9)	69 (24.5)	61 (21.6)	52 (18.4)	155 (55.0)	72 (25.5)
College / graduate	148	16 (10.8)	38 (25.7)	32 (21.6)	59 (39.9)	77 (52.0)	45 (30.4)
Total	**980**	**107 (10.9)**	**350 (35.7)**	**210 (21.4)**	**179 (18.3)**	**494 (50.4)**	**223 (22.8)**
χ^2 value		4.555	51.832	5.586	60.134	4.518	17.056
Degrees of freedom		4	4	4	4	4	4
P value		0.336	< **0.0001**	0.232	< **0.0001**	0.340	**0.002**

The prevalence of smoking tobacco and alcohol consumption was higher among participants who had their education up to primary level. However there was no significant association between them ($P > 0.05$).

The smokeless form of tobacco was consumed more by participants who did not have any formal education and the prevalence decreased with higher education levels ($P < 0.0001$).

Participants who had their education up to college level and above were in sedentary work and did not spend much energy while travelling to work place, as compared to others. This difference was statistically significant with $P < 0.0001$ and 0.002 respectively. However, there was no significant association between education level and leisure time sedentary activities ($P > 0.05$).

Table 24 (b): Association between educational status and risk factors for CAD (N = 980)

Educational status	Number	Self reported Hypertension (%)	Self reported Diabetes (%)	Over weight (%)	Obese (%)
No formal education	279	83 (29.7)	19 (6.8)	79 (28.3)	18 (6.5)
Primary	137	35 (25.5)	17 (12.4)	33 (24.1)	19 (13.9)
Higher primary	134	22 (16.4)	07 (5.2)	37 (27.6)	05 (3.7)
High school	282	38 (13.5)	12 (4.3)	75 (26.6)	19 (6.7)
College / graduate	148	20 (13.5)	07 (4.7)	37 (25.0)	08 (5.4)
Total	**980**	**198 (20.2)**	**62 (6.3)**	**261 (26.6)**	**69 (7.0)**
χ^2 value		31.413	11.615	13.501	
Degrees of freedom		4	4	8	
P value		**< 0.0001**	**0.020**	0.096	

Both self reported hypertension and diabetes prevalence was high in participants without any formal education and primary school level respectively. This association had statistical significance with P < 0.0001 and 0.020 respectively.

Though prevalence of overweight and obesity was more in lesser educated participants but it was not significant statistically (P = 0.096).

Table 24 (c): Association between educational status and risk factors for CAD (N = 980)

Educational status	Number	Systolic hypertension (%)	Diastolic hypertension (%)	WC category (%)	WHR category (%)
No formal education	279	109 (39.1)	102 (36.6)	132 (47.3)	225 (80.3)
Primary	137	33 (24.1)	43 (31.4)	61 (44.5)	108 (78.8)
Higher primary	134	36 (26.9)	39 (29.1)	41 (30.6)	82 (61.2)
High school	282	54 (19.1)	68 (24.1)	92 (32.6)	187 (66.3)
College / Graduate	148	29 (19.6)	32 (21.6)	45 (30.4)	76 (51.4)
Total	**980**	**261 (26.6)**	**284 (29.0)**	**371 (37.9)**	**678 (69.2)**
χ^2 value		34.373	15.312	22.969	50.351
Degrees of freedom		4	4	4	4
P value		**< 0.0001**	**0.004**	**< 0.0001**	**< 0.0001**

The prevalence of systolic and diastolic hypertension were significantly high (39.1% and 36.6%) among participants without any formal education and the prevalence decreased with higher education levels (P < 0.001; =0.004).

The prevalence of abdominal obesity assessed by WC and WHR categories were also significantly high among participants without any formal education; the difference was statistically significant with P < 0.0001.

C. Main work status and Risk factors for CAD.

Table 25 (a): Association between main work status and risk factors for CAD (N = 980)

Main work status	No.	Smoking (%)	Tobacco use (%)	Alcohol (%)	Sedentary at work (%)	Sedentary during Leisure (%)	Sedentary during Travel (%)
Govt. employee	65	06 (9.2)	14 (21.5)	16 (24.6)	27 (41.5)	19 (29.2)	07 (10.8)
Non - govt. employee	119	14 (11.8)	49 (41.2)	48 (40.3)	25 (21.0)	58 (48.7)	23 (19.3)
Self employee	378	71 (18.8)	168 (44.4)	119 (31.5)	59 (15.6)	154 (40.7)	67 (17.7)
Home maker	355	01(0.3)	90 (25.4)	06 (1.7)	31 (8.7)	219 (61.7)	109 (30.7)
Student	21	01 (4.8)	05 (23.8)	01 (4.8)	14 (66.7)	10 (47.6)	05 (23.8)
Retired	17	06 (35.3)	13 (76.5)	08 (47.1)	11 (64.7)	16 (94.1)	07 (41.2)
Unemployed	25	08 (32.0)	11 (44.0)	12 (48.0)	12 (48.0)	18 (72.0)	05 (20.0)
Total	**980**	**107(10.9)**	**350 (35.7)**	**210 (21.4)**	**179 (18.3)**	**494 (50.4)**	**223 (22.8)**
χ^2 value		88.239	50.729	151.077	119.897	61.721	27.715
Degrees of freedom		6	6	6	6	6	6
P value		**< 0.0001**	**< 0.0001**	**< 0.0001**	**< 0.0001**	**< 0.0001**	**< 0.0001**

The prevalence of smoking tobacco was high among participants who were retired from work (35.3%) and unemployed (32.0). The lower prevalence was noted among home makers (0.3%) and students (4.8%).

Chewing tobacco was highly prevalent among retired personnel (76.5%) followed by Self employed (44.4%), unemployed (44.0%) and non-government employees (41.2%). The lowest prevalence was noted among students (23.8%).

Similarly high prevalence of alcohol consumption was observed among unemployed (48.0%) and retired persons (47.1%). Students and home makers had lower prevalence; 1.7% and 4.8% respectively.

High prevalence of physical inactivity was observed among retired personnel all the categories (64.7 %, 94.1% and 41.2%).

All these behavioral risk factors were significantly associated with work status ($P < 0.0001$).

Table 25 (b): Association between main work status and risk factors for CAD (N = 980)

Main work status	Number	Self reported Hypertension (%)	Self reported Diabetes (%)	Over weight (%)	Obese (%)
Govt. employee	65	19 (29.2)	04 (6.2)	21 (32.3)	07 (10.8)
Non - govt. employee	119	18 (15.1)	07 (5.9)	37 (31.1)	05 (4.2)
Self employee	378	60 (15.9)	25 (6.6)	113 (29.9)	16 (4.3)
Home maker	355	86 (24.2)	18 (5.1)	77 (21.7)	38 (10.7)
Student	21	01 (4.8)	0 (0)	03 (14.3)	0 (0)
Retired	17	10 (58.8)	5 (29.4)	06 (35.3)	01 (5.9)
Unemployed	25	04 (16.0)	03 (12.0)	04 (16.0)	02 (8.0)
Total	**980**	**198 (20.2)**	**62 (6.3)**	**261 (26.6)**	**69 (7.0)**
χ^2 value		32.254	19.104	27.072	
Degrees of freedom		6	6	12	
P value		**< 0.0001**	**0.004**	**0.008**	

High prevalence of self reported hypertension and diabetes was noted among retired personnel (58.8% and 29.4%) and lowest prevalence was among students (4.8% and 0%) (P < 0.0001, =0.004)

High prevalence of overweight and obesity was observed among retired personnel (35.3%) and government employees (10.8%) respectively. The association was found be statistically significant (P = 0.008)

Table 25 (c): Association between main work status and risk factors for CAD (N = 980)

Main work status	Number	Systolic hypertension (%)	Diastolic hypertension (%)	WC category (%)	WHR category (%)
Govt. employee	65	15 (23.1)	15 (23.1)	31 (47.7)	45 (69.2)
Non - govt. employee	119	25 (21.0)	31 (26.1)	31 (26.1)	61 (51.3)
Self employee	378	112 (29.6)	124 (32.8)	124 (32.8)	225 (59.5)
Home maker	355	93 (26.2)	100 (28.2)	170 (47.9)	314 (88.5)
Student	21	02 (9.5)	02 (9.5)	02 (9.5)	11 (52.4)
Retired	17	06 (35.5)	05 (29.4)	06 (35.3)	09 (52.9)
Unemployed	25	08 (32.0)	07 (28.0)	07 (28.0)	13 (52.0)
Total	**980**	**261 (26.6)**	**284 (29.0)**	**371 (37.9)**	**678 (69.2)**
χ^2 value		8.286	8.272	37.253	104.634
Degrees of freedom		6	6	6	6
P value		0.218	0.219	**< 0.0001**	**< 0.0001**

The prevalence of systolic hypertension was high among retired persons (35.3%) followed by unemployed (32.0%). Home makers had highest prevalence of diastolic hypertension (32.8%). However this association was not statistically significant (P = 0.218, 0.219). A high prevalence of abdominal obesity assessed by WC and WHR criterion was observed among home makers (47.9% and 88.5%) which had statistically significant association (P < 0.0001).

D. Socio economic status and Risk factors for CAD.

Table 26 (a): Association between socio-economic status and risk factors for CAD (N = 980)

Socio-economic status	No.	Smoking (%)	Tobacco use (%)	Alcohol (%)	Sedentary at work (%)	Sedentary during Leisure (%)	Sedentary during Travel (%)
Class I	31	03 (9.7)	05 (16.1)	08 (25.8)	09 (29.0)	19 (61.3)	13 (41.9)
Class II	153	23 (15.0)	49 (32.0)	43 (29.4)	43 (28.1)	77 (50.3)	42 (27.5)
Class III	295	33 (11.2)	107 (36.3)	71 (24.1)	51 (17.3)	151 (51.2)	69 (23.4)
Class IV	369	37 (10.0)	137 (37.1)	58 (15.7)	49 (13.3)	178 (48.2)	71 (19.2)
Class V	132	11 (8.3)	52 (39.4)	28 (21.2)	27 (20.5)	69 (52.3)	28 (21.2)
Total	**980**	**107(10.9)**	**350 (35.7)**	**210(21.4)**	**179 (18.3)**	**494 (50.4)**	**223 (22.8)**
χ^2 value		3.942	7.225	14.515	19.086	2.419	11.246
Degrees of freedom		4	4	4	4	4	4
P value		0.414	0.124	**0.006**	**0.001**	0.659	**0.024**

The prevalence of smoking tobacco was more among participants belonged to class II (15.0%) and smokeless form of tobacco was more among participants belong to class V (39.4%); while the least number of smokers belonged to class V and least number of smokeless tobacco users were in class I.

Current alcohol consumption was more (29.4%) prevalent in participants belonging to SES class II, followed by SES class I (28.4%), while it was least (15.7%) prevalent in SES class IV.

Leisure time sedentary activities were more prevalent among all the SES groups as compared to job and travel related sedentary activities. Prevalence of work related, leisure time and travel related sedentary activities were more in the SES class I (29.0%, 61.3% and 41.9% respectively).

The alcohol use and work and travel related physical activities were significantly associated with different socio economic status ($P < 0.05$).

Table 26 (b): Association between socio-economic status and risk factors for CAD (N = 980)

Educational status	Number	Self reported Hypertension (%)	Self reported Diabetes (%)	Over weight (%)	Obese (%)
Class I	31	05 (16.1)	01 (3.2)	12 (38.7)	03 (9.7)
Class II	153	31 (20.3)	13 (8.5)	39 (25.5)	15 (9.8)
Class III	295	45 (15.3)	18 (6.1)	94 (31.9)	16 (5.4)
Class IV	369	79 (21.4)	22 (6.0)	86 (23.3)	28 (7.6)
Class V	132	38 (28.8)	08 (6.1)	30 (22.7)	07 (5.3)
Total	**980**	**198 (20.2)**	**62 (6.3)**	**261 (26.6)**	**69 (7.0)**
χ^2 value		11.168	1.842	13.594	
Degrees of freedom		4	4	8	
P value		**0.025**	0.765	0.093	

Self reported hypertension was more prevalent among class V (28.8%) with significant association (P = 0.025).

Self reported diabetes was more prevalent among class II; however the difference in prevalence between other SES classes was not significant (P = 0.765)

Higher prevalence of overweight and obesity was observed among class I (38.7%) and class II (9.8%) respectively. The difference in the prevalence among different SES classes was not statistically significant (P = 0.093).

Table 26 (c): Association between socio-economic status and risk factors for CAD (N = 980)

Educational status	Number	Systolic hypertension (%)	Diastolic hypertension (%)	WC category (%)	WHR category (%)
Class I	31	07 (22.6)	06 (19.4)	14 (45.2)	17 (54.8)
Class II	153	40 (26.1)	48 (31.4)	56 (36.6)	100 (65.4)
Class III	295	73 (24.7)	86 (29.2)	108 (36.6)	207 (70.4)
Class IV	369	99 (26.8)	105 (28.5)	147 (39.8)	269 (72.9)
Class V	132	42 (5.3)	39 (29.5)	46 (34.8)	85 (64.4)
Total	**980**	**261 (26.6)**	**284 (29.0)**	**371 (37.9)**	**678 (69.2)**
χ^2 value		2.641	1.895	2.124	7.987
Degrees of freedom		4	4	4	4
P value		0.620	0.755	0.713	0.092

High prevalence of systolic and diastolic hypertension was observed among SES class V (31.8%) and class II (31.4%) respectively.

High prevalence of abdominal obesity was observed class I (45.2%) by WC criteria; class IV (72.9%) by WHR criteria.

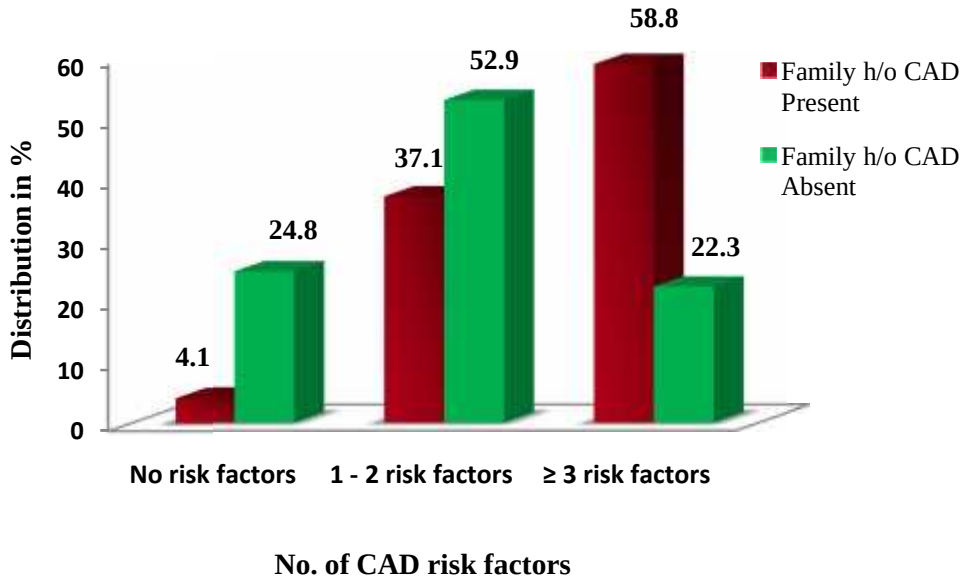
The above biological risk factors were not having statistical association with socio-economic status of the participants ($P > 0.05$).

E. Family history of CAD and Risk categories

Table 27: Association of family history of CAD and number of risk factors for CAD (N = 980)

Risk categories	Family history of CAD		Total (%)
	Present	Absent	
No risk factors	04 (4.1)	219 (24.8)	**223 (22.8)**
1 – 2 risk factors	36 (37.1)	467 (52.9)	**503 (51.3)**
3 or more risk factors	57 (58.8)	197 (22.3)	**254 (25.9)**
Total	**97 (100)**	**883 (90.1)**	**980 (100)**
χ^2 = 65.468	**Df = 2**	**P < 0.0001**	

Graph 17 : Association of the family history of CAD and no. of CAD risk factors



In our study, 58.8% participants who had 3 or more risk factors for CAD had family history of CAD and 37.1% who had 1 to 2 risk factors had family history of CAD. Only 1.7% of them did not have any risk factors of CAD but had family history of CAD. This association was statistically significant ($P < 0.0001$).

DISCUSSION

The present study was conducted at Kakati – A sub centre under Primary Health Center, Vantamuri which is a rural field practice area of Department of Community Medicine, Jawaharlal Nehru Medical College, Belgaum, during the period January 2012 to December 2012.

I. PROFILE OF STUDY PARTICIPANTS

In the present study, 48.8% were men with mean age 38.2 ± 10.66 years and 51.2% were women with mean age 40.4 ± 11.32 years. Maximum numbers (33.9%) of male participants were in age group of 30 – 39 years and minimum (18.4%) in ≥ 50 years age group. Maximum numbers of female participants were (29.1%) in the age group of ≥ 50 years and minimum (17.5%) were in 30 – 39 years age group. Two studies conducted in rural area of Faridabad and Delhi districts of North India showed that, the proportion of women was higher (52.0%; 62.5%) as compared to men (48.0%; 37.5%).[79, 82] Similar to our study, a study conducted at Mukim Dengkil, Malaysia showed that, participants aged 30 – 39 years were 20.7% and ≥ 50 years were 15.8% with higher proportion of women.[73] (Tables 1 & 2)

In the present study, majority of study participants were self employed (38.6%) and home makers (36.2%). Only 6.6% of them were Govt. employees. Study done at Northern Delhi district also showed that higher proportion of participants were self employed (49.2%) followed by Govt. employees (16.4%).[79] (Table 3)

In the present study 28.5 % did not have any formal education, 27.6% studied up to primary and higher primary, 28.8% up to high school and 15.1% up to college or graduation level. A study conducted in rural Rajasthan showed that, more number of participants did not have formal schooling (40.7%), but similar to our study 26.8% of them had education up to high school level and only about 11.6% were graduates.[95] (Table 4)

In our study Hindus were less (82.8%) as compared to a study done in rural area of Tamil Nadu (89.2%).[80] The proportion of married participants were similar in our study and in study done at Kancheepuram district, Tamil Nadu which was 88.2% vs. 90.8% respectively. [80] (Table 5 & 7).

In the present study, majority of study participants belonged to class IV SES (37.6%) followed by class III (30.1%) and the least belonged to class I (3.2%). On the contrary in a study done at Tirupati district, Andhra Pradesh reported higher proportion in class II (24.6%), followed by class IV (23.5%) and least were in class V (17.1%).[86] (Table 6)

In our study, 9.9% had family history of CAD among parents of which 7.5% had history of CAD in father only, 2.2% had history in mother only and 0.2% had history of CAD in both parents. A study done at rural area of Pune district showed similar results i.e., family history of CAD was 7.4% and 5.1% in a study done at Kancheepuram district.[79, 80] A study done at Eastern Nepal, revealed higher prevalence of family history of CAD i.e., 19.3%.[75] This result could be due to smaller sample size of the study (N =140). (Table 8)

II. PREVALENCE AND DISCRIPTION OF THE RISK FACTORS

In the present study, the prevalence of smoking tobacco was 10.9% with significantly high proportion among men (22.0%) compared to women (0.4%). Other studies conducted at Delhi and Kancheepuram districts revealed a higher prevalence of smoking compared to our study i.e., 17.6% and 29.4% respectively.[79, 80] The mean age of onset of smoking and average duration of smoking was comparable to other studies.[79, 80] Daily smokers were significantly higher in our study and only two women reported to be current smokers; in other studies none of the females were smokers.[79, 80] Although a higher proportion of smoking was observed among men, it is well below the national average according to NFHS – III estimate for rural area i.e., 35.0% and 1.8% among men and women respectively.[60] (Tables 9.a – b)

In our study the prevalence of use of smokeless tobacco (35.7%) and was considerably higher among men (46.7%) compared to women (25.3%). High use of smokeless tobacco among both men and women was due to social acceptance and belief regarding role in minor ailments like tooth ache. NFHS – III report documented a lower rate of smokeless tobacco use among men (39.6%) and women (9.8%) as compared to our study.[60] The overall prevalence of smokeless tobacco, the mean age of onset and duration was comparable with a population based study done in rural Andhra Pradesh.[95] In our study the prevalence among men was two times that of women. On the contrary a study conducted in Pune district the proportion among men (25.7%) was five times that of women (4.8%).[81] (Tables 10.a – b)

In the present study, prevalence of alcohol use was 21.4%. Among men the prevalence was very high (41.8%) as compared to that of women (2.0%). A study conducted at rural Tamil Nadu showed a higher prevalence among men (69.8%) and lower prevalence among women (1.3%).[80] Daily consumption of alcohol was noted in 19.5% of participants in our study which was much higher than recorded in a study conducted at rural area of Vietnam (9.9%) and Pune (9.4%).[76, 81] (Tables 11.a – b)

In our study, most of the participants (61.1%) consumed fruits on 1 to 3 days a week, whereas 8.2% of the participants consumed every day and an equal proportion of them never consumed fruits (8.0%). Our results are comparable to a similar observation in a resettlement area of Delhi.[96] In our study, men consumed lesser fruits compared to women. A contrary observation was documented in a study conducted in 18 states of India where lower consumption was observed among women.[83] A daily vegetable consumption was noted among 82.3% of participants and 15.7% of them reported vegetable consumption, 4 to 6 days a week. A study conducted in rural Vietnamese population revealed a lower vegetable consumption rate i.e., 28.4%.[76] (Tables 12.a – b)

Among the participants 58.8% of them used ground nut oil for cooking followed by sunflower oil (16.5%) and palm oil (10.8%). The reason for preference was ease of availability. Study conducted in rural area of Kancheepuram and Thiruvallur districts reported palm oil as the predominant type (39.8%) followed by sunflower oil (35.0%) and ground nut oil (29.1%).[80] (Table 12.c)

Extra salt consumption documented in our study was 20.4% with a higher proportion among men (59.5%). In a study conducted in rural area of Pune, a higher proportion of participants consumed extra salt (34.2%) especially among women.[81] (Table 12.d)

In our study, work or job related sedentary activity was observed among 18.3% with higher proportion among men (61.4%). A similar prevalence (18.5%) was noted in a study conducted in Pune; [81] on the contrary a very high prevalence (57.2%) was seen in a rural area of Faridabad district.[82] In our study, leisure time and travel related sedentary activity was noted among 50.4% and 22.8% of individuals respectively. A similar study conducted in rural area of Chennai district reported higher proportion of sedentary activity during leisure time i.e., 98.6%.[97] (Tables 13.a – c)

In the present study, the prevalence of self reported hypertension was among 20.2% of the participants, with higher prevalence among women (22.9%) compared to men (17.4%). A study conducted at rural area of Indonesia reported a similar overall prevalence (21.6%).[77] Another study done at rural area of Mukim Dengkil, Malaysia reported a higher prevalence of self reported hypertension among men (31.7%).[73] In a similar study done at rural Faridabad district showed a higher prevalence of self reported hypertension among women (6.8%) compared to men (3.5%).[82] (Table 14.a)

In our study, 6.3% of them reported having diabetes mellitus; prevalence among men was 7.9% and 4.8% among women. A similar prevalence was noted in a study conducted at rural area of Tamil Nadu (4.0%).[80] Another study done in

18 states of India documented a prevalence of 3.3% and 4.4% in men and women respectively.[83] (Table 14.b)

In the present study the overall prevalence of overweight and obesity were 26.7% and 7.0% respectively. Study conducted in rural area of Pune reported 18.0% of overweight and 3.2% of obesity which was much less compared to our study.[81] The prevalence of obesity among women was high compared to men. Similar findings were documented in a study done in other rural areas of Tamil Nadu and Mukim Dengkil, Selangor.[73, 80] Overall 33.7% of the paricipants had BMI >25.0 Kg/m^2 in our study which was well in accordance with the estimated range of overall prevalence for South East Asia i.e., 26.3% – 56.0%.[98] (Table 15.a)

The overall prevalence of central obesity assessed by WC and WHR were 37.9% and 69.2% respectively. Women had higher values of WC and WHR. Other similar studies documented a lesser over all prevalence but the proportion was higher among women.[79, 80, 81 and 83.] The remarkably high WHR and WC observed in our study in both males (41.0% and 23.0% respectively) and females (96.0% and 52.0% respectively) which requires special attention. Similar finding with two fold increased prevalence among women was observed in a study done in rural area of Thiruvanantapuram district of Kerala.[87] (Tables 15.b – c)

Increased predisposition to premature CAD in Indians has been attributed to the "Asian Indian phenotype", characterized by less of generalized obesity measured by BMI and greater central body obesity as shown by greater WC and WHR.[99] Our study substantiates this hypothesis. (Table 15.c)

In the present study the prevalence of systolic and diastolic hypertension was 26.6% and 29.0% respectively. Hypertension prevalence was slightly high in males as compared to females. A study done in rural area of Pune district also substantiated our findings of higher proportion of systolic and diastolic hypertension among men (19.7% and 17.0% respectively) compared to women (15.6% and 14.4% respectively).[81] Two other studies reported overall higher prevalence of hypertension of 35.3% and 36.9% done at Eastern Nepal and Delhi respectively.[75, 79.] (Tables 16.a – b)

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 as; no risk factors, 1 to 2 risk factors and ≥ 3 risk factors and the proportion of the participants were 22.8%, 51.3% and 25.9% respectively. Men were having more risk factors than compared to women. This could be attributed to higher prevalence of tobacco use and alcohol consumption among them. A study conducted in rural Indonesia reported the clustering of risk factors for risk assessment into 3 groups as; no risk factors, 1 risk factor and ≥ 2 risk factors in the proportion of 59.7%, 33.3% and 7.0% respectively.[77] (Table 17)

Based on the risk assessment 10 % of each group of risk categories were randomly selected for STEP 3 i.e., biochemical risk factor assessment, i.e., **23** from no risk factor category, **51** from 1 – 2 risk factors category and **26** from more than or equal to 3 risk factors categories.

In our study, the prevalence of the Impaired Fasting Glucose (IFG) was high in 1 to 2 risk factor group and blood sugar level of ≥ 126 mg/dL was seen in more than or equal to 3 risk factor prevalence was high in more than or equal to 3 risk factor group. This difference was statistically significant (P = 0.017). The mean ± standard deviation of serum FBS was found to be increasing with increased number of risk factors. (Table 18)

Our study noted a high prevalence of hyper cholesterolaemia among sample of participants with 3 or more CAD risk factors (P = 0.023). The mean ± standard deviation of serum TC was found to be increasing with increased number of risk factors. (Table 19)

In our study, the prevalence of hyper triglyceridemia done on selected participants was noted higher in individuals with one of more risk factors (86.1%) (P = 0.020). The mean ± standard deviation of serum TGL was found to be increasing with increasing number of risk factors. (Table 20)

Our study noted a higher proportion of a HDL value of < 40 mg/dL among sample of individuals with one or more risk factors; although it did not show statistical difference (P = 0.113). The mean ± standard deviation of serum HDL was decreasing with increasing number of risk factors. (Table 21)

The Indian migration study which was conducted in 18 states of India showed that the mean values of serum TC and TGL increased with increasing age whereas mean values of serum FBS and HDL did not show any difference across different age groups.[83]

The CAD risk was predicted using WHO / ISH risk prediction charts among the participants aged 40 years and above. 50.6% of the participants had some risk of fatal or non-fatal cardio vascular event in their near future decade which is a significant high burden in the rural area. Women exhibited a significant higher risk in each level of risk prediction categories. This could be attributed to the attainment of menopause and associated higher prevalence of smokeless tobacco use, overweight and raised blood pressure, which pose an increasing risk for CAD and in the middle age women tend to develop more number of risk factor. (Table 22)

III. ASSOCIATION BETWEEN RISK FACTORS AND SOCIO – DEMOGRAPHIC VARIABLES

In our study the association of various risk factors with **age** was statistically significant for; tobacco and alcohol use, leisure and travel related physical inactivity, self reported hypertension and DM, overweight and obesity, systolic and diastolic hypertension, WC and WHR categories ($P < 0.0001$). The prevalence of these risk factors increased with advancing age. The smoking prevalence was higher among ≥ 50 years age group, but statistical difference was not established ($P = 0.327$). The rising trend of smoking even in younger age group could be the reason. Work related physical inactivity did not show any significant trend with increasing age ($P = 0.721$). The possible reason was that the similar prevalence at the extreme age groups i.e., 20 – 29 years and ≥ 50 years age group. The younger age group consisting students and unemployed

participants and older age group consisting retired individuals were more sedentary at work. Similar findings were reported by other studies conducted in rural area of, Nigeria, Malaysia, Vietnam, Indonesia, Tamil Nadu, Maharashtra and Northern India.[71, 73, 76, 77, 80, 81, 100] (Tables 23.a – c)

In the present study, an inverse graded relationship of various risk factors and **educational status** was observed for; tobacco use, self reported hypertension and DM, systolic and diastolic hypertension, WC and WHR categories ($P < 0.001$) where the prevalence decreased with increased education levels. A significant increase in work and travel related physical inactivity was observed with increasing education ($P < 0.001$). The prevalence of smoking, alcohol use and leisure time sedentary activity did not differ with the educational status ($P > 0.05$).This could be attributed to the work status of the individual. Prevalence of overweight and obesity did not differ statistically with education, though the lowest prevalence was among highest level of education ($P = 0.09$). Similar finding was noted in a multi centre study conducted in India.[95, 101] (Table 24.a – c)

In our study, the association of various risk factors with **main work status** was statistically significant for; smoking, tobacco and alcohol use, all categories of physical inactivity, self reported hypertension and DM, Overweight and obesity, WC and WHR categories ($P < 0.0001$). Prevalence of systolic and diastolic hypertension did not show statistical difference between work categories. ($P = 0.219$). Retired individuals had highest prevalence of tobacco use in any form, alcohol use, physical inactivity, self reported hypertension and DM and overweight. Government employees were more obese. Home makers who

were predominantly women were having highest prevalence of central obesity. Similar findings were noted in a study conducted in rural Vietnam.[76, 95] (Table 25.a – c)

In the present study, the association of various risk factors with **socio-economic status** was statistically significant for; alcohol use, work and travel related physical inactivity and self reported hypertension ($P < 0.0001$). The prevalence of alcohol use was high among SES class II. Individuals belonging to class I was more sedentary compared to other SES class. Self reported hypertension was more prevalent among class V. Smoking, tobacco use, self reported DM, high blood pressure and abdominal obesity did not differ in their prevalence across the SES class. A similar finding was observed in a multicentre study conducted in 18 states of India and rural Vietnam.[76, 83] (Table 26.a – c)

In our study, the association between family history of CAD and the presence of the number of risk factors was statistically significant ($P < 0.0001$). More number of positive family histories of CAD had 3 or more risk compared to risk factors. A similar finding was observed in other studies.[53, 102.] (Table 27)

CONCLUSION

The present community based study, reported a higher prevalence of behavioral risk factors for CAD which included tobacco consumption in any form, alcohol use, low fruit and extra salt consumption, sedentary at work, leisure and travel and history of hypertension and DM was documented; with higher proportion among men. Biological risk factors which included hypertension and overweight were observed in a significantly higher proportion among men; whereas women were more obese with a significant higher proportion of them being centrally obese.

Three fourth of the participants had one or more risk factors for CAD; whereas about one third of them had 3 or more risk factors. Bio-chemical risk factors including FBS, TC and TGL levels showed a significant increase in their mean values with increase in number of risk factors, whereas HDL level was more in those with lesser number of risk factors. Half of the participants, especially women had some risk of major cardio vascular event in their near future decade. Higher proportion of CAD risk factors were noted among individuals with family history of CAD.

The prevalence of behavioral and biological risk factors increased with advancing age; lesser or no education was a significant factor for higher prevalence of tobacco use; hypertension, DM and abdominal obesity. Conversely, higher education was proportional to increased sedentary life style.

Sedentary work status was the determinant factor in high prevalence of tobacco use in any form, alcohol use, physical inactivity, hypertension, DM and

overweight. Higher SES was noted to be more sedentary. But majority of the behavioral and biological risk factors did not differ in their prevalence across the SES class.

Our study demonstrated a significant higher prevalence of behavioral and biological risk factors for CAD in rural population in South India. Burden of CAD risk factors in this population reflects epidemiological transition which requires an immediate attention.

LIMITATIONS

The limitations of the study were:

1. Biochemical risk factors could not be assessed among all the study participants as it was not feasible.

2. Risk prediction was not carried out among all the participants due to unavailability of risk prediction charts for younger age i.e., < 40 years.

3. Invisible fat was not taken into consideration while assessing consumption of fat

4. Exact quantity of salt intake was not assessed, only extra salt intake was considered.

5. Memory bias could have occurred while assessing some of the behavioral risk factors for CAD.

RECOMMENDATIONS

Based on the findings of our study, following recommendations are being suggested for prevention and control of CAD by assessment of the risk factors:

1. Health education about modifiable risk factors like
    - ❖ Reducing the use of tobacco and alcohol
    - ❖ Increasing the consumption of fruits and vegetables
    - ❖ Reducing intake of extra salt
    - ❖ Avoiding sedentary lifestyle at work, leisure and travel.
    - ❖ Maintenance of ideal body weight
2. Screening for detection of hypertension and diabetes mellitus through high risk screening.
3. Special focus on adolescents of rural area – targeted for health promotional programmes for primary prevention of CAD, by reducing the modifiable risk factors.
4. Strengthening the surveillance for CAD risk factors through national and regional data base of CAD risk factors.
5. A nationwide initiative to create awareness among the people through mass media regarding the harmful effects of tobacco and alcohol, with main focus on children and adolescents, so as to deter early initiation of smoking and alcohol.

6. Fixed days and time for NCD clinic for creating awareness about CAD and other NCD's at primary health centre.

7. Strict enforcement of laws and monitoring for the control of tobacco and alcohol use.

8. Mandatory screening for risk factors for CAD among individuals aged 40 years and above attending sub centre or primary health centre and use of risk prediction charts at primary care level for identification of high risk individuals for early intervention.

SUMMARY

The present study was a community based cross sectional study undertaken to assess the risk factors for coronary artery disease among rural adults aged between 20 to 60 years and also to predict the future risk of major cardiovascular event based on the WHO – ISH risk prediction charts.

The study included 980 participants aged between 20 to 60 years belonging to Kakati – A sub centre under PHC, Vantamuri 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 2012 to 31st December 2012. A pre-designed and pre-tested questionnaire was used to collect the data from the participants.

In the present study, 48.8% were men with mean age 38.2 ± 10.66 years and 51.2% were women with mean age 40.4 ± 11.32 years. Majority were in between 40 – 49 years (26.7%).

Majority of the study participants were self employed (38.6%) and home makers (36.2%). 28.5% of the participants did not have any kind of formal education; 27.6% of them studied up to primary and higher primary; Majority of study participants belonged to SES class IV (37.8%); 82.8% of participants were Hindus; most of them were married (91.6%) and 9.9% of the participants had family history of CAD among parents.

The prevalence of smoking was 10.9% and use of smokeless tobacco was 35.7%, with higher proportion among men. The mean age of onset of tobacco

use was ≈ 22 years. Most of them were daily users. The prevalence of alcohol consumption was seen among 21.4% with significantly higher proportion among men. Majority of them (60.0%) consumed 1 – 4 days per week.

Among the participants 8.0% of them did not consume any fruits regularly and an equal proportion of them consumed every day (8.2%). Vegetable consumption was noted on all days among 82.3% participants. Groundnut oil was the most type of oil used. One fifth of the participants (20.4%) had habit of extra salt consumption.

Work, leisure time and travel related sedentary activity was observed among 18.3%, 50.4% and 22.8% of the participants respectively with higher proportion among men in all three categories.

One fifth of the participants reported themselves to be hypertensive (20.2%), with higher prevalence among women compared to men. The prevalence of self reported diabetes mellitus was 6.3% with higher prevalence among men.

The overall prevalence of overweight and obesity was 26.7% and 7.0% respectively. The prevalence of overweight was more among men compared to women (31.8% vs. 21.7%); whereas among obese, women outnumbered men (10.3% vs. 3.5%). Prevalence of central obesity assessed by WC and WHR were 37.9% and 69.2% respectively. This prevalence among women was two times higher than that of men.

The prevalence of systolic pre-hypertension (43.1%) was nearly two times to that of systolic hypertension (26.6%) among the participants. The prevalence diastolic pre-hypertension and hypertension was similar (28.7% and 29.0%). Men were relatively at higher risk of being pre-hypertensive and hypertensive in both systolic and diastolic blood pressure categories.

Three fourth of the participants had one or more risk factors for CAD. About half of the participants had 1 to 2 risk factors (51.3%) and One fourth of the participants had 3 or more coronary risk factors (25.9%).

Among randomly selected 10% of total participants based on the risk stratification, bio-chemical risk factors was estimated; where the mean ± SD values of FBS, TC and TGL significantly increased with increase in number of risk factors; whereas mean ± SD value of HDL was more in those with lesser number of risk factors.

The CAD risk was predicted using WHO / ISH risk prediction charts among the participants aged 40 years and above; where half of the participants (50.6%) had some risk of major cardio vascular event in their near future decade. Women exhibited a significant higher risk compared to men.

As age advanced the prevalence of tobacco and alcohol use, leisure and travel related sedentary life, self reported hypertension and DM, overweight and obesity, systolic and diastolic hypertension and abdominal obesity increased; with higher proportion among participants aged more than 50 years.

An inverse graded relationship of various risk factors and educational status was observed where lesser or no education was a significant factor for higher prevalence of tobacco use, self reported hypertension and DM, systolic and diastolic hypertension and abdominal obesity. Conversely, a significant higher proportion of work and travel related physical inactivity was observed with increasing education.

Retired individuals had highest prevalence of tobacco use in any form, alcohol use, physical inactivity; self reported hypertension, DM and overweight. Government employees were more obese. Home makers who were predominantly women were having highest prevalence of central obesity.

The prevalence of alcohol use was high among SES class II. Individuals with class I were more sedentary compared to other SES class. Self reported hypertension was more prevalent among class V. Smoking, smokeless tobacco use, self reported DM, high blood pressure and abdominal obesity did not differ in their prevalence across the SES class.

Among individuals with family history of CAD, > 50.0% had 3 or more risk factors as compared to 22.3% participants without any family history of CAD.

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ANNEXURE I – ETHICAL CLEARANCE CERTIFICATE

K.L.E.SOCIETY'S
JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELGAUM-590010 (KARNATAKA-INDIA)
(Affiliated to KLE University, Belgaum)

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Ref: MDC/PG/ **Date: 21/10/2011**

To, **Reg.No:BD0111001.**

Postgraduate Student,
Department of Community Medicine,
J.N.Medical College,
BELGAUM.

Sub: Institutional Ethical Clearance for the study.

Dear Dr. **Reg.No:BD0111001.**

With reference to the above, I wish to inform you that the research project "**ASSESSMENT OF THE RISK FACTORS FOR CORONARY ARTERY DISEASE AMONG ADULTS RESIDING IN RURAL AREA – A CROSS SECTIONAL STUDY**", is Ethical and justifiable and has been cleared by the departmental Ethical Committee and College Dissertation and Research Committee.

Chairman
College Ethical Dissertation
And Research Committee,
J.N.Medical College, Belgaum.

ANNEXURE II – CONSENT FORM

INFORMED CONSENT FORM

"ASSESSMENT OF THE RISK FACTORS FOR CORONARY ARTERY DISEASE AMONG ADULTS RESIDING IN RURAL AREA – A CROSS SECTIONAL STUDY."

Investigator: REG. NO.BD0111001

INTRODUCTION (PURPOSE OF THE STUDY):

The present study is conducted among people aged between 20 to 60 years residing in the Kakati village to know the risk factors associated with Coronary Artery Disease. 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 Blood pressure 3 times along with measurements of weight, height, waist and hip circumference. Selected 100 participants will undergo investigation for fasting blood sample for investigation Serum FBS, TC, TGL and HDL and the reports will be shared with the participants. 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 you will 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 Chairman, Jawaharlal Nehru Medical College Institutional Ethics Committee on human subject's research on 0831-2471701.

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.

1. Name of the **Participant**:_____

Signature/ left thumb impression of the participant:_____

2. Name of the **Investigator**:_____

   Signature of the investigator:_____

3. Name of the **Eye witness**:_____

   Signature/ left thumb impression of the eye witness:_____

   Date: _____ Place:_____

ANNEXURE III – PROFORMA

K.L.E. UNIVERSITY's

J.N.MEDICAL COLLEGE, BELGAUM

DEPARTMENT OF COMMUNITY MEDICINE

RESEARCH QUESTIONNAIRE

Investigator: REG. NO.BD0111001

"ASSESSMENT OF RISK FACTORS FOR CORONARY ARTERY DISEASE AMONG ADULTS RESIDING IN RURAL AREA - A CROSS SECTIONAL STUDY"

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

Identification number: |___|___|___| Date of interview: : |___|___|___|

Place: _____ Area: _____

STEP 1: SOCIO DEMOGRAPHIC FACTORS			
1	Name		
2	Age	(in years)	
3	Sex	Male -1 , Female -2	
4	Address		
5	Work (occupation)	Govt. employee (1) Non-govt.emp.(2) Self employee(3) Home maker(4) Student(5) Retired (6) Refused (7)	
6	Education	No formal Schooling (1) Primary(2) Secondary (3) High school (4) College and degree (5) Post-graduation (6)	
7	Religion	H 1 M2 C3 O4	
8	Marital status	Married (1) Unmarried (2)	
9	Income (per capita)		
10	Socio economic status	I / II / III / IV / V	
11	Family history	Present (1) Absent (2) CAD (1), DM (2), HTN (3)	
12.	Family members	Father (1) Mother (2) Both (3)	

STEP 1: BEHAVIORAL MEASUREMENTS

1. (A) SMOKING TOBACCO			
13	Do you currently smoke any tobacco products Such as cigarettes, cigars or pipes?	Yes 1 No 2	

14	If yes, How often do you smoke any tobacco products?	Daily 1 Occasionally 2 Past smoker 3	
15	For daily smokers A. What was your age? When you first started? Smoking daily?	Age (years)	
	B. On an average how many of the following, do you smoke daily?	Cigarette 1 Beedis 2 Pipe 3 Other (specify) 4	
	C. During the past 12 months have you ever reduced or stopped smoking as a conscious decision, even for a continuous period of 1 month?	Yes 1 No 2	
16	If past smoker: What was your age when you stopped smoking?	Age (years)	

1. (B) SMOKLESS TOBACCO			
17	Do you use any smokeless tobacco (Snuff, Gutka, chewing tobacco)?	Yes 1 No 2	
18	How often you consume any smokeless tobacco products?	Daily 1 Occasionally 2 Past smoker 3	
19	For daily consumers, **A**. What was your age when you first started consuming tobacco products daily?	Age (years)	
	B. On an average how many times a day do you consume the following?	Snuff 1 Ghutka 2 Chewing tobacco 3 Others (specify) 4	
	C. During the past 12 months have you ever reduced or stopped consuming smokeless tobacco as a conscious decision even for a continuous period of 1 month?	Yes 1 No 2	
20	If past user, what was your age? When you stopped consuming smokeless tobacco?	Age (years)	

2. ALCOHOL CONSUMPTION			
21	Have you ever consumed a drink that contains alcohol?	Yes 1 No 2	
22	Have you consumed alcohol within past 12 months?	Yes 1 No 2	
23	Type of beverage?	Beer (1) Whisky(2) Rum(3) Brandy (4) Country liquor(5)	
24	In the past 12 months, how frequently have you had at least one drink?	5 or more days a week 1 1 – 4 days a week 2 1 – 3 days a month 3 Less than once a month 4	
25	When you drink alcohol, an average, how many drinks do you have during one day?	Numbers _____1 Don't know 2	
26	During the past 12 months, have you ever reduced or stopped drinking, as a conscious decision, even for a continuous period of 1month?	Yes 1 No 2	

3. DIET			
27	In a typical week, on how many days do you eat fruit?	Number of days Don't know	
28	How many servings of fruit do you eat on one of those days?	Number of servings Don't know	
29	In a typical week, on how many days do you eat vegetables?	Number of days Don't know	
30	How many servings of fruit do you eat on one of those days?	Number of servings Don't know	
31	What type of oil or fat is most often used for meal preparation in your household?	Sunflower oil (1) Soyabean oil (2) Groundnut oil (3) Palm oil (4) Others (5)	
32	Do you take extra salt other than which has already been added in your food?	Yes 1 No 2	

33	Do you consume salted food? If Yes, Mention the salted food you consume?	Yes 1 No 2 Pickle 1 Papad 2 Others 3	
34	On an average how many meals per week do you eat that were not prepared at home?	Number Don't know	

4. PHYSICAL ACTIVITY **A. JOB RELATED PHYSICAL ACTIVITY**			
35	Does your work involve mostly sitting or standing, with walking for not more than 10 minutes at a time? [if yes, the person was graded as sedentary at work]	Yes 1 No 2	
36	Does your work involve moderate-intensity activity, like brisk walking [or carrying light loads] for at least 10 minutes at a time? [if yes, the person was coded moderately active at work]	Yes 1 No 2	
37	Does your work involve vigorous activity like (heavy lifting, digging or other work] for at least 10 minutes at a time? [if yes, the person was graded as vigorously active at work]	Yes 1 No 2	
B. LEISURE TIME PHYSICAL ACTIVITY			
38	Does your [recreation, sport or leisure time] involve mostly sitting, reclining, or standing, with no physical activity lasting more than 10 minutes at a time? [if yes, the person was graded as sedentary during leisure]	Yes 1 No 2	
39	A. In your [leisure time] do you do any moderate intensity activities like brisk walking (cycling or swimming) for at least 10 minutes at a time? [if yes, the person was coded as moderately active during leisure]	Yes 1 No2	
	B. In a typical week, on how many days do you do moderate activities as part of your leisure time?	Days a week	
	C. How much time do you spend doing this on a typical day?	Hours: Minutes	
40	A. In your [leisure time] do you do any vigorous activities like (running or strenuous sports, weight lifting] for at least 10 minutes at a time? [if yes, the person graded vigorously active during leisure]	Yes 1 No 2	
	B. In a typical week, on how many days do you do	Days a	

	vigorous activities as part of your leisure time?	week	
	C. How much time do you spend doing this on a typical day?	Hours: Minues	
	C. TRAVEL RELATED PHYSICAL ACTIVITY		
41	A. Do you walk or use bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?	Yes 1 No 2	
	B. In a typical week, on how many days do you walk or ride bicycle for at least 10 minutes to get to and from places?	Days a week	
	C. How much time would you spend walking as bicycling for travel on a typical day?	Hours: Minutes	
	5. HISTORY OF RAISED BLOOD PRESSURE		
42	When was your blood pressure last measured by a health professional?	Within 12 month 1 Within 1-5 years 2 Not in last 5years 3 Not measured 4	
43	During the past 12 months have you been told by a doctor or other health profession that you have elevated blood pressure or hypertension?	Yes 1 No 2	
44	Are you currently receiving any of the treatments for high blood pressure prescribed by a doctor?	Yes 1 No 2	
	6. HISTORY OF DIABETES MELLITIS		
45	Have you had your blood sugar measured in the last 12 months by any health professional?	Yes 1 No 2	
46	Have you ever been told by a doctor or other profession that you have diabetes/raised blood sugar?	Yes 1 No 2	
47	Are you currently receiving any of the treatment for diabetes prescribed by a doctor?	Yes 1 No 2	

STEP 2: PHYSICAL MESUREMENTS

48	M1 → Height	Cm.	
49	M2 → Weight	Kg.	
50	Body Mass Index	Kg/m^2	
51	M3 → Waist circumference	Cm.	
52	M4→Hip circumference	Cm.	
53	Waist : Hip ratio		
54	Blood Pressure in mm of Hg. A. Reading – 1	Systolic Diastolic	
	B. Reading – 2	Systolic Diastolic	
	C. Reading – 3	Systolic Diastolic	
	Average of reading 2 & 3	Systolic Diastolic	

STEP 3: BIOCHEMICAL MEASUREMENTS
(SELECTED PARTICIPANTS ONLY)

01.	Serum Fasting Blood Sugar	mg /dL.	
02.	**LIPID PROFILE :**		
a.	Serum Total Cholesterol	mg /dL.	
b.	Serum Triglycerides	mg /dL	
c.	Serum High Density Lipoprotein	mg /dL	

ANNEXURE IV – KEY TO MASTER CHART

A. Serial number

B. Age in years

C. Gender

1. Male
2. Female

D. Main work status

1. Government employee
2. Non-government employee
3. Self employee
4. Home maker
5. Student
6. Retired
7. Unemployed

E. Education

1. No formal education
2. Primary school
3. Higher primary school
4. High school
5. College / Graduation
6. Post graduation

F. Religion

1. Hindu
2. Muslim

3. Christian
4. Others

G. Marital status

1. Married
2. Unmarried
3. Widowed

H. Per capita income

Rs._____

I. Socio economic status

1. Class I
2. Class II
3. Class III
4. Class IV
5. Class V

J. Family history of CAD / Stroke

1. Father
2. Mother
3. Both

K. Family history of Diabetes Mellitus

1. Father
2. Mother
3. Both

L. Family history of Hypertension

1. Father

2. Mother
3. Both parents

M. History of smoking tobacco

1. Present
2. Absent

N. Frequency of smoking tobacco

1. Daily
2. Occasionally
3. Never
4. Past smoker

O. Age at initiation of smoking tobacco (X)

X = _____ years

P. Total years of consumption (Y)

Y = (Present age – X) = _____ years

Q. Forms of tobacco smoking

1. Cigarette
2. Beedi
3. Pipe
4. Others

R. Quantity of use of smoking tobacco

Number: _____

S. History of stopping smoking for > 1 month

1. Yes
2. No

T. If past smoker, age of stopping

Age: _____ years.

U. History of using smokeless tobacco

1. Present
2. Absent

V. Frequency of using smokeless tobacco

1. Daily
2. Occasionally
3. Never
4. Past user

W. Age at initiation of smoking tobacco (P)

P = _____ years

X. Total years of consumption (Q)

Q = (Present age – P) = _____ years

Y. Forms of smokeless tobacco use

1. Snuff
2. Gutka
3. Chewing tobacco
4. Others

Z. Quantity of use of smoking tobacco

Number: _____

AA. History of stopping smoking for > 1 month

1. Yes
2. No

AB. If past smoker, age of stopping

Age: _____ years.

AC. History of alcohol consumption

1. Present
2. Absent

AD. Current alcohol use

1. Yes
2. No

AE. Type of alcohol drink consumed

1. Beer
2. Whisky
3. Brandy
4. Rum
5. Others – country liquor, etc.,

AF. Frequency of alcohol consumption

1. 5 or more days in a week
2. 1 – 4 days per week
3. 1 – 3 days a month
4. < 1 day / month

AG. Quantity of alcohol on the days of consumption

Quantity: _____ ml.

AH. History of stopping alcohol for > 1 month

1. Yes
2. No

AI. Days of fruit consumption in a week

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

AJ. Servings of fruit consumption on those days

1. 1 serving
2. 2 servings
3. 3 servings
4. 4 servings
5. 5 or more servings
0. Not applicable

AK. Days of vegetable consumption in a week

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

AL. Servings of vegetable consumption on those days

1. 1 serving
2. 2 servings
3. 3 servings
4. 4 servings
5. 5 or more servings
0. Not applicable

AM. Most often used oil for cooking

1. Sunflower oil
2. Soya bean oil
3. Groundnut oil
4. Palm oil
5. Others

AN. Consumption of extra added salt

1. Yes
2. No

AO. Consumption of extra salted food

1. Yes
2. No

AP. Forms of salted food consumption

1. Pickle
2. Papad
3. Others

AQ. Number of meals consumed out of house

0. Never
1. 1 – 3 meals
2. 4 – 6 meals
3. 5 or more meals

AR. Work related sedentary activity

1. Present
2. Absent

AS. Work related moderate activity

1. Present
2. Absent

AT. Work related vigorous activity

1. Present
2. Absent

AU. Leisure time sedentary activity

1. Present
2. Absent

AV. Leisure time moderate activity

1. Present
2. Absent

AW. Days spent on doing moderate activity in a week

0. Not applicable
1. 1 day
2. 2 days
3. 3 days
4. 4 days
5. 5 days
6. 6 days
7. All the days of week

AX. Time spent in doing moderate activity (E)

E = _____ hours.

AY. Effective duration of moderate activity (F)

F = Days x E = _____ hours.

AZ. Leisure time vigorous activity

1. Present
2. Absent

BA. Days spent on doing vigorous activity in a week

0. Not applicable
1. 1 day
2. 2 days
3. 3 days
4. 4 days
5. 5 days
6. 6 days
7. All the days of week

BB. Time spent in doing vigorous activity (G)

G = _____ hours.

BC. Effective duration of vigorous activity (H)

H = Days x G = _____ hours.

BD. Travel related physical activity

1. Present
2. Absent

BE. Number of days spent on doing travel activity

0. Not applicable
1. 1 day

2. 2 days
3. 3 days
4. 4 days
5. 5 days
6. 6 days
7. All the days of week

BF. Time spent in travel related physical activity (I)

I = _____ hours

BG. Effective duration of travel related activity (J)

J = Days X I = _____ hours

BH. Last measured blood pressure

1. Within last 1 year
2. 1 – 5 years
3. Not in last 5 years
4. Not measured

BI. Known / diagnosed to be hypertensive

1. Yes
2. No

BJ. Currently receiving treatment for hypertension

1. Yes
2. No

BK. Blood sugar measured in past 1 year

1. Yes
2. No

BL. Known / diagnosed to be diabetic

1. Yes
2. No

BM. Currently receiving treatment for diabetes mellitus

1. Yes
2. No

BN. Height in centimeters

BO. Weight in Kilograms

BP. BMI in Kg/m^2

BQ. Waist circumference in centimeters

BR. Hip circumference in centimeters

BS. Waist: Hip ratio

BT. Average Systolic Blood pressure in mm of Hg

BU. Average Diastolic Blood pressure in mm of Hg

BV. Risk factor categories

1. No risk factor present
2. 1 – 2 risk factors present
3. 3 or more risk factors present

BW. Risk prediction categories

0. Risk not assessed
1. < 10% risk
2. 10 – 19% risk
3. 20 – 29% risk
4. 30 – 39% risk
5. ≥ 40% risk