STUDY OF LIFESTYLES AND THEIR BEHAVIOURAL DETERMINANTS LEADING TO CARDIOVASCULAR DISEASE AMONG DIFFERENT POPULATION GROUPS

THESIS

Submitted in partial fulfillment
of the requirements for the degree of
DOCTOR OF PHILOSOPHY

by

VIJAY PRATAP RAGHUVANSHI

Under the Supervision of

DR. RAJKISHORE PRASAD AGRAWAL

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE
PILANI (RAJASTHAN) INDIA
2014

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE
PILANI (RAJASTHAN) INDIA

CERTIFICATE

This is to certify that the thesis entitled "**Study of lifestyles and their behavioural determinants leading to cardiovascular disease among different population groups"** which is submitted by **Vijay Pratap Raghuvanshi I.D. No. 2007PHXF040P** for award of Ph.D. Degree of the Institute, embodies original work done by him under my supervision.

Signature in full of the Supervisor: _____

Name in capital block letters: _____

Designation: _____

Date:

ACKNOWLEDGEMENTS

I want to thank of God, my Ram and Krishna, who gave me inner strength to complete this work. I would like to acknowledge the support of my Father Shri. Ram Charan Singh, Mother Smt. Vimleash Kumari and Brother Dr. Shiv Pratap Raghuvanshi without their moral support this research was not possible. Their never ending love, their words of encouragement and constant prayers from across the miles gave me the strength and inspiration to continue in this long journey. To them I am forever grateful.

No research project may be accomplished without the full support and the assistance of many people. Many thanks go to Dr. Ashutosh Raghuvanshi, Chairman & Group CEO, Narayana Hrudalaya Hospitals, Bangalore who first planted the idea that I should undertake this project.

Dr. Raj Kishore Prasad Agrawal, Senior consultant, General Surgery, Wockhardt Hospitals, Bhavnagar as my supervisor for his invaluable support and provision of much time are much appreciated. My sincere thanks and appreciation also goes to Dr. S.D. Gupta, Director, IIHMR, Jaipur without their constant encouragement, support, guidance and feedback this project should not have been completed.

My sincere thanks also go to Prof. Dr. R.P.Pareek and Prof. Dr. R. Mahesh, Professor BITS, Pilani for their valuable advice and suggestions to my thesis work.

Very special thanks are extended to my wife for her friendship, support and guidance, who were so understanding, loving and supportive throughout the stages of this project.

My sincere appreciation is extended to all who participate in the data collection process.

Last but not least, thankful to all those who supported me somewhere in this project to me.

ABSTRACT

Introduction: Cardiovascular disease (CVD) is a major cause of morbidity and mortality in the world today and will become the leading cause of death and disability worldwide by 2020. India is undergoing a rapid health transition associated with a rising burden of CVD. In India, studies identified non- communicable diseases risk factors in the population among them cardiac diseases plays an important role. Several of these established cardiovascular risk factors like age, gender, family history of heart disease, hypertension, diabetes, obesity, tobacco, smoking, alcohol consumption, physical inactivity and diet are strongly influenced by modern lifestyle and their behaviour. Lifestyle behaviours such as physical inactivity, a poor or high fat diet and cigarettes smoking are particularly common among people. CVD is higher in urban Indian populations compare to stroke mortality is similar in urban and rural regions. CVD is the top five causes of deaths in different populations (rural *vs.* urban, economically backward *vs.* developed states, men *vs.* women and at all ages *vs.* middle age individuals). Several empirical epidemiological studies have associated the cardiovascular disease to the stresses of modern lifestyle, sedentary habits, obesity, smoking, alcoholism, etc. A greater understanding of the cognitive and environmental factors involved in altering these health behaviours is necessary to assist health professionals and healthy population in their efforts to decrease CVD rates among individuals.

Aim : The aim of this thesis was to study on lifestyles and their behavioural determinants leading to cardiovascular disease among different population groups.

Method: A descriptive cross- section study was conducted. 4 different population groups from three different states namely Bhavnagar-Gujarat, Tonk- Rajasthan,Kolkata-West Bengal and Ahmedabad - Gujarat, were selected. The rational for selection these areas were purposively selected as lifestyle and behavioural risk factors leading to CVD, life habits, culture and food habits are devise. They also represent different regions of the country as urban and rural population with different culture and community status. Also very few studies are available on association between CVD and lifestyle risk factors in these areas. We had evaluated 2500 adult participants i.e. 625 from each area for the study. 71.6% males and 28.1% females with age

range from 25 to 80 (mean 45.99±12.09) years was selected as participants, then their effects of commuting activity, food habits, occupational, leisure time, physical activity on risk of CVD were studied. Various parameters which were studied included: family history of heart disease, history of diabetes mellitus, hypertension, coronary artery disease, smoking, alcohol, tobacco, physical activities, and diet. Measurement of height and weight was taken to calculated body mass index.

Results : The study revealed that among 23.4% of the current smokers respondents , about 12.5 % were suffering from the problem of blood pressure, diabetes, obesity related health problem. From those who were suffering from blood pressure, about 12.2 % were from the urban area and 58.5 % from rural area. Among 17.2 % urban respondents and 14.0 % rural have a family history of heart disease.

Among the current smokers, who were suffering from the CVD , 16.0 % were from the urban area and around 7.4% were from the rural area. 26% of the respondents who were current alcoholics, 15.8 % were from the urban area and around 10.5% were from the rural area. More than 13.3 % of the current alcoholics were suffering from any type of risk factor related to CVD. 47.8 % of the respondents (27.9% from the rural area and 19.8 % from the urban area) reported that they were engaged in some physical activity or exercise.

Study shows a clearly increased risk of having CVD was found among smoker versus non-smoker. The study indicates notably decrease in physical activities with increase in age. Age group between 31- 40 years were performing more (more than 30 minutes) physical activities in comparison to other age groups. High versus low leisure time physical activity was also found associated with decreased risk of CVD. Low occupational physical activity was associated with risk of CVD in men.

The non-alcoholic, physically active and vegetarian had lower risk of CVD than those who all are consuming alcohol, tobacco, non-vegetarian and physically inactive.

Conclusion: The study highlights and proposed a conceptual framework of various non-modifiable, modifiable lifestyle behavioral risk factors and their association with CVD in the community. Since majority of risk factors are modifiable, timely intervention can help in reducing morbidity and mortality of this disease.

The research have been consistently supported the positive relationship between the major risk factors for CVD ; these include hypertension, diabetes, obesity, cigarette smoking, alcohol, sedentary lifestyle, lack of physical exercise, eating habits, habits (addicted to TV, computer), stress.

The study clearly shows that urban populaces were more at risk of CVD due to modifiable lifestyle and other- modifiable risk factors, then the rural populace. It shows that urban were leading more sedentary life than rural and that's sedentary lifestyles are the primary cause of increasing obesity, B.P. which was leading to increased rate CVD.

These findings contribute to our knowledge about the factors that can alert CVD risk factors in healthy subjects, and which could reduce the risk of developing CVD. The stress and awareness need to be created for the modifiable risk factors, so that healthy and risk factors might reveal even more benefits.

CONTENTS

- Acknowledgements
- Abstract

CHAPTERS **PAGE**

CHAPTER -1

1 BACKGROUND

1.1 Introduction 1

1.2 Principal causes of Death Worldwide and India 4

1.3 Basic Demographic Indicators of India and Areas of study 12

1.3.1 Association of Life Expectancy with CVD in India 14

1.3.2 Association of CVD with broad age groups and literacy rate in India 15

1.3.3 Basic Demographic Indicators of the Study Areas – A) Kolkata, B)Ahmedabad, C) Bhavanagar, D) Tonk 18

1.4 Cardiovascular Disease and its Risk factors 21

1.4.1 Modifiable and Non-Modifiable risk factors of CVD 27

Non- Modifiable CVD Risk Factors -

1.4.2 Age, Sex, Family History of Heart Disease 30

Modifiable CVD Risk factors

1.4.3 BMI Index, Hypertension/ High Blood pressure and Diabetes 33

1.4.4 Alcohol and Tobacco use 39

1.4.5 Diet and Nutrition 43

1.4.6 Physical Activity 44

1.4.7 Obesity and overweight 45

1.5 Gap in Existing Research 47

1.6 Aim of Research 48

1.7 Objectives of the Research 48

1.8 Research Questions 48

1.9 Proposed Conceptual framework for study 49

CHAPTER -2

2 LITERATURE REVIEW

2.1 Current Status of CVD 51

2.2 Risk factors for CVD : Indian scenario 55

2.3 Prevalence/Incidence of Coronary Heart Disease in India 58

2.4 Cardiovascular Disease - Risk factors 61

2.4.1 High Blood Pressure/Hypertension 61

2.4.2 Stroke 66

2.4.3 Physical activity 67

2.4.4 Diet and Nutrition, Eggs consumption, Salt Intake and Fast Food 70

2.4.5 Obesity 77

2.4.6 Smoking, Tobacco and Alcohol 79

2.4.7 Diabetes 82

2.4.8 Yoga and CVD 83

2.4.9 Television or computer use, Less Sleep and Mental Relaxation and CVD 87

CHAPTER -3

3 METHODOLOGY

3.1	Sample Design	89
3.2	Sample Size	89
3.3	Study Survey Area	91
3.4	Sample Age Criteria	92
3.5	Sample Enrolment, Inclusion and Exclusion criteria	92
3.6	Study Tools & Techniques	93
3.7	Data Analysis	94
3.8	Study Variables	95

CHAPTER – 4

4 RESULTS AND DISCUSSIONS

4.1		General characteristic of the study Participant's	100
	4.1.1	Participant's-Gender, Age, Height & Weight, Occupation and Marital Status	100
	4.1.2	BMI Index	105
4.2		Non -Modifiable Risk Factors of CVD	108
	4.2.1	High Blood Pressure, High Blood Cholesterol, Obesity and Overweight, Diabetes, Family history of heart disease, First degree relative suffered from heart disease, undergone surgery	108

4.3	Association with Alcohol, Tobacco, Cigarettes (Smoking) consumption and CVD	115
4.4	Association with Physical Activity and CVD	124
4.5	Association of diet habits and CVD	126
4.6	Association of behaviours and Habits with CVD	140
4.7	Association of Risk Factors with CVD in study Area	147

CHAPTER 5

5 Conclusion and Recommendations

5.1	Conclusion	154
5.2	Recommendation	158
5.3	Limitations	160
5.4	Future scope of study	161
	Reference	162
	Publications	179
	Annexure	180

LIST OF TABLES

Table No.	Description	Page No.
1.	Scheme to illustrate the life-course perspective on heart disease and other chronic diseases	4
2.	Top 10 causes of mortality in the world	5
3.	Burden of Disease – Worldwide	6
4.	Global death from CVD (In Millions)	7
5.	Ten largest populations Countries in the World	9
6.	Top 10 causes of Death in India (all ages as %) 2001-2003	9
7.	Global urbanization	10
8.	Urbanization in India	11
9.	Top 5 causes of deaths in India according to areas of residence & gender	11
10.	Basic demographic indicators of the survey areas	13
11.	Cardiovascular diseases- Cause of Death (all ages as %) in India Regions	14
12.	Broad categories of age groups in India	15
13.	Literacy rates in India	15
14.	Prevalence rate of CVD and related risk factors in areas of study.	16
15.	Risk factors for coronary Heart disease and Stroke	29
16.	Percentage of distribution of deaths by CVD in age group & gender in India.	30
17.	Forecasting prevalence rate (%) of coronary heart disease (CHD) in India	31
18.	Estimated mortality from Coronary Heart Disease (CHD) in India-2015	31
19.	Lifetime risk of developing Heart Disease	32
20.	Body Mass Index values	34

21.	Classification of adults according to BMI in Indians	35
22.	Profile of reported behavioural, anthropometric, biochemical risk factors for Cardiovascular disease in India	56
23.	ICMR-WHO six site study: profile of reported behavioral, anthropometric and biochemical risk factors among men and women aged 15-64 yr in urban, rural and peri-urban/slum populations.	57
24.	Cardiovascular deaths in India, China and developed countries in millions (Global Burden of diseases study)	58
25.	Estimates of total years of life lost due to CVD in 2000 and 2030	59
26.	Prevalence of coronary heart disease in India	60
27.	Coronary risk factors studies	61
28.	Studies of hypertension prevalence in Indian population	64
29.	Recent Indian hypertension prevalence studies (BP ≥140/90)	65
30.	Major types of fatty acids in fats and oils	71
31.	Age-specific prevalence (%) among males and females of regular tobacco users in rural and urban areas(NSS 1993-1994)	81
32.	Urban prevalence rates of probable CHD per 1000 by age group (numbers in parenthesis represent numbers studied in each age band)	86
33.	Rural prevalence rates of probable CHD per 1000 by age group (numbers in parenthesis represent numbers studied in each age band)	86
34.	Study variables	95
35.	Distribution of gender for study.	100
36.	City and gender wise distribution among Urban and rural participants	101
37.	Age group distribution among men and women	102
38.	Comparison of anthropometric parameters	103

39.	Distribution of occupation in urban and rural	104
40.	BMI status among male and females	105
41.	Association between age group and BMI	106
42.	Division of urban and rural population based on BMI	107
43.	Male and female suffer from disease related to CVD	110
44.	Family history of heart disease among male & female, urban and rural	111
45.	First degree relative suffer from disease related to CVD	113
46.	Association between risk factors and family history of heart disease.	114
47.	Risk factors tobacco, smoking and alcohol of CVD	116
48.	Prevalence of smoking and alcohol consumption in various age-group	118
49.	Prevalence of alcohol, smoking and tobacco consumption in urban and rural	119
50.	Prevalence of CVD risk factors among smokers	120
51.	Percent prevalence of alcohol consumers	120
52.	Prevalence of CVD risk factors among Alcohol Consumers	121
53.	Comparison of prevalence of CVD risk factors among Male and female	122
54.	Association between exercise and CVD risk factors	124
55.	Association between age groups involved in any kind of exercise	126
56.	Risk factors - dietary	127
57.	Association between vegetable, fruit and dairy product consumption per day	130
58.	Obesity and any kind of oil consumption	131
59.	Different type of oil consumption and CVD	132

60.	Consumption of kind of fat or oil in urban and rural	133
61.	Total meat consumption	133
62.	Non-veg. consumption among male and female, urban and rural	134
63.	Egg consumption among male and female, urban and rural	136
64.	Extra salt intake among male & females , urban and rural	137
65.	No. of glasses water consumption among male and female , urban and rural	138
66.	Fast food consumption among gender, Rural and Urban	139
67.	Consumption of soft (Carbonated)drink per week among gender, Rural and Urban	139
68.	Association between gender, Rural and urban and health checkup	140
69.	Association between age group and yearly health checkup	141
70.	Association between occupation and yearly health checkup	141
71.	Average hours spend on TV/ Computer among genders, urban and rural	142
72.	Activeness among male & female, urban & rural	143
73.	Sleeping hours among male and female	144
74.	Percent of participants obese and sleeping hours per day	144
75.	Association between pollution among male & female, urban & rural	146
76.	Travelling per day for job related work	146
77.	Association of CVD risk factors among different cities	147
78.	Association between CVD and Lifestyle and behaviour risk factors	151
79.	Binary logistic regression between CVD and significantly associated risk factors	152

LIST OF FIGURES

Figure No.	Description	Page No.
1	Mortality from major communicable and Non-communicable diseases 2030	6
2	Burden of disease - Worldwide	7
3	Global death from CVD (In Millions)	8
4	Burden of disease in India	8
5	Causes of Death in India, 2008	12
6	Fishbone diagram: shows the different causes of NCDs	23
7	A schematic model presenting the relations between cardiovascular disease, established and novel risk factors, lifestyle factors, socioeconomic and psychosocial factors.	24
8	Framework -Lifestyle, Living conditions (outer circle), SCI- specific CVD risk profile and biomarkers of relevance for CVD risk	25
9	Primary and Secondary prevention strategies on CVD risk	26
10	Conceptual framework for study	50
11	Major causes of ischemic heart disease	54
12	DALYs lost to CVD 1990-2020	59
13	Percentage distribution of gender of participants	101
14	Percentage distribution of male and female in Rural and Urban	102
15	Age distribution of participants for the study	103
16	Total percentage of occupation in urban and rural	104
17	Association of BMI among gender	107
18	Alcohol, smoking & tobacco consumption in urban and rural area	119
19	Vegetable, Fruit & dairy product consumption per day	130
20	Non- Vegetarian consumption among different cities	135
21	CVD Modifiable lifestyle risk factors among four selected cities	148
22	CVD Modifiable risk factors among four selected cities	148
23	CVD Modifiable other risk factors among four selected cities	149

LIST OF ABBREVIATIONS

AHA	American Heart Association
BMI	Body Mass Index
BP	Blood Pressure
CAD	Coronary Artery Disease
CHD	Coronary Heart Disease
CVD	Cardiovascular Vascular Disease
DALYs	Disability adjusted life years
DASH	Dietary Approaches to Stop Hypertension
DM	Diabetes Mellitus
DPAS	Diet Physical Activity and Health
HDL	High Density Lipoprotein
HDL Cholesterol	High Density Lipoprotein Cholesterol
HTN	Hypertension
ICMR	Indian Council of Medical Research
LDL	Low Density Lipoprotein
MI	Myocardial Infarction
MET's	Multiples of the resting metabolic rate
MUFA	Mono-Unsaturated Fatty Acids
NCDs	Non-Communicable Diseases
NFHS	National Family Heath Survey
PUFA	Poly- Unsaturated Fatty Acids
SCORE	Systematic Coronary Risk Evaluation
TC	Total Cholesterol
TC/HDL ratio	Total Cholesterol/High Density Lipoprotein Ratio
TLC	Therapeutic Lifestyle Changes

UTI	Urinary Tract Infection
VLDL	Very low density lipoprotein
WHO	World Health Organization

CHAPTER -1

1. BACKGROUND

1.1. INTRODUCTION

The human heart is only the size of a fist but it is the strongest muscle in the human body. The heart starts to beat in the uterus long before birth, usually by 21 to 28 days after conception. The average heart beats about 100000 times daily or about two and a half billion times over a 70 year lifetime. With every heartbeat, the heart pumps blood around the body. It beats approximately 70 times a minute, although this rate can double during exercise or at times of extreme emotion. Blood is pumped out from the left chambers of the heart. It is transported through arteries of ever-decreasing size, finally reaching the capillaries in all the tissues, such as the skin and other body organs. Having delivered its oxygen and nutrients and having collected waste a product, blood is brought back to the right chambers of the heart through a system of ever-enlarging veins. During the circulation through the liver, waste products are removed(1).

Charaka Sutra (1000 BC) indicated that over eating, heavy and fatty meals, worries, sedentary habits and over-indulgence in sleep are the cause of cardiac diseases. “Heart disease before the age of 80 is not God’s will but due to our faults” This statement was given by the world renowned cardiologist of this century, late Dr. Paul Dudley White which contains the concepts and the message of preventive cardiology. Dr. White practiced what he preached and not only lived he beyond the ripe age of 80 years but also many others do that. His prescriptions invariably stressed the need for self-controlled lifestyles including moderation in eating habits, tackling stressful situations with positive attitude and doing regular physical exercise.

The ancient Indian physicians laid down basic principles for the maintenance of normal (positive) health and pronounced certain of normal (positive) health and pronounced certain preventive measures against the cardiac ailments.

They laid stress on:

ACHAAR = Normal conduct

AHAAR = Diet

VYAYAAM = Physical exercise

YOGA = Yoga

Charaka particularly mentioned to shun anxiety, tension, emotional stress, hatred and competitive haste to keep fit against cardiac ailments(2).

Disease of heart comprises a significant proportion of cardiovascular disease(CVD). The World Bank Global Burden of Disease (GBD) study has predicted that CVD will be one of the major causes of death in developing countries by the year 2020(3).

TYPES OF CARDIOVASCULAR DISEASE (4)

- **Coronary Heart Disease (CHD):** CHD is a narrowing of the small blood vessels that supply blood and oxygen to the heart. CHD is also called coronary artery disease. It can lead to a heart attack.CHD is the most prevalent heart disease in India contributing more than 95% of the total CVD prevalence, and more than 85% of all CVD related deaths.
- **Cerebrovascular Disease (Stroke):** A stroke is caused when the supply of oxygen to a part of brain stops. When a stroke is caused due to a clogged artery or a blood clot in heart or some other part of the body it is called an 'ischemic stroke'. Stroke is second largest cause of death due to heart disease in India with more than 0.8 million deaths.
- **Hypertensive Heart Disease:** Hypertensive heart disease refers to coronary artery disease, heart failure, and enlargement of the heart that occur because of high blood pressure. High blood pressure increases the pressure in blood vessels. As the heart pumps against this pressure, it must work harder causing the heart muscle to thicken and the left ventricle to become enlarged. In 2004, nearly 0.17 million people who were nearly 80% above 60 years old, died due to Hypertensive heart disease.
- **Congenital Heart Disease:** A defect in the structure of the heart and great vessels of a new-born and result from abnormal fetal heart development.
- **Others:** There are some more heart diseases with low level of occurrence in India, like rheumatic heart disease, peripheral heart disease and inflammatory heart disease.

Cardiac Care Cycle

Heart diseases are considered to be 'silent' diseases whose symptoms are not evident in a patient suffering from them till the disease is in an advanced state.

The cycle of cardiac care starts from:

- The **Prevention** of the occurrence of any such disease. Measures need to be taken to control risk factors which lead to development of heart diseases.
- Patients suffering from the disease need to undergo an **Intervention**, typically a surgical or medical procedure, to get specialized treatment to prevent any future cardiac incident, or control the damage, if they have already had an incident.
- This is followed by **Maintenance** of a healthy state and prevention of any further complications. The entire population can be categorized into healthy, at risk, diseased or controlled population, depending on the stage in the cardiac cycle.
- **Healthy** population should be educated about risk factors and symptoms and encouraged to adopt healthier lifestyles including a balanced diet and regular exercise.
- The **At Risk** population, which has already developed some risk factors, needs to use secondary preventive measures, which include regular screening or early interventions, to control the disease in the early stages and prevent hospitalization.
- **Diseased** population needs an intervention to control the disease before it become chronic.
- **Controlled** population needs to focus more on maintenance and tertiary prevention which include rehabilitation, disease management, balanced diet and lifestyle modification to avoid recurrence of the disease.

LIFE COURSE OF CHRONIC DISEASES

Although most of the heart attacks, heart failure and other chronic diseases usually occur in middle-aged and older people, the influences of risk factors can start before birth and will have an impact throughout life. Therefore, the processes for prevention and management of heart disease must start early and be present throughout life(5). **(Table No. 1)**

Table No. 1: Scheme to illustrate the life-course perspective on heart disease and other chronic diseases

THE LIFE-LONG IMPACT OF HEART AND OTHER CHRONIC DISEASES AND THEIR RISK FACTORS			
Prevention **Whole population**		**Diagnoses, Cost-effective management** **High risk patients**	
Before Birth ➢ Genes ➢ In the womb **Environment** ➢ Poverty ➢ Cultural ➢ Political	**Unhealthy Lifestyle** ➢ Unhealthy diet ➢ Tobacco use ➢ Lack of aerobic exercise ➢ Stress	**Modifiable risk Factors** ➢ Obesity ➢ Hypertension ➢ Tobacco addiction ➢ Diabetes ➢ High blood cholesterol and other fats	**Morbidity** **Damage to Organs** ➢ Arteries ➢ Heart ➢ Brain ➢ Kidneys ➢ Lungs ➢ Eyes ➢ Legs	**Mortality** ➢ Heart attack ➢ Heart failure ➢ Stroke ➢ Kidney failure ➢ Cancer ➢ Chronic lung disease

Source: World Health Organization. Prevention chronic diseases: A vital investment: WHO global report. Geneva: World Health Organization, 2005. (5)

1.2. PRINCIPAL CAUSES OF DEATH WORLDWIDE AND INDIA

Heart disease has emerged as a major health problem in most of the societies in 21st century, affecting many people in their prime and often resulting death or disability. Heart disease is also the leading cause of morbidity and mortality in India. Every year thousands of Indians suffer from heart attack. Over the past few years, the numbers have raise and cardiovascular disease may become the number 1 (One) Killer disease in India (6). Research has shown that many of the risk factors for coronary heart disease are related to the modern lifestyle, such as sedentary habits, smoking, obesity, hyperlipidemia and the like.

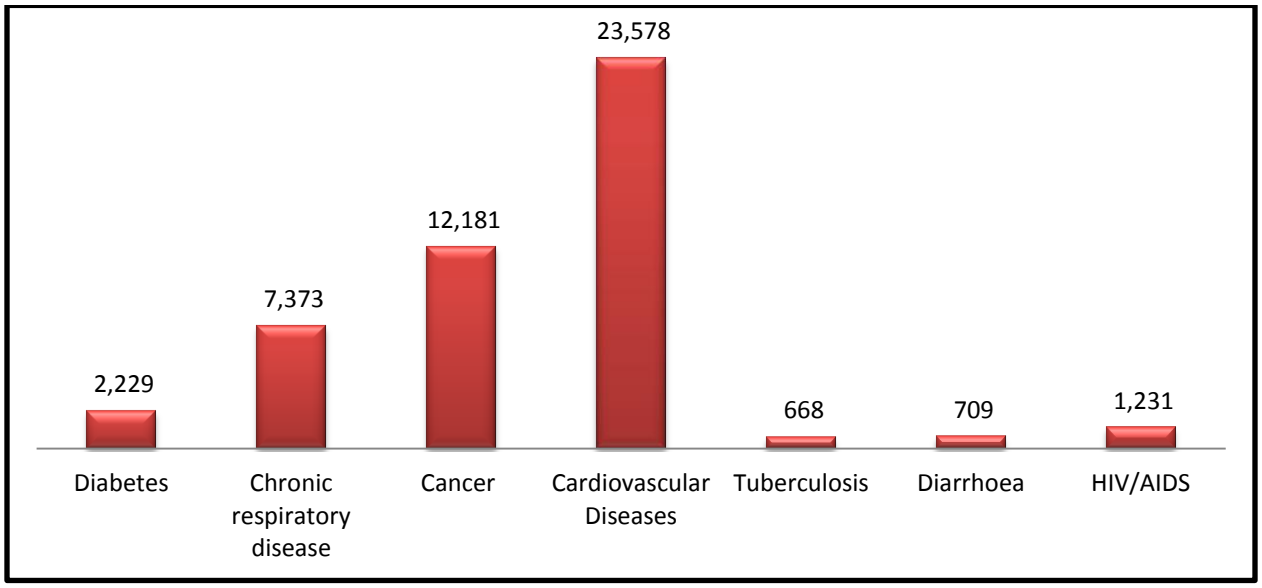
Between 2008 and 2030, the global population is projected to grow by 20%, from 6.7 billion to 8.1 billion people. The crude death rate is expected to remain more or less stable at around 8.4 deaths per thousand. However, a major shift is currently underway in the overall disease burden in the world. In 2008, five out of the top ten causes for mortality worldwide, other than injuries, were non-communicable diseases; 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 NCDs(7) **(Table No. 2 and Figure No. 1).**

Table No. 2: Top 10 causes of mortality in world

Top 10 causes of mortality		
Rank	**2008**	**2030**
1.	**Cardiovascular diseases**	**Cardiovascular diseases**
2.	**Cancers**	**Cancers**
3.	**Chronic Respiratory diseases**	**Chronic Respiratory diseases**
4.	Respiratory infections	Respiratory infections
5.	Perinatal Conditions	**Diabetes Mellitus**
6.	Diarrhoeal diseases	**Digestive diseases**
7.	**Digestive diseases**	Perinatal Conditions
8.	HIV/AIDS	**Neuropsychiatric conditions**
9.	Tuberculosis	**Genitourinary diseases**
10.	**Neuropsychiatric conditions**	HIV/AIDS

Source: World Health Organization Global Report. 2005(7)

Figure No. 1: Mortality from major communicable and non-communicable diseases 2030



Source: Global burden of diseases 2004. Proposed deaths, 2030. Baseline Scenario, World Health Organization, 2008. Number of Deaths in '000s (7)

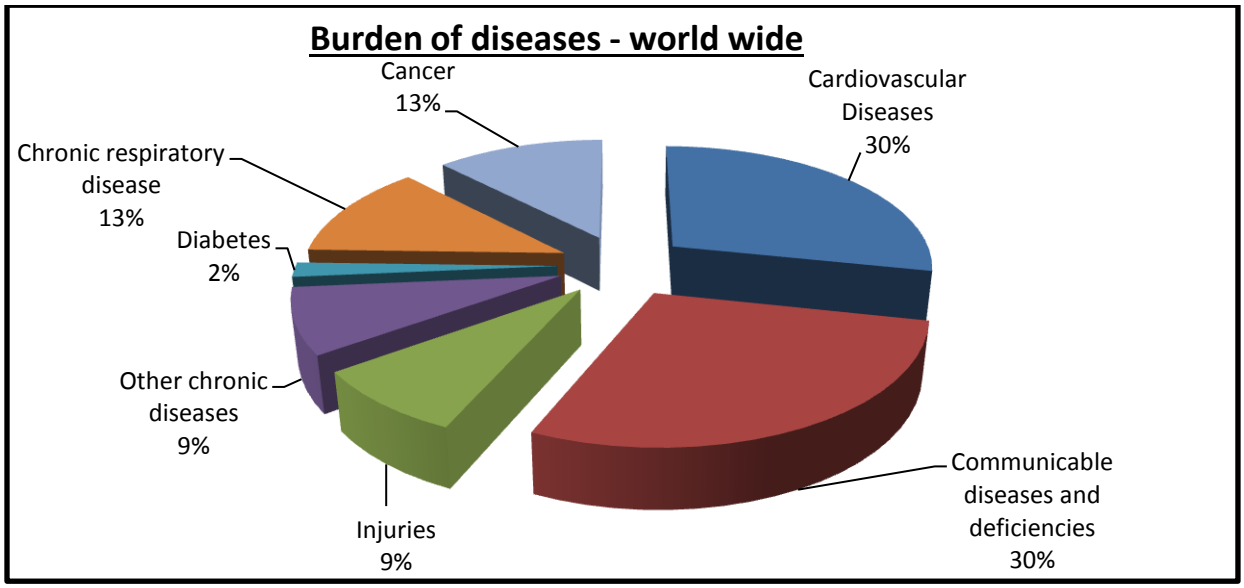
The disease burden worldwide and in India for all age groups and major causes of death are presented in **Table No. 3 and Figure No. 2.** Total Deaths in all ages: 58 million (2005). 30% worldwide are suffering from cardiovascular disease, while in India 29% suffer from CVD.

Table No. 3: Burden of Disease – Worldwide

Disease	Worldwide (% age)	India (% age)
Cardiovascular Diseases	30%	29%
Communicable diseases, Maternal/Perinatal conditions and nutritional deficiencies	30%	36%
Injuries	9%	11%
Other chronic diseases	9%	8%
Diabetes	2%	2%
Chronic respiratory disease	13%	7%
Cancer	13%	7%

Source: World Health Organization Global Report,2005 (7)

Figure No. 2: Burden of disease – Worldwide



Source: World Health Organization Global Report. 2005 (7)

16.7 million total global deaths occurred from CVD in 2002, from which coronary heart disease causes 7.2 million (43.1%) deaths, stroke contributes 5.5 million (32.9%) deaths and other forms of heart diseases causes 2.4 million (14.3%) deaths globally **(Table No. 4 and Figure No. 3).**

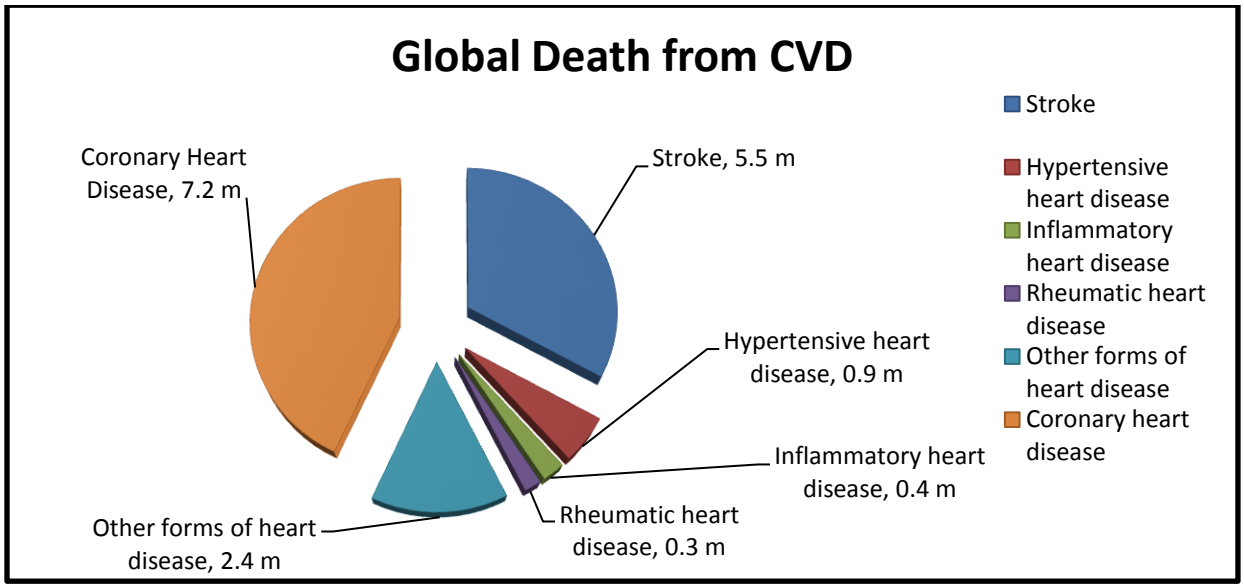
Table No. 4: Global death from CVD (In m- Millions)

Global Death from CVD	
Stroke	5.5 m
Hypertensive heart disease	0.9 m
Inflammatory heart disease	0.4 m
Rheumatic heart disease	0.3 m
Other forms of heart disease	2.4 m
Coronary heart disease	7.2 m

Source: Global atlas on cardiovascular disease prevention and control, WHO, 2011 (8)

India is the second largest population country in world and will be ranking first by 2050. This category of health conditions accounts for the second largest share, after communicable health conditions. The disease burden in India includes cancers, CVD, diabetes, respiratory conditions such as asthma and COPD, and mental health disorders **(Figure No. 4)**.

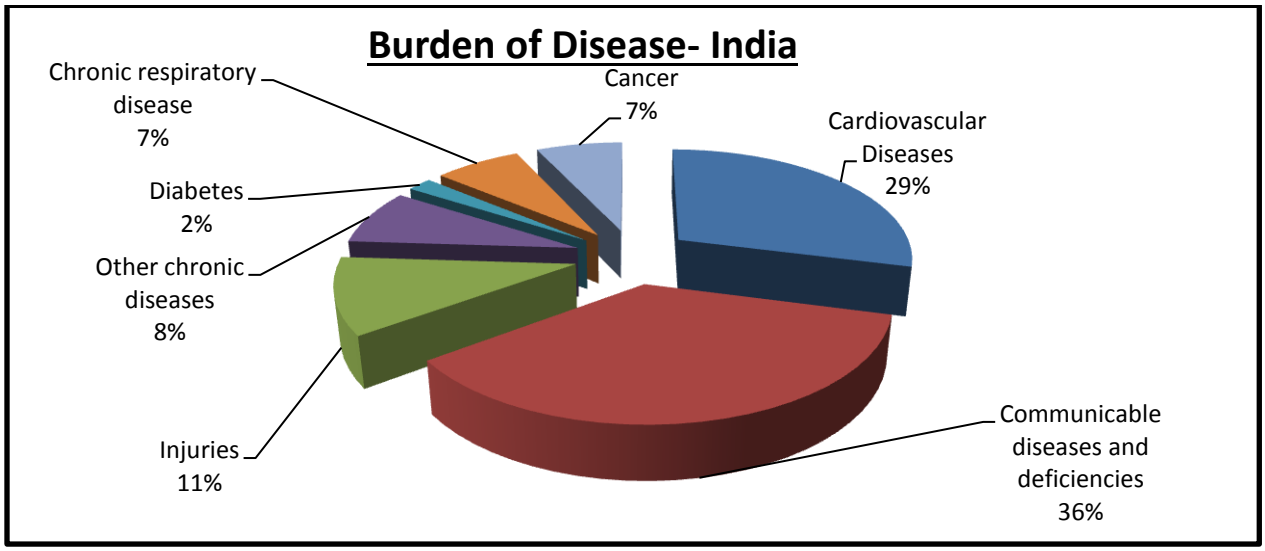
Figure No. 3: Global death from CVD (In Millions)



Source : Global atlas on cardiovascular disease prevention and control, WHO, 2011 (8)

Available data suggest that these conditions will account for a sharp increase in India's disease burden in the future. According to recent estimates, cases of CVD on India may increase from about 2.9 crore in 2000 to as many as 6.4 crore in 2015, and the numbers of deaths from CVD will also more than double (8).

Figure No. 4: Burden of disease in India



Source : National Commission on Macroeconomics and Health, 2011 (9)

The ten largest populations in world were China, India and USA in 1950. In 2000 china was the largest population country in the world. But by 2050 India will become number one in largest population **(Table No. 5)**, so the chances of sharp increase in the NCDs and CVD in the country.

Table No.5: Ten largest populations Countries in the World

1950	2000	2050
China	**China**	**India**
India	**India**	**China**
USA	*USA*	*Pakistan*
Russia	**Indonesia**	*USA*
Japan	**Brazil**	Nigeria
Indonesia	*Russia*	**Indonesia**
Germany	*Pakistan*	**Brazil**
Brazil	*Japan*	**Bangladesh**
UK	**Bangladesh**	*Ethiopia*
Italy	Nigeria	*Iran*

Source: United Nations 1999 (10)

In 2002 -2003 the top 10 leading causes of death overall in India is CVD (18.8%), followed by respiratory diseases (8.7%) which include chronic obstructive pulmonary disease or COPD, asthma, other respiratory diseases, diarrheal diseases (8.1%), and others shown in **Table No. 6**. Notable differences by gender are seen with CVD accounting for 16.9% female deaths versus 20.3% for males, diarrheal diseases 9.9% of female deaths against 6.7% for males, tuberculosis 4.7% for female deaths in comparison to 7.1% for males (10).

Table No. 6: Top 10 causes of death in India (all ages as %) 2001-2003

Rank	Cause of Death	Male			Female			Person		
		Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
1	CVD	20.3	18.2	**30.3**	16.9	15.1	**26.3**	18.8	16.8	**28.6**
2	COPD, Asthma	9.3	9.5	7.5	8.0	8.3	8.5	8.7	9.0	7.9
3	Diarrheal diseases	6.7	7.3	8.1	9.9	10.7	6.7	8.1	8.8	7.5
4	Perinatal Condition	6.4	6.9	5.9	6.2	6.7	4.5	6.3	6.8	5.3
5	Respiratory Infection	5.4	6.0	3.4	7.1	7.6	7.4	6.2	6.7	5.1

6	Tuberculosis	7.1	7.3	3.9	4.7	4.7	6.1	6.0	6.1	4.8
7	Malignant and other Neoplasm's	5.4	5.0	4.1	6.0	5.6	4.7	5.7	5.2	4.4
8	Senility	4.0	4.1	4.0	6.5	6.3	4.6	5.1	5.1	4.3
9	Unintentional Injuries: Other	5.2	5.4	5.0	4.5	4.5	2.5	4.9	5.0	3.9
10	Symptoms signs and ill-defined conditions	4.6	4.7	3.0	5.0	5.1	4.5	4.8	4.9	3.7

Source: Report on Causes of Death in India, 2001-2003; Page No. 9 & 10. Ministry of Home affair, New Delhi. 2008 (10)

Risk factor for CVD among rural and urban population

CVD is the leading cause of death among males as well as females and more in urban (28.6%) than in rural (16.8%) population. The male-female proportion of deaths in India : female deaths from cancer (12%) are more than males (8%), deaths from tuberculosis (11%) males versus females (8%) and digestive diseases (6%) males versus females (4%) (10) **(Table No.6).**

The prevalence rates of CVD in the rural population will remain lower than that of the urban populations. They will continue to increase, reaching around 13.5% of the rural population in the age group of 60-69 years by 2015. Prevalence rates in younger adults (age group of 40 years and above) are also likely to increase; the prevalence rates among women will keep pace with those of men across all age groups.

Global urbanization is also increasing sharply **(Table No.7,8)**. For the first time since independence, the absolute increase in population is more in urban areas that in rural areas and rural – urban distribution are 68.84% & 31.16%. Level of urbanization increased from 27.81% in 2001 to 31.16% in 2011 Census. The proportion of rural population declined from 72.19% to 68.84%.

Table No. 7: Global Urbanization

Countries	**Urban**	**Rural**
China	30%	70%
India	27%	73%
USA	76%	24%

Source : United Nations, 1999 (11)

Table No. 8: Urbanization in India

	2001	2011	Difference	(%) 2011
India	102.9	121.0	18.1	-
Rural	74.3	83.3	9.0	68.84%
Urban	28.6	37.7	9.1	31.16%

Source: Census of India, 2011(12) Note: Population (in Crore) (11)

In-spite of the fact that India is still rural based, the absolute increase in population is more in urban areas that in rural areas. 70% of the population is occupied in agriculture, the estimated CVD mortality was 1.6 million in 2000. The burden of CVD in India is estimated to be more than 32 million. Epidemiological studies show the burden in rural areas is (3-5%) and urban (7-10%) of the population.

In India, CVD is the largest cause of mortality in all regions of the country. **Table No. 9** shows the top 5 causes of deaths in different populations (rural *vs.* urban, economically backward *vs.* developed states, men *vs.* women, and at all-ages *vs.* middle aged individuals). There are large regional differences in CVD mortality in India among both men and women. Deaths due to CVDs constitute a higher proportion in urban areas (33%) than that in rural areas (23%) (13).

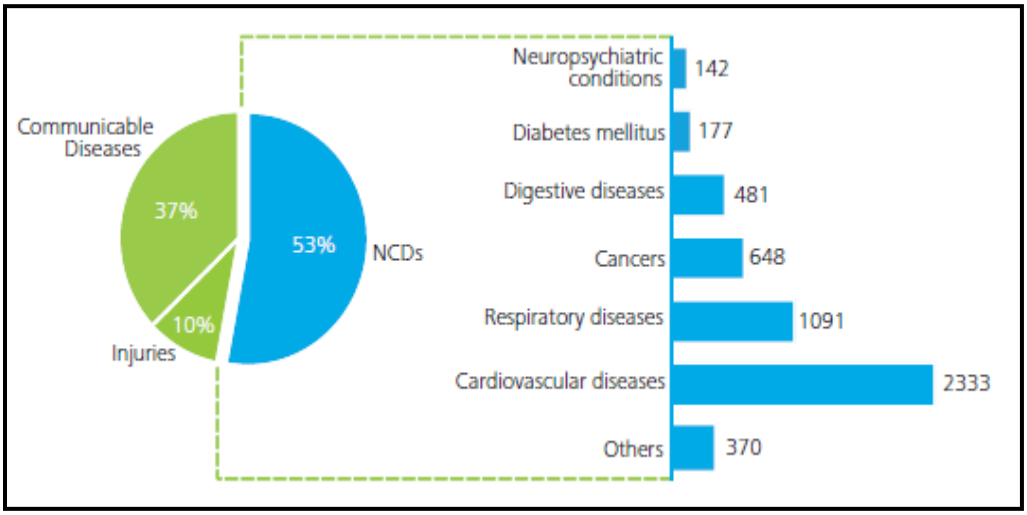
Table No. 9: Top 5 causes of deaths in India according to areas of residence & gender

Age groups		**Economically**		**Populations**		**Men**	**Women**
All	**(25-69 yr)**	**Backward states**	**Advanced states**	**Rural**	**Urban**		
CVD	**CVD**	**CVD**	**CVD**	**CVD**	**CVD**	**CVD**	**CVD**
COPD, Asthma	COPD, Asthma	Diarrhea	COPD, Asthma	COPD, Asthma	**Cancers**	COPD, Asthma	Diarrhea
Diarrhea	**Tuber culosis**	Respiratory infections	**Cancers**	Diarrhea	COPD, Asthma		COPD, Asthma
Perinatal	**Cancers**	COPD, asthma	**Senility**	**Perinatal**	**Tuber culosis**	Diarrhea	Respiratory infections
Respiratory infections	Ill-defined	Perinatal	Diarrhea	Respiratory infections	Senility	Perinatal	Senility

Source: Adapted from Registrar General of India Report. (13)

Hospital statistics reveal that 20-25% of all medical admissions are due to CVD. During the past 30 years, the CVD rates in India have doubled in both urban and rural India. As a result, the prevalence of CVD is now four-fold higher in urban India than in the US. When compared with Americans, Europeans and other Asians, CVD rates among Indians are two to four fold higher at all ages and five to ten fold higher under the age of 40 years (6). **(Figure No. 5)**.

Figure No. 5 : Causes of Death in India, 2008 (Number of deaths in '000s)



Source: WHO, 2010. Causes of death 2008: Data sources and methods. Geneva. (6)

1.3 BASIC DEMOGRAPHIC INDICATORS OF INDIA & AREAS OF STUDY:

India is the world's second most populated country after the People's Republic of China. Every State of India is closest to a country if compare in term of population like West Bengal to Vietnam, Rajasthan to Thailand and Gujarat to Italy.

The most common heart diseases plaguing Indians between the age group of 25-60 are CVDs, cardiac arrests, congestive heart failures, CHDs, rheumatic heart diseases and strokes.Pace of urbanization has been steadily growing in India and 31% of India's population is inhabited in urban areas in 2011. CVD is number one contributor of lost years of living, leading cause of hospital stay, most common cause for consulting doctors and the most prevalent indication for drug treatment. Rapid change in lifestyle has contributed more to heart diseases among older people across the globe, but the case is entirely different in India with almost 25% of the victims of cardiac arrests falling under the age of 40.

The basic demographic indicators for the states according to the study areas compared to the whole India are presented in **Table No. 10.**

Table No. 10: Basic demographic indicators for Survey areas states and India

Index		**India**	**West Bengal**	**Kolkata**	**Gujarat**	**Ahmedabad**	**Bhavnagar**	**Rajasthan**	**Tonk**
Population (‘000)		1,210,193	91,347 (7.55%)	4,486	60,383 (5.00%)	5,570	2,877	68,621 (5.67%)	1,421
Density (per sq.km)		325	1029 *	242	258	224	247	165	198
% Urban Population		27.82	31.89	100%	42.58	100%	25.07	24.89	22.36
% Rural Population		72.18	68.11	0%	57.42	0%	74.30	75.11	77.64
Death Rate (‘000)		7.3			6.9			6.7	
Sex Ratio (Nos.)		933	934	899	920	897	931	921	949
Literacy Rate (%)		74.04	77.08	87.14	79.3	79.89	66.20	67.06	62.46
Men		82.14	82.67	89.08	87.2	87.81	78.02	80.51	78.27
Women		65.46	71.16	84.98	70.7	71.12	53.73	52.66	46.01
Life Expectancy at Birth	Male	62.6			62.9			61.5	
	Female	64.2			65.2			62.3	

Source : Census of India, 2001(14) *-State with Highest Population Density

CHD prevalence within India is not consistent across studies. In one study, Muslim men have been shown to have the highest CHD prevalence rates and Christian men have been shown to have the lowest CHD prevalence rates. However, another study demonstrated highest CHD prevalence rates in Hindu men, whereas a two other studies have reported the highest rates in Gujarati men. A similar degree of heterogeneity appears present for women (15).

Other study shows that CHD risk factors prevalent in Gujarati’s.(16) Children might also be under greater threat of developing CVDs with over 60,000 to 90,000 kids getting affected by heart ailments every year in India.

Table No. 11: Cardiovascular diseases- Cause of Death (all ages as %) in India Regions

Region -	Male	Female	Person
North: (Chandigarh, Delhi, Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab and Uttarakhand)	24.0	19.9	22.3
North East: (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura)	17.2	13.7	15.7
East: (Bihar, Jharkhand, Orissa and **West Bengal**)	19.5	17.0	**18.3**
Central: (Chhattisgarh, Madhya Pradesh, **Rajasthan** & Uttar Pradesh)	13.5	10.4	**12.1**
West: (Dadra & Nagar Haveli, Daman & Diu, Goa, **Gujarat**, and Maharashtra)	23.6	22.0	**22.9**
South: (Andhra Pradesh, Andaman & Nicobar Islands, Karnataka, Kerala, Lakshadweep, Pondicherry and Tamil Nadu)	27.1	22.7	25.1

Source: Report on Causes of Death in India, 2001-2003; Page No. 9 & 10. Ministry of Home affair, New Delhi. 2008 (10)

1.3.1 ASSOCIATION OF LIFE EXPECTANCY WITH CVD IN INDIA

The average life expectancy at birth in India is 63.7 years, being 62.6 for males and 64.2 for females compared with the national average of 41.2 years in 1951–1961 (17). This rise in life expectancy in India is attributed to a decrease in infectious, parasitic, and nutritional disorders and, in itself, is a remarkable achievement. However, this demographic transition has also led to an increase in the number of older people (aged ≥60 years), from 19.61 million in 1950 to 75.93 million in 2000. The increase in life expectancy has brought a large section of the population to an age where CVD starts manifesting itself (18).

Avoiding a sedentary lifestyle during adulthood not only prevents CVD independently of other risk factors but also substantially expands the total life expectancy and the CVD free life expectancy for men and women. This effect is already seen at moderate levels of physical activity, and the gains in cardiovascular disease-free life expectancy are twice as large at higher activity levels.(19)

1.3.2 ASSOCIATION OF CVD BROAD AGE GROUP AND LITERACY RATE IN INDIA

In India more than one-third (35.3 %) of the population is below 15 years of age and 7.5 % is above age 59, with the remaining 56.9 % in the 15-59 age group. According to World Health Report 2002, in 2020 AD, 2.6 million Indians are predicted to die due to coronary heart disease which constitutes 54.1 % of all CVD deaths. Nearly half of these deaths are likely to occur in young and middle aged individuals (30-69 years). The broad category of age group in India is shown **(Table No. 12)**

Table No. 12: Broad categories of age groups in India

Age Groups	**Persons**	**Males**	**Females**
6 years and below	163,819,614	84,999,203	78,820,411
Proportion to total population (%)	15.9	16.0	15.9
7 to 14 years	199,791,198	104,488,119	95,303,079
Proportion to total population (%)	19.4	19.6	19.2
15 to 59 years	585,638,723	303,400,561	282,238,162
Proportion to total population (%)	**56.9**	**57.0**	**56.9**
60 years and above	76,622,321	37,768,327	38,853,994
Proportion to total population (%)	7.5	7.1	7.8

Source: Census of India. 2011(14)

India has managed to achieve an effective literacy rate of 74.04 % in 2011. The most notable thing that came across in the 2011 census is the sharp rise in the literacy of females over males. According to the latest census (2011) there are almost 74 % literates that constitute the total population of India aged between seven and above. The improvement in literacy rate in rural area is two times that in urban areas. The rural urban literacy gap which was 21.2 percentile points in 2001 has come down to 16.1 % percentile points in 2011. **(Table No. 10, 13).**

Table No. 13: Literacy rates in India (in %)

2001 India	**2001**	**2011**	**Difference**
Overall	64.8	74.0	+9.2
Rural	58.7	68.9	+10.2
Urban	79.9	85.0	+5.1

Source: Census of India. 2011 (14)

Studies show that there is significant inverse association of literacy status with all-cause mortality in urban Indian men and women. Case-control studies have reported that SES, as measured by educational status, is inversely related to acute myocardial infarction and observational studies have reported that low SES subjects are more likely to die from acute coronary events as compared to the rich groups (20). The association of education and mortality (all-cause, CVD, IHD, and stroke) in both men and women appears to be influenced mainly by age, followed by tobacco usage and BMI. The association between level of education and prevalence of CHD and coronary risk factors in a rural population, rural have a high prevalence of illiteracy (45% men, 70% women) and provide a useful model for assessing the influence of illiteracy and of different levels of education on various coronary risk factors and the prevalence of CHD (21). Studies have shown that during the past 30 years CHD and coronary risk factors have become more prevalent among uneducated people and people of low social class. Among uneducated and less educated people in rural India major coronary risk factors such as smoking and hypertension are more prevalent. This may make these people prone to CHD(22).

The prevalence of diabetes in India is 881 in women and 1,051 in men, Gujarat 524/100,000 in men and 1,641 /100,000 in women. It is higher in West Bengal among men and women while lower in Rajasthan men and women (**Table No. 14)**. Four of the six states with the highest levels of diabetes among men (above 1,500 per 100,000 men) are also states which exhibit some of the highest levels among women, although prevalence of diabetes among men exceeds that of women in each of the four states: Kerala (3,078/100,000), Goa (3,016/100,000), Tripura (2,392 /100,000), and West Bengal (2,323/100,000). In five other states (Tamil Nadu, Goa, Tripura, West Bengal, and Delhi) the number with diabetes is relatively high (above 1,500 / 100,000 women).

Table No. 14: Prevalence rate of CVD and related risk factors in areas of study.

	India		**West Bengal**		**Gujarat**		**Rajasthan**	
	W	**M**	**W**	**M**	**W**	**M**	**W**	**M**
Who use any kind of tobacco	10.8	57.0	15.6	70.2	8.4	60.2	7.8	60.4
Who smoke cigarettes/*bidis*	1.4	32.7	1.3	50.1	0.6	26.1	3.3	41.8
Who drink alcohol	2.2	31.9	1.7	34.0	0.8	7.0	0.2	19.1

Diabetes /100,000	881	1051	1641	2323	968	524	282	362
Asthma /100,000	1696	1627	3304	2323	1530	1844	1565	1739
% of households that don't use government health facilities	65.6		71.2		72.5		29.8	
Reason – No Nearby facility	13.1		54.3		45.0		35.3	

Note: W- Women, M- Men
Source: National family health survey -2, 2005-06. (23)

National family health survey-2 (2005-06) found that the prevalence of current use of alcohol ranged a low of 7 % in Gujarat (officially under prohibition) to a high of 75% in Arunachal Pradesh and among women exceeded 5 % only in the north-eastern states (West Bengal). 39.1 % of men and 3.2 % of women between age group 35-49 drink alcohol. In rural areas 32.5% of population drinking alcohol than in urban 30.9% in India **(Table No. 14)** (23).

In 1990, CVD accounted for 63 % of all deaths and India contributed to 17 % to the worldwide mortality. Several surveys conducted across the country over the past two decades have shown a rising prevalence of major risk factors for CVD in urban and rural populations. These surveys are limited by their generalisability to other parts of the country, and more was required to roll out of an action plan.

Coronary heart disease is more prevalent in Indian urban populations and there is a clear declining gradient in its prevalence from semi-urban to rural populations.Epidemiological studies show a sizeable burden of CHD in adult rural (3–5%) and urban (7–10%) populations. Thus, of the 30 million patients with CHD in India, there would be 14 million of whom are in urban and 16 million in rural areas. In India about 50 per cent of CHD-related deaths occur in people younger than 70 yr compared with only 22 per cent in the West.

The weighted average prevalence for ischemic heart disease was estimated to be 6.4 per cent in urban areas and 2.5 per cent in rural areas. Studies show that urban populations had higher prevalence of CVD risk factors as compared to rural populations(9).

1.3.3. BASIC DEMOGRAPHIC INDICATORS OF THE STUDY AREAS:

A) Kolkata: West Bengal is an eastern state and the 4th most populous state in India. It ranks 9th among the most populous states in the world. Kolkata or Calcutta is the capital of Indian state of West Bengal. As of 2011, the city had 4.5 million residents; the urban agglomeration, which comprises the city and its suburbs, was home to approximately 14.1 million, making it the 3rd most populous metropolitan area in India among South Asian cities, behind Mumbai and Delhi. As a growing metropolitan city in a developing country, Kolkata confronts substantial urban pollution, traffic congestion, poverty, overpopulation, and other logistic and socioeconomic problems. **(Table No.10)**

CVD emerged as major killer in Bihar, Orissa, Jharkhand, West Bengal (eastern region) of the country. At least 18.3 % people die of CVDs in this eastern region and out of them 19.5 % are male while the share of female is 17 %. A recent report on the current trends of public health in West Bengal Government revealed that 62.4% of NCD deaths were caused by heart diseases and strokes. In West Bengal more than 75% of the population use some form of tobacco and maximum number of lung cancers are also reported from this state (Cancer Foundation of India).

A study carried out by the Department of Community Medicine of Midnapore Medical College in Paschim Midnapore, found out that in 70.12% of the population who were in the age group of 18-45 years, alcoholism was the main form of addiction. A substantial proportion (22.99%) of individuals exhibited stage 1 (14.72%) and stage 2 (8.27%) hypertension and 39.69% were in pre-hypertensive category. Only 2.66% were on medication. About 30% of the women and 18% of the men in Kolkata are obese. Bengalis are somewhat unique in their food habits nearly every community will eat meat or fish, majority 99 % of the populace in Kolkata are non-vegetarian. Rice is the staple food, fish, goat, mutton and chicken are commonly eaten across social strata; the only exception is beef, which if ever, is restricted to Muslim communities. *Shorsher tel* (mustard oil) is the primary cooking medium in Bengali cuisine although *Moongphali tel* (groundnut oil) is also used, because of its high smoke point. (24)

Kolkatan's will have to pledge to take better care of their hearts by growing more healthy food habits and leading a disciplined lifestyle. A recent study showed that 74% of respondents from the city had the risk of developing CVDs, highest among the metros. The all-India figure stands

at 72%, according to Saffola Life Heart Study 2012. Kolkata also emerged the 'smoking capital' with 19% of the respondents being smokers, the all-India figure being about 16%. According to doctors, smoking is known to increase blood pressure and release free radicals (25).

B) Ahmedabad: (also Amdavad), originally known as Karnavati, is the largest city and former capital of the Indian state of Gujarat. With a population of more than 5.5 million and an extended population of 6.3 million, it is the 5th largest city and 7th largest metropolitan area of India. The district Ahmedabad is the most urbanized district in the state. *Forbes* magazine list of the world's fastest growing cities included Ahmedabad at number 3 after Chengdu and Chongqing from China. **(Table No. 10)**

Gujarat is ranked 15th among the states of India considering population density. Two-fifths (42%) population of Gujarat resides in urban areas and it has ranked 5th urbanized state of India. 57.47 % of population in Gujarat is living in rural areas. A sex ratio of 920 girls for 1000 boys one of the lowest (ranked 24) among the 29 states in India. Gujarat has some of the largest business corporations in India. Its 98.86% village connectivity with all-weather roads is one of the highest in India. More than 900,000 internet users and all villages are connected with broadband internet. On average, households in Gujarat are comprised of about 5 members. About one-third of the population in Gujarat (32%) is under age 15, only 5 % is age 65 and above.

Gujarat is considered as “Diabetic capital of India”. Adults in Gujarat suffer from a dual burden of malnutrition; more than one-third of adults are too thin (36% of both women and men age 15-49), and 17 % of women and 11 % of men are overweight or obese. Only 47 % of women and 53 % of men are at a healthy weight for their height. Overweight and obesity are most common in older adults and among those in urban areas, well-educated, and those in highest wealth quintile.

Tobacco use is more common in rural areas than in urban areas. 60% of men and 8% of women use some form of tobacco, including 7 % of pregnant women. Women and men who use tobacco are most likely to chew tobacco in the form of *paan masala, gutkha,* or other tobacco. Among men who use tobacco, smoking cigarettes or *bidis* is also quite common. In Gujarat women and men are more likely to use tobacco than to drink alcohol. One in six men (16%) and 1 % of women drink alcohol. 38% of men, who drink, consume alcohol once a week or more frequently. Among men, use of alcohol is lower in Gujarat than in any other state.

Majority 82 % of the populace in Gujarat is vegetarian, only 8% Muslims, 6% SC & OBC's and 4 % Adivasis are meat eating. The typical Gujarati food consists of *Rotli*, *Dal* or *Kadhi*, Rice, and *Shaak/Sabzi* (a dish made up of different combinations of vegetables and spices, which may be spicy or sweet). Most snacks or light meals are deep fried and made with Besan (Gram Flour). The 108 Emergency Services was launched by the State Government in collaboration with EMRI to cater to wide ranging medical emergencies including cardiac arrests, which now form the largest group of cases attended by the service. Response time in urban areas is between 7-14 minutes and rural areas between 30-45 minutes depending upon the remoteness of the location.

Gujarati's lead the toll for diabetes as well, and the dietary aspect of this is really the fallout of the state's economic success. Unlike most Indian states, Gujarat has a rich and developed urban culture because of the mercantile nature of its society. Gujarati's have been living in cities for centuries. According to Associated Chambers of Commerce and Industry of India (ASSOCHAM) report, Delhi ranked (1^{st})in terms of people afflicted to heart disease, followed by Bangalore (2^{nd}), Mumbai (3^{rd}), Ahemdabad (4^{th}), Chandigarh (5^{th}), Hyderbad (6^{th}) and Pune (7^{th}). The survey conducted by Metropolis Healthcare screened over 1 lakh samples to evaluate risk factors for coronary diseases in both men and women and found that men between 25 and 45 years in Ahmedabad have alarmingly high cholesterol and triglyceride levels, which are one of the key risk factors for heart disease. A another survey shows 54% Amdavadis over 30 have low levels of good cholesterol, or HDL, that draws out the body's excess fatty cholesterol molecules and ejects them through the liver. Across India's urban hubs, the survey puts the number of heart-unhealthy people at a high 72%. Ahmedabad is a step ahead at 73%. "This means 72% of the total respondents had a moderately high risk of developing CVD.(26)

C) Bhavnagar: is a city in the Indian state of Gujarat. Bhavnagar is situated 198 km from the state capital Gandhinagar. The total Population of Bhavnagar 2,469,630 among male 1,274,920 and female are 1,194,710 with the sex ratio of 931 and Population density is 247 and % urbanization is 25.07 %. Bhavnagar is well connected to other major cities of Gujarat such as Vadodara, Ahmedabad, Rajkot, Jamnagar, Surat, etc. by road, rail. The larger the elderly population the greater would be the need for social support for the elderly. 7.43 % of the Bhavnagar population is over the age of 59 years. The vast majority nearly 70% of the Gujarati people consume a vegetarian diet.

India has diverse lifestyle pattern and ethnic variations, thus epidemiological profile of diabetes mellitus may be different in different geographical areas. A diet rich in oil and sugar content has pushed Gujarat to the forefront of contributors of diabetic patients in India. Ethnic Gujarati people are presumed to have high prevalence of CVD risk factors: Obesity, metabolic syndrome, diabetes, hypertension, because of traditional Gujarati food and less physically active lifestyle in another study on diabetic in Gujarati population, even rural underdeveloped areas of Gujarat had shown an increasing trend of lifestyle disorders like diabetes and obesity. Another study had also shown increasing prevalence of another lifestyle disorder – hypertension and obesity in Gujarati population.(27)

D) Tonk: Rajasthan is the 2nd largest state in India having 10.4% of the total area of the country. However, it ranks 9th in terms of population, having only 5.20% of the total population. Most of area of the state is arid or semiarid, and more than 3/4th of population resides in rural area. Tonk is one of the well renowned Districts of Rajasthan. The City of Tonk is the Administrative Headquarters of the district. Nawabi Nagari 'Tonk' is famous not only in Rajasthan but also all over India for its historical Importance. According to 2011 census 82 % of population is Hindu and 10.3% of the Muslim in Tonk area. Rajasthan is predominantly an agricultural state with a little more than 77% of population living in rural areas. In Tonk 97% of population are living in the rural areas and agriculture is the single largest sector. The Food habit of most of the population is vegetarian. The town was purposively selected, taking into consideration the feasibility of the study. The town is well connected with the Road and Railway and has a community health center. The town is having few private clinics and trust hospitals.

1.4 CARDIOVASCULAR DISEASE AND ITS RISK FACTORS

CVD and its risk factors constitute the main focus of this thesis. Nearly 95 % of people who developed a fatal CVD had at least one of these major risk factors. But it can also develop in the absence of any traditional risk factors and evidence is accumulating that several other risk factors may help predict or contribute to CVD. Modification of CVD risk factors requires a change in lifestyle habits and behaviors.

The major risk factors for developing heart disease are the same; these include hypertension, obesity, cigarette smoking, hyperlipidemia, diabetes, sedentary lifestyle, stress, age, heredity and

race. The adverse effects of distance on access to services, lack of population growth in many communities, insufficient communication systems, response times, small population numbers and potential stigma from the greater visibility of circumstance exacerbate these risk factors. With modernization, a large proportion of Asians are trading healthy traditional diets for fatty foods, physical jobs for deskbound sloth, the relative calm of the countryside for the stressful city (6).

Knowledge of the true magnitude of the problem is limited in India. But it is usually assumed that the burden on the health system due to CVD will definitely be on the increase in the future, because of several reasons:

- Increase awareness of the problem and the demand for health care facilities.
- Control of infectious disease and subsequent emerging importance of non-infectious conditions in the total disease load.
- Ageing of the population, leading increase in the absolute numbers of CVD.

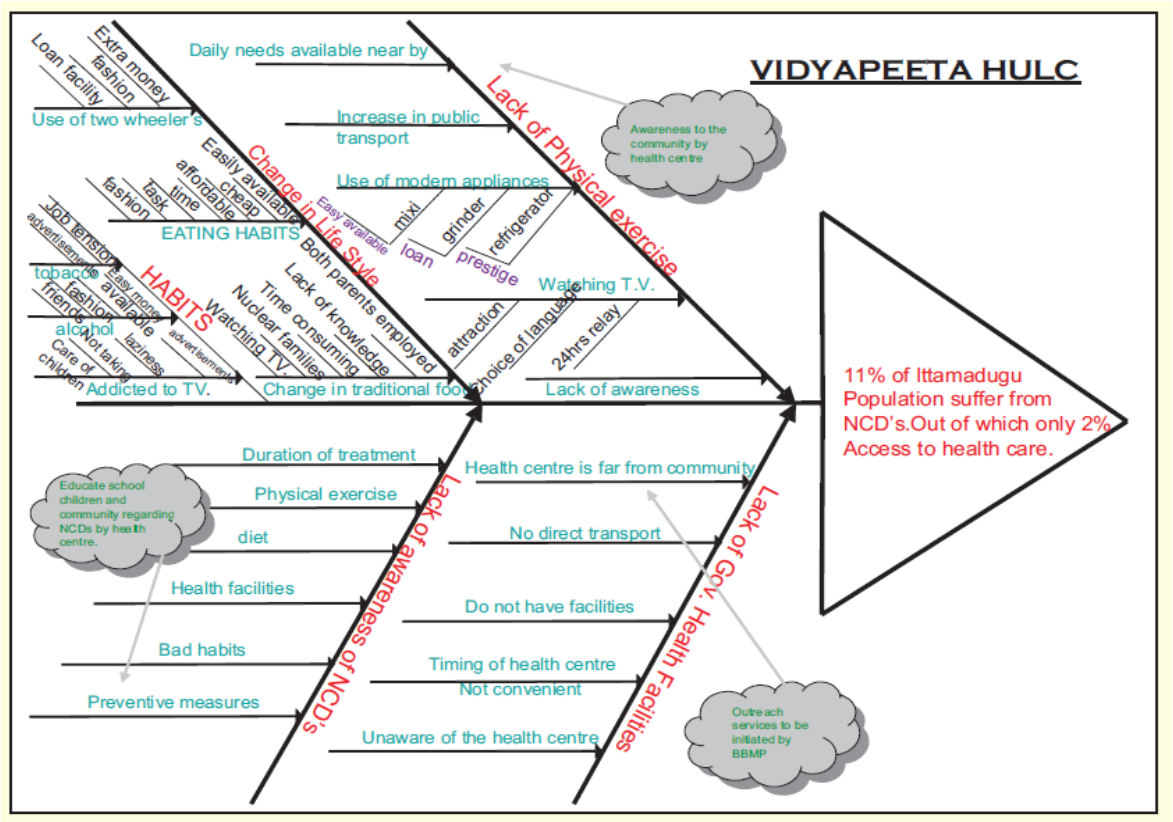
The epidemiological transition (from traditional living patterns to typical westernized lifestyles) that takes place in countries undergoing development is associated with a change from a low CVD level to very high risk factor levels preceding the eventual emergence of high CVD rates as predicted by the global burden of disease study (28).

It is estimated that US$24 billion or 2.4% of the US health care expenditure is directly related to a lack of physical activity (29). Regular physical activity reduces the risk of obesity, blood lipid abnormalities, hypertension, and non-insulin dependent diabetes mellitus, and has been shown to reduce substantially the risk of CHD. Conversely, measures of sedentary lifestyles or physical inactivity have been associated with a 1.5 to 2.4 fold elevation in CHD risk(30). As a result of economic changes and increased mechanization, the prevalence of physical inactivity is increasing in India, particularly in urban areas, to levels comparable with the West. However, the association between leisure-time exercise, sedentary lifestyles, and risk of CHD has not been assessed within India (31).

Studies have already shown that NCDs have their roots in unhealthy lifestyles or adverse physical and social environments. Risk factors like unhealthy nutrition over a prolonged period, smoking, physical inactivity, excessive use of alcohol, and psychological stress are among the major lifestyle risk factor issues.

Fishbone diagram shows the causes of NCDs in relation to habits and lifestyle, causes of the lack of awareness and community's lack of access to the BBMP health centre(32) **(Figure No. 6)**

Figure No. 6: Fishbone diagram: shows the differnt causes of NCD's



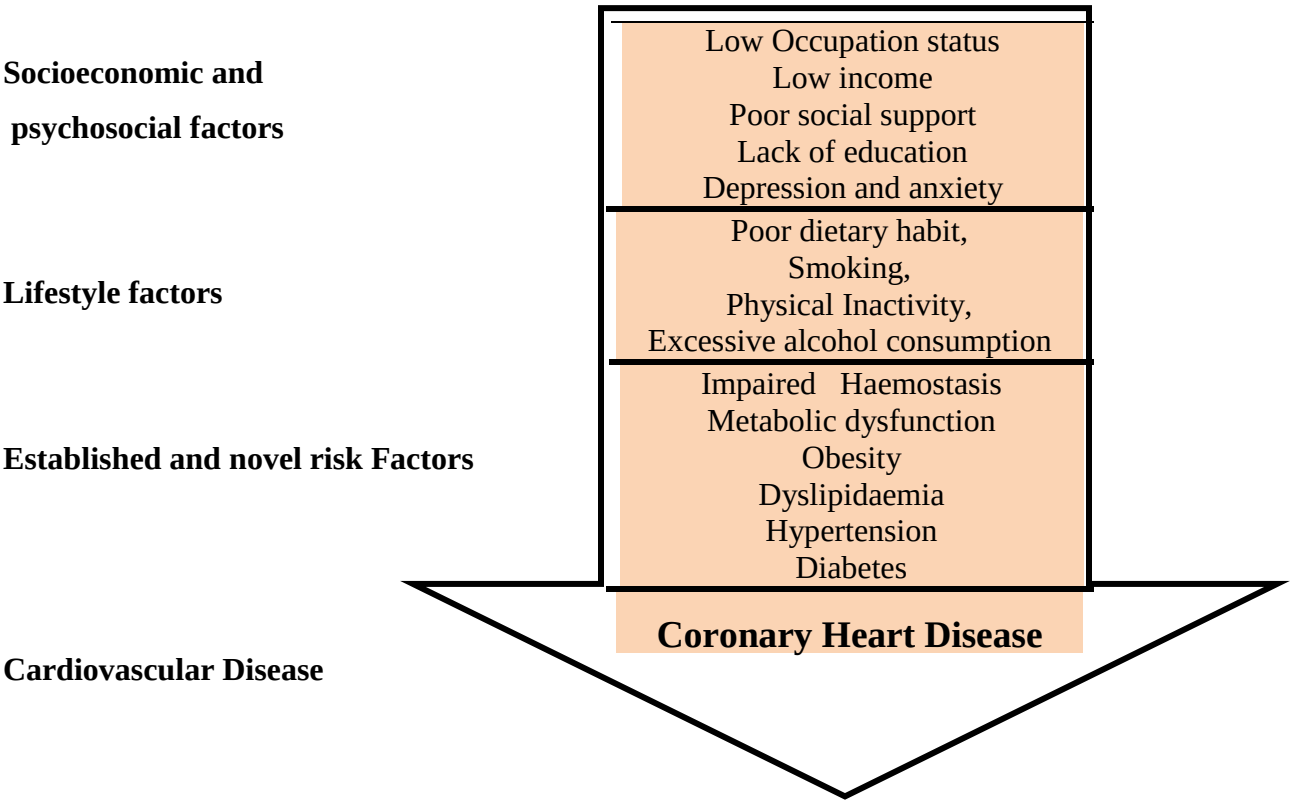
Source : Bangalore Heathy urbanization project "An enquiry into the social determinants of health through healthy urbanization learning circles"(32).

There is also an increasing interest in the effect and understanding of the lifestyle factors, which are considered the main underlying causes of the established risk factors; physical inactivity, poor dietary habits, smoking, and excessive alcohol consumption.

The interest in lifestyle factors was further heightened in 2004 when the Canadian-led INTERHEART study was published. This global study identified nine (9) modifiable risk factors (smoking, lipids, hypertension, diabetes, obesity, diet, physical activity, alcohol consumption, and psychosocial factors) that account for over 90% of the risk of myocardial infarction. The INTERHEART investigators found these risk factors universal, occurring in almost every geographic region and racial/ethnic group worldwide, and are consistent in men and

women(33). The lifestyle factors are in turn, strongly influenced by a number of psychosocial factors also such as depression, anxiety and social support, and socioeconomic factors like education, occupational status and income(34). Relations between CVD, established and novel risk factors, lifestyle factors, socioeconomic and psychosocial factors are described in model. (**Figure No.7)**

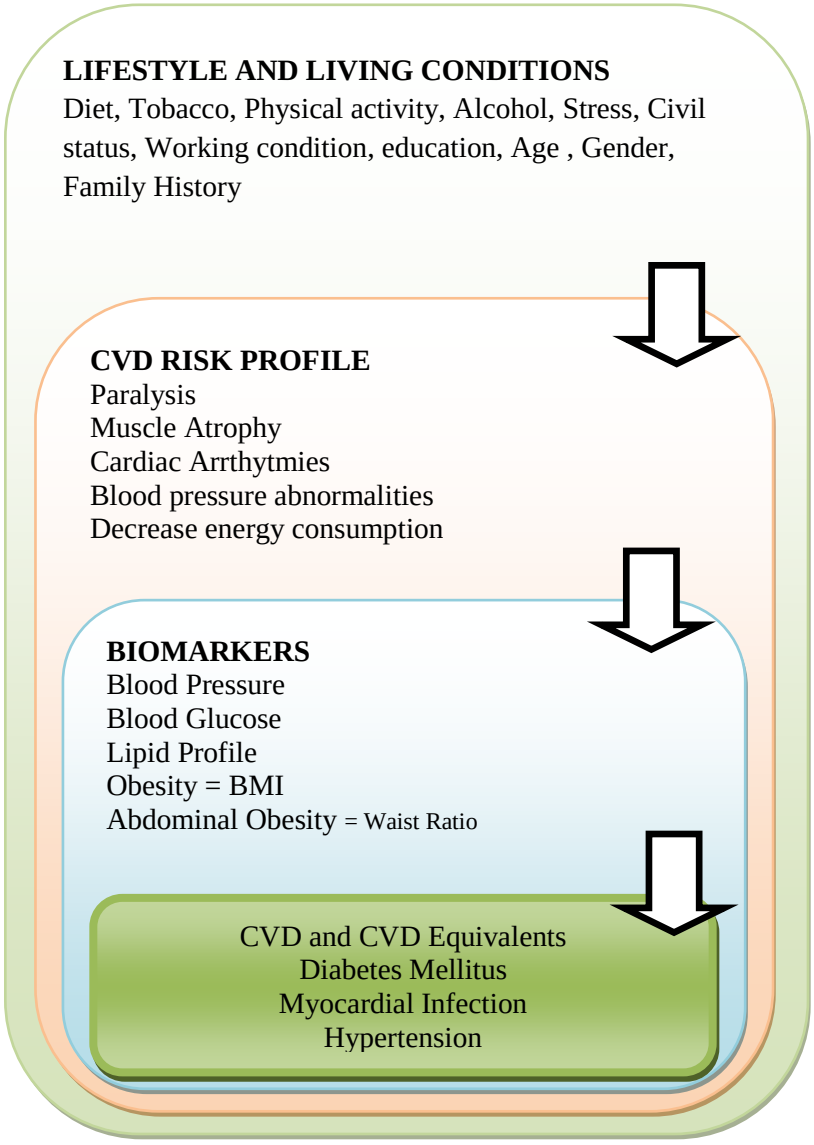
Figure No 7. A schematic model presenting the relations between CVD, established and novel risk factors, lifestyle, socioeconomic and psychosocial factors.



Source : Risk factors : Lifestyle factors and novel biomarkers, Patrik Wennberg; 2009(35)

Another framework shows the risk factors promoting the CVD process can be sub classified into *non-modifiable factors* such as age, gender and family history of premature CVD and *modifiable factors* such as physical activity, smoking, eating habits, overweight/obesity, stress and depression. Further, conditions such as diabetes mellitus (DM), (DL) and hypertension (HTN), comprise diagnoses in their own right as well as constitute biomarkers indicating an accelerated atherosclerotic process **(Figure No. 8)**(36) .

Figure No. 8: Frame work - Lifestyle, Living conditions (outer circle), SCI- specific CVD risk profile and biomarkers of relevance for CVD risk

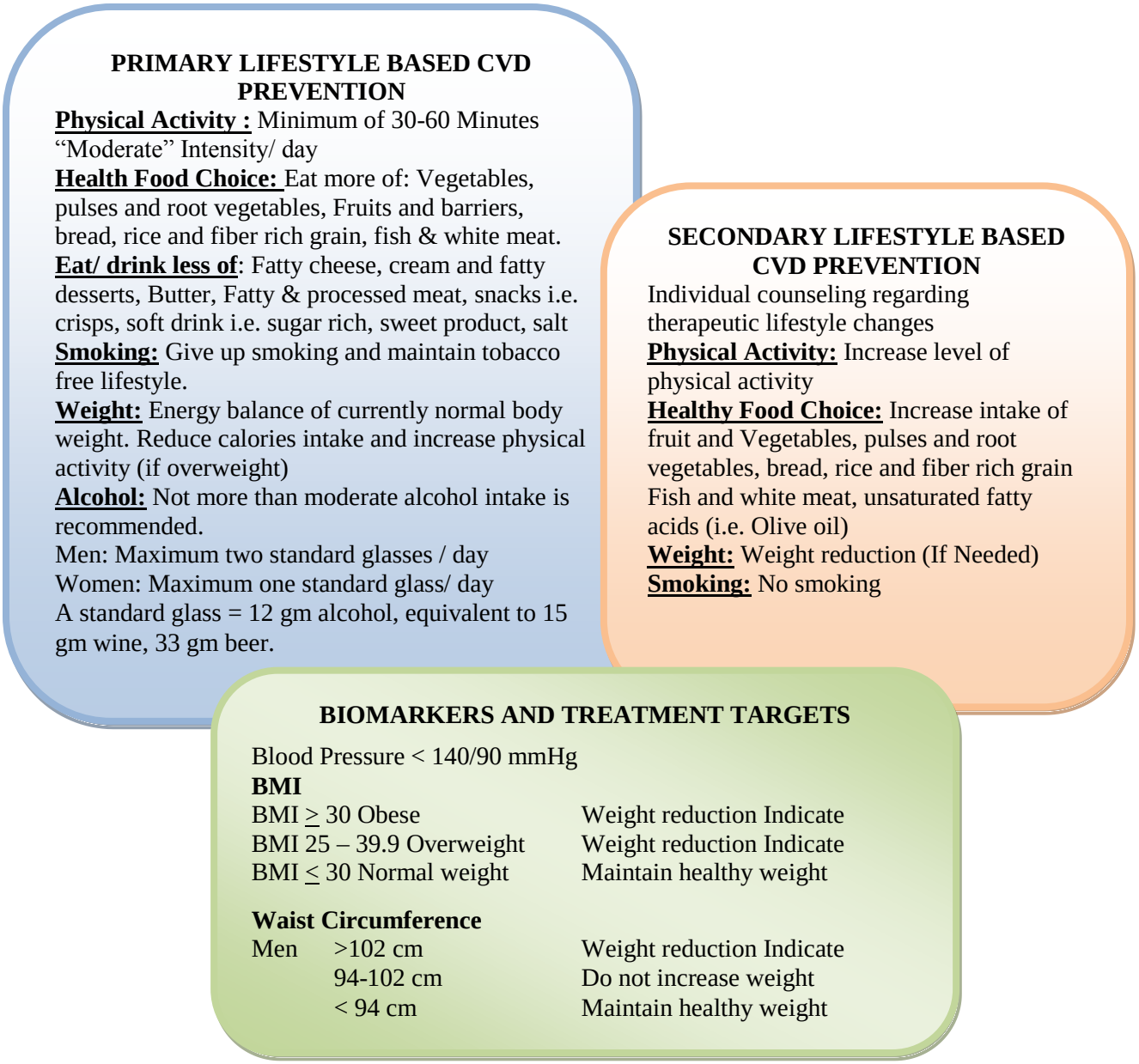


The studies included in the thesis do not cover the full spectrum of CVD. A number of key CVD diagnoses and CVD risk factors have been selected as indicators of the need for CVD related prevention. Additionally, the modifiable CVD risk factors smoking and overweight, the non-modifiable risk factors: age, gender and family history (of premature CVD) were included.

Primary and secondary prevention strategies on CVD risk

Primary as well as secondary prevention strategies on CVD and CVD risk factors in able-bodied persons are based on TLC regardless of whether additional measures (e.g. medication) are deemed to be indicated or not(37). **(Figure No. 9)**

Figure No. 9: Primary and Secondary prevention strategies on CVD risk (37)



1.4.1 MODIFIABLE AND NON- MODIFIABLE RISK FACTORS OF CVD

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

(1) A high prevalence in many populations,

(2) A significant independent impact on the risk of coronary heart disease,

(3) Treatment and control result in reduced risk.

Risk factors for CVD are now significant in all populations. In the developed countries, at least one-third of all CVD is attributable to five risk factors: tobacco use, alcohol use, high blood pressure, high cholesterol and obesity. In developing countries with low mortality, such as India, populations face a double burden of risks, grappling with the problems of under nutrition and communicable diseases, while also contending with the same risks as developed nations. Even in developing countries with high mortality, such as those in Sub-Saharan Africa, high blood pressure, high cholesterol, tobacco and alcohol use, as well as low vegetable and fruit intake, already figure among the top risk factors.

Some major risks are modifiable in that they can be prevented, treated, and controlled. There are considerable health benefits at all ages, for both men and women, in stopping smoking, reducing cholesterol and blood pressure, eating a healthy diet and increasing physical activity(1).

Major Modifiable Risk factors of CVD (1)

- **High blood pressure:** Major risk for heart attack and most important risk factor for stroke.
- **Abnormal blood lipids:** High total cholesterol, LDL-cholesterol and triglyceride levels, and low levels of HDL cholesterol increase risk of CHD and ischemic stroke.
- **Tobacco use:** Increases risks of CVD, especially in people who started young and heavy smokers. Passive smoking an additional risk.
- **Physical inactivity:** Increases risk of heart disease and stroke by 50%.
- **Obesity:** Major risk for CHD and diabetes.
- **Unhealthy diets:** Low fruit and vegetable intake is estimated to cause about 31% of CHD and 11% of stroke worldwide; high saturated fat intake increases the risk of heart disease and stroke through its effect on blood lipids and thrombosis.
- **Diabetes mellitus:** Major risk for coronary heart disease and stroke.

Other modifiable risk factors of CVD

- **Low socioeconomic status (SES):** Consistent inverse relationship with risk of heart disease and stroke.
- **Mental ill-health:** Depression is associated with an increased risk of CHD.
- **Psychosocial stress:** Chronic life stress, social isolation and anxiety increase the risk of heart disease and stroke.
- **Alcohol use:** One to two drinks per day may lead to a 30% reduction in heart disease, but heavy drinking damages the heart muscle.
- **Use of certain medication:** Some oral contraceptives and hormone replacement therapy increase risk of heart disease.
- **Lipoprotein (a):** Increases risk of heart attacks especially in presence of high LDL-cholesterol.
- **Left ventricular hypertrophy (LVH):** A powerful marker of cardiovascular death.

Non-Modifiable risk factors of CVD

- **Advancing age:** CVD becomes increasingly common with advancing age. Most powerful independent risk factor for CVD; risk of stroke doubles every decade after age 55. As a person gets older, the heart undergoes subtle physiologic changes, even in the absence of disease.
- **Heredity or family history of Heart Disease:** A family's history of CVD indicates a person's risk. The risk increased, if a first-degree blood relative has had CHD or stroke before the age 55 years (for a male relative) or 65 years (for a female relative).
- **Gender:** Higher rates of CHD among men compared with premenopausal age women. Risk of stroke, however, is similar for men and women.
- **Ethnicity or race:** Increased stroke noted for Blacks, some Hispanic Americans, Chinese, and Japanese populations. Increased CVD deaths noted for South Asians and American Blacks in comparison with Whites.

"Novel" risk factors

- **Excess homocysteine in blood:** High levels may be associated with an increase in cardiovascular risk.

- **Inflammation:** Several inflammatory markers are associated with increased cardiovascular risk, e.g. elevated C-reactive protein (CRP).
- **Abnormal blood coagulation:** Elevated blood levels of fibrinogen and other markers of blood clotting increase the risk of cardiovascular complications.

The famous study conducted in United States of America was one of the first studies to identify several classes of contributors to CVD. The risk factors of CVD, notably CHD and strokes are presented in **Table No. 15**. Although research into CVD risk factors has identified factors that are non-modifiable of CVD, it is now recognized that most of the premature deaths and much of the morbidity caused by CVD are to a significant extent, preventable through behaviour change. The positive relationship between sedentary lifestyle, high fat diet and cigarette smoking and CVD have been consistently supported by the research (38).

Behaviour change strategies play an important role in the modification of risk factors, prevention and treatment of CVD. Lifestyle behaviors can be considered as primary modifiable CVD risk factors because of their direct impact on the physical inactivity, high fat diet and cigarette smoking, also influence on development of obesity, diabetes and hypertension, which are considered as clustering or secondary modifiable risk factors for CVD.

Table No. 15: Risk factors for coronary Heart disease and Stroke

Risk Factors	**CHD**	**Stroke**
Demographic and Hereditary Factors (Non- Modifiable)		
Age	✓	✓
Sex	✓	-
Family History of Disease	✓	✓
Behavioral Risk Factors (Modifiable)		
Tobacco	✓	✓
Smoking	✓	✓
Physical Inactivity	✓	✓
High Fat Intake	✓	✓
Physiological Risk Factors (Modifiable)		
High Blood Pressure	✓	✓
Obesity	✓	✓
Diabetes Mellitus	✓	✓

Source : Australian Institute of health and Welfare (1999) (38)
Note: (✓) -substantial evidence of association between the risk factor and disease.
(-) -No known association

NON- MODIFIABLE CVD RISK FACTORS

1.4.2 AGE, SEX, FAMILY HISTORY OF HEART DISEASE

A) Age

Chronological age is the strongest single risk factor for CVD, even after adjustment for other risk factors (39). Age is a "non-modifiable" risk factor for CVD. CVD remains the most important cause of death and physical impairment among older people. Extensive evidence has indicated a positive linear relationship between age and CVD. Men 45 years of age and older and women 55 years of age and older are more likely to have CHD. However now-a-days, CHD can occasionally strike a person in their 20's (40). A more worrying fact is that the incidences of CVDs have gone up significantly for people between the ages 25 and 69 to 24.8%, which means we are losing more productive people due to these diseases (4).

There is a marked difference in the prevalence rate in percentage of CHD in India. The statistics presented deaths by major causes, CVD alone at different ages, gender (male or female) (**Table No.16)**. A higher percentage of female deaths occur than male deaths below the age of 5 years, despite the fact that neonatal mortality in the first month of life is more common among males. The proportion of female deaths is higher even in the age groups 5-14 years and 15-24 years. In contrast, men have a higher proportion of deaths occurring at ages 25-54 and 55-69.There is sharp increase double folds in deaths by CVD at 25-34 age groups(10).

Among adults over 20 yr of age, the estimated prevalence of CHD is around 3-4 per cent in rural areas and 8-10 per cent in urban areas, representing a two-fold rise in rural areas and a six-fold rise in urban areas between the years 1960 and 2000(41).

Table No.16: Percentage of distribution of deaths by CVD in age groups, gender in India.

Age Group	**(%age deaths by CVD)**	
	Male	**Female**
0 – 4	0.4	0.4
5 – 14	1.3	1.9
15 – 24	6.3	6.3
25 – 34	11.6	9.3
35 – 44	18.8	14.3
45 – 54	27.0	21.8
55 – 69	31.6	27.6

Source: Report on Causes of Death in India, 2001-2003; New Delhi. 2008 (10)

Greater age standardized prevalence rate for men aged 60-69 years. There are also marked contrasts in CHD between urban and rural in India. Forecasting the prevalence rate (%) of CHD in India among men and women and urban and rural is shown in **Table No. 17 and 18**.

Table No. 17: Forecasting prevalence rate (%) of coronary heart disease (CHD) in India

Years	Area	20-29 years		30-39 years		40-49 years		50-59 years		60-69 years	
		M	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
2000	Urban	5.14	5.06	6.16	6.14	8.16	10.29	12.14	11.29	17.76	17.27
	Rural	1.80	1.30	3.10	2.90	3.17	6.55	4.64	10.38	10.21	9.67
2005	Urban	6.53	6.37	7.35	7.49	9.11	12.26	12.68	12.62	19.50	19.14
	Rural	1.80	1.30	3.78	2.90	3.55	7.39	4.93	11.88	11.24	11.02
2010	Urban	7.92	7.67	8.54	8.84	10.06	14.22	13.31	13.95	21.25	21.00
	Rural	1.80	1.30	4.45	2.90	3.94	8.23	5.22	13.38	12.28	12.37
2015	Urban	9.30	8.98	9.73	10.16	11.01	16.19	13.77	15.28	22.99	22.87
	Rural	1.80	1.30	5.13	2.90	4.32	9.08	5.50	14.89	13.31	13.71

Source: NCMH Background papers-Burden of disease in India (New Delhi, India), Sept. 2005(9)

Note: M- Male and F- Female

Table No. 18: Estimated mortality from Coronary Heart Disease (CHD) in India-2015

Year	Death in age group (years) (4%)			Death in age group (years) (6%)		
	20-29	**30-39**	**40-49**	**50-59**	**60-69**	**Total deaths**
2000	180,448	219,571	244,778	352,758	302,503	1,300,057
2005	246,016	290,149	333,361	462,978	385,940	1,718,444
2010	332,687	363,820	438,981	438,981	512,452	2,250,378
2015	419,680	498,062	572,420	572,402	675,636	2,946,268

Source: NCMH Background papers- Burden of disease in India (New Delhi, India), Sept,2005(9)

There is a marked regional variation in the contribution of various causes to the leading deaths. CVD is the leading cause of death in the all regions of India, with the highest proportion in the southern region (25%) and the lowest in the central region (12%). The other prominent causes of death across different regions are respiratory diseases, diarrhoeal diseases, perinatal conditions, tuberculosis and cancer.

The Top ten (10) leading causes of death among different age groups (10)**:-**

Age group 15-24 :

1. Intentional self-harm (16%)	**2.** Unintentional injuries: other (12%)
3. Symptoms signs and ill-defined conditions (7%)	**4.** Motor vehicle accidents (7% - 12% males and 2% females)
5. Tuberculosis (7%),	**6.** Maternal conditions (13% females)
7. Cardiovascular diseases (6.3% chiefly reflecting rheumatic or others)	**8.** Diarrhoeal diseases (6.2%)
9. Other infectious and parasitic diseases (4.8%)	**10.** Malaria (4.7%)

Age group 25-69: The mortality rate rises sharply in this age group.

1. CVD (25%)	**2.** COPD, other respiratory (10.2%)
3. Tuberculosis (10.1%)	**4.** Malignant and other neoplasms (9%)
5. Symptoms signs & ill-defined conditions (5.3%)	**6.** Digestive diseases (5.1%)
7. Diarrhoeal diseases (5%)	**8.** Unintentional injuries: other (4.6%)
11. Intentional self-harm or suicide (3%)	**12.** Malaria (2.8%)

B) Sex

The threat of CVD is prominent in both females and males. However, of the two sexes, men have the greater relative risk of developing CVD at any given combination of age and risk profile score than women. Males are twice as likely to die from CVD related illness than females, while males aged under 65 years experiencing 3 to 5 times higher death rates than females. Once past the menopause, a women's risk is similar to a man's (42). **Table No. 19.**

Table No.19 : Lifetime Risk of Developing Heart Disease (43)

Lifetime Risk of Developing Heart Disease		
Age	**Men**	**Women**
After age 40	49%	32%
At age 70	35%	24%

C) Family History of Heart Disease

A person have a family history of early heart disease if a first-degree relative (parent, brother or sister, or child) was diagnosed with heart disease or died suddenly from heart problems before age 65 in female relatives, or before age 55 in male relatives. Family history, a well-known "non-modifiable risk factor" for CVD, represents genetic, environmental, and behavioral

elements, and the interactions between them. Family history of CHD concluded that CHD risk increases up to two times with a parental history of disease.

A positive family history of early heart disease increased risk for heart disease, even if don't have other risk factors such as high cholesterol, high blood pressure, diabetes, and obesity. If have a family history, can reduce risk of getting CVD by controlling other risk factors such as not smoking, managing high blood pressure, managing high blood cholesterol, being physically active, keeping to a healthy weight and body shape and controlling diabetes.

MODIFIABLE CVD RISK FACTORS

1.4.3 BMI INDEX, HYPERTENSION/HIGH-BLOOD PRESSURE, DIABETES AND STROKE

A) Body Mass Index (BMI)

While the formula previously called the Quetelet Index for BMI dates to the 19th century, the new term "Body Mass Index" for the ratio and its popularity date to a paper published in the July edition of 1972 in the Journal of Chronic Diseases by Ancel Keys, which found the BMI to be the best proxy for body fat percentage among ratios of weight and height(44); the interest in measuring body fat being due to obesity becoming a discernible issue in prosperous Western societies.

BMI was explicitly cited by keys as being appropriate for *population* studies, and inappropriate for individual diagnosis. Nevertheless, due to its simplicity, it came to be widely used for individual diagnosis, despite its inappropriateness.

BMI provided a simple numeric measure of a person's "thickness" or "thinness", allowing health professionals to discuss over- and under-weight problems more objectively with their patients. However, BMI has become controversial because many people, including physicians, have come to rely on its apparent numerical authority for medical diagnosis, but that was never the BMI's purpose; it is meant to be used as a simple means of classifying sedentary (physically inactive) individuals, or rather, populations, with an average body composition (45).

Define BMI:

Body mass index is defined as the individual's body weight divided by square of height.

Formula: The formulae universally used in medicine produce a unit of measure of kilogram/meter^2.

$$BMI = \frac{\text{Weight in kilogram}}{(\text{Height in meter})^2}$$

A frequent use of the BMI is to assess how much an individual's body weight departs from what is normal or desirable for a person of his or her height. The weight excess or deficiency may, in part, be accounted for by body fat (adipose tissue) although other factors such as muscularity also affect BMI significantly.

The WHO regards a BMI of less than 18.5 as underweight and may indicate malnutrition, an eating disorder, or other health problems, while a BMI greater than 25 is considered overweight and above 30 is considered obese (46).

These ranges of BMI values are valid only as statistical categories shown in **Table No. 20**.

Table No. 20: BMI values

Category	**BMI range – kg/m^2**
Severely underweight	less than 16.0
Underweight	from 16.0 to 18.5
Normal	from 18.5 to 24.99
Overweight	from 25 to 29.99
Obese Class I	from 30 to 34.99
Obese Class II	from 35 to 39.99
Obese Class III	$\geq$ 40

Source: Adapted from WHO, 1995, WHO, 2000 and WHO 2004.

BMI values are age-independent and the same for both sexes. However, BMI may not correspond to the same degree of fatness in different populations due, in part, to different body

proportions. The health risks associated with increasing BMI are continuous and the interpretation of BMI grading in relation to risk may differ for different populations.

Classification of adults according to BMI in Indian (47):

Though globally a BMI of 25 is accepted as normal, for Asian Indians this value is considered higher because at lower BMI they tend to accumulate higher fat percent age which is the actual cause behind developing various other medical disorders and diseases. A normal BMI should ideally fall between 18.5 and 22.9. A BMI between 23 and 24.9 is considered overweight and anything above that qualifies as obese. The classification of Underweight, Normal Overweight and Obese according to BMI in Indian is given in the **Table No.21** below:

Table No. 21: Classification of adults according to BMI in Indians

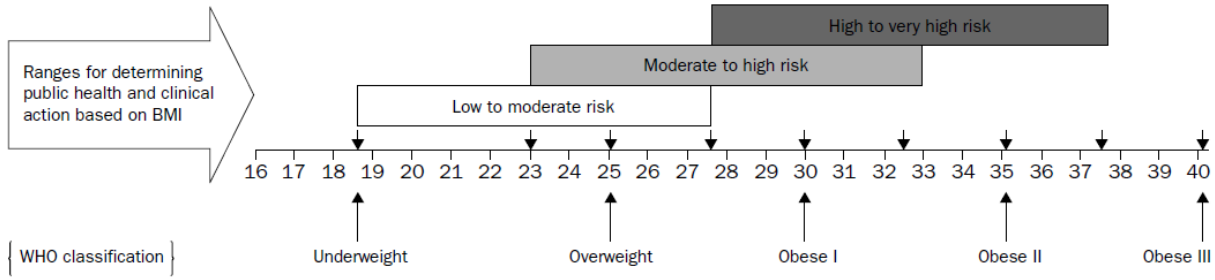
Classification	**Popular Description**	**BMI (kg/m^2)**	**Risk of co-morbidities**
Underweight	Thin	<18.5	Low (but risk of other clinical problems increased)
Normal range	Normal	18.5 - 22.9	Average
Overweight		$\geq$ 23	
At risk	Overweight	23.0 - 24.9	Increased
Obese Class I	Obese	25.0 - 29.9	Moderate
Obese Class II	Obese	30.0 -39.9	Severe
Obese Class III	Morbidly Obese	$\geq$ 40.0	Very severe

Source: Adapted from WHO, The Asia-Pacific Perspective: Redefining Obesity and its treatment; Feb,2000; page:18 (47)

Body-mass index (BMI) cut-off points for public health action: BMI cut-off points for overweight and obesity have many uses, all of which are applicable to Asian countries. For policy purposes, such cut-off points are applied to population data to inform and trigger policy action, to facilitate prevention programs, and to measure the effect of interventions. For epidemiological purposes, associations between BMI and health outcomes within and across populations are used to help ascertain the cause of diseases. When assessing the effect of BMI on health outcomes, the rate difference was regarded as the best measure, since relative risk depends on baseline data and could be misleading when baseline rates are vastly different. However,

relative risk should be considered when investigating causes. Population attributable risk is particularly useful for policy since it identifies the largest burden of risk.

BMI cut-off points are also used clinically to identify high-risk individuals for screening; identify individuals for absolute risk assessment; determine the type and intensity of treatment; monitor individuals for effects of treatment over time; determine institutional policies on individuals, for example, insurance reimbursement; and increase awareness of risk for individuals. Factors to be considered, and a relevant clinical decision-making algorithm, were described by the 1997 WHO Expert Consultation. For clinical applications, the cut-off points should be used with an individual's clinical history and with other clinical measurements, such as waist circumference and presence of other related risk factors.



Source: "Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies". http://www.who.int/nutrition/publications/bmi_asia_strategies.pdf

Three specific factors lead WHO to convene another expert consultation on BMI classifications.

1. There was increasing evidence of the emerging high prevalence of type 2 diabetes and increased cardiovascular risk factors in parts of Asia where the average BMI is below the cut-off point of 25 kg/m2 that defines overweight in the current WHO classification.
2. There was increasing evidence that the associations between BMI, percentage of body fat, and body fat distribution differ across populations. In particular, in some Asian populations a specific BMI reflects a higher percentage of body fat than in white or European populations. Some Pacific populations also have a lower percentage of body fat at a given BMI than do white or European populations.

3. Most evidence suggests a J-shaped relationship between BMI and mortality, with the obese having the highest risk. Increased mortality among the obese is evident for several life-threatening diseases including Type 2 diabetes, CVD, gall bladder disease and hormone-sensitive and gastrointestinal cancers. Risks are also higher for some non-fatal conditions such as back pain, arthritis, infertility and poor psychosocial functioning (47).

During 1975 to 2005, the proportion of adults with body mass index below 18.5 fell from 56% to 33% among men and 52% to 36% among women. Similarly, between 1975-79 and 2004-05, there have been reductions of around 50 % in the prevalence of severe under nutrition, among children as well an upward trend has been observed in the height and weight of urban middle and upper class children (48). Despite this improvement in BMI, for both adults and children, anthropometric indicators of nutritional status in India are among the worst in the world. Close to half of all Indian children are underweight, about half suffer from anemia and India is among the most "undernourished" countries in the world (49). Another study in 2005 showed that "overweight" people had a similar relative risk of mortality to "normal" weight people as defined by BMI, while "underweight" and "obese" people had a higher death rate (50).

B) Hypertension / High Blood Pressure

Hypertension is one of the modifiable risk factor for CVD and also number one killer disease in India. The cause of hypertensive heart disease is chronically elevated blood pressure (BP); however, the causes of elevated BP are diverse. CVD's are the major causes of mortality in persons with hypertension, and many factors, contribute to this high prevalence of CVD. Hypertension is the cause of 57% of deaths due to stroke and 24% of deaths due to CHD. Epidemiological studies have shown that the prevalence of hypertension is steadily increasing over the past 40 years, and is more in the urban when compared to rural areas. Rough estimates from Indian studies show that there are 34 million hypertensive individuals in urban and 31.5 million in rural populations.

Some people experience essential hypertension, which has no identifiable cause. If you are diagnosed with this its origins may be genetic, or due to your lifestyle including diet, weight and physical inactivity. Secondary hypertension is caused by another condition such as problems with your kidneys, certain medicines and some other medical problems.

Though hypertension can affect almost anyone, you are a more likely target, if you have any of the following risk factors:

Age: Blood pressure can increase with age. Being a male over 45 years or a female over 55 years will increase your risk for hypertension. Isolated systolic hypertension is the most common form of hypertension in older people.

Gender: Men are at a higher risk of developing hypertension than women in all ages.

Over-weight or obesity: If you are overweight or obese, you are at greater risk of developing diseases like diabetes and heart diseases, which will lead to pre-hypertension or hypertension.

Unhealthy lifestyle and dietary habits: Consuming foods high in salt (sodium), Heavy alcohol consumption, Very little intake of potassium in your diet, Lack of Exercise, Smoking.

Other Risk Factors: If your parents or other close relatives have high blood pressure, you are more likely to develop it.

C) Diabetes

Diabetes mellitus (*Madhumeha*) has been discussed even in Ayurveda (the ancient system of medicine in India) from ancient times as a urinary disorder characterized by sweetness of urine. Projection estimates show that the number of people with diabetes in India is 40.9 million and is expected to rise to 69.9 million by 2025.

The International Diabetes Federation in October 2009 ranked India as the country with the most diabetics worldwide. CVD accounts for about 60 % of all mortality in people with diabetes. The risk of CVD events is from two to three times higher in people with type-1 or type-2 diabetes and the risk is disproportionately higher in women. In the same age groups, people with diabetes have a two-fold increase in the risk of stock. Patients with diabetes also have a poorer prognosis after cardiovascular events compared to people without diabetes. Cardiovascular risk increases with raised glucose values. Lack of early detection and care for diabetes results in severe complications, including heart attacks, strokes, renal failure, amputations and blindness. Primary care access to measurement of blood glucose and cardiovascular risk assessment as well as essential medicines including insulin can improve health outcomes of people with diabetes. In the ICMR study on Assessment of Burden of NCDs in India, the prevalence rates of diabetes varied from 103 per thousand to 124 per thousand in these studies. The overall prevalence rate of

diabetes in urban and rural areas combined was estimated as 62.47 per thousand. The pooled estimates of prevalence rates for diabetes mellitus for urban and rural areas were found to be 118.02 per thousand and 38.67 per thousand respectively. It was estimated that there are 37.77 million diabetics in India in 2004; 21.4 million in urban areas and 16.36 million in rural areas. Diabetes accounts for 1.09 lakh deaths in a year(51).

According to National Family Health Survey-3, self reported prevalence of diabetes in the age group of 35-49 was 2.1% among women and 2.7% among men suggesting substantial gaps in the awareness. Population based surveys done in the early 1970s in different Indian cities and nearby rural areas reported prevalence of diabetes ranging from 1.2% to 2.5%. The first multi-centric study in India was done by the ICMR between 1972 and 1975, reported a prevalence of 3.0 % in urban areas and 1.3% in rural areas. From these reports, it is evident that till the 1970s, the prevalence of diabetes was less than 3.0% even in urban areas. Several studies showed declining ages of diabetes reporting to around 30 years, and a concomitant rise in urban and rural populations(52).

It has been proposed that diabetes should be considered as a CHD risk equivalent i.e. diabetic individuals without previous MI have as high a risk of future heart attack or death as compared to non-diabetic subjects with previous MI. Hence early detection and management of diabetes is important(52).

1.4.4 ALCOHOL AND TOBACCO USE

A) ALCOHOL

Use of alcohol by the human species is perhaps as old as the creation itself. Alcohol has been consumed in India for centuries. The pattern of drinking in India has undergone a change from occasional and ritualistic use to being a social event.

India has been identified as the potentially 3rd largest market for alcoholic beverages in the world. Alcohol consumption has been steadily increasing in India since the 1980's. The total consumption of alcoholic beverages in India is expected to touch 217.1 million cases in 2010, marking a growth of 8 %. India is also one of the largest producers of alcohol in the world and there has been a steady increase in its production over the last 15 years, according to new

statistics. India is a dominant producer of alcohol in South-East Asia, with 65% of the total share, and contributes to around 7% of the total alcohol beverage imports into the region. Whisky and Rum is the most popular alcoholic beverage in India (53).

Drinking more alcohol can increases dangers such as alcoholism, high blood pressure, obesity, stroke, suicide and accidents. Any advice about the consumption of alcohol must take into account not only the complex relation between alcohol and CVD but also the well-known association of heavy consumption of alcohol with a large number of health risks. Drinking too much alcohol can raise the levels of fats in the blood (triglycerides). Other serious problems include fetal alcohol syndrome, cardio-myopathy, cardiac-arrhythmia and sudden cardiac death.

Excessive use of alcohol more than two ounces or any equivalent drink a day, has been found to be related to increased prevalence of hypertension. It is estimated that about 10% of the adult hypertension is secondary to excessive intake of alcohol. At all age groups both systolic and diastolic pressures show a dose-dependent rise in pressure with the increasing intake of alcohol. The hypertensive effect of alcohol is a complex mechanism and includes high heart rate and cardiac output, increased sympathetic activity and break-down of ethyl alcohol to acetaldehyde is a powerful vasoconstrictor agent.

All alcoholic beverages contain the same mood-changing agent - ethyl alcohol though in varying %age. Distilled Spirits (whisky, brandy, rum) contains 45.55%, Arrack 35-75%, Wine 10-12%, Beer / Toddy 6 - 8% (53).

Some researchers have suggested that the benefit may be due to wine, especially red wine. Others are examining the potential benefits of components in red wine such as flavonoids and other antioxidants in reducing heart disease risk. Some of these components may be found in other foods such as grapes or red grape juice. The linkage reported in many of these studies may be due to other lifestyle factors rather than alcohol. Such factors may include increased physical activity, and a diet high in fruits and vegetables and lower in saturated fats. No direct comparison trials have been done to determine the specific effect of wine or other alcohol on the risk of developing heart disease or stroke (54). Overall there is a causal relationship between alcohol consumption and more than 60 types of diseases and injury.

The per capita consumption of alcohol per year in India is estimated to be of two liters per adult. Community based studies have reported that alcohol use ranges between 25% and 40% in north India and 33% and 50% in south India, with a higher prevalence among the less

educated and the poor. The proportion of frequent heavy drinkers, who consume five or more standard drinks in four or more days per week, is estimated to be 1.3%. Punjab, Andhra Pradesh, Goa and northeastern states have the highest consumption. The prevalence of alcohol is reported to be lowest in Gujarat (7%) and the highest is in the north-eastern state of Kolkata, Arunachal Pradesh (75%). Low prevalence in Gujarat is likely to be due to underreporting due to the prevailing ban on alcohol in the state (16).

The prevalence of alcohol use among women has been less than 5% in India. About 80% of alcohol consumption is in the form of hard liquor with high concentrations of alcohol. Furthermore, country liquor accounts for 60% of alcohol consumption with the poor being the predominant consumers (55). Although moderate consumption of alcohol appears to be protective for heart attacks in western populations it appears to be either neutral or conferring higher risk among South Asians (56).

B) TOBACCO

Tobacco was introduced into India from Europe over four hundred years ago (1558), its harmful effects on lung and brain become known in the 17th century and its effects on cardiovascular morbidity and mortality were clearly demonstrated in Framingham Study (1991).

Tobacco has also been identified as the risk factor for 6 of the 8 leading causes of death globally as well as in India. It is one of the common risk factors for 4 major NCDs, i.e. cancer, CVD, and accounts for more than two third of all new cases of NCD. Tobacco use alone accounts for one in six of all deaths resulting from NCD. Smoking is estimated to cause nearly 10% of all CVD. Smokers' risk of heart attack is more than twice that of nonsmokers. The risk of developing CVD is higher in female smokers, young men and heavy smokers. There are currently about 1 billion smokers in the world today. People who smoke cigars or pipes seem to have a higher risk of death from CHD (possibly stroke) than people who don't smoke tobacco. However, their risk isn't as great as cigarette smokers'. This is probably because they're less likely to inhale the smoke. Globally approx. 6 million people die each year as result of diseases from tobacco consumption and if urgent actions are not taken, the death toll could rise to more than 8 million by 2030. CVD, 21% of coronary deaths especially CVD are tobacco related. Within two years of quitting, the risk of CHD is substantially reduced, and within 15 years the risk of CVD returns to that of a non-smokers.

As per the tobacco control report nearly one million deaths annually can be attributed to smoking alone in India and majority of these deaths will occur in the most productive age group i.e. 30-69 years.

There is scientific evidence available to prove the health hazards to Second hand Smoke (SHS) or Environmental Tobacco Smoke (ETS). This is the smoke resulting from smoking by someone else and inhaled by the non smoker. SHS is known to contain more than 4000 chemicals; many of these are cancer causing substances (carcinogens). Inhalation of SHS results in cancer and heart diseases in adults, and Sudden Infant Death Syndrome (SIDS), acute respiratory diseases, exacerbation of asthma, middle ear diseases in children. There are studies to indicate that every day more than 5500 new youth in India get addicted to tobacco.

STATUS OF TOBACCO USE IN INDIA

In India tobacco is consumed in many forms, both smoking and smokeless, e.g. (57)

Smoked tobacco in India

Beedis - Crushed and dried tobacco is wrapped in tendu leaves and rolled into a beedi. Beedis are smaller in size than the regular company-made cigarettes so more beedis are smoked to achieve the desired feeling caused by nicotine. Beedi smokers are at least at an equal risk of developing cancers as cigarette smokers due to use of smoked tobacco.

Cigarettes and cigars – A cigar is a roll of tobacco wrapped in leaf tobacco, and a cigarette is a roll of tobacco wrapped in paper. Cigarettes may come with filters, as thins, low-tar, menthol, and flavored – to entice more users, including women and youth and also to suggest the cigarettes have a lower health risk, which they do not. Many people view cigar smoking as less dangerous than cigarette smoking. Yet one large cigar can contain as much tobacco as an entire pack of cigarettes.

Cigarette - smoking is more common in the urban areas of India, and cigar use is seen in the big cities. Cigarette smoking in on the rise and is now also seen among teenage girls and young women.

Chillum – This involves smoking tobacco in a clay pipe. Chillum smoking increases chances of oral cancer and lung cancer. A chillum is shared by a group of individuals, so in addition to increasing their risk of cancer, people who share a chillum increase their chances of spreading colds, flu, and other lung illnesses. A chillum is also used for smoking narcotics like opium.

Hookah - Hookah smoking involves a device that heats the tobacco and passes it through water before it is inhaled. It is not a safer way to use tobacco. The use of hookah was once on the decline, but it has increased in recent years.

Smokeless tobacco in India

Smokeless tobacco is very common in India. Tobacco or tobacco-containing products are chewed or sucked as a quid, or applied to gums, or inhaled.

Gutka - This is rapidly becoming the most popular form of chewed tobacco in India. It is very popular among teenagers and children because it is available in small packets (convenient for a single use), uses flavoring agents and scents, and is inexpensive. Gutkha consists of areca nut (betel nut) pieces coated with powdered tobacco, flavoring agents, and other "secret" ingredients that increase the addiction potential.

Khaini - This is one of the most common methods of chewing tobacco. Dried tobacco leaves are crushed and mixed with slaked lime and chewed as a quid.

The practice of keeping the quid in the mouth between the cheeks and gums causes most cancers of the gums – the most common mouth cancer in India.

Paan with tobacco: The main ingredients of paan are the betel leaf, areca nut (supari), slaked lime (chuna), and catechu (katha). Sweets and other condiments can also be added. The varieties of paan are named for the different strengths of tobacco in it.

Paan masala - Paan masala is a commercial preparation containing the areca nut, slaked lime, catechu, and condiments, with or without powdered tobacco.

Chutta, Gul or Mawa,- This is a combination of areca nut pieces, scented tobacco, and slaked lime that is mixed on the spot and chewed as a quid. The popularity of mawa and its ability to cause cancer matches that of gutkha. Its use is rising among teenagers and young adults in India.

1.4.5 DIET AND NUTRITION

Dietary patterns are a major crucial factor in the development of CHD, CVD and other chronic disorders. Diet is one of the key things you can change that will impact all other cardiovascular risk factors. An unhealthy diet high in saturated fats, salt and refined carbohydrates increases the risk of NCDs, particularly CVDs and diabetes.

The body needs a certain amount of cholesterol to build cell membranes, etc. however, the liver makes enough cholesterol to meet these needs, that's why diet is important. A diet high in saturated fats, *trans*-fats and cholesterol tends to raise total blood cholesterol and LDL cholesterol. A diet low in saturated fat, *trans* fat and cholesterol helps lower blood cholesterol levels. Dietary cholesterol is only found in foods from animals. Foods from plants, such as fruits and vegetables, don't have cholesterol. High dietary intakes of saturated fat, trans-fats and salt, and low intake of fruits, vegetables and fish are linked to cardiovascular risk.

The eating habits in the Indian culture are largely based on religion and tradition. From the northern tip of Kashmir to the southern state of Kerala and from the western of Gujarat to Nagaland in the east, India's food habits are as varied as people of India.

Approximately 16 million (1.0 per cent) DALYs and 1.7 million (2.8 per cent) of deaths worldwide are attributable to low fruit and vegetable consumption. Studies of risk factors for chronic disease have shown that vegetarians have lower serum cholesterol concentrations, lower body mass indices, and possibly lower blood pressures than comparable non-vegetarians, but the associations of a vegetarian diet with mortality from specific causes are not firmly established(58). The amount of dietary salt consumed is an important determinant of blood pressure levels and overall cardiovascular risk and the WHO recommends a population salt intake of less than 5 grams/person/day to help the prevention of CVD. Frequent consumption of high-energy foods, such as processed foods that are high in fats and sugars, promotes obesity compared to low-energy foods. High consumption of saturated fats and trans-fatty acids is linked to heart disease; elimination of trans-fat and replacement of saturated with polyunsaturated vegetable oils lowers coronary heart disease risk. Adequate consumption of fruit and vegetables reduces the risk of CVD. A healthy diet can contribute to a healthy body weight, a desirable lipid profile and a desirable blood pressure. It is estimated that decreasing dietary salt intake from the current global levels of 9–12 grams/day to the recommended level of 5 grams/day would have a major impact on blood pressure and CVD (59).

1.4.6 PHYSICAL ACTIVITY

Physical activity is a key determinant of energy expenditure, and thus is fundamental to energy balance and weight control. Insufficient physical activity is the 4th leading risk factor for mortality. A physically active life reduces the risk of CHD, type-2 diabetes, stroke, colon cancer

and breast cancer (60). Insufficient physical activity can be defined as less than five times 30 minutes of moderate activity per week, or less than three times 20 minutes of vigorous activity per week, or equivalent. When physical inactivity is combined with overeating, excess weight, higher blood cholesterol levels and diabetes all of these raise the risk of CVD.

Regular, moderate-to-vigorous exercise is important to reduce the risk of heart and blood vessel disease. Exercise can help control blood cholesterol, diabetes and obesity as well as help lower blood pressure in some people. However, rapid changes in urbanization and associated mechanization and sedentary jobs increase the level of physical inactivity in the population.

For most healthy people, the American Heart Association(AHA) recommends 30–60 minutes of physical activity on most days of the week to condition the heart and lungs. Moderate activities such as walking, gardening, housework and dancing for at least 30 minutes on most days can help the heart. The time may be broken into three 10-minute, one 10-minute and one 20-minute, or two 15-minute periods per day. People who've been inactive can start with 10 minutes, and then work up to more.

The World Health Survey which used standardized questionnaires reported that, overall in India, 29% of the population were having inadequate physical activity (in all domains of life) particularly in the older age groups. A quarter of men (24%) and one-third of women (34%) of women report inadequate physical activity (defined as 1-149 minutes of activity in the seven days preceding the survey). The proportion of respondents with inadequate physical activity is 39% in urban and 27% in rural areas. High income countries have more than double the prevalence of insufficient physically inactive (41% of men and 48% of women) as compared to low-income countries. The NCD risk factor study carried out by the ICMR has shown that work related sedentary is high in urban (64.1%) and peri-urban areas (44.8%) as compared to rural areas (39.0%). The figures for leisure time physical inactivity were urban: 84.3%; peri-urban/slum: 87.9%; and rural: 86.0% (61).

1.4.7 OBESITY AND OVERWEIGHT

Overweight and obesity are recognized as an "escalating epidemic" affecting both developed and developing countries. Obesity is a disease characterized by excessive body fat. People who are medically obese usually are affected by behavior, genetic and environmental factors that are

difficult to control with dieting. Obesity increases the likelihood of certain diseases and other related health problems.

India is in epidemiological, nutrition, socio-economic and lifestyle transition, all contributing to problem of obesity. Obesity has reached epidemic proportions in India in the 21st century, with morbid obesity affecting 5% of the country's population. India is following a trend of other developing countries that are steadily becoming more obese. Unhealthy, processed food has become much more accessible following India's continued integration in global food markets.

Worldwide obesity has more than doubled since 1980. Worldwide, at least 2.8 million people die each year as a result of being overweight or obese, and an estimated 35.8 million (2.3 per cent) of global DALYs are caused by overweight or obesity. Obesity and its associated morbidities are leading causes of CVD, type-2 diabetes, some types of cancer and several other health problems. Physical inactivity and inappropriate nutrition are directly reflected in the growing burden of overweight in the Indian population predominantly in the urban areas. Almost 30-65% of adult urban Indians are reported to be either overweight (BMI>=25) or obese (BMI>=30) or have central obesity. The prevalence of obesity (BMI>=30) was 1.3% of the population. (62). Large national studies such as NFHS-3 reported higher prevalence of overweight (BMI>=25) among the well-off (23.6% in men & 30.5% in women) as compared to the poor (1.4% in men & 1.8% in women) (63).

1.5 GAP IN EXISTING RESEARCH

India is undergoing a rapid health transition associated with a rising burden of CVD. CVD related deaths in India are expected to rise from 24.2 % in 1990 to 41.8 % of total mortality in 2020, making it the leading cause of mortality and disability.

In India in the past decades rates of CHD among the urban populations have risen from 4% to 11%. WHO estimates that 60% of the world's cardiac patients will be Indian by 2020. Nearly 50% of CVD related deaths in India occur below the age of 70 years, compared with just 22% in the West. In India, the estimated adult prevalence (of the age >30 yr) of CHD is around 8-10 % in urban settings and 3-4 % in rural areas, reflecting a rise of six-fold and two-fold respectively between 1960 and 2002.

Furthermore, rapid changes in behavioral and lifestyles that have occurred with urbanization, sedentary lifestyle, economic development and market globalization have accelerated over the past decade. This is having a significant impact on the health particularly in developing countries and in countries in transition. While standards of living have improved, food availability has expanded and become more diversified, and access to services has increased, there have also been significant negative consequences in terms of inappropriate knowledge about dietary patterns, decreased physical activities and increased tobacco use, and a corresponding increase in diet-related chronic diseases, especially among urban people.

The ICMR has also now emphasized on high priority to identifying the preventable/ modifiable causes of CHD risk factors which are major contributor to CVD events. It is estimated that by year 2020, the burden of CVD risk factors is even more alarming. There are currently 40.9 million people with diabetes and 118 million people with hypertension, which is anticipated to reach 69.9 and 213 million respectively by year 2025 unless urgent population vide preventive steps are taken. These startling numbers are compounded by the fact that Indians succumb to diabetes, high blood pressure and CVD (64).

This trend is particularly alarming because of its potential impact as India is one of Asia's fastest –growing economies, because of these changes in lifestyles and behavioral pattern influence the incidence and mortality from CVD, so there is a need to conduct a comprehensive study of lifestyles and their behavioral determinants leading to cardiovascular disease among different population groups in India.

1.6 AIM OF RESEARCH

Study on lifestyles and their behavioural determinants leading to cardiovascular disease among different population groups.

1.7 OBJECTIVE OF THE PROPOSED RESEARCH

- To identify lifestyle behaviours related to risk of Cardiovascular Disease.
    - To understand the perceived risk of different lifestyle behaviours
    - To find out the health seeking behaviour related to Cardiovascular Disease.
    - To understand the barriers and motivators for behavioural changes
- To find out the determinants of risky life style behaviours.
- To study the associated socio-economic and cultural factors.

1.8 Research Questions

1. What are the relationships between CVD related lifestyle risk factors and their association with CVD among different population of above 25 years and below 80 years of age?

2. What is the relationship between Cultural, Food habits and practice of health behaviours for CVD prevention among different population of above 25 years and below 80 year of age?

3. What is relationship between CVD risk factors among different group urban and rural population of above 25 years and below 80 years of age?

4. What are the relationship between health seeking behaviour and their association with CVD among different population of above 25 years and below 80 years of age?

1.9 PROPOSED CONCEPTUAL FRAMEWORK FOR STUDY

The conceptual framework was prepared and it is guiding the present study. It was developed based on the lifestyles and their behavioral determinants leading to cardiovascular disease among different population groups. Categorization and definition of CVD is an extensive and complex topic.

The study focused on major risk factors promoting for CVD process that were categorized as

Non – Modifiable Risk Factors

- **Age**
- **Hereditary/ Family History of CVD**
- **Gender**
- **Ethnicity or Race**

Major Modifiable Risk Factors

- **Hypertension / High blood pressure**
- **Abnormal blood cholesterol level**
- **Diabetes**
- **Smoking and Tobacco use**
- **Alcohol use**
- **Physical inactivity**
- **Overweight and Obesity**
- **Unhealthy Diets**

Other modifiable risk factors

- **Low socioeconomic status (SES)**
- **Mental ill-health:** Depression
- **Psychosocial stress**

"Novel" risk factors

- **Excess homocysteine in blood**
- **Inflammation**
- **Abnormal blood coagulation**

CONCEPTUAL FRAMEWORK

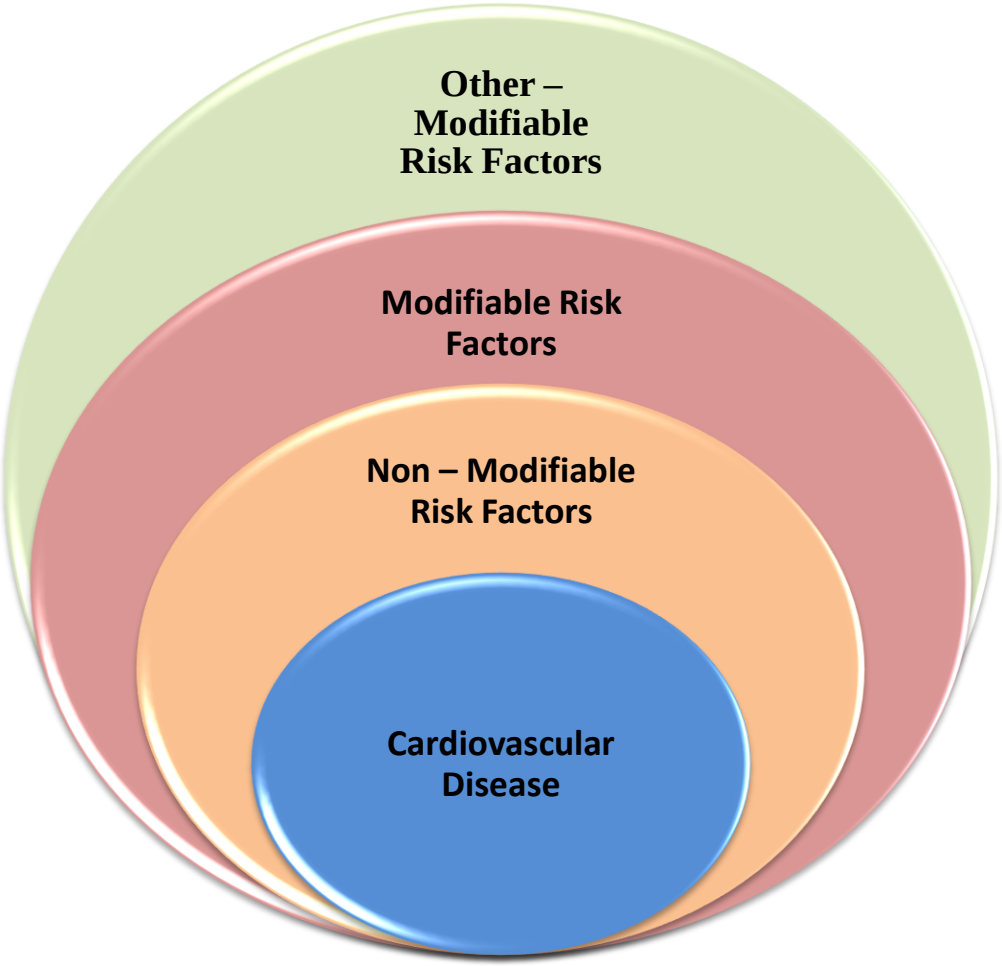


Figure No. 10: Conceptual Framework for CVD

This study do not cover full spectrum of risk factors for CVD. The questionnaire was prepared on the bases of Non-modifiable, Modifiable and other- modifiable risk factors.

CHAPTER -2

LITERATURE REVIEW

2.1 CURRENT STATUS OF CVD

With a little effort on each of our parts and a willingness to change, we can make a big difference in the incidence of this nation's number one killer, cardiovascular disease (CVD). The Global Burden of Disease (GBD) study estimates that 52% of CVD deaths occur below the age of 70 years in India as compared to 23% in developed country, resulting in a profound adverse impact on its economy. The contributing factors for the growing burden of CVDs are increasing prevalence of cardiovascular risk factors especially hypertension, diabetes, overweight or obesity, physical inactivity and tobacco use.

NCD's especially CVD, diabetes mellitus, cancer, stroke and chronic lung diseases have emerged as major public health problems in India, due to an ageing population and environmentally driven changes in behaviour. Premature morbidity and mortality in the most productive phase of life is posing a serious challenge to Indian society and its economy.

Public health experts have predicted a global epidemic of cardiovascular and other chronic diseases in the developing world by 2020(65). It is estimated that by 2020, CVD will be the largest cause of disability and death in India. The country already has more than 40.9 million people with diabetes and more than 118 million people with hypertension, which is expected to increase to 69.9 and 213 million respectively, by 2025 unless urgent preventive steps are taken(66).

WHO have been sounding an alarm on the rapidly rising burden of CVD for the past 15 years. An epidemiological transition is taking place in most of the states in India with a decline in communicable diseases and an increase in chronic NCDs that has resulted in more than 50 % of total deaths in India in 2005 due to chronic diseases and 29% were due to cardiovascular diseases alone (67). The ICMR study on NCDs in India has estimated that the burden of Diabetes Mellitus, IHD and Stroke are 37.8 million, 22.4 million and 0.93 million respectively. The causes

of CVDs are universally known and are the same in India as in wealthy countries. The common causal risk factors are tobacco and alcohol use, unhealthy diet and physical inactivity. The WHO STEPwise approach to surveillance of NCD risk factors (STEPS) which has been carried out in 5 sites in India by WHO and ICMR has revealed that only 50 % of the population aged 15-64 years consumed vegetables daily and 60-80 % leads a sedentary lifestyle. At least 80 % of premature heart disease, stroke, Diabetes and 40 % of cancer can be prevented through avoidance of tobacco products and the adoption of healthy diet and regular physical activity.

The reported prevalence of CHD in adult surveys has risen four-fold in 40 years and even in rural areas the prevalence has doubled over the past 30 years(68). The impact of NCDs will rapidly increase in countries in view of the rapid health and demographic transition. Most studies in other countries have shown that physical in-activities and unhealthy diet are the two most important factors for NCDs.

Of further concern is the fact that Indians are succumbing to diabetes, high blood pressure and heart attacks 5–10 years earlier than their Western counterparts (69), in their most productive years. Unfortunately, scientific data also show that socio-economically disadvantaged sections of the population are now the dominant victims of CVD and its risk factors. There is also preliminary evidence that the burden of CVD in rural areas is increasing (70). Therefore, there is a need to initiate urgent action to forestall this grave portent of increasing mortality and morbidity due to CVD.

Non-communicable diseases are multi-factorial in causation due to both modifiable and non-modifiable risk factors. The World Health Report of 2002 lists 6 NCD's related risk factors, amongst the 10 most important risk factors accounting for a large proportion of the global burden of chronic disease. These are: elevated blood pressure, high cholesterol, overweight/ obesity, low fruit and vegetable intake, physical inactivity and tobacco use.

The INTERHEART study(71), a case-control study, done in 52 countries involving 11,119 cases and 13,648 controls, suggests that more than 90% of the population-attributable risk for myocardial infarction can be explained by nine simple environmentally determined risk factors. Though Indians developed myocardial infarction at a younger age, it was largely due to a higher

prevalence of these risk factors. Although tobacco use, unhealthy diet and physical inactivity are amongst the leading causes of CHD, stroke, and diabetes, their preventive potential as a public health measure remains largely unrecognized and unaddressed(56).

With the current trends, the top five causes of disability adjusted life years (DALYs) lost in 2020 are likely to be ischemic heart disease, uni-polar major depression, road traffic injuries, cerebro-vascular diseases, and chronic obstructive lung disease(72).

CHD is more prevalent in Indian urban populations and there is a clear declining gradient in its prevalence from semi-urban to rural populations. Epidemiological studies show a sizeable burden of CHD in adult rural (3-5%) and urban (7-10%) populations. Thus, of the 30 million patients with CHD in India, there would be 14 million of who are in urban and 16 million in rural areas. In India about 50 % of CHD related deaths occur in people younger than 70 year compared with only 22 per cent in the West. Extrapolation of these numbers estimates the burden of CHD in India to be more than 32 million patients(11).

Cardiovascular disease risk factors and surveillance: the need

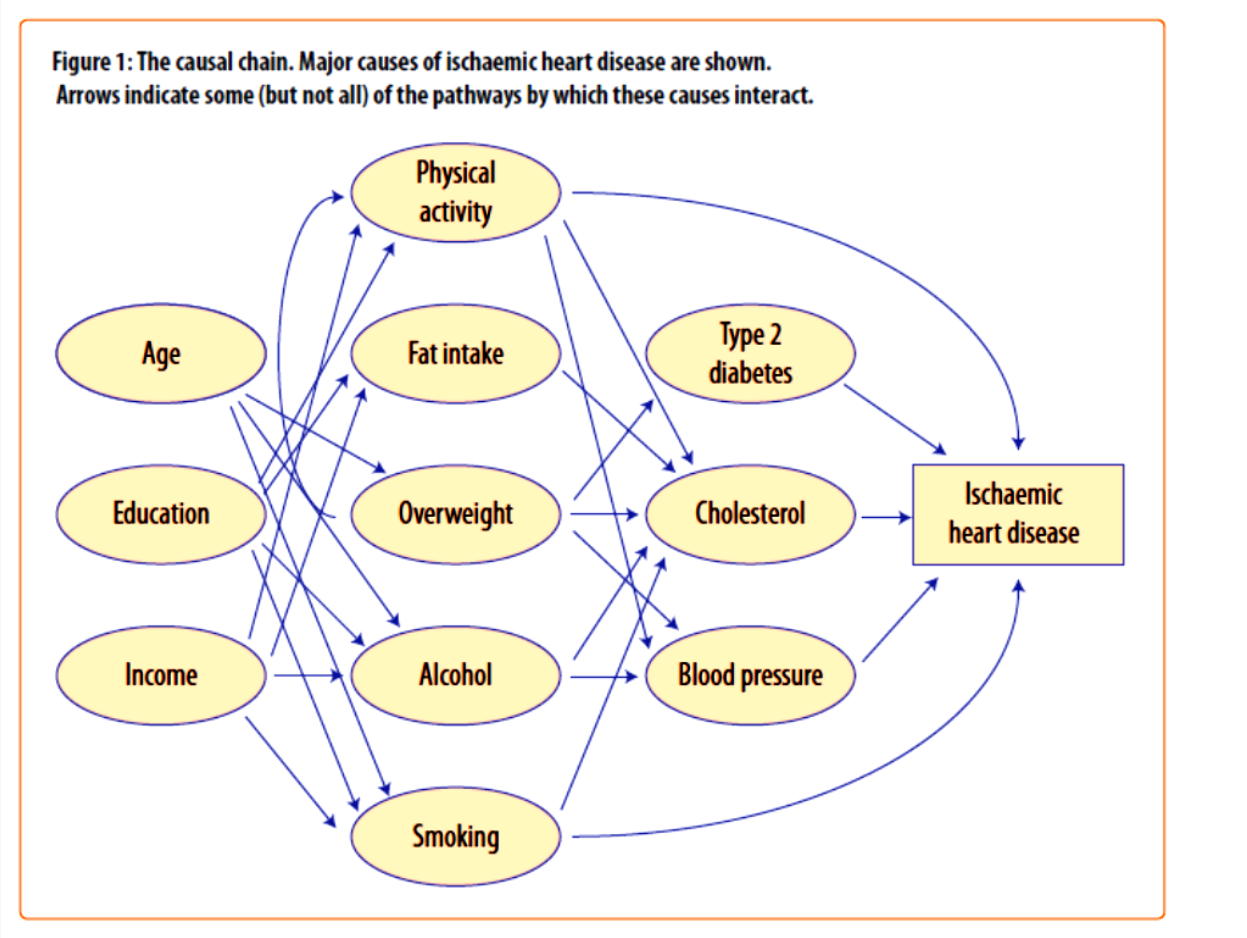
'Risk' is defined as a probability of an adverse health outcome, whereas 'risk factor' refers to an attribute or characteristic or exposure of an individual whose presence or absence raises the probability of an adverse outcome(73). The need for CVD surveillance arises from the demographic transition being accompanied by a "risk transition". In the context of public health, population measurements of these risk factors are used to describe the distribution of future disease burden in a population, rather than predicting the health of a specific individual. The World Health Report 2002 identifies top 20 leading risk factors in terms of the burden of disease according to the mortality status in the population.

Risk factors are present for a long period of time during the natural history of CVD. It is now well established that a cluster of major risk factors (tobacco, alcohol, inappropriate diet, physical inactivity, obesity, hypertension, diabetes and dys-lipidemias) govern the occurrence of CVDs much before these are firmly established as diseases. Collecting data on these and monitoring helps in making projections of trends of disease prevalence. Since these risk factors are amenable

to interventions, efforts to tackle these would reduce the overall disease burden and promote health. Collecting data can be targeted at the entire population, at the high risk population, and special settings (workplace, schools, hospitals) (74).

Major causes of IHD are shown in **Figure No.11,** some elements in the chain, such as high blood pressure or cholesterol, act as a relatively direct cause of the disease. Some risks located further back in the causal chain act indirectly through intermediary factors. These risks include physical inactivity, alcohol, smoking or fat intake. For the most distal risk factors, such as education and income, less causal certainty can be attributed to each risk. However, modifying these background causes is more likely to have amplifying effects, by influencing multiple proximal causes; such modifications therefore have the potential to yield fundamental and sustained improvements to health. **(75)**

Figure No.11: Major Causes of ischemic heart disease.



Source: WHO, Global Health Risks , Mortality and burden of disease attributable to selected major risks, 2009 (75)

2.2 RISK FACTORS FOR CARDIOVASCULAR DISEASES: INDIAN SCENARIO

Traditionally, risk factors for CVDs have been categorized as behavioral, anthropometric and biochemical in **Table No. 22.** Several epidemiological studies conducted on the prevalence of CVD risk factors have indicated to an increasing trend. These are studies which have been done at several locations across the country, in different time periods and using varying study methodologies.

These studies show that urban populations had higher prevalence of CVD risk factors as compared to rural populations. Risk factor prevalence from slum/peri-urban areas lay somewhere in between the urban and rural populations, but more inclined towards urban trends. Alcohol as a risk factor was reported by very few studies. Fruit and vegetable consumption of at least 5 servings per day was very low. Subjects studied in the industrial settings were more physically active than those in the free living populations. Overweight, obesity and central obesity were more in the urban than in rural populations. Women showed higher obesity prevalence than men. Hypertension in most studies was reported in more than 20 per cent subjects. Diabetes and hyperlipidaemia prevalence also followed similar patterns. The data from these studies lack comparability due to methodological variations.

A study on a semi-urban population in southern India found that higher socio-economic status was associated with greater prevalence of CHD risk factors(76). In contrast, a study of industrial workers found that risk factors (tobacco use and hypertension) for CVD were concentrated among the lesser educated in both urban and rural areas, however, the prevalence of diabetes and being overweight increased with better education(77). In rural northern India the prevalence of clinically diagnosed coronary heart disease and risk factors (smoking and hypertension) were higher among lesser educated groups.

Further, findings from epidemiological studies suggest that prevalence of coronary heart disease increases from rural to semi-rural to urban areas. Recent national surveys indicate that the prevalence of self-reported diabetes among adults (15 to 49 years of age) increases with economic status while tobacco consumption decreases with better education and economic status(22) **(Table No. 22).**

Table No.22: Profile of reported behavioural, Anthropometric, Biochemical risk factors for Cardiovascular disease in India (22)								
	Gupta (78)	**Chow (79)**	**Prabhkran (80)**	**Hazarika (81)**	**Gupta (82)**	**Kaur (83)**	**Thankppan (84)**	**Anand (85)**
Site	**Jaipur**	**Andhra Pradesh**	**Delhi**	**Dibrugarh**	**Jaipur**	**Chennai**	**Kunarokam**	**Ballabgarh**
Year	2007	2007	2005	2004	2002	2007	2006	2007
No. of Subjects	1091	345	2122	3180	1800	2262	4955	2564
Population Studies	Urban	Rural	Industry men only	Rural	Urban	Industry	Rural	Urban
Tobacco Smoking (%)	24.3	19.0	36.0	12.5	23.9	20.2	17.8	M-36.5 W- 7.0
Alcohol consumer (%)	-	-	-	36.4	-	34.8	13.4	M-25.9 W- 0.0
Physical Inactivity (%)	37.8	11.3	-	-	25.5	10.7	-	M-14.8 W- 55
Overweight (%)	44.2	16.9	35	6	27.4	36.3	21.1	M-16 W- 21.9
Obese (%)	16.5	4.4	3.3	0.9	-	6.9	-	M-3.5 W- 20.6
Hypertension (%)	37.3	20.3	30	33.3	36.9	17.2	36.7	M-17.2 W- 15.8
Diabetes (%)	12.3	3.7	15	-	12.5	3.4		
High total cholesterol (%)	39.1	12.3	30.1	-	39.1	30.3		
High LDL Cholesterol (%)	41.5	12.3	67.2	-	41.5	-		
Low HDL Cholesterol(%)	55	87.2	33	-	55	-		

M- Men, W= Women

Surveillance for Cardiovascular Disease risk factors in India(86)

A multi-centric study conducted by the ICMR aimed at developing sentinel sites for NCD risk factor surveillance across the country as well as assessing the feasibility of adapting the WHO STEPS instrument for use in surveillance in the country. The study participants included men and women aged 15-64 yr, residing in the selected urban, rural and slum areas. The sample size was calculated for the 10 year age categories (15-24, 25-34, 35-44, 55-64 year) for each sex and population, and the target was 250 subjects per cell. The highlights of the results are summarized in **Table No. 23.**

Table No. 23.(86) ICMR-WHO six site study: profile of reported behavioral, anthropometric and biochemical risk factors among men and women aged 15-64 yr in urban, rural and peri-urban/slum populations.

Characteristics	**Men**			**Women**		
	Urban (N=7557)	Rural (N=6668)	Peri-Urban (N=7646)	Urban (N=7666)	Rural (N=6849)	Peri-urban (N=8105)
Daily tobacco smokers (%)	26.5	26.7	34.3	0.7	4.3	2.7
Mean age at initiation of smoking (yr) (SE)	21.6 (7.0)	21.96 (8.0)	20.3 (7.5)	34.8 (12.3)	32.2 (11.8)	32.1 (13.5)
Daily smokeless tobacco consumption (%)	19.9	36.1	37	7.6	20	20.2
Ever consumption of alcohol (%)	40.1	49	54.7	3.4	8.3	13.7
Mean number of days/week of fruit consumption (SE)	2.9 (2.4)	1.5 (1.9)	1.9 (2.1)	2.7 (2.3)	1.2 (1.6)	1.6 (1.8)
Subjects consuming < 5 servings of fruits and vegetables per day (%)	79.2	82.1	85.1	84.1	87.2	90.2
% Subjects reporting physical inactivity						
Work	69.7	40.8	50.3	61	37	39.7
Transportation	37.1	12.9	17.9	46.3	29.6	34.4
Leisure time	76.6	81	84	86.4	90.5	94.1
Mean BMI (kg/m^2) (SE)	23.1(0.5)	20.3 (0.4)	21.2 (0.4)	23.9 (0.6)	20.7 (0.5)	22.2 (0.5)
Proportion with BMI (%)	N- 7461	N-6613	N-7518	N-7556	N-6756	N-7952
25-29.9	25.5	8.3	14.4	27.7	11.5	19.6
≥30	5.4	1.1	2.5	11.1	2.5	6.5
Mean BP (SBP/DBP mmHg), (SE)	N-7482 130/80(18.9/11.6)	N-6620 126/77 (18.6/11.6)	N-7529 128/79(20.2/12.7)	N-7611 126/78(21.6/11.4)	N-6809 123/76(20.3/11.4)	N-8022 124/77 (21.5/11.5)
Grades of high BP (%)						
Normal	N- 7510	N-6639	N-7551	N-7630	N-6829	N-8033
Gr I	23.1	23.7	22.5	19.8	20.1	19.0
Gr II	20.6	15.5	18.1	16.0	13.7	14.3
Gr III	6.6	4.9	6.0	6.4	4.6	5.4
	3.0	1.9	3.2	3.3	2.3	3.0
Proportion with total cholesterol ≥ 200 mg/dl, n (%)	397 (31.7)	245 (19.5)	237 (18.1)	431 (32.8)	344 (26.4)	334 (23.4)

SE -Standard error, SBP- Systolic blood pressure, DBP – Diastolic blood pressure
U – Urban R – Rural S-Slum/ Peri-Urban

2.3 PREVALENCE/INCIDENCE OF CHD IN INDIA

CHD prevalence appears to be worsening in India. Indians affects with greater frequency and at a younger age than counterparts in developed countries, as well as many other developing countries. CHD prevalence rates can be estimated from several studies over the past several decades in either rural or urban cohorts. Unadjusted CHD rates have ranged from 1.6% to 7.4% in rural populations and 1% to 13.2% in urban populations. In 2000, there were an estimated 29.8 million people with CHD in India, out of a total estimated population of 1.03 billion people, or a nearly 3% overall prevalence (87). Age-standardized CVD death rates in people 30-69 years old are 180 per 100,000 in Britain, 280 per 100,000 in China, and 405 per 100,000 in India. Also, 50% of CHD-related deaths in India occur in people <70 years of age, whereas only 22% of CHD-related deaths in Western countries occur in this age group (88).

Ethnic differences in CHD prevalence within India are not consistent across studies. In one study, Muslim men have been shown to have the highest CHD prevalence rates and Christian men have been shown to have the lowest CHD prevalence rates (15). However, another study demonstrated highest CHD prevalence rates in Hindu men, whereas a two other studies have reported the highest rates in Gujarati men. A similar degree of heterogeneity appears present for women (15).

In developed countries, IHD is predicted to raise 30-60% between 1990 and 2020. In developing countries, rates are predicted to increase by 120% in women and 137% in men from 1990 to 2020(89). Sixty % of the world's patients with heart disease, including CHD, are predicted to live in India by 2010(90). **Table No. 24** demonstrates this rising prevalence of CHD in India compared to China and established market economies from 1990 – 2020(74).

Table No. 24 : Cardiovascular deaths in India, China and developed countries in millions (Global Burden of diseases study) (74)

	1990			**2000**			**2010**			**2020**		
	I	**C**	**EME**	**I**	**C**	**EME**	**I**	**C**	**EME**	**I**	**C**	**EME**
CVD	2.26	2.57	3.18	3.01	3.30	3.49	3.80	3.81	3.63	4.77	4.63	3.66
CHD / IHD	1.16	0.76	1.59	1.59	0.99	1.84	2.03	1.15	1.87	2.54	1.37	1.95

I – India, C- China, EME – Established Market economies

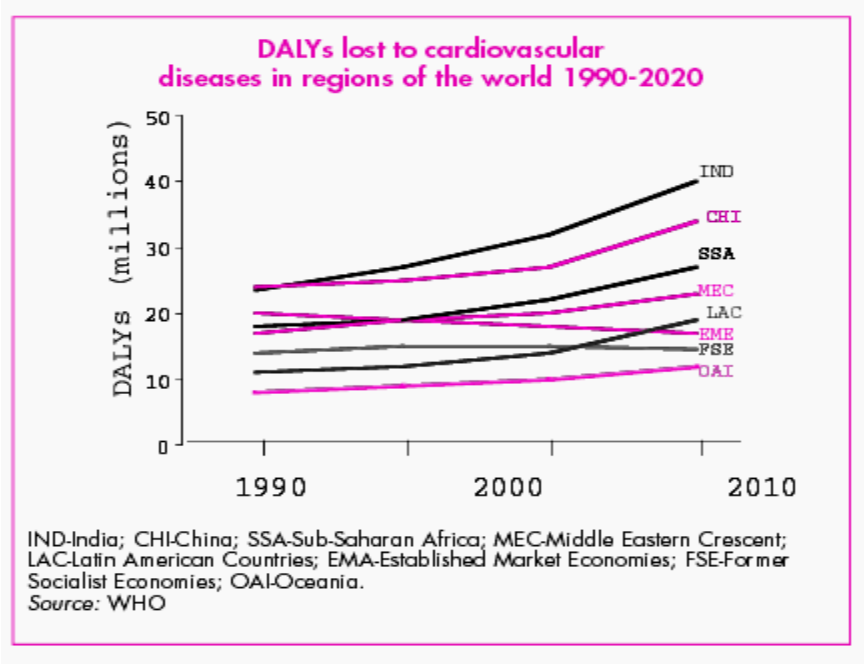
Estimate total years of life lost due to total CVD among the Indian men and women aged 35- 64 to be higher than comparable countries such as Brazil and China, as demonstrated in **Table No.25.** These estimates are predicted to increase from 2000 to 2030, when the differences may become more marked(91).

Table No.25 : Estimates of total years of life lost due to CVD in 2000 and 2030(91)**.**

	2000		**2030**	
	Total years life lost	Rate per 100,000	Total years life lost	Rate per 100,000
India	9,221,165	3,572	17,937,070	3,707
Brazil	1,060,840	2,121	1,741,620	1,957
China	6,666,990	1,595	10,460,030	1,863

Disability adjusted life years (DALYs), a commonly used metric of premature of death and disability, is also estimated to increase at rates comparable or above most other regions throughout the world . Beyond these projections, DALYs lost secondary to CHD in India have been predicted to increase from 7.67 million to 14.4 million in men and 5.6 million to 7.7 million in women from 2000 to 2020 (87).

Figure No. 12: DALYs lost to CVD 1990-2020



Source: DALYs lost to CVD in regions of the world (1990 – 2020). (92)

A population-based survey (persons aged more than 30 years) compared the prevalence of CHD in a rural and urban community in Rohtak (Haryana) and its adjoining areas. The number examined in the rural and urban setting was 1,504 and 750 respectively with a CHD prevalence rate of 45.3/1,000 and 17.2/1,000 respectively(93). Another study (persons between 25 to 64 years of age) shows overall prevalence of CHD using both clinical & ECG data was 96.7/1,000 (94). In another study the prevalence rate of CHD surveyed in the rural population was estimated 74/1, 00 persons with probable CHD, a rate lower than reported by from Delhi (95).

Table No. 26 gives the relative information in these contemporary studies and shows that CHD is quite prevalent in the urban population and little less in the urbanized rural area of India. Whether this prevalence holds true figure for other parts of our country need to be identified by similar well planned and well executed studies using a common survey, execution, methodology and analysis.

Table No. 26: Prevalence of Coronary Heart disease in India

Survey	**Year**	**Age Group**	**Sample Size**	**CHD%**		**Place**
Mathur KS	1960	30-70	1046	1.05±0.3	Urban	Agra
Chaddha (94)	1990	25-64	13,723	9.67±0.5	Urban	Delhi
Kutty(95)	1993	25-80	1,130	6.60±0.6	Semi-Urban	Thrivanpuram
Wander	1994	30-70	1100	3.30±0.5	Rural	Punjab
Gupta (96)	1995	20-80	2,212	7.59±0.5	Urban	Jaipur
Mohan	2001	20-70	1150	11.00±1.0	Urban	Chennai
Gupta	2002	20-80	1160	3.53±0.3	Rural	Himachal
Pinto (97)	2004	35-64	371	13.21±1.1	Urban	Panjim

CHD is more prevalent in Indian urban populations and there is a clear declining gradient in its prevalence from semi-urban to rural populations. Epidemiological studies show a sizeable burden of CHD in adult rural (3-5%) and urban (7-10%) populations. Thus, of the 30 million patients with CHD in India, there would be 14 million of who are in urban and 16 million in rural areas.

In India about 50 % of CHD-related deaths occur in people younger than 70 year compared with only 22 % in the West. Extrapolation of these numbers estimates the burden of CHD in India to be more than 32 million patients (11).

2.4 CORONARY RISK FACTORS

The coronary risk factor profile in the Indian subjects has been sparsely studied. These three studies provide some data in this regard **(Table No. 27)**

Table No. 27: Coronary Risk Factors studies

Risk factor	**Gupta (1995)(96)**			**Kutty (1993) (95)**	**Chaddha (1990) (94)**	
	Male	**Women**	**Total**	**Total**	**Male**	**Women**
Hypertension	30	34	31	17.9	22.9	20.5
Smoking	39	19	32	21.9	36.7	3.8
Obesity	11	11	11	5.5	25.2	34.6
Diabetes Mellitus	1	1	1	4.0	3.5	3.4
Family h/o CHD	-	-	-	-	17.9	17.4

The coronary risk factor data from these three studies does not provide adequate information. However, may more studies, especially in equivalent populations from Maharashtra, Gujarat and the North East are required since a large number of migrants belong to these areas and may have a different ranking order and type of coronary risk factors.

2.4.1 High Blood Pressure / Hypertension

According to the Framingham Study, hypertension accounts for about one quarter of heart failure cases (98). In the elderly population, as many as 68% of heart failure cases are attributed to hypertension. Community-based studies have demonstrated that hypertension may contribute to the development of heart failure in as many as 50-60% of patients. In patients with hypertension, the risk of heart failure is increased by 2-fold in men and by 3-fold in women(99).

The ICMR-WHO study on Burden of Disease reviewed literature till 2003 on NCDs. The meta-analysis of eight studies carried out in urban areas gives a pooled prevalence rate of 164.18/1,000 and in rural areas was 157.44/1,000. About 16% of Ischemic heart 21% of peripheral vascular diseases and 24% of AMI (Acute Myocardial Infraction) cases could be attributed of elevated hypertension. Hypertension is present in 25% urban and 10% rural subjects in India. At an underestimate, there are 31.5 million hypertensive in rural and 34 million in urban populations.

Hypertension prevalence is lower in the rural Indian population, although there has been a steady increase over time here as well (100),(9).

Hypertension is common in urban and rural population in the Indian subcontinent. Recent studies in years showed a high prevalence of hypertension among urban adults: men 30% and women 33% in Jaipur (1995), men 44% and women 45% in Mumbai (1999), 27% men and 28% women executives in Mumbai (2000), men 31% and women 36% in Thiruvananthapuram (2000), men 36% and women 37% in Jaipur (2002) (101). Over the years, from 1942 to 1997, there has been a significant increase in the mean levels of systolic blood pressure in the Indian population particularly among urban men aged 40–49 years (from 120.4 mmHg to 130 mmHg). Emerging data support a target BP goal of less than 150/80mm Hg in patients older than 80 years as a means of reducing the risk of congestive heart failure by 64% (102),(82). The mean BP levels also did not change in short term possibly, a longer time is needed to effect changes in a given population (103).

There is a strong correlation between changing lifestyle factors and increase in hypertension in India. The various environmental influences that have been implicated in the genesis and aggravation of hypertension include: excess body weight, salt and other dietary factors, excess alcohol intake, lack of physical exercise; and adverse psychosocial factors. It is though the abnormal interplay of one or more of these factors that primary hypertension occurs and hence their control will help in preventing hypertension(104). Studies have shown that diet and a healthy lifestyle alone or in combination with medical treatment can lower BP and decrease the symptoms of heart failure, as well as reverse LVH. Various treatment strategies for Blood Pressure can be including through Lifestyle Modifications like- Dietary modifications, Regular aerobic exercise, Weight loss, etc.

A heart-healthy diet is part of the secondary prophylaxis in patients with CHD and of the primary prophylaxis in patients at high risk for this disease. Specific dietary recommendations include a diet low in sodium, high in potassium (in patients with normal renal function), rich in fresh fruits and vegetables, low in cholesterol, and low in alcohol consumption(105).

In a large cohort study of women, the following six(6) modifiable lifestyle and dietary factors for lowering the risk of hypertension were identified:

(1) A body mass index (BMI) below 25kg/m^2,
(2) Vigorous exercise for a daily mean period of 30 minutes,
(3) A high score on the Dietary Approaches to Stop Hypertension (DASH) diet,
(4) Modest alcohol intake (up to 10gram/day),
(5) Non-narcotic analgesic use less than once weekly
(6) Intake of 400mg/day or more of supplemental folic acid(106).

Data also indicate that sodium reduction, previously shown to lower BP, may also reduce the long-term risk of CVD events. The recommended daily sodium intake is 50-100 mm, equivalent to 3-6g of salt per day, which leads to an average 2-8mm Hg reduction in BP(105).

The DASH diet has been shown to significantly lower the BP (8-14mm Hg) in patients with hypertension regardless of whether or not they maintain constant sodium content in their diet. The DASH diet is not only rich in important nutrients and fiber but also includes foods that contain far more potassium, calcium, and magnesium than are found in the average diet. This diet should be advised in patients with hypertension. High intakes of red or processed meat were associated with modest increases in total mortality, cancer mortality and CVD mortality (107).
Heavy alcohol consumption has been associated with high BP and an increase in LV mass. Moderation in alcohol consumption is advised; no more than 1-2 drinks daily is recommended(108).
Regular dynamic isotonic (aerobic) exercise, such as walking, running, swimming or cycling, has been shown to decrease BP and improve cardiovascular well-being(100). It also has additional favorable cardiovascular effects, including improved endothelial function, peripheral vasodilatation, reduced resting heart rate, improved heart rate variability. Regular aerobic exercise sessions of at least 30 minutes for most days of the week can produce an average reduction in BP of 4-9mm Hg. Isometric and strenuous exercise should be avoided.

Studies have shown that weight reduction is one of the most effective ways to reduce BP. A 5-20mm Hg BP reduction occurs with each 10kg of weight loss. Gradual weight reduction (1kg weekly) should be advised (107).

According to the estimates of the ICMR, 24% of acute MI, 29% for stroke and 21% of peripheral vascular diseases in the country are attributed to hypertension. Detection and management, though relatively easier, less than half (31-37%) the hypertensive subjects get to identify their hypertensive status. Less than half of the hypertensive subjects undertake any kind of medication and only half of them achieve good control(109).

Hypertension, on the other hand, is a multi-factorial disease and has psychosocial, cultural, socio-economic and educational aspects. In India as per 1991 census, there were 421 million people above the age of 20 suffer from hypertension. Several population studies from India have given the prevalence rate of hypertension from 3% in rural areas to 6 to 15 % in the urban. Recent studies shown that hypertension is significant problem in public **(Table No. 28).**

Table 28: Studies of hypertension prevalence in Indian population

Principal Author	Year	Age Group	Criteria	Prevalence %	
				Males	Females
Rural Areas					
Padmavati(110)	1959	20 +	≥ 160/95	1.71 (1356)*	
Wasir HS (111)	1983	20 +	≥ 160/95	3.20(441)	7.50 (464)
Dash SC (112)	1986	20 +	≥ 160/95	0.45 (2870)	0.42 (1653)
Puri DS (113)	1986	15-82	≥ 160/95	2.44 (1592)	2.38(1511)
Hussain SA (114)	1988	20+	≥ 160/95	6.15 (2887)	7.33 (2255)
Kumar (115)	1991	21+	≥ 160/95	4.0 (3742)	3.60 (3098)
Joshi PP (116)	1993	16+	≥ 160/95	4.86 (227)	3.17(221)
Jajoo UN (117)	1993	20+	≥ 160/95	2.8 (2247)	4.06 (1798)
Kutty VR (95)	1993	25+	≥ 160/95	17.90(1130)*	-
Gilberts (118)	1994	20 +	≥ 160/95	12.4 (1027)*	-
Agarwal AK (119)	1994	20 +	≥ 160/95	1.57 (3760)*	-
Gupta R (22)	1994	20 +	≥ 140/90	23.71 (1982)	16.89
Sharma			≥ 160/95	7.60 (1982)	6.20 (1166)
Urban Areas					
Mathur KS (120)	1963	20 +	160/95	3.9 (1408)	6.64 (227)
Gupta SP (93)	1978	20 +	160/95	6.0 (1151)	7.0 (872)
Dalal PM (121)	1980	18+	160/95	15.63 (3148)	15.38 (2575)
Wasir HS (111)	1984	20-60	160/95	3.80 (1767)	1.45 (688)
Gopinath (15)	1994	15-24	140/85	4.10(3086)	2.20 (3457)
Gupta R. (122)	1995	20 +	140/90	29.47 (1415)	33.50 (797)
			160/95	10.32 (1415)	12.17(797)
*Numbers in parentheses are sample size.					
- Male: Females prevalence not given.					

Previous hypertension epidemiological studies done to determine the changing trends of hypertension prevalence in Indian urban and rural populations aged 20–80 years, Indian urban population studies from 1949-1999 reported a significant positive trend hypertension prevalence of 1.2–13.11%. Subsequent studies in rural population shows changes 0.52-7.08% in prevalence. This is of obvious clinical significance in light of the recent evidence that systolic BP is more closely linked to cardiovascular events and cardiac mortality (123).

In recent Indian studies years 1995 -2005 (Table No.29), reported hypertension in Jaipur in 30% men and 33% women aged ≥20 years, Mumbai in 44% men and 45% women, Trivandrum (2000) reported it in 31% men and 41% women, while in Chennai an age-adjusted prevalence of 14%. Hypertension in 34.1% middle-class executives in Mumbai, but after multiple BP measurements, it was confirmed in 26.8% male and 27.6% female officers. These findings are in consonance with other regions of Asia where it has been reported that, at any one time, about half of all individuals have high BP.

Table No. 29: Recent Indian hypertension prevalence studies (BP ≥140/90)

First author	***Year***	***Age group***	***Place***	***Sample size***		***Prevalence (%)***	
				Men	Women	Men	Women
Urban							
Gupta R(103)	1995	20–75	Jaipur	1415	797	29.5	33.5
Gupta PC(124)	1999	18–60	Mumbai	40067	59522	43.8	44.5
Joseph A(125)	2000	20–89	Trivandrum	76	130	31.0	41.2
Anand MP(126)	2000	30–60	Mumbai	1521	141	34.1[a]	
Mohan V(127)	2001	20–70	Chennai	518	657	14.0[a]	
Gupta R(82)	2002	20–75	Jaipur	550	573	36.4	37.5
Rural							
Gupta R(122)	1994	20–75	Rajasthan	1982	1166	23.7	16.9
Malhotra P(128)	1999	16–70	Haryana	2559		3.0	5.8[b]

[a] Gender-specific data not available. [b] Prevalence rates based on multiple examinations.

Among the rural populations, hypertension prevalence using recent criteria was first reported in 1994 among aged ≥20 years was present in 24% men and 17% women. The prevalence of hypertension diagnosed on the basis of multiple blood pressure measurements was reported 3.5% men and 5.8% women in Haryana adults aged 16–70 years; this low prevalence was attributed to very low body-mass index in this population.

2.4.2 STROKE

CVD denotes a mix of conditions that includes acute MI, angina pectoris, congestive heart failure, inflammatory heart disease and cerebro-vascular diseases (stroke). After CHD and cancer of all types, stroke is the third commonest cause of death worldwide. However unlike the Caucasians, Asians have a lower rate of CHD and a higher prevalence of stroke (129).

Stroke is no longer a disease of the developed world: Low and middle-income countries account for 85.5% of total stroke deaths worldwide and the number of disability-adjusted life years in these countries was approximately seven times that in high-income countries. It was estimated that stroke represented 1.2 % of the total deaths in the country, when all ages were included. The proportion of stroke death increased with age, and in the oldest group (> 70 years of age) stroke contributed to 2.4% of all deaths. The gender ratio of death due to stroke was one. One would expect a high mortality of stroke with low prevalence and median annual incidence of stroke in India.(130)

Several population-based surveys on stroke were conducted from different parts of India. During the last decade, the age-adjusted prevalence rate of stroke was between 250-350/100,000. Recent studies showed that the age-adjusted annual incidence rate was 105/100,000 in the urban community of Kolkata and 262/100,000 in a rural community of Bengal. The ratio of cerebral infarct to hemorrhage was 2.21. Stroke prevalence among the elderly in rural India was 1.1% and urban India was 1.9%. The Framingham Heart Study and other international prospective epidemiological studies identified the major atherogenic risk factors for stroke as hypertension, diabetes mellitus, hyperlipidemia, and smoking (131).

More recently it has been estimated that 12% of all strokes occur in those less than 40 years: previous stroke is a major risk factor for stroke for those aged more than 65. As life expectancy is projected to increase, India will likely face a significant socioeconomic burden to meet the costs of managing stroke (1).

Three transitions have contributed to the emergence of the stroke epidemic in India: (1) Demographic, (2) lifestyle and (3) socioeconomic. The demographic shift is characterized by increased life expectancy, lifestyle by a shift in food consumption and less physical activity and socioeconomic status with raising living standards by urban elite who adopt western lifestyles. The resulting effect of these transitions increases risk factors for stroke, many of which are modifiable.(132). Non-modifiable stroke risk factors include, age, sex, low birth weight,

ethnicity and genetic factors. In a recent study conducted in Gujarat, It was found that modifiable risk factors such as hypertension (40%), alcoholism (35%), smoking (28%) and hyperlipidemia (17%) are the commonest cause of stroke among the elderly(133); and smoking, alcoholism, increased BMI, diabetes and hypertension are significantly associated with strokes among young people (134). A case-control study from the North India among urban, rural, and semi-urban people has produced similar results and documented low consumption of fruits and vegetables, sedentary lifestyles, and psychological stress as contributory factors(87).

A crude estimate of mortality on account of CVD, which could throw some light on prevalence, also shows wide inter-state disparities; with Rajasthan and Madhya Pradesh having higher mortality levels of 275 and 229 per 100,000 than Kerala and Karnataka, which were 187 and 175, respectively. Of course this also reflects the level of treatment and management facilities available(135).

2.4.3 PHYSICAL ACTIVITY

A large number of observational studies in different settings have shown that regular physical activity is associated with decreased risks of CVD morbidity and mortality (136). The association has shown a clear dose-response pattern with continuously lower risk with higher levels of regular physical activity. However, industrialization, urbanization, and motorized transport have reduced physical activity and more than 60% of the world's populations are not sufficiently active. Physical inactivity has grown to become a major concern for public health. Globally, physical inactivity is believed to account for 22% of CHD. Successful promotion of physical activity has a potential to save 2 million premature deaths and a loss of 19 million disability-adjusted life years in the world every year(137). Regular physical activity reduces the risk of obesity, blood lipid abnormalities, hypertension, and non-insulin dependent diabetes mellitus, and has been shown to reduce substantially the risk of CHD. Conversely, measures of sedentary lifestyles or physical inactivity have been associated with a 1.5 to 2.4 fold elevation in CHD risk(138).

Physically active population has lower reading of their BP in general and lesser prevalence of hypertension. Several studies have shown an inverse relation of physical activity to the levels of BP. Physically active people and those engaged in regular physical exercise have low resting heart rates and pressure and their rise during exercise. Dynamic physical

exercise plays its positive role by making the body to work more efficiently and economies on oxygen needs by training the large muscle groups for better oxygen extraction capacity. Exercise can reduce "bad" cholesterol levels in the blood (the low-density lipoprotein [LDL] level), as well as total cholesterol, and can raise the "good" cholesterol (the high-density lipoprotein level [HDL]). In diabetic patients, regular activity favorably affects the body's ability to use insulin to control glucose levels in the blood. Although the effect of an exercise program on any single risk factor may generally be small, the effect of continued, moderate exercise on overall cardiovascular risk, when combined with other lifestyle modifications (such as proper nutrition, smoking cessation, and medication use), can be dramatic.

Physical activity can improve several metabolic risk factors associated with cardiovascular disease (CVD) and is associated with a lower risk of CVD mortality.

Physical activity (defined as any bodily movement produced by skeletal muscles that result in energy expenditure), *exercise* (defined as physical activity that is planned, structured, and repetitive, and done to improve or maintain physical fitness) and *physical fitness* (defined as a set of attributes such as aerobic endurance, muscular endurance, muscular strength, flexibility and body composition, that people have or achieve, which relate to the ability to perform physical activity) are related terms which describe different concepts(139).

The CRA (Comparative Risk Assessment) 2000 study categorized physical activity into three levels – inactive, insufficiently active and sufficiently active – with the counterfactual exposure distribution being 100% sufficiently active. Recent CRA studies have treated physical inactivity as a four-level categorical variable by subdividing the "sufficiently active" exposure group into those "meeting current recommendations" and "highly active". Although physical activity levels equivalent to 2.5 hours per week of moderate-intensity activity or 1 hour per week of vigorous activity – approximately equivalent to 600 MET's (multiples of the resting metabolic rate) minutes per week – are considered an important target for population health benefits, the protective effects are expected to continue at higher levels (140).

Physical activity can be described in different dimensions, commonly *activity type, frequency* (the number of events of physical activity during a specific time period), *duration* (time of participation of a single bout of physical activity), *intensity* (the physiological effort associated with participating in a special type of physical activity) and *context*. National Institutes of Health

report agreed that the benefits mentioned above will generally occur by engaging in at least 30 minutes of modest activity on most, preferably all, days of the week. Modest activity is defined as any activity that is similar in intensity to brisk walking at a rate of about 3 to 4 miles per hour. These activities can include any other form of occupational or recreational activity that is dynamic in nature and of similar intensity, such as cycling, yard work, and swimming. This amount of exercise equates to approximately five to seven 30-minute sessions per week at an intensity equivalent to 3 to 6 METs (multiples of the resting metabolic rate), or approximately 600 to 1200 calories expended per week(141).

Sedentary working conditions increased in men but not in women. This trend was especially pronounced among highly educated men in which nearly 50% reported sedentary working conditions in 1999. In women, sedentary working conditions were more stable at about 20% during the study period. Approximately 80% of men and women reported at least two hours per week of light to moderate leisure time physical activity, such as walking or bicycling(142).

The current recommendation (from the American College of Sports Medicine and American Heart Association) suggests moderate-intensity aerobic (endurance) physical activity for a minimum of 30 minutes on 5 days each week or vigorous-intensity aerobic physical activity for a minimum of 20 minutes on 3 days each week to promote and maintain health. All these factors help in prevention or better control of diabetes and also overall CVD risk. Additionally, reduction in CVD risk is very important for individuals with diabetes who have double the risk of developing serious CVD events and are two to four times as likely to die from complications of cardiovascular events compared to the general population(143). Adoption and maintenance of an active lifestyle can reduce this risk by an estimated 35-55%.

The other benefits of regular physical activity are it contributes to the prevention or delay in the development of other long-term diabetes complications, such as neuropathy, retinopathy and nephropathy and slows the progression of existing complications, Reduce stress and anxiety and heightens sense of well-being, Reduce risk of other chronic diseases, reduce the functional decline that occur with aging(138).

1.4.10 DIET AND NUTRITION

Dietary patterns are a major factor in the development of CHD and other chronic disorders. The role of diet is crucial in the development and prevention of CVD. Diet is one of the key things you can change that will impact all other cardiovascular risk factors. The eating habits in the Indian culture are largely based on religion and tradition. From the northern tip of Kashmir to the southern state of Kerala and from the western of Gujarat to Nagaland in the east, India's food habits are as varied as people of India.

India is passing through the course of economic development, populations undergo nutrition transition characterized by an increase in the consumption of fats and simple sugars moving away from the traditional diets that are high in carbohydrates and low in fat, to a modern diet which has higher contribution of energy from fats and lower contribution of energy from complex carbohydrates and a decrease in fruit and vegetable intake (59). An unhealthy diet high in saturated fats, salt and refined carbohydrates increases the risk of NCDs, particularly CVDs and diabetes.

In general, Indians are more likely to be vegetarians and use high-fat dairy products and fried foods. Vegetarianism often results in reduced consumption of omega-3 fatty acids, which are found in fish products and are thought to be cardio-protective. However, CAD rates are similarly increased in people from Bangladesh and South India, areas where fish consumption is typically high (144). Prevalence of over-nutrition is also emerging as a significant problem, especially in the urban areas. The prevalence of overweight/ obesity was higher among the women (10.9%) compared to men (7.8%) in rural areas. The prevalence of diabetes and CHD is also higher in urban areas as compared to their rural counterparts. Vegetarians are one-third less likely to be hospitalized or die from heart disease than meat and fish eaters, according to a new UK study.

The body needs a certain amount of cholesterol to build cell membranes, etc. A diet high in saturated fats, *trans* fats and cholesterol tends to raise total blood cholesterol and LDL cholesterol. A diet low in saturated fat, *trans* fat and cholesterol helps lower blood cholesterol levels. Dietary cholesterol is only found in foods from animals. Foods from plants, such as fruits and vegetables, don't have cholesterol. Comparisons between a diet low in saturated fats, with plenty of fresh fruit and vegetables, and the typical diet of someone living show that in the

former there is a 73% reduction in the risk of new major cardiac events. Studies of risk factors for chronic disease have shown that vegetarians have lower serum cholesterol concentrations, lower BMI, possibly lower BP than comparable non-vegetarians, but the associations of a vegetarian diet with mortality from specific causes are not firmly established(58).

Within the dietary profile, macronutrients such as fats/oils play an important role in the development of NCDs. For example, among fats, trans-fats and saturated fatty acids add to higher risk for CHD. Although the exact data on consumption of these different types of oils/fats at the individual and household level is missing, national aggregates on consumption statistics show a high consumption of unhealthy oils in India (145).

The share of raw oil, refined oil and vanaspati oil (hydrogenated oils) in total edible oil market is estimated at 35%, 55% and 10% respectively. Trans-fats, present in the popular vanaspati are widely used in the commercial food industry including sweets due to higher shelf life of products. Fats from coconut oil, vanaspati oil, animal fats (ghee and butter) and animal foods like milk, milk products and meat provide saturated fatty acids. The short and medium chain saturated fatty acids present in ghee, butter and coconut oil are easily digested and absorbed and are therefore, good for infants and young children. However, high intake of saturated fatty acids increases atherogenic risk and their intake should be limited in adults. An ideal quality cooking fat/oil for good health is one which maintains a balance so as to give a ratio of polyunsaturated/ saturated (PUFA/SFA) of 0.8-0.0, and linoleic/ α -linolenic (n-6/n-3) of 5-10 in total diet(146).

Table No.30: Major Types of Fatty Acids in Fats and Oils (146)

<table>
<tr><th>SATURATED</th><th>MONO-UNSATURATED</th><th colspan="3">POLY-UNSATURATED</th></tr>
<tr><td rowspan="4">Coconut
Palm kernel
Ghee/butter
Vanaspati</td><td rowspan="4">Red palm oil
Palmolein
Groundnut
Ricebran
Sesame</td><td colspan="2">LINOLEIC (n-6)</td><td>α –LINOLENIC (n-3)</td></tr>
<tr><td>Low</td><td>Red palm oil
Palmolein</td><td rowspan="3">Rapeseed, Mustard
Soyabean</td></tr>
<tr><td>Moderate</td><td>Groundnut,
Ricebran, Sesame</td></tr>
<tr><td>High</td><td>Safflower,
Sunflower, Corn
Cottonseed,
Soyabean</td></tr>
</table>

Oils from sources such as palm, groundnut, cottonseed, sesame and olive are rich in monounsaturated fatty acids (MUFA) as compared to other oils. Linoleic (n-6) and α-linolenic (n-3) acids are the simple PUFA which are present only in plant foods. All vegetable oils (except coconut) are good sources of linoleic (n-6) acid. Soyabean, rapeseed and mustard oils are the only vegetable oils which contribute significant proportion of α–linolenic (n-3) acid. Legumes/pulses mustard and fenugreek seeds and green leafy vegetables are also good sources of α-linolenic (n-3) acid (Table No.30). On the other hand, fish and fish oils provide long chain n-3 fatty acids which are biologically more active than α -linolenic (n-3) acid present in plant foods. Saturated fatty acids are known to increase serum total and LDL cholesterol levels, reduce insulin sensitivity and enhance thrombo genicity and increase CVD risk (146).

One can reduce both saturated fat and cholesterol intake by limiting the consumption of high-fat animal foods like butter, ghee, meat, egg and organ meats and consuming low fat (skimmed) milk instead of whole milk. However, consumption of eggs (3 eggs/ week) is recommended in view of several nutritional advantages. (146).

Dietary use of coconut oil is confined to southern states such as Kerala and Tamil Nadu, whereas, Palm oil is widely used and India. Poor and the food industry use more Palm oil, due to its cost advantage over healthy oils such as sunflower oil, soya oil, groundnut oil, mustard oil, sunflower oil and rice bran oil which are high in PUFA and MUFA. Re-heating and re-cooking vegetable oil is often practiced at both households and commercial food vendor level. These practices alter the healthy profile of fatty acids in the vegetable oils, increases the content of trans-fats and release free-radicals that increases the risk of both CHD and cancers(48).

Household use of cooking oils has been reported by the ICMR-WHO survey that was carried out in six sites in India covering 44491 subjects during 2003-05. It is reported that a large proportion of those surveyed used vegetable oils (83%) for cooking meals. The use of hydrogenated oils (such as *vanaspati*) was higher in urban areas (4.8%) compared to rural areas (1.7%) and is higher among the slum group (4.1%). Butter/ghee is used as the major cooking oil/fat by 0.6 - 0.7% of the participants. Among dietary components, fruits and vegetable are protective against several NCDs but their intake is grossly inadequate among Indians (49).

Adequate consumption of fruits and vegetables (5 or more servings per one typical day) is reported to be higher in urban areas than rural population (27% vs. 21%). Insufficient intake of fruits (less than five servings a day) was higher in low income groups as compared to the high income groups (lowest quartile: 84.5%; highest quartile: 78.3%). The sharp rise in price of fruits and vegetables as compared to oils and fats has resulted in a negative impact on the consumption pattern among poor. The poor tend to reduce the consumption of vegetables and fruits that are healthy while the consumption of cheaper saturated oils tends to remain the same Nearly 10-15 per cent of the grains and 25 per cent of the fruit and vegetables in India perish each year due to lack of warehouse infrastructure in the rural areas(147).

A study shows the "fruit and dairy" dietary pattern which was positively associated with abdominal adiposity and hypertension, "pulses and rice" pattern was inversely related to diabetes and "snacks and sweets" pattern was positively associated with abdominal adiposity, "fruit and vegetable" pattern was inversely associated with hypertension and the "snack and meat" pattern appeared to be positively associated with abdominal adiposity (148).

Data regarding the association between red meat intake and the risk of CHD is conflicting. Several large studies comparing vegetarians to non-vegetarians have found an increased risk of CHD in persons who consume meat. One mechanism by which red meat intake could increase CHD risk is by increasing levels of harmful cholesterol levels. Increased total cholesterol has long been associated with increased risk of CHD. Total cholesterol is composed of three main elements: Low-density lipoprotein cholesterol ("LDL cholesterol"), High-density lipoprotein cholesterol ("HDL cholesterol") and triglycerides. Increased levels of LDL cholesterol and triglycerides in particular have been associated with higher risk of CHD. LDL cholesterol is therefore called "bad cholesterol". In contrast, HDL cholesterol has been found to protect against CHD and therefore, increased levels are desirable and therefore is called "good cholesterol". The reason red meat has the potential to increase CHD risk is because it contains a high proportion of saturated fat. Saturated fat can be converted to both "good" and "bad" cholesterol in the body. Hence, these changes could offset one another resulting in no increase in CHD risk (149).

Red meat intake has most consistently been found to increase the future risk of heart disease; fish intake may have beneficial effects, although data are inconsistent. One hypothesis is that a beneficial effect of fish consumption is due to omega-3 fatty acids contained in fish. Omega-3

fatty acids have a favorable effect on serum lipids and may also reduce the propensity to form blood clots. A reduced clotting tendency could explain why fish consumption tends to be more protective in persons already at high-risk of developing heart disease(149).

A recent study that combined results from five large prospective studies showed that vegetarians have about a 25% lower risk of heart disease than non-vegetarians(58). It is important to note that vegetarians may have lower disease risk because of their lack of meat consumption, but it is also possible that this protection could be due to increased consumption of fruits, vegetables, or nuts. Vegetables, fruit, grains, and nuts contain phytosterols and unsaturated fats that lower harmful blood cholesterol concentrations. In addition, they contain a number of antioxidants (e.g., tocopherols, ascorbate, carotenoids, saponins, and flavonoids) that may reduce the risk of heart disease by preventing the oxidation of LDL cholesterol, and may also reduce the risk of cancer by preventing oxidative damage to nucleic acids and other cellular components(150) .

Five Heart-Smart Strategies Directed Towards Healthy Dietary Habits

Five Heart-smart strategies directed towards healthy dietary habits are (151):

1. **Limit intake of unhealthy fats and cholesterol –** limit the amount of saturated and trans fat intake. If fat is to be used, choose oils high in monounsaturated fat. Use of monounsaturated fats lowers the total cholesterol and low-density lipoprotein (LDL) cholesterol (the "bad" cholesterol).
2. **Choose low-fat protein sources -** Meat, poultry and fish along with dairy products and eggs are best sources of protein but are high in total fat, saturated fat and cholesterol. Skim milk is lower fat. Fish is another good alternative to high-fat meats. Fish have less total fat, saturated fat, cholesterol and certain types of fish are heart healthy because they're rich in omega-3 fatty acids than do meat and poultry. These fats may help lower triglyceride levels and may reduce the risk of sudden cardiac death.
3. **Eat more fruits and vegetables -**Fruits and vegetables are low in calories, good sources of vitamins and minerals, and rich in dietary fiber. They also contain photochemical substances found in plants that may help prevent CVD.
4. **Select whole grains -**Whole grains have good sources of fiber, a diet high in fiber can help lower blood cholesterol levels and reduce the risk of heart disease. Whole grains are also

important sources of vitamins and minerals, such as thiamin, riboflavin, niacin, selenium, zinc and iron.

5. **Practice moderation and balance -** Knowing which foods and how much food to consume is the first step in creating a heart-healthy diet. Overloading can lead to excess calorie, fat and cholesterol intake. Keep track of the number of servings and use serving sizes.

American Heart Association (AHA) 2006 recommends that selecting fat-free (skim), 1% fat and low-fat dairy products; and minimizing intake of partially hydrogenated fats. Minimize your intake of beverages and foods with added sugars, choose and prepare foods with little or no salt, do so in moderation can reduce chances of CVD (152).

Although the vast studies have focused on individual nutrients and foods, it is well recognized that multiple dietary factors influence the risk of developing CVD and its major risk factors. These data have documented that healthy dietary patterns are associated with a substantially reduced risk of CVD (153). Diets rich in vegetables and fruits have been shown to lower BP and improve other CVD risk factors. Studies shows persons who regularly consume such diets are at a lower risk of developing CVD, particularly stroke (154). A diet rich in vegetables and fruits is a strategy for lowering energy density of diet to control energy intake (155).

Fish, especially oily fish, is rich in very long-chain omega-3 polyunsaturated fatty acids: eicosapentaenoic acid, C20:5n-3 (EPA) and docosahexaenoic acid, C22:6n-3 (DHA). The consumption of 2 servings (8 ounces) per week of fish high in EPA and DHA is associated with a reduced risk of both sudden death and death from coronary artery disease in adults. In addition to providing EPA and DHA, regular fish consumption may facilitate the displacement of other foods higher in saturated and *trans* fatty acids from the diet, such as fatty meats and full-fat dairy products. Methods used to prepare fish should minimize the addition of saturated and *trans* fatty acids, as occurs with the use of cream sauces or hydrogenated fat during frying(156).

A) <u>EGGS</u>

Eggs are unique because of their high-cholesterol content. And it is a major source of dietary cholesterol with an average egg containing ≈200 mg cholesterol that can negatively influence the development of atherosclerosis, it is also known that eggs are rich in other important nutrients

such as minerals, folate, B vitamins, proteins, and monounsaturated fatty acids that could reduce the risk of CHD. Major effects on atherosclerosis are observed in experimental animals but extrapolation to humans is doubtful. A large observational study suggested that there was no increase in the risk of CHD up to one egg per day (except in a diabetic subgroup), in the United State population. In terms of global recommendations, it may still be prudent to limit the intake to 3–4 eggs per week (157).

In a study shows that egg consumption up to 6 per week was not related to Heart Failure, whereas consumption of 1 per day and ≥2 per day was associated with a 28% and 64% increased risk of Heart Failure (158).

B) <u>SALT INTAKE</u>

All food substances contain sodium, but added salt (sodium 40%, chloride 60%) is the major source of sodium in our diet. There is a strong association between salt intake and blood pressure. According to the WHO, 62% of all strokes and 49% of CHD events are attributable to high blood pressure. The causal relation between habitual dietary salt intake and blood pressure has been established through experimental, epidemiological, migration, and intervention studies.

Salt or sodium intake has been directly correlated with mean blood pressure levels and prevalence of hypertension in many populations. Dietary intake of sodium, from all sources, influences blood pressure levels in populations and should be limited so as to reduce the risk of CHD and both forms of stroke. Potassium-rich foods such as fresh vegetables and fruits decrease blood pressure. In fact, it is the ratio of sodium to potassium in the diet which is important (146). Although the WHO recommends that adults consume less than 5 grams of salt per day in order to reduce hypertension-associated cardiovascular and cerebrovascular disease, Indian adults consume between 8.5 grams and 15 grams per day on average Salt intakes higher than 5 grams have been identified as a risk factor for hypertension (159).

Studies and randomized controlled clinical trials have shown that it is possible to achieve significant reductions in blood pressure with reduced salt intake in people with and without hypertension. Based on the effects of high salt intake on blood pressure and on the prominent role of high blood pressure in promoting cardiovascular diseases, it has been suggested that a

population-wide reduction in salt intake could avert someone and a quarter million deaths from stroke and almost three million deaths from CVD each year.(160)

C) FAST FOOD

Worldwide consumption of fast food is steadily increasing. Fast-food restaurants are sources of both sustenance and social interaction. Fast foods are foods already made or cooked to order within minutes for consumption – noodles, burgers, fried fish, chips, salads, pizzas, sandwiches, etc. Storage, handling and microbiological contamination are the major concerns. These foods are unhealthy in terms containing little or no proteins, vitamins or minerals but are rich in sugar, fats and are high in energy (calories) or salt contents. New evidence shows diet heavy in fast food increases the risk of developing Type 2 diabetes and CHD (161).

Eating fast food two or more times a week was also found to increase the risk of developing Type -2 diabetes by 27%. The study showed those who consumed fast food three or more times a week was twice as likely to suffer from heart disease. The risk of death from heart disease related causes was also eighty % higher in those who frequently consume fast food.

When dealing with fast-food restaurants, teens should think about healthy choices before arriving and stick with their choices despite the tempting marketing promotions. On both an economical and educational level, the big industries fight changes that might affect their status and income. The meat, dairy, and egg mega-businesses still try to deny the relationship between their foods and high cholesterol levels and cardiovascular disease. Advertising their products as being good for everybody and providing literature to young children to encourage regular use of their foods.

2.4.5 OBESITY

Obesity can be seen as the first wave of a defined cluster of non-communicable diseases called "New World Syndrome," creating an enormous socioeconomic and public health burden in poorer countries. WHO has described obesity as one of today's most neglected public health problems, affecting every region of globe. Nutritional status of the Indian population varies significantly across regions. Certain regions are associated with extremely high rates of

childhood under nutrition (ranging from 20% to 80%), whereas others have a high prevalence of adult under-nutrition (>50%), and some have both(162).

Both cross-sectional and prospective population studies have shown a positive relation of body mass index to levels of blood pressure. Prevalence of pre-hypertension and hypertension was higher among males. Body Mass Index of 27 is believed to be associated with higher risk of many diseases; including coronary heart disease. Obesity is greater in prevalence among females(163).

A comparison of two major studies in a sample population conducted by NFHS-2 in 1998-1999 and NFHS-3 in 2005-2006 showed that prevalence of obesity among Indian women has elevated from 10.6% to 12.6% (increased by 24.52%). The prevalence is more profound in the women of age between 40 and 49 years (23.7%), residing in cities (23.5%), having high qualification (23.8%), belonging to Sikh community (31.6%) and households in the highest wealth quintile (30.5%). Highest percentage of obese women is found in Punjab (29.9%). Although this number seems small in the international perspective, it is significant because of the sheer size of population in India. While the problem of under-nutrition still exists in many parts of India, the additional burden of obesity due to increasing sedentary lifestyle, junk food habits in some urban and economically sound areas is really alarming.(164) The prevalence of overweight was lower among the urbanizing rural population, than in the urban areas. However, the rural population had a more rapid change as shown by nearly 8.6-fold increase in a period of 14 years.(165)

Similar trends are observed in other parts of the country. The earliest study from the south Indian population reported a prevalence of 27% during 1989 in urban Chennai and 2% in rural Tamil Nadu. Subsequent studies from urban Chennai reported the prevalence of overweight/obesity at 23% in the year 1995 and 30% during 2000. Prevalence in the rural areas of Tamil Nadu rose sharply from 2% in 1989 to 17% in 2003. A study in rural Kerala during 1991 using (BMI>27) and prevalence was found to be 5.8%. Later studies in Kerala reported 49% prevalence of overweight among 30-64 age group in 1998 and 41% among 40-60 age group during 2000. A higher prevalence of 54% (criteria: BMI>22.25) was recorded among elderly populations (age group: >=60) during 2000(125).

Projection studies show that prevalence of overweight is expected to rise from 12.9% (134.8 million) in 2005 to 27.8% (290.7 million) by the year 2030. Similarly obesity figures will rise from 4.0% (42.2 million) in 2005 to 5.0% (52.1 million) by the year 2030 (166).

Several small but well designed community studies report the prevalence of central obesity as high as 72% in urban men and 40% in urban women as against a lower rural prevalence of 55% in men and 36% in women. Central obesity is an important risk factor for diabetes and appears to better predict the risk of diabetes among Asian Indians (167). In Northern India obesity rates was most prevalent in urban populations (male 5.5%, female 12.6%), followed by the urban slums (male 1.9%, female 7.2%) and lowest in rural populations (male 1.6%, female 3.8%)(168).

2.4.6 SMOKING, TOBACCO AND ALCOHOL

A) SMOKING & TOBACCO USE

Smoking is a universal problem. India is also the 2nd largest consumer and producer of tobacco in the world. By recent counts, there are about 94 million smokers in India. Almost 5 % of women and a third of all men aged between 30 and 69 in India smoke. Smoking of bidis has been found to cause deaths faster; about 6 years for men and 8 years for women, cigarettes smoking causes death 10 years sooner than a non smoker.

Tobacco is the most important preventable cause of premature disability and death, and is responsible for a myriad of harmful effects. There are currently 250 million tobacco users and every year about 800,000– 900,000 Indians die due to tobacco use (169). The study found that 61% of women and 62 % of men respectively aged between 30 and 69 are likely to die from smoking related diseases (170). Unfortunately, the poor, the uneducated and marginalized sections of the society are the dominant victims of the adverse socioeconomic and health consequences tobacco (171). Almost half (48%) of the acute MI, 22% of the strokes and 14.8% of the IHD have been attributed to tobacco. The attributable risk in India due to hypertension is 16% for IHD, 21% for peripheral vascular disease, 24% for acute MI and 29% for stroke. For diabetes, the attributable risk is 9% for acute MI, 4% for stroke, 2% for neuropathy and 32% for cataract among Indians. Since curative therapy is expensive and largely palliative, prevention appears to be a natural choice to reduce chronic diseases (172).

The cost of the tobacco attributable burden of just three groups of diseases -cancer, heart disease and lung disease - was estimated as Rs 277.611 billion (US$ 6.5 billion) in 1999. This increased to Rs 308.33 billion (US$ 7.2 billion) in the year 2002-2003(173). As per the Global Adult Tobacco Survey (GATS-India) 2009-10 the prevalence of tobacco use among adults (15 years and above) is 35%. The prevalence of overall tobacco use among males is 48 % and that among females is 20 %. Nearly two in five (38%) adults in rural areas and one in four (25%) adults in urban areas use tobacco in some form. According to NFHS-3 carried out during 2005-06, prevalence of tobacco use (all forms) was 57% in men and 10.8% in women. One third of men (33.4%) and 1.4% of women were cigarette/ bidi smokers. The number of adult current daily smokers is reported to be higher in rural (31.3%) as compared to urban areas (21.5%)(23).

In this large prospective study of Japanese men and women, confirmed excess mortality from total stroke, coronary heart disease, and total cardiovascular disease associated with current smoking for both men and women and that these excess risks were more evident for those aged 40–64 years than for those aged 65–79 years.

In addition, daily consumption of all forms of tobacco use was higher among the lower income quintile (41.8%) compared to higher income quintile (15.5%) and elderly population (43.9% among 65+ age group) compared to younger age group (14.7% among 18-24 age group). 14% of students in the age group of 13-15 years were using some form of tobacco. High prevalence of tobacco use among school students has been reported in the north eastern states like Nagaland (63%), Manipur (46.7%) and Sikkim (46.1%)(174).

A large national case control study carried out in India has smoking accounts for 1 in 5 deaths among men and 1 in 20 deaths among women. By 2010, smoking in adult cause 70% of deaths between the ages of 30 and 69 years. Because of population growth, the absolute number of deaths in this age group is rising by about 3% per year(175).

The National Household Survey of Drug and Alcohol Abuse in India (NHSDAA)(176), conducted in 2002 among males, covered over 40,000 individuals aged 12.60 years in nearly 20,000 households in 25 states (Table No. 31). The overall prevalence of current tobacco use from the NHSDAA was 55.8%.

Table No. 31 : **Age-specific prevalence (%) among males and females of regular tobacco users in rural and urban areas(NSS 1993-1994)** [176]

Age group	Male		Female	
(years)	Rural	Urban	Rural	Urban
10-14	1.3	0.4	0.9	0.2
15-24	19.1	8.7	4.6	1.2
25-44	61.3	40.7	12.2	4.5
45-59	72.3	50.9	20.4	11.4
60+	65.0	39.5	21.2	13.0
Total	43.0	27.7	10.9	4.7

B) ALCOHOL USE

A large number of observational studies have consistently demonstrated a J-shaped relation between alcohol consumption and total mortality. This relation appears to hold in men and women who are middle aged or older. The lowest mortality occurs in those who consume one or two drinks per day. In occasional drinkers, the rates are higher than in those consuming one or two drinks per day. In persons who consume three or more drinks per day, total mortality climbs rapidly with increasing numbers of drinks per day (177). It is clear that a stepwise decline in CHD death occurs with increasing drinks per day. Because CHD accounts for one third or more of total deaths, those with no alcohol consumption have higher total mortality than those drinking one to two drinks per day(178).

In a study identified three different types of drinkers: abstainers, social drinkers, and alcoholics. Of the men included in the study, 44.5 % were abstainers, 16.4 % were social drinkers, and 39.1 % were heavy drinkers or alcoholics(179). One reason for the specific drinking patterns in India may be the strong advocacy of abstinence by Indian religious groups. For example, among the Hindus (who make up more than 80 % of India's population) alcoholic beverages are forbidden for Brahmins and other upper-caste groups who are strict vegetarians. Members of all other caste groups who are meat eaters (e.g., the warrior, farmer, and scavenger-untouchable castes) are permitted to drink. Muslims also are not supposed to drink, although some Muslim men consume alcohol. Finally, Buddhists and Jains, who are strict vegetarians, are forbidden to drink. Furthermore, alcohol consumption rates were substantially higher among Hindus than among either Muslims or Jains, who rarely consumed alcoholic beverages(180).

Another epidemiological study conducted in the rural areas demonstrated that although alcohol consumption had become accepted among men, it was still infrequent among women (180). However, drinking by women was more accepted in certain castes, particularly on festive occasions, such as weddings.

Studies in northern India found the 1 year prevalence of alcohol use to be between 25 and 40% (181). In southern India, the prevalence of current alcohol use varies between 33 and 50%, with a higher prevalence among the lesser educated and the poor conducted a survey in three districts (central, north and north-east India), which involved 32,000 people and used standardized questionnaires. They reported a prevalence of current alcohol use of 20–38% in males and of 10% among females (127). Studies found 18.3% of the 50+ age group to be current users of alcohol and 23.3% to be 'ever' users of alcohol. Study found current use of alcohol to vary between 19.6 and 27.8% amongst the 50+ age group. Current heavy users, i.e. those consuming 75 ml or more of absolute alcohol in a day, accounted for between 79.9 and 84.1% of this 50+ age group of users(127).

Studies have shown that alcohol consumption rates are much higher among men than women. No clear findings for association of drinking with socio-economic categories are available, but there are indications to suggest that drinking may be more prevalent among lower categories and among the poorly educated. However, observations require further corroboration and more careful study of the association between patterns of alcohol intake and CVD risk in the Indian.

2.4.7 DIABETES

The prevalence of diabetes is rapidly rising all over the globe at an alarming rate. Over the past 30 years, the status of diabetes has changed from being considered as a mild disorder of the elderly to one of the major causes of morbidity and mortality affecting the youth and middle aged people(182).

In an ICMR-WHO six site study across four regions of the country on comprehensive NCD risk factors using WHO STEPS approach, the lowest prevalence of self-reported diabetes diagnosed by a physician was recorded in rural (3.1%) followed by peri-urban/slum (3.2%) and the highest in urban areas (7.3%, odds ratio (OR) for urban areas: 2.48, 95% confidence interval (CI): 2.21–2.79, $p < 0.001$). Urban residents with abdominal obesity and sedentary activity had highest

prevalence of self-reported diabetes (11.3%) while rural residents without abdominal obesity performing vigorous activity had lowest prevalence (0.7%). Increase in prevalence of diabetes has also been reported among marginalized and poor. Urban locations have been observing a reversal of socio economic trends with burden of disease increasing among poor (183).

The study reported that the age standardized prevalence of diabetes was 12.1 %. The prevalence in the southern part of India to be higher-13.5 % in Chennai, 12.4 % in Bangalore, and 16.6 % Hyderabad; compared to eastern India (Kolkata), 11.7 %; northern India (New Delhi), 11.6 %; and western India (Mumbai), 9.3 %.(66)

Diabetes substantially increases the propensity to macrovascular and microvascular complications, such as CVD, retinopathy, nephropathy, neuropathy and foot problems, all of which account for considerable mortality and morbidity. Assuming 40 million people with diabetes in India, the prevalence of various complications would be: Retinopathy (7 million); Nephropathy (0.8 million); Neuropathy (10.4million); CHD (8.5 million); and Peripheral vascular disease (2.5 million). In addition, a third of the heart attack patients in India have concurrent diabetes (92).

2.4.8 YOGA AND CVD

Yoga is a philosophical doctrine in India at about 500 BC. In India yoga can be presented to patients as a popular, culturally acceptable and economically feasible prescription for combating sedentary habits, psychological stress and improper dietary preferences. With its emphasis on regular physical exercises, medication and moderation in food and drink, yoga offers a means of countering the ill effects of urbanization. On the therapeutic front are the well-documented benefits of yogasans and yogic relaxation techniques in the management of hypertension. The practice of yoga has also been shown to add to hypocoagulable state and reduce the fat fold thickness even with no significant change in body weight, the effects that could greatly help in countering many CVD(184).

Dr Harbans Singh Wasir, Head of Department of Cardiology, AIIMS(All India Institute of medical sciences), New Delhi, said that through the practice of Yoga, the mind got trained for good health and prevention of diseases including disorders of the heart. Dr. Wasir said

that the role of yoga in the human well-being had now been recognised all over the world. Concerned with the management of patients suffering from various heart disease and high blood pressure over the last 30 years, Dr. Wasir said he was convinced of the role that the mind had in creation or aggravation as well as cure of many CVD specially high blood pressure, heart attacks, angina pectoris and arrhythmias. Quoting the Charaka Samhita to substantiate the important role that mind played in health and disease, he said yoga was the catalytic agent that made the body and mind function in the most balanced way.

Explaining the therapeutic effects of an integrated yoga programme on several psychosomatic ailments, Dr. H.R.Nagendra said that published studies on asthmatics had shown a reduction in the need for medication as well as an improvement in lung function. Dr. Nagendra said the therapy had also benefited those suffering from chaenic rheumatoid disease, in chasmic heart disease and even breast cancer. A medical specialist from Bologna in Italy, Dr. Simonetta Fabri, said that yoga had a complete system for mankind and as such it could be introduced at the therapeutic level to bring about a deep cure, not only of the symptoms of a disease but of man's whole being on the physical, mental, psychic and spiritual levels. Eminent cardiologist of France, Dr. Doussey said that she had been a heart patient but after she took to yoga she was cured.

Epidemiological study of transmigrated population has demonstrated a higher incidence of coronary disease among Asians and among other nations. These studies showed a strong relationship with saturated fat intake and the long term incidence of coronary artery disease, thus, the process of atherosclerosis was being greatly affected by diet. Although alcohol ingestion does cause a favorable rise in the HDL fraction of cholesterol but higher consumption of alcohol by increasing blood pressure and other fractions in blood lipids result in increased incidence of coronary disease.

PREVALENCE OF PROBABLE CHD IN INDIAN URBAN AND RURAL AREAS

Over the 27 year period there was little evidence of a rise in prevalence in urban areas, particularly in men. Evidence suggesting an increased urban prevalence over time in women in the symptomatic and asymptomatic population where rates were 28/1000 in 1975 and 84/1000 in 1995 respectively **(185).**

In the rural studies, again the evidence for a rise in prevalence was very limited. Prevalence of probable CHD in the symptomatic and asymptomatic populations increased from 17/1000 to 26/1000 in men and 13/1000 to 38/1000 in women. Among the asymptomatic population, prevalence appeared to decrease over time, at least in women.

Three studies explicitly compared urban and rural prevalence rates. The prevalence of urban was higher (93) than rural prevalence in men(186) (45/1000 *versus* 17/1000) and women (28/1000 *versus* 13/1000). Comparing the asymptomatic urban and rural Delhi and found rates to be higher in urban Delhi men (56/1000 *versus* 6/1000) and women (76/1000 *versus* 27/1000) compared with their rural counterparts(187). Urban prevalence rates therefore exceeded rural rates by between 40% and 900% in men and between 220% and 300% in women.

Comparison over time in age specific prevalence rates

The projected rise in both proportional and absolute CVD mortality rates in the developing countries during the next few decades is alarming. We are experiencing a major surge in life expectancy due to decline in deaths occurring in infancy, childhood and adolescence due to more effective public health responses to perinatal, infectious and nutritional deficiency disorders and improved economic indicators.

Five urban (Table No. 32) and five rural (Table No. 33) studies reported prevalence of probable CHD by age groups. Only one gave a date for fieldwork. Among the symptomatic and asymptomatic urban populations, Gupta *et al* (Table No. 32, Study 2) and Gupta *et al* (Table No. 32, Study 3) published prevalence in the same Rajasthan area some years apart had highlighted the persistent high prevalence of cardiovascular risk factors in the urban middle class in Jaipur, north western part of India.

Although no difference in total prevalence was reported, age specific rates show a decline in males less than 40 years old, but an increase in those aged 40–59 years but no important changes in females. However, comparing Gupta et al (Table No. 32, study 3) with Gupta and Malhotra (Table No. 32, study 1), over a 27 year period, there appeared to be no difference in age specific rates between males whereas an increase was clear cut in females. Among the asymptomatic urban population (Table No. 32, studies 4 and 5), there was no evidence of a rise in either males or females.

Table No. 32: Urban prevalence rates of probable CHD per 1000 by age group (numbers in parenthesis represent numbers studied in each age band) (185)

Author		Location	**Males**				**Females**			
			20–29 years	30–39 years	40–49 years	50–59 years	20–29 years	30–39 years	40–49 years	50–59 years
Symptomatic and asymptomatic										
1	Gupta 1975	Haryana	NS	4 (241)	36 (252)	84 (215)	NS	0 (176)	2 (176)	46 (153)
2*	Gupta 1995	Rajasthan	23 (526)	32 (379)	27 (183)	57 (211)	52 (136)	76 (157)	85 (211)	80 (151)
3*	Gupta 2002	Rajasthan	10 (99)	7 (53)	34 (117)	80 (100)	44 (90)	53 (151)	76 (132)	78 (113)
Asymptomatic†			25–34 years	25–44 years	45–54 years	55–64 years				
4	Chadha 1992	Delhi, 1988	0 (69)	66 (61)	132 (38)	160 (25)	16 (191)	46 (108)	27 (74)	65 (46)
5	Singh 1997	Moradabad	23 (304)	41 (290)	6 (182)	23 (128)	34 (354)	31 (254	35 (171)	48 (123)
*Studies 2 and 3 represent the same population (not same individuals) re-investigated some years apart;†asymptomatic studies used mid decade cut offs, that is 25–64 years; NS, not studied.										

Among the rural population, a clear cut rise among the symptomatic and asymptomatic females was seen with some evidence of a rise in men.

Table No. 33: Rural prevalence rates of probable CHD per 1000 by age group (numbers in parenthesis represent numbers studied in each age band) (185)

	Author	Location	Males				Females			
			30–39 years	40–49 years	50–59 years	60–69 years	30–39 years	40–49 years	50–59 years	60–69 years
*No fieldwork dates given;†Singh used mid decade cut offs; NS, not studied.										
Symptomatic and asymptomatic										
1	Jajoo 1988	Sevagram	5 (408)	14 (353)	26 (265)	27 (222)	30 (365)	43 (323)	25 (202)	31 (159)
2	Gupta 1997	Rajasthan	20 (495)	30 (366)	30 (268)	60 (282)	23 (342)	38 (212)	87 (127)	68 (103)
Asymptomatic										
3	Wander 1996	Rajasthan	5 (213)	13 (150)	47 (128)	53 (94)	30 (133)	15 (136)	56 (125)	75 (53)
			25–34 years	25–44 years	45–54 years	55–64 years				
4†	Singh1997	Moradabad	23 (296)	17 (178)	8 (120)		11 (264)	12 (165)	31 (96)	

2.4.9 TELEVISION OR COMPUTER USE, LESS SLEEP, MENTAL RELAXATION AND CVD

A) TELEVISION OR COMPUTER USE AND LESS SLEEP

Television (TV) viewing is a well-known sedentary behavior and too much time spent watching TV is considered an unhealthy behavior associated with obesity and other harmful health outcomes in youth. Prolonged TV viewing is the most prevalent and pervasive sedentary behavior in industrialized countries and has been associated with morbidity and mortality. Longer duration of TV viewing time was associated with an increased risk of fatal or nonfatal CVD. The associations between time spent viewing TV and risk of type-2 diabetes and CVD were linear, the risk of all-cause mortality appeared to increase with TV viewing duration of greater than 3 hours per day(188). Little is known about how TV viewing and CVD risk factors are linked in youth because the majority of the studies have been conducted in adults(189).

Children today are less physically active than in the past. They play less outside and have less physical education in school. There is a strong correlation between childhood obesity and access to TV. Children are more likely to be obese if they eat meals in front of the TV, have multiple TVs in the home, and have a TV in their bedroom(190). The prevalence of obesity is highest in children who watch four or more hours of television per day and obesity risk increases 6% for each additional hour of TV viewing per day(191). Children are consuming more calories and more high-fat foods. Food is abundantly available and relatively inexpensive. Vending machines abound and typically contain sweetened beverages or highly refined snack foods. Children who consume soft drinks take in ~ 200 more calories per day in their diets. This can contribute to an annual weight gain of > 10 lb(192).

Other contributing factors in the development of CHD may be related to the lack of rest and poor unwinding, as well as sleep deprivation, which has been shown to be associated with both long working hours and CHD.

Few studies shows that Individuals who worked on average 11 hours or more per day have a 67% higher risk of heart attack or heart disease than the individuals who worked only 8-hour days. And those working between 10 and 11 hours have a 45% higher risk (193).

Several recent studies show links between shortened sleep duration, defined as less than six hours of sleep, and increased risk of heart disease. A review of 15 medical studies involving almost 475,000 people found that short sleepers had a 48% increased risk of developing or dying from CHD in a seven to 25-year follow-up period (depending on the study) and a 15% greater risk of developing or dying from stroke during this same time. Interestingly, long sleepers- those who averaged nine or more hours a night- also showed a 38% increased risk of developing or dying from CHD and a 65% increased risk of stroke (193). Research in developing countries over the last two decades has ample demonstrated the various factors which have a primary role in prevention and management of CVD.

Stressful circumstances, making people feel worried, anxious and unable to cope, are damaging to health and may lead to premature death. Medical researchers are sure exactly how stress increases the risk of heart disease. Stress itself might be a risk factor, or it could be that high levels of stress make other risk factors (such as high cholesterol or high blood pressure) worse. For example, if you are under stress, your blood pressure goes up, you may overeat, you may exercise less, and you may be more likely to smoke.

Stress itself is a risk factor for heart disease; it could be because chronic stress exposes your body to unhealthy, persistently elevated levels of stress hormones like adrenaline and cortisol. Studies also link stress to changes in the way blood clots, which increases the risk of heart attack.

B) MENTAL RELAXATION

Situation like anger, excitement, anxiety and apprehension are known to raise blood pressure. This is often seen in several professions for example level of blood pressure the air traffic control staff is higher than those in the ground staff and during the 24-hour ambulatory blood pressure monitoring, there being higher peaks under the situations as mentioned above. The reverse is also true: mental relaxation would results in lower blood pressure. The concept and practice of mental relaxation as achieved through yoga and meditation has a great potential in the prevention of hypertension, especially when instituted at younger ages before the structural changes have set in at the arterial level. CHD is invariably associated with obese male corporate jet-setters addicted to high-adrenaline lifestyles and high-cholesterol food.

CHAPTER -3

METHODOLOGY

The aim of this study was to study the lifestyle and their behvaioural determinants (non-modifiable, modifiable and other modifiable risk factors) those are leading to cardiovascular disease among different groups of population in India.

Epidemiological methods, developed and used to such good effect in the study of the causes and control of communicable diseases, have been increasingly applied in chronic conditions. The simpler techniques of analysis of the incidence of disease in relation to characteristics of time, place and person are certainly of enduring value even in this new context. There is a need for a review of these developments so that some of the important of them can be commanded to those concerned with the emerging problems of disease in public health. These problems are most urgent in the developing countries. However, a swing towards public with these diseases has already begun; there are many opportunities for fruitful etiological studies in the rapidly changing patterns of disease and ways of life in these areas.

3.1. STUDY DESIGN

The study was a **descriptive cross-sectional study** about CVD disease related lifestyle and behaviors among different population group in India

3.2. SAMPLE SIZE

In designing an experiment the variability over the characteristic in the population and the statistical significance with which the parametric estimates are to be derived play significant role in determining the size of the sample. This is also true for a cross sectional study survey for prevalence of a disease.

Ideally the research work should be done in the entire population to find the exact nature of problem and its possible solutions however the scarcity of resources and limited times does not always permit to do that. Therefore for a statistically significant derivations and conclusions for

the management decision making it is important those sufficient samples are drawn from the total populations using the modern techniques.

The sample size was calculated using the formula:

$$\mathbf{n = t_x\, p\, (1\text{-}p)/e^2}$$

Where **n** is sample size, $\mathbf{t_x}$ is value of normal variate =1.96 for 95% confidence interval, **p** is proportion of prevalence of the disease and **e** is the marginal error. From the studies conducted "Global burden of disease" the prevalence rate of CHD is 13.2/1,000. If we take the reported proportion of CHD patients as 0.02 and the margin of permission error (e) taken to be small, say, 0.01 with coefficient 0.99, then

$$\mathbf{n = (1.96)^2(0.0132)\ (0.98)/\ (0.0001)}$$

$$\mathbf{= 496.94}$$

The sample size thus achieved was 496 for 1.96 i.e. 95% confidence level, to take care of non-response, missing data, etc. 30% i.e. 149 extra samples were taken, so total was **645** samples needs to be collected(from one survey area)..

After collecting final data from different survey areas a total sample of **625** from each region were completed in all respects i.e. all missing data and non response in few question in questionnaire.

Total sample sizes of **2500** from all four regions of survey areas excluding non-response, missing data, etc. were completed in all respect and were used for the analysis purpose. Thus a sample size of **625** each from each urban area Ahmedabad (Gujarat) and Kolkata (West Bengal) and rural area Bhavnagar (Gujarat) and Tonk (Rajasthan) was collected.

Population sizes of study area were obtained from Census of India, 2001. A house-to-house survey of the selected individuals using simple random sampling was done. The selection process was carefully planned beforehand and for the urban and rural component was randomly selected using computer-generated numbers. Next, streets within the ward were randomly allocated using a computer programme and a house-to-house survey was conducted in each

selected street until the urban sample of 625 for each area, total of 2500 participants from all 4 areas was achieved. A particularly poor response was observed from the people in the lower socioeconomic stratum. Hence, it was decided to contact with the help of local leaders to fill questionnaire. In the urban and rural non-resettlement colonies, home visits were made, and the interviews were performed in the homes of participating households.

The sample data was conducted between April, 2010 to December, 2010 and January, 2011 to June, 2011, respectively.

3.3. SURVEY AREA

The study was carried out in States i.e. West Bengal - Kolkata, Gujarat - Ahmedabad, Rajasthan-Tonk (Jaipur) and Gujarat – Bhavnagar which represent different regions of the rural as well as metropolitan cities. Kolkata and Ahmedabad selected as metropolitan and Tonk and Bhavnagar as Rural cities. Within each state two districts, one with high Below Poverty Line (BPL) status and the other with low BPL status will be selected for the study of the rural sample.

The rationale for selection these areas were purposively selected because Kolkata and Ahmedabad are metropolitan cities with 100% urban population while Bhavnagar and Tonk are having 75% rural population but their lifestyles and behavioral risk factors leading to CVD, life habits, culture and food habits are diverse. Other criteria for selection was Kolkata as urban and Tonk as rural populace are more Non-vegetarian and using alcohol and tobacco and diverse in food habits with other two, Ahmedabad as urban and Bhavnagar as rural with vegetarian populace and alcohol and tobacco use is less.
Also there are very few studies available on association between CVD and lifestyle, behavioral risk factors in these populations of Gujarat and West Bengal while few studies were available from South Indian urban population and few from North Indian urban and rural population.

The Urban and rural sample was drawn from houses of these states. The definitions of urban and rural areas were based on the guidelines of the Registrar General of the Census of India. In urban areas, 32.8 per cent deaths occur because of heart ailments, while this %age in rural areas is 22.9.

3.4. SAMPLE AGE CRITERIA

Participants were eligible for the study if lower age limit is equal to 25 years and above and upper age limit less than or equal to 80 years and had resided in the household for at least 2 year at the time of survey.

We have kept the lower age limit as 25 years instead of 30-35 years and upper 80 years as life expectancy increase as in other Indian Studies. There is concern over the increasing incidence of CVD among young people below 30 years in Indian as compared to the west, where the average is 40 years. Previous studies from India have suggested that CVD occurs at a lower ages as compared to Western population.

In the age group 25-69 years, 70 years and above the mortality rate rises sharply and is the leading causes of death in this age group is CVD (25%). But in age group 25-69 among the males (26.3%) and females (22.5%) and 70+ age group among males (26.5%) and females (24.8%) first causes of death in India is CVD. Cardiovascular disease is the leading cause of death, accounting for one in every four deaths and one in every five deaths respectively. (10).

3.5. ENROLMENT OF PERSON FOR STUDY

INCLUSION CRITERIA

We had included for this study:

- Participants were eligible if their lower age limit is 25 years or more and upper less than or equal to 80 years.
- Only one individual in the household was considering as one participant per home. If the selected household did not have an eligible individual, the next household was contacted
- Participants had resided in the household for at least 2 year at the time of survey.
- BMI was calculated on the base of Height in feet's (converted into meters) and Weight in Kilograms measured at the time of interview.

EXCLUSION CRITERIA

We have excluded from this study

- Person having or diagnosed any type of heart disease or having medicine for heart disease. (The reason for excluding sample with diagnosed CVD or heart disease was that they are likely to have received health education and advice from the doctor following their diagnosis of CVD and might have changed their lifestyle, dietary habits, and physical activity practices, so an accurate depiction might not be reflected in the study if they were included).
- Person had resided in the household for at least 2 year at the time of survey. (The reason for exclusion sample at least resided 2 years at the area; the sample may be migrate from rural to Urban or vice versa).

3.6. Study Tools & Techniques

The following tools and techniques were used during the study: a pre-designed, semi-structured questionnaire, a measuring tape, and a weighing machine.

Height is measured by participants straight standing position, straight eye, without shoes, point with scale measures. Weight is taken by the calibrated weighing machines, sensitivity 0.01mm, participants wearing light clothes. Informed consent was obtained from each respondent prior to the interview and physical examination.

Pre-Testing of Questionnaire - Prior data collection pilot-testing of the questionnaire was done. 50 sample questionnaire (contain 45 questions) were used for study, Questionnaire has been reviewed and approved by the supervisor and expert's opinion on sustainability was taken for improving the reliability of the instruments. After pilot survey total 41 questions were approved with combining of the modifiable and non–modifiable risk factors.

The questionnaire was converted into local language and distributed with the prior consent. Example of questionnaire in English, Hindi, Bengali and Gujarati is given in **(Annexure No. 1)**

Within each selected states two districts, one with high below poverty line (HBPL) status and the other with low below poverty line (LBPL) status were selected for the study of the rural sample. This analysis was carried out from a large database obtained through a cross-sectional survey was carried out in Urban area – Ahmedabad (Gujarat), Kolkata (West Bengal) and rural areas-Bhavnagar (Gujarat), Tonk-Jaipur (Rajasthan).

The independent variables includes personal information age, sex, marital status, family history (FH) of CHD, obesity, hypertension, diabetes, physical activity, alcohol/ caffeine/ tobacco consumption, exercise program, nutrition habits, sodium(salt) intake and other habits was collected covering major aspects of lifestyle and behaviour risk factors leading to CVD. The ethically questionnaire was distributed to the participants and data was collected.

The questionnaire was divided into 5 sections:
The personal information questions – Age, gender, marital status, height, weight, city

Section - 1: Non controllable risk factors
Section - 2: Alcohol / tobacco consumption
Section - 3: Exercise program
Section - 4: Nutrition Habits
Section - 5: Personal health history and habits

3.7. Data Analysis

Advanced empirical research is largely based on sophisticated statistical analysis of the data. The data was pooled and computerized. Data cleaning was done after all entries for any possible keyboard error. Significance of various risk factors was calculated using analysis being a special feature of the statistical package viz. SPSS for windows version-16 and Microsoft Excel spreadsheet.

The basic statistical measures like mean and standard deviation (S.D) were provided in the form of mean $\pm$SD as these provides intervals within which the sample values are supported to be located. We used Pearson Chi Square ($\chi 2$) tests for trend to established whether increasing risk

levels are associated with a modify behavior between the groups. Analysis was also performed to determine whether any socio or demographic variables affected the risk behaviour of those at increased risk.

All p value quoted were two tailed; 95% confidence level was calculated using the confidence interval program and significant when less than 0.05 and highly significant when less than 0.01.

Odd ratios and 95% confidence intervals have been calculated for the likelihood of individual perceiving lifestyle risk behaviour, either the non-smoker or the non-alcohol group has been used as a denominator for the calculation of respective odds ratios.

Relative risk estimation for smoking and alcohol consumption was made using Cox's multivariate proportional hazard method, where the time dependent variable "age at initiation of smoking or alcohol consumption" was taken as the dependent variable for these habits respectively.

Finally Multivariate logistic regression was used to investigate the association between the risk factors and CVD. The "Step-wise" forward procedure was adopted for the above multivariate analysis and relative risk (RR) was obtained for statistically significant factors.

Pearson Chi –square Test -

Chi –square test is a statistical test to examine differences with categorical variables, like sexual orientation, political preferences etc. It is commonly used measure for comparing proportions, because it can be used to compare two or more independent proportions. The Chi –square test is used for: a) Estimating how closely an observed distribution matches an expected distribution – we'll refer to this as the goodness-of-fit test. b) Estimating whether two random variables are independent. The other primary use of the chi-square test is to examine whether two variables are independent, or are not related.

Logistic Regression -

Logistic regression analysis has been used for estimating the probability that an event occurs.

Multivariate analysis to determine overall relationship of level of education with CVD and risk factors was performed by logistic regression technique. The dependent variables were presence or absence of CVD, Family history of CVD.

3.8. Study Variables

Table No. 34: Study variables

By Questionnaire *
Health status: ➢ History of cardiovascular disease and diabetes ➢ Family history of hypertension, diabetes and cardiovascular disease **Socio-economic:** ➢ Occupation **Demographic and personal:** ➢ Age ➢ Gender ➢ Marital status ➢ Urban/rural residence **Behavioral:** ➢ Smoking – Cigarette / Bedi ➢ Consumption of tobacco or other forms ➢ Alcohol consumption ➢ Diet – Meal , Vegetable, Fruits ➢ Vegetarian / Non- Vegetarian ➢ Physical activity ➢ Stress ➢ Sodium
By Examination
➢ Weight ➢ Height

*Annexure No -1 Cardio Vascular disease related lifestyle and behaviour Questionnaire.

Data were collected on socio and demographic characteristics including age, sex, marital status, height, weight and occupation. Demographic characteristics, age, gender, marital status, occupation, city were obtained by using the personal information questionnaire. Height and weight was measured.

Family History of CVD

Participants who had family history of Heart attack, Heart operation, Cholesterol, Diabetes and stroke were considered. Number of family members died or diagnosed heart disease before 55 years and after 55 years; diabetes, stroke and CVD were reported.

Smoking and Tobacco Consumption

Respondents were classified as either current smoker or non-smoker, whether passive smoke and lived with a smoker and worked with a smoker or quit smoking.

People who smoked daily two or more cigarettes at the time of the survey were considered current smokers; those who had smoked cigarettes in the past (Quit smoking less than 5 years or more than 5 years) but did not smoke at the time of the survey were considered ex-smokers; and those who declared themselves non-smokers, or who smoked one cigarettes occasionally were labeled non-smokers. The rate of smoking cessation was calculated as

- Light smokers -up to 1-2 cigarettes per day
- Moderate smokers- 2-5 cigarettes per day
- Heavy smoker - more than 6 cigarettes per day

Consuming tobacco – Never, Sometime, Quite often, mostly and form of tobacco they consume.

Alcohol consumption

In this study, alcohol consumption was assessed by questioning the subject about their drinking pattern. The amount of alcohol ingested daily, in grams, was determined by daily consumption during the previous week. The interviewees were classified as: Occasionally drinkers, 2 days per week or more and number of packs and types of alcohol (whisky, wine, desi and any form) consumed. The limits of alcohol for a 1-2 drinks, 3-4 drinks, 5 drinks, 6 or more drinks daily reflect levels at which the risk of overall mortality increases.

The study sample has been further analyzed after classification into following groups:

- Smoking and non-smoking groups
- Alcohol consumption and non-alcohol consumption groups
- Passive smokers and non-passive smokers
- Smokers with tobacco chewing habits
- Smokers with alcohol consumption
- Non-smokers with alcohol consumption

Physical Activity

This variable was defined as the total physical activity usually involved and form of exercise (Walking, cycling, Machine or Yoga). Again the number of days per week doing exercise was classified into 1-2 days, 3-4 days, more than 5 days per week and 1-2 days per month. It was obtained from a question in which the activity was catalogued as important or intense (physical activity requiring important physical effort – Machine, cycling), moderate (frequent walking), light (Yoga), or none (Not doing any type of exercise now).

People who regularly and vigorously performed any form of exercise three or more times per week were classified as having performed physical activity, because it has been demonstrated that this amount of physical activity improves cardiovascular fitness.

Dietary habits

Dietary habits were classified by knowing whether having regular breakfast, proper meal per day. Fat intake was classified as No fat, Both Low and High, Low fat, High Fat. Participants consuming vegetable, dairy products and fruits (1 piece of banana, apple) per day, type of oil they are using for cooking, type and quantity of meat they consumed, number of eggs consumed per day, whether they add extra salt in their food, average number of glasses of water they consumed, times they eat fast food outside, carbonated drinks consumed was checked by the respondents through self reported questionnaire.

Obesity

We defined obesity from the measurement as those having a body mass index of $\geq$ 23 overweight and having $\geq$25.0 are obese. This is in accordance with the recommendation of Indian BMI standards. An increase in BMI above 25.0 has been reported to be associated with higher risk of CVD, hypertension and other chronic disease.

Diabetes

The presence of diabetes was ascertained by questionnaire only. This method misses those whose diabetic status has not yet been diagnosed, and those who are not properly aware of their condition. Hence, there could have been an under-estimation of the prevalence of diabetes by using this method. Self-reporting also makes it difficult to assess the degree of seriousness of the diabetic state.

Job and activity:

We also questioned the subjects on other aspects which are known to have a bearing on CVD, such as the physical activity of the subjects. This was done in a semi-quantitative manner. Each subject was asked about his/her daily activities in three respects: household, leisure, and work. The activity under each heading was graded into four subheadings (depending on the severity of the effect), i.e. very active, active, moderate, not active.

Health checkup annually of within 2 years provide awareness about the health status of the individual, question was covered which may help in awareness and pre-diagnosed the status of health.

Sedentary Lifestyle:

Sedentary lifestyle related questions was asked by the participants may cause CVD, like number of hours spending in front of TV/ computer, stress, depression, hours of sleep, which may increase obesity and lead to CVD.

CHAPTER -4

RESULTS AND DISCUSSION

CVD will be the largest killer of persons in India. It has been predicted that CVD will be the most important cause of fatality in India by the year 2020. Conventional risk factors of CVD epidemic in India are smoking, alcohol consumption, obesity, diabetes, high blood pressure and high cholesterol. Unconventional and lifestyle risk factors such as high saturated fat diet, lack of mentally and physically relaxing activities and lack of physical activity may also be an important cause of CVD. These factors should remain the focus of action in arresting and reversing this epidemic. Since adverse effects of these factors are greater in Indians, the benefits of modifying them are also correspondingly greater.

The study was a descriptive cross-sectional study about CVD disease related lifestyle and behaviors among different population group. The role of lifestyle modification in the prevention, examine risk factors of the severity of CVD in Indians has been reviewed in this study.

4.1. GENERAL CHARACTERISTIC OF THE STUDY SUBJECTS

The description of general characteristics of the study subjects includes, gender, age, marital status, occupation, reported history of CVD related illness.

4.1.1 GENDER, AGE, HEIGHT & WEIGHT, OCCUPATION AND MARITAL STATUS

Gender

Study population of 100% (n=2500) participants comprised of 71.9% males and 28.1% females. Studies show that both male & female were at risk of CVD. (Table No.35, figure no. 13).

Table No. 35: Distribution of gender for study.

	Number
Male	1798 (71.9)
Female	702 (28.1)
Total	2500 (100.0)

Figure in parentheses indicate percentages

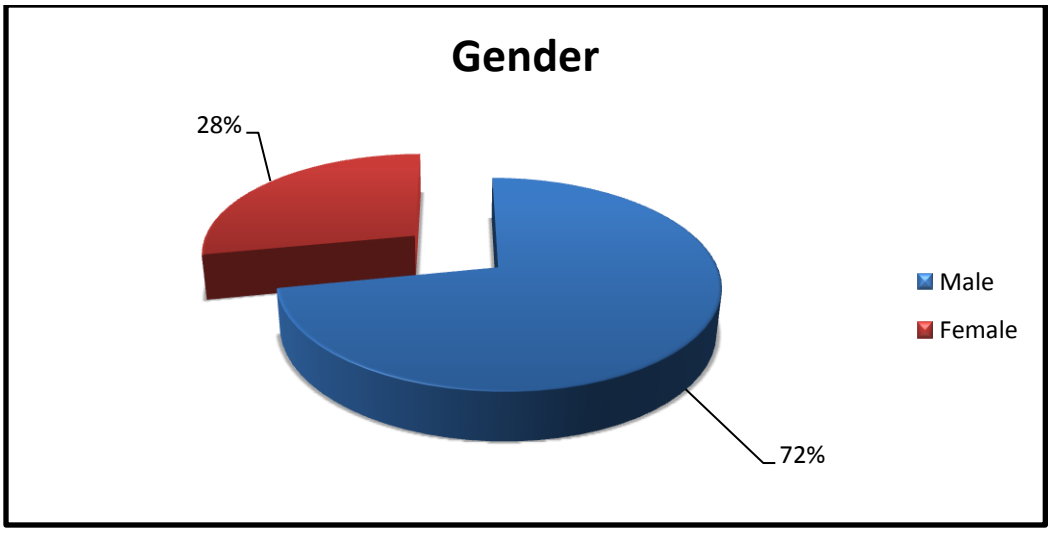


Figure No. 13: Percentage distribution of gender of participants

Overall, 625 (100%) participants, males and females were participated from each city. The participants were from 4 different cities (Kolkata, Ahmedabad, Bhavnagar and Tonk). Participants of Kolkata-West Bengal and Ahmedabad-Gujarat were considered as urban population, while Bhavnagar-Gujarat and Tonk–Rajasthan were as the rural population. From overall total 2500 (100%) 39.1% urban males and 10.9% females participants. While rural males participants were 32.8% and females were 17.2% participate for study. (Table No.36 and Figure No.14)

Table No. 36: City and gender wise distribution among urban and rural participants

	City	Gender	
		Male	Female
Urban	Ahmedabad	486 (19.4)	139 (5.6)
	Kolkata	492 (19.7)	133 (5.3)
Rural	Bhavnagar	478 (19.1)	147 (5.9)
	Tonk	342 (13.7)	283 (11.3)
	Total	1798 (71.9)	702 (28.1)

Figure in parentheses indicate percentages

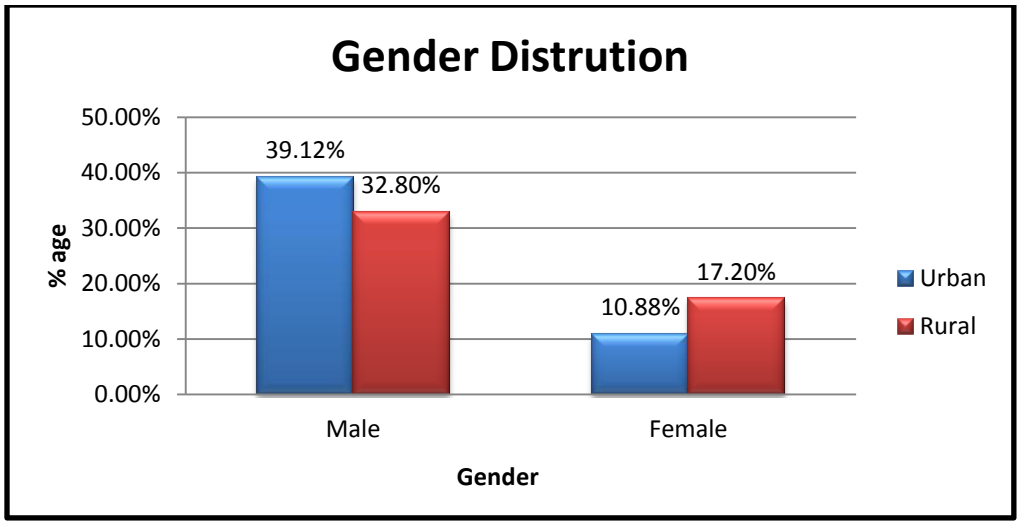


Figure No. 14: Percentage distribution of male and female in rural and urban

AGE DISTRIBUTION

Age is the most significant non-modifiable risk factor for developing CVD, followed by gender. The age of participants ranged between 25 to 80 years. The overall mean ages of the participants were 45.99 ±12.09. Mean age for male was 47.43 ± 12.42 and female 42.31±10.35. Mostly respondents 62.9% were from age group of 31-50 years participated for the study. 14.8% were from the age group of 60 years and 14.9 % were from above 61 years to 80 years. Studies show that male spend more years of life with CVD and it is subtypes at middle age, but that the burden of CVD at older ages (80+ years) was higher for females. (Table No. 37 and Figure No.15)

Table No. 37: Age group distribution among men and women.

Age Group (Years)	Male	Female	Total
25-30	123 (6.8)	60 (8.5)	183 (7.3)
31-40	**489 (27.2)**	**281 (40.0)**	**770 (30.8)**
41-50	**557 (31.0)**	**246 (35.0)**	**803 (32.1)**
51-60	313 (17.4)	57 (8.1)	370 (14.8)
61-70	215 (12.0)	43 (6.1)	258 (10.3)
71-80	101 (5.6)	15 (2.1)	116 (4.6)
Total	1798 (71.9)	702 (28)	2500 (100.0)

Figure in parentheses indicate percentages

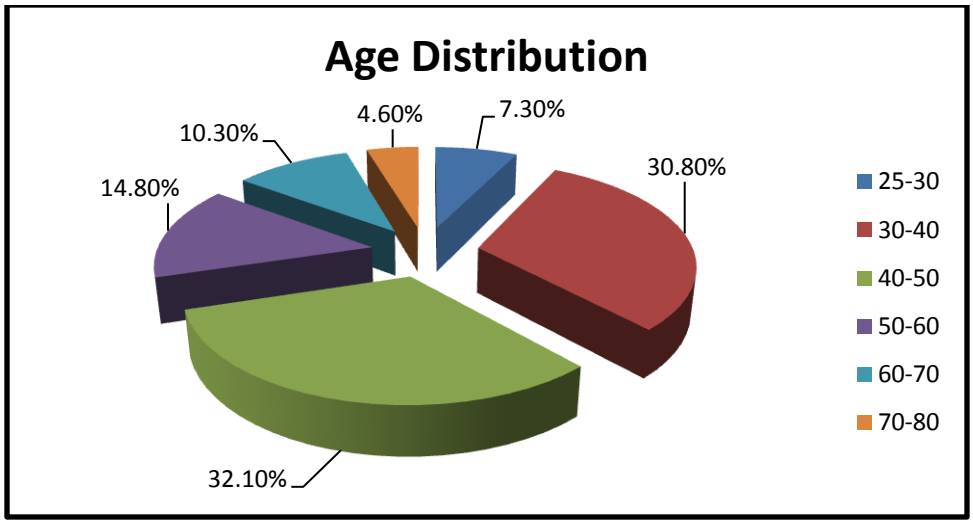


Figure No. 15: Age Distribution of the participants for the study

Age was found to be positive correlated with increasing CVD risk. Aging being a non-modifiable risk factor for developing CVD is already well documented in the population. The excess risk of CVD in Indians appears to be more at younger ages. When people move from a rural to urban environment, they become sedentary and / or may adopted western lifestyles.

HEIGHT AND WEIGHT

Height and weight was taken to calculate the BMI. It was observed that participants had a statistically mean height (5.45±0.37 feet), weight (70.28 ± 11.84 kilo gram) and BMI (25.85 ± 5.73). The distribution of study participants with their mean was depicted in Table No.38.

Table No.38: Comparison of anthropometric parameters

	Mean ± SD	*P value*
Height (ft)	5.45 ± 0.37	< 0.01**
Weight (kg)	70.28 ± 11.84	< 0.01**
BMI (kg/m^2)	25.85 ± 5.71	< 0.01**

** = Significant (P value <0.001)

OCCUPATION

Occupational status was based on a self report by the participants. Participants involved in study were in service, business, farming, house-wife and retired was recorded. 41.2% were doing service in the private or government sector, 18.6% worked for their own business, 18.8% of the

respondents were from farming. The rest 16.24% were housewife and 5.20% retired (Figure No.16).

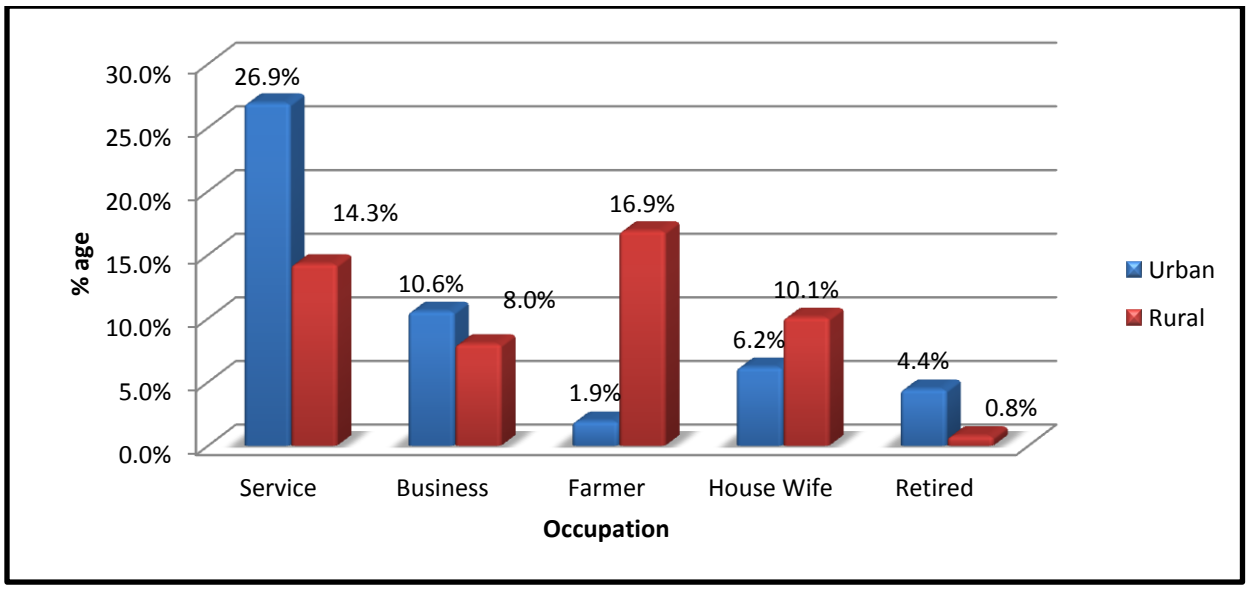
The percentage of occupation distribution between urban and rural was given in Table No. 39 shows that 26.9% participants in urban areas were doing service and 10.6% were business, while in rural higher 16.9% were farmers, 14.3% doing service and 10.1% were housewives. The retired participants were higher in urban 4.4% compared to the 0.8% in rural population.

Table No.39: Distribution of occupation among Urban and Rural

	Service	Business	Farmer	House Wife	Retired
Urban	673 (26.9)	264 (10.6)	48 (1.9)	154 (6.2)	111 (4.4)
Rural	357 (14.3)	200 (8.0)	422 (16.9)	252 (10.1)	19 (0.8)

Figure in parentheses indicate percentages

Figure No. 16: Total Percentage of occupation among Urban and Rural



Living or working in an urban environment increased sedentary lifestyle. This was more evident among men, most of whom were moderately or heavily active in the rural area, although the most of their urban counterparts had occupations with low energy demands.

MARITAL STATUS

Marital status was self-reported by participants. Among the participants both men and women 90.3% were married, 7.8% were single, 1.2% was divorced and 0.6% was widowed. The majority of participants in each age group were married.

4.1.2 Body Mass Index (BMI)

BMI was used to define overweight, obese or normal. According to the Indian standard "overweight" is as a value between 23.0 – 24.9 and "Obesity" is a BMI value greater than or equal to 25.0. Moderate obese range is 25.0 -29.9 whereas severe obese is ≥ 30.0.

The BMI Mean ± SD was 25.84 ± 5.73, among male participants 25.2 0 ± 5.5 and female 27.52 ± 5.8. BMI shows significantly association with male and females ($p < 0.001$). Even at lower BMI (<18.5), the high body fat percent was found to be 2.3%. High body fat percent in the BMI cut score (BMI ≥ 23) was 31.2 %. High body fat in the BMI range 23.0 - 24.9 was found to be 18.5%, respectively BMI range 25.0 - 29.9 and ≥ 30.0 kg/m^2 showing large number of participants having body fat more than 26.8 % and 21.2 %, that an alarming signal for CVD risk factor. 44.3% of male were more overweight against of 22.2% female. 2.3% participants of the study were underweight i.e. BMI < 18.5 kg/m^2 and 31.2 % are in normal range i.e. BMI 18.5 – 22.9. (Table No. 40 and Figure No.17).

Table No. 40: BMI status among male and females

Classification	Popular Description	BMI (kg/m^2)	Risk of co-morbidities	Gender		
				Total	Male	Female
Underweight	Thin	<18.5	Low	58(2.3)	39 (1.6)	19(0.8)
Normal range	Normal	18.5 - 22.9	Average	779(31.2)	652(26.1)	127(5.1)
Overweight		≥ 23				
At risk	Overweight	23.0 - 24.9	Increased	463(18.5)	368(14.7)	95(3.8)
Obese Class I	Obese	25.0 - 29.9	Moderate	670**(26.8)**	432**(17.3)**	238**(9.5)**
Obese Class II	Obese	≥ 30.0	Severe	530(21.2)	307(12.3)	223(8.9)

Figure in parentheses indicate percentages

7.0% participants from age group 31-40 years were over-weight and 6.6% under obese class I & 6.9% obese class II. Participants from age group of 41-50 years were in risk of co-morbidities, 11.1% obese I & 10.5% class II, which was very high in comparison to all age groups, which is an alarming sign and shows an increase in sedentary lifestyle with increase in age (Table no.41).

Maintaining BMI < 23 throughout adult life has been recently recommended. For most participants with a BMI between 18.5 and 22.9, lifestyle modifications including diet and exercise are appropriate. Fatness is associated with a number of co-morbidities, including several forms of heart disease(194).

Table No.41: Association between age groups and BMI

Age groups	Low (Underweight <18.5)	Average (Normal 18.5 - 22.9)	Increased (At Risk 23.0 - 24.9)	Moderate (Obese Class I 25.0 - 29.9)	Severe (Obese Class II ≥ 30.0)
25-30	9 (0.4)	101 (4.0)	31 (1.2)	26 (1.0)	16 (0.6)
31-40	17(0.7)	240 (9.6)	174 (7.0)	166 (6.6)	173 (6.9)
41-50	9 (0.4)	145 (5.8)	110 (4.4)	**277 (11.1)**	**262(10.5)**
51-60	10 (0.4)	124 (5.0)	69 (2.8)	125 (5.0)	42 (1.7)
61-70	11 (0.4)	101 (4.0)	59 (2.4)	57 (2.3)	30 (1.2)
71-80	2 (0.1)	68(2.7)	20 (0.8)	19 (0.8)	7 (0.3)
Total	58 (2.3)	779 (31.2)	463 (18.5)	670 (26.8)	530(21.2)

Figure in parentheses indicate percentages

This study shows BMI increased significantly ($p < 0.001$) with age. Knowing that in the age group 41-50 energy consumption is high, the physical activity is low, 4.4% of respondent were overweight and 21.6% were obese Class I &II, so chance of CVD were higher.

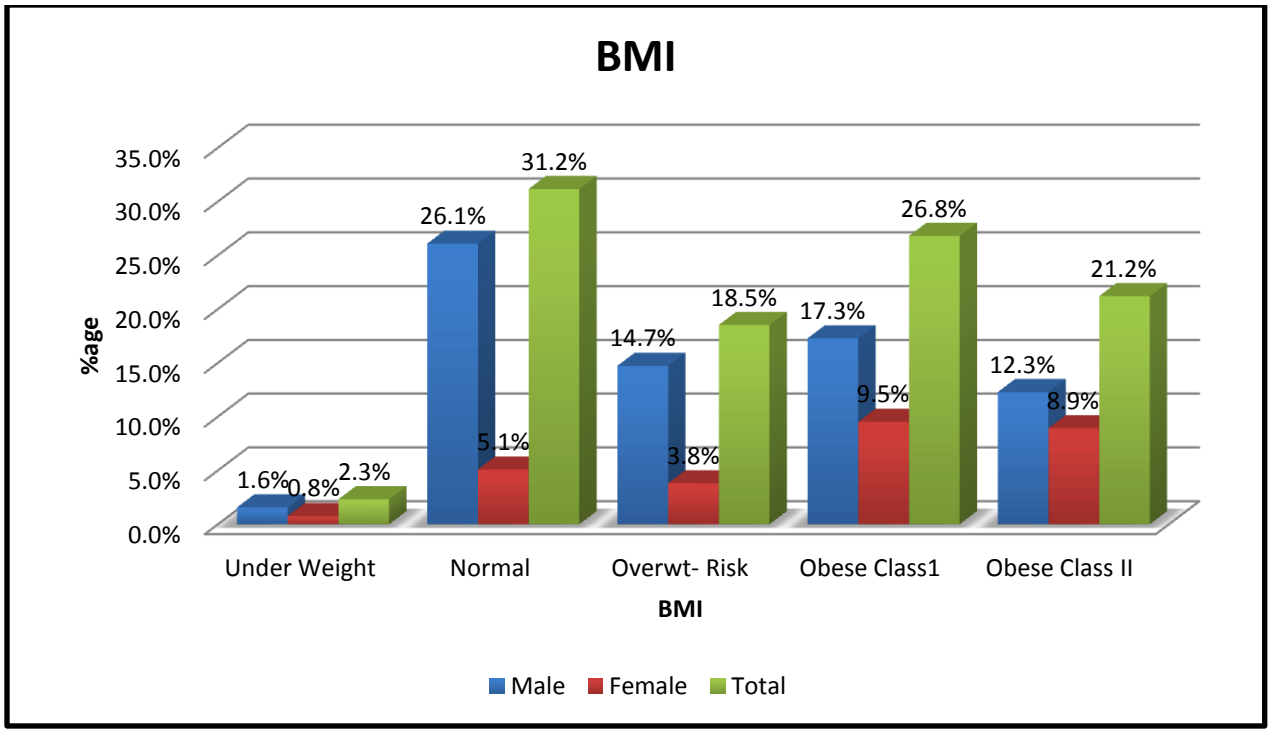


Figure No.17: Association of BMI among gender

Study reported that rural participants had a higher BMI 39.6% often increased, moderate and severe obese compare to their urban counter part 26.9% (See Table No. 42). Urban and rural males were more obese than females. Study shows that there highly significant association of BMI and urban and rural ($\chi 2$ -4.05, P value was < 0.01).

Table No. 42: Division of urban and rural population based on BMI

Region	Gender	Low (Underweight <18.5)	Average (Normal 18.5 - 22.9)	Increased (At Risk 23.0 - 24.9)	Moderate (Obese Class I 25.0 - 29.9)	Severe (Obese Class II ≥ 30.0)
Urban	Male	29 (1.2)	455 (18.2)	224 (9.0)	182 (7.3)	88 (3.5)
	Female	13 (0.5)	81 (3.2)	59 (2.4)	80 (3.2)	39 (1.6)
Rural	Male	10 (0.4)	197 (7.9)	144 (5.8)	250 (10.0)	219 (8.8)
	Female	6 (0.2)	46 (1.8)	36 (1.4)	158 (6.3)	184 (7.4)

Figure in parentheses indicate percentages

Study shows that urban were having normal BMI, while rural were more obese. Moderate and severe obesity were found much more often in rural areas, which was similar to observations in the above-mentioned American Heart study.

4.2. NON- MODIFIABLE RISK FACTORS

SUFFER FROM RISK FACTORS RELATED TO CVD

When compared with the risk factors between women and men, consistent findings had indicated that total cholesterol, BMI, high blood pressure (HTN), diabetes (DM),obesity appeared greater in men than in women (Shown in Table No. 43). Between rural and urban populations, urban population had higher prevalence of most risk factors of CVD than their rural counterparts. Therefore, for physiological risk factors, men have a greater risk for CVD than women. Also, urban populations have greater risks than rural populations.

HIGH BLOOD PRESSURE/ HYPERTENSION:

Blood pressure is a measure of the force of the blood in the arteries when the heart beats. Increased blood pressure causes the heart to work harder, which weakens the heart muscle over time, and can cause damage to the heart and arteries. Left untreated, high blood pressure can cause stroke, heart attack or heart failure. One is considered as having high blood pressure if readings are consistently at or above 140/90 mm Hg. People of all ages are at risk for high blood pressure, but it generally affects people over 45years.

In our study 13.8% participants of age group of 41-70 years were having high B.P as compared to any other age group. 5.1% male and 2.2% female participants were suffering from the high Blood Pressure that may be the result of stress, physical inactivity, overweight, excessive alcohol use, smoking, salt sensitivity, heredity, age, race or sex. Males were more hypertensive then females. This study shows that there is highly significant association between blood pressure and among males and females. ($\chi 2 - 10.95$, P value was < 0.001).

HIGH BLOOD CHOLESTEROL

Cholesterol is a fatty substance found in the human body and in foods that come from oil, meat. It has many positive functions within the body and is required for us to be healthy. However, excessive amounts of cholesterol in the blood can increase the development of plaque on the walls of the arteries and lead to coronary artery disease. A full cholesterol profile includes total cholesterol, LDL, HDL and triglyceride levels.

A total of 7.4% participants self reported for suffering from high blood cholesterol, among them 5.1% were male and 2.2% female. Participants of 25-30 year age group mostly reported of normal blood cholesterol range; it was higher 5.2 % in 31-50 age groups. Other studies also showed a significant association between high blood cholesterol and male and females. In our study, no significant association shown between high blood cholesterol and among males and females ($\chi 2 - 0.65$, P value was 0.418).

OBESITY AND OVERWEIGHT

Being overweight is more than just unhealthy. The more excess weight you carry, the more strain on your heart. People who are overweight tend to have higher blood pressure, elevated cholesterol and are more likely to develop diabetes, and obese adults have an increased risk of developing heart disease and stroke. Total 3.8% participants self reported to be overweight, and among them 2.5% were males and 1.3% were female. There was no significant association with obesity between male and female gender ($\chi 2 - 1.95$, P value was 0.162) in this study, but other studies show that there were significant difference in obesity between males and females.

DIABETES

Diabetes Mellitus interferes with the body's ability to produce adequate amounts of insulin needed for your body to use sugars and carbohydrates. Low levels of insulin raise the level of triglycerides, which greatly increases the plaque buildup in blood vessels. Therefore, people with diabetes are at a much higher risk for developing coronary artery disease.

Diabetes cannot be cured but it can be controlled by medications, weight reduction, and a regular exercise program. Discuss any other risk factor concerns you may have with your health care

provider to do your best to lower your other modifiable risks for heart disease. In this study shown that there was a significant association between diabetes and males & females (χ2 – 38.87, P value was <0.001).

When the participants were asked for self reporting diseases related to CVD, 17.7 % were reported suffering from the High B.P, and 13.8% male and 3.8 % female were having diabetes. Data shows that High B.P and diabetes were the major modifiable risk factor for CVD.

Table No. 43: Male and female suffer from disease related to CVD

Disease	Male	Female	Total	Mean ±SD	χ^2	*P Value*
IHD	35(1.4)	4 (0.2)	39 (1.6)	0.02 ± 0.124	6.23	0.013*
High Blood Cholesterol	129(5.1)	57 (2.2)	186 (7.4)	0.07 ± 0.262	0.65	0.418
High B.P	347 (13.8)	96 (3.8)	443 (17.7)	0.18 ± 0.382	10.95	<0.001*
Diabetes	298 (11.9)	49 (1.96)	347 (13.8)	0.14 ± 0.346	38.87	<0.001*
Obesity	63 (2.5)	33 (1.3)	96 (3.8)	0.04 ± 0.192	1.95	0.162
Total	**889 (35.5)**	**242 (9.6)**	**1131 (45.2)**			

Figure in parentheses indicate percentages, ** = Significant (P value <0.001), * = Significant (P value 0.05)

FAMILY HISTORY AND CVD

Family history of heart disease being reported by total of 31.3 % participants, and among them 22.5% male and 8.8 % were female. When compared between urban population and rural population, results shows in urban 17.2% participants were having a family history of heart disease whereas in rural it was only 14.0%.

Results show that men and urban had a higher percentage of history of heart disease, which is the non-modifiable risk factor and may lead to CVD (See table no. 44). Our results regarding more history of heart disease in urban was in agreement with some previous studies (195). In this study no significant association (χ^2 – 0.001, P value was 0.977) between family history of CVD and males and females being found.

Table No. 44: Family history of heart disease among male & female, urban and rural and disease related to CVD.

Gender / Having FHD	Yes	Total
Male	562 (22.5)	1798 (71.9)
Female	219(8.8)	702(28.1)
Urban	431(17.2)	1250 (50.0)
Rural	350(14.0)	1250(50.0)
Disease related to CVD- Yes	371 (14.8)	922 (36.9)
Disease related to CVD -No	410 (16.4)	1578(63.1)

Figure in parentheses indicate percentages

14.8% of the participants were suffer from the disease may cause CVD and family history of Heart disease. In this study significant association (χ^2 – 55.06, P value was < 0.001) between family history of CVD and diseases related to CVD (Table No. 44).

FIRST DEGREE RELATIVE EXPERIENCE HEART OR RELATED DISEASE

If a first-degree male relative (e.g. father, mother, daughter, son, sister, brother) has suffered a heart attack before the age of 55, or if a first-degree female relative has suffered one before the age of 65, you are at greater risk of developing heart disease. "Research finds a person with both a first degree relative like a parent or sibling who suffered from heart disease before age 60, and a second degree relative like an aunt, uncle or grandparent with a similar profile, is nearly ten times as likely to suffer from heart disease earlier in life than someone whose family history includes no heart disease,".

If both parents have suffered from heart disease before the age of 55, your risk of developing heart disease can rise to 50% compared to the general population. However, you can protect yourself by taking care of your heart, as the development of cardiovascular disease involves many different factors, not just your family history.

Your increase of having a stroke is slightly increased if first-degree relatives have had heart disease or strokes. If they were young when they had their heart disease or stroke, then the risk is

slightly higher. Studies have shown that risk increases if you are a woman and your mother has suffered a heart disease or stroke. Studies have shown a genetic component for both hypertension and abnormal blood lipids, factors related to the development of CVD (196).

Out of total participants 67.3% said that their first degree relatives never had any type of heart disease, while 32.7% said that their first degree relative had gone under any king of heart disease (Heart attack, Heart operation, Congenital Heart disease, High cholesterol, Diabetes).

The majority of participants said that their first degree relatives 42.3% (male 31.8% and female 10.5%) had undergone heart attack and 27.9% (male 22.2% and female 5.6%) had a heart operation while 18.9% (male 11.5% and female 7.5%) suffer from high cholesterol and 9.9% (male 8.6% and female 1.3%) diabetes. (Table No.44)

Table No. 45: First degree relative (parents) suffer from disease related to CVD

Gender	Heart Attack	Heart Operation	Congenital IHD	High Cholesterol	Diabetes
Male	260(31.8)	182(22.2)	6(0.7)	94(11.5)	70(8.6)
Female	86(10.5)	46(5.6)	2(0.2)	61(7.5)	11(1.3)
Total	346(42.3)	228(27.9)	8(1.0)	155(18.9)	81(9.9)

Figure in parentheses indicate percentages

There was a highly significant association among males and females and first degree relatives suffer from disease related to CVD (χ^2 – 25.36, P < 0.001).

16.3% of the participants were suffer from the disease related to CVD (diabetes, high, BP and obesity) and their first degree relative (parents) also suffer from the disease like hear attach, heart operation, high cholesterol, diabetes. Results shows that there is significant association between diseases suffer from CVD related disease and first degree relative disease suffering cause CVD (χ^2 – 88.23, P < 0.001).

DIRECT FAMILY MEMBERS SUFFERED FROM HEART OR RELATED DISEASE

11.2 % of participant's one person and 3.1% more than one person direct family member died or diagnosed with CHD before age of 55 years. Participants' direct family member died or diagnosed with CHD after age of 55, 13.2% one person and 1.6% more than one person.

19.4 % participant's one person and 8.0 % more than one person direct family member diagnosed with diabetes, which shows that 27.4% direct family were highly prevalence to CVD. 4.2 % one person and 0.2% more than one person participant's direct family member died or diagnosed with the strokes or cerebral vascular disease.

The prevalence of CVD among first–degree relatives of participants was higher, especially in men. Risk factor identification and modification should be considered in individuals with a positive family history of CVD. (See Table No. 46)

In this study shows that

- No significant association among males and females and direct family members died or diagnosed before age of 55 (The P value was 0.409)
- No significant association among males and females and direct family members died or diagnosed after age of 55 (The P value was 0.982)
- No significant association among males and females and direct family members died or diagnosed with diabetes (The P value was 0.664)
- There was a significant association among males and females and direct family members died or diagnosed with stroke (The P value was 0.002)

But other studies show that there is significant association between male and females and direct family members died or diagnosed heart disease before age of 55, after the age of 55 and diagnosed with diabetes.

Table No. 46: Association between risk factors and family history of heart disease.

	Male	Female	Total	χ^2	Odd ratio 95% CI	P value
Died or diagnosed CHD before age of 55				0.68	1.261(0.727-2.186)	0.409
None	1539(61.6)	604(24.2)	2143(85.7)			
One Person	206 (8.2)	74(3.0)	280(11.2)			
More than One	53(2.1)	24(1.0)	77(3.1)			
Coronary Heart Disease after age of 55				0.00	1.008(0.500-2.031)	0.982
None	1547 (61.9)	582 (23.3)	2129 (85.2)			
One Person	224 (9.0)	107 (4.3)	331 (13.2)			
More than One	27 (1.1)	13 (0.5)	40 (1.6)			
Diagnosed with diabetes				0.18	1.077(0.771-1.505)	0.664
None	1394 (55.8)	422 (16.9)	1816 (72.6)			
One Person	289 (11.6)	196 (7.8)	485 (19.4)			
More than One	115 (4.6)	84 (3.4)	199 (8.0)			
Diagnosed with stroke				9.42	1.208(0.979-1.490)	0.002*
None	1708 (68.3)	681 (27.2)	2389 (95.6)			
One Person	88 (3.5)	17 (0.7)	105 (4.2)			
More than One	2 (0.1)	4 (0.2)	6 (0.2)			

Figure in parentheses indicate percentages, ** = Significant (P value <0.001), * = Significant (P value 0.05)

SURGERY AND CVD

The participant's response to the question, have you ever had surgery of any kind, 10.9% male and 2.3% female had undergone any kind of surgery. 3.7% in between 41-50 years and 3.1 % in 61-70 years had undergone any kind of surgery. The percentage of surgery was increased as per the age grown.

4.3 ALCOHOL, TOBACCO, SMOKING CONSUMPTION

The increasing habit of smoking has resulted in a rising incidence of tobacco-related disease all over the developing countries. According to the WHO report (1993), the tobacco related pulmonary and CVD would be become a major community health problem in India. CVD is common in both among smokers and non-smokers and increase sharply with age. Of the four established major CVD risk factors – high blood cholesterol levels, smoking, hypertension and rich diet – two factors – rich diet and cigarette smoking – are aspects of lifestyle that become mass phenomena in the 20th century in western industrialized countries(197).

Studies from more than 20 countries show that moderate drinker have 20-40% more CVD than non-drinkers. Women those who smoke risk having a heart attack 19 years earlier than non-smoking women. Non-smokers have more than a 70% increase in risk of stroke if they live with a smoker. The overall prevalence of smoking and alcohol intake according to age and sex distribution is shown in Table no. 47 and 48.

For behavioral risk factors, the prevalence of smoking was much higher among men than women and among rural men than their urban counterparts. 76.6% participants reported as non-smoker and 23.4% was smoker (we classified never smokers as those with all available records coded as a "non-smoker" and always smokers as those with all available smoking records coded as a "smoker"), from them 94% were men and only 6% were women. All the women smoke were belonging to the urban area. 16.0% participant smokers were from the urban area and 7.4% were from the rural area. Males smoked for considerably more years than females.

Participants who said they were not smoker 2.7% quit smoking less than 5 years, while 1.5 % quit smoking more than 5 years ago.

11.6% of the participants were smoker and chew any type of tobacco also. 7.3 % of respondents were from urban and 4.3% from rural. Self reported by the participants, a total of 13.2%, male 10.6% and female 2.5% were found passive smoker. 10.9 % said they were living with smoker from last 1- 5 years while 8.5% said they were working with the smoker.

Studies show that passive smokers are more sensitive to CVD than smokers, about a 30% increase in risk of death from IHD or MI among non-smokers living with smokers(198).

Table No. 47: Risk factors Tobacco, Smoking and Alcohol of CVD

	Male	**Female**	**Total**	**$\chi 2$**	***P value***
Whether smoking					
Yes (Smokers)	549 (22.0)	36 (1.4)	585 (23.4)	1.81	< 0.001**
Number of Cigarettes/ bidis smoking per day				1.87	< 0.001**
1-2 Cigarettes	62 (2.5)	11 (0.4)	73 (2.9)		
2-5 cigarettes	219 (8.8)	10 (0.4)	229 (9.2)		
6-10 cigarettes	219 (8.8)	7 (0.3)	226 (9.0)		
10 or more	49 (2.0)	8 (0.3)	57 (2.3)		
If Not smoking, then				1.18	< 0.001**
Quit smoking ≤ 5 yrs	57 (2.3)	11 (0.4)	68 (2.7)		
Quit smoking ≥ 5 yrs	37 (1.5)	1 (0.0)	38 (1.5)		
Whether consuming any form of tobacco				1.95	< 0.001**
Sometime	171 (6.8)	42 (1.7)	213 (8.5)		
Quite often	238 (9.5)	14 (0.6)	252 (10.1)		
Mostly	264 (10.6)	15 (0.6)	279 (11.2)		
Whether drinking alcohol				2.05	< 0.001**
Yes (Drinkers)	616 (24.6)	43 (1.7)	659 (26.4)		
No. of days consuming alcohol per week				2.14	< 0.001**
Occasionally	381 (15.2)	22 (0.9)	403 (16.1)		
2 days / week	122 (4.9)	1 (0.0)	123 (4.9)		
3 days / week	79 (3.2)	11 (0.4)	90 (3.6)		
4 day /week	35 (1.4)	9 (0.4)	44 (1.8)		
No. of alcohol drinks				2.34	< 0.001**
1-2 drinks	272 (10.9)	17 (0.7)	289 (11.6)		
3-4 drinks	259 (10.4)	15 (0.6)	274 (11.0)		
5 drinks	85 (3.4)	3 (0.1)	88 (3.5)		
≥ 6 drinks	2 (0.1)	8 (0.3)	10 (0.4)		

	Male	Female	Total	$\chi 2$	*P value*
Type of Alcohol consuming				2.21	< 0.001**
Whisky/Rum	479 (19.2)	27 (1.1)	506 (20.2)		
Wine	24 (1.0)	6 (0.2)	30 (1.2)		
Deshi / Tarri	17 (0.7)	9 (0.4)	98 (3.9)		
Any form	97 (3.9)	1 (0.0)	98 (3.9)		

Figure in parentheses indicate percentages, ** = Significant (P value <0.001)

In this study there was a significant association among males and females and smokers, tobacco consumers, quit smoking and consumed alcohol (P value was <0.001).

Cigarette smokers have been defined as individuals are considered to be daily smokers if they regularly smoke at least one cigarette per day. When the respondent discussed how many cigarettes they smoke per day, 2.9 % of the participants consume 1-2 cigarettes, 9.2% consume 2-5, 9.0% consume 6-10 cigarettes and 2.3% consume 10 or more cigarettes per day. Male were more smoker than female.

Women who smoke only 3-5 cigarettes a day double their risk of heart attack, while men who smoke 6-9 cigarettes a day double their risk (199). Light smoking was reported by 7.4% and 16.0% of rural and urban men and women, respectively.

Overall, tobacco consumption was also lower in men and women, but consumption of tobacco was more in rural than in urban. The cigarette smoking and tobacco consumption were found inversely proportion in urban and rural area. (Figure no. 19) The average consumption of cigarettes was 5.47 ± 2.4 per person per day. For smokers, cigarette smoking was 22.6% in the age group 31 – 40 years among male and female, which was higher among all age groups and 31.4% between 51-70 years.

5.7 % of the urban and rural, respectively, had stopped smoking. Tobacco use, other than smoking and passive smoking are also implicated as CVD risks. The study shows that rural to

urban leads changes in lifestyle and behavior's. Smoking and tobacco consumption are increasing slowly from urban to rural, which may cause a higher risk of CVD in rural population. 53.3% participants from Kolkata were found more smokers in respect to other cities, 14.9% from Ahmedabad while 19.0% from Tonk and 12.8% of Bhavnagar participants were smokers.

26.9% Male and 2.8% female participants chew tobacco, While tobacco consumption was 15.3% in urban and 14.4% in rural areas. Most of the participants chew tobacco in form of gutka in urban areas while raw tobacco form (mawwa) in rural areas. The total participants who smoke as well as chew tobacco together, 37.9% said sometime, 30.3% said quite often and 31.7% said mostly they do that.

Table No. 48: Prevalence of smoking and alcohol consumption in various age-groups

Age Group	Male			Female		
	Total	**Smoking**	**Alcohol**	**Total**	**Smoking**	**Alcohol**
25-30	123 (4.9)	26 (21.1)	29 (23.6)	60 (2.4)	8 (13.3)	12 (20.0)
31-40	489 (19.6)	156 (31.9)	200 (40.9)	281 (11.2)	18 (6.4)	16(5.7)
41-50	557 (22.3)	149 (26.8)	177 (31.8)	246 (9.8)	6(2.4)	7 (2.8)
51-60	313 (12.5)	112 (35.8)	115 (36.7)	57 (2.3)	3 (5.3)	4(7.0)
61-70	215 (8.6)	81 (37.7)	73 (34.0)	43 (1.7)	0(0.0)	4 (9.3)
71-80	101 (4.0)	25 (24.8)	22 (21.8)	15 (0.6)	1(6.7)	0(0.0)
Total	1798 (71.9)	549(30.5)	616 (34.3)	702 (28.1)	36 (5.1)	43(6.1)

Figure in parentheses indicate percentages

34.3% men than 6.1% women participant's consume alcohol, which was higher in men. Study shows that an increase trend of smoking and alcohol consumption with age in male. 5.1% of female were consumed cigarettes-smoking and 6.1% consume alcohol.

As the female group of smoker and alcohol consumer was small it has not been further analyzed more. In female, alcohol consumption and smoking were higher in 25-30 years age group. The consumption of alcohol and smoking in females is higher in urban population only. Majority of the female consume alcohol occasionally and prefer to drink wine or whisky. Female smokers consume 1-2, 3-5 cigarettes per day only.

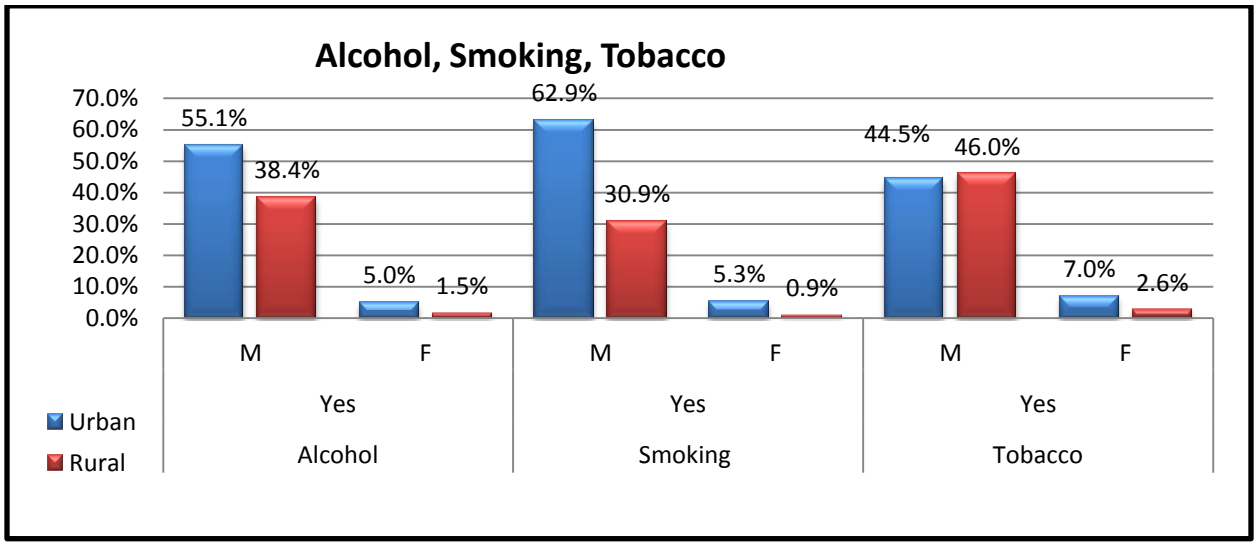


Figure No.198: Alcohol, smoking & tobacco consumption in urban and rural area

Smokers and alcohol consumers are further classified according to the amount of the cigarettes and drink consumed among male and females. Smokers, alcohol consumer and tobacco eater among male and female was classified among urban and rural population (Table No.49 & Figure No. 18). On the other hand, the increase of smoking in India and other developing countries implies a likelihood of increased incidence of CHD and other tobacco-related diseases in the future.

Table No. 49: Prevalence of alcohol, smoking, tobacco consumption in urban and rural

	Alcohol		**Smoking**		**Tobacco**	
	Yes		**Yes**		**Yes**	
	M	**F**	**M**	**F**	**M**	**F**
Urban	363 (55)	33 (5)	368 (63)	31 (5)	331 (44)	52 (7)
Rural	253 (38)	10 (1)	181 (31)	5 (1)	342 (46)	19 (3)
Total	659		585		744	

Figure in parentheses indicate percentages (M- Male, F- Female)

The relative risk of IHD in smoker was higher i.e. 1.39 as compared to nonsmokers odds ratio (OR 0.71, Confidence Interval (CI) 0.31-1.62). The odds ratio (OR) for high cholesterol among smoker as compare to non-smoker was (OR 2.83, Confidence Interval (CI) 2.09 - 3.85).

Table No.50: Prevalence of CVD risk factors among smokers

	Number (%)	**R. Risk**	**Odd Ratio (95% CI)**
Ischemic Heart Disease	7 (0.1)	1.39	0.71(0.31-1.62)
High Cholesterol	82(14.0)	0.38	2.83(2.09-3.85)
Blood Pressure	121(20.7)	0.81	1.29(1.02-1.62)
Diabetes	112(19.1)	0.64	1.69(1.32-2.16)
Obesity	29(5.0)	0.70	1.43(0.92-2.24)
Family H/O	236(40.3)	0.70	1.70(1.40-2.06)

Figure in parentheses indicate percentages

A higher incidence of heart disease was often found among regular and excessive drinkers than among moderate (less than one to two drinks daily) or nondrinkers. Besides leading to car and other types of accidents, depression, suicide and alcoholism, alcohol raises blood pressure and triglycerides, constricts the arteries of the heart and can contribute to obesity.

Table No. 51: Percent prevalence of alcohol consumers

Age Group	**Light**	**Moderate**	**Heavy**
	<2 drinks/ day	**3-4 drinks/day**	**>4 drinks /day**
25-30	19 (2.9)	13 (2.0)	9 (1.4)
31-40	80 (12.1)	119 (18.0)	19 (2.9)
41-50	89 (13.5)	63 (9.5)	32 (4.8)
51-60	56 (8.5)	40 (6.1)	23 (3.5)
61-70	30 (4.5)	34 (5.1)	13 (2.0)
71-80	15 (2.3)	5 (0.8)	2 (0.3)
Total	289 (43.7)	274 (41.5)	98 (14.8)

Figure in parentheses indicate percentages

A significant proportion of the male participants were regular consumers of alcohol. The age-distribution of alcohol consumers shows that the majority were light drinkers at middle age and moderate drinkers at a younger age and again heavy drinkers in middle age. Heavy drinkers seem a class apart and their number does not change much with increasing age.

In this study those who consumed 2 or less than 2 alcohol drinks per day was considered as a light drinker, while who consume 3-4 drinks per day as moderate drinker and consumed more than 4 drinks per day was considered as heavy drinker.

In this study 43.7% of male were light drinker, 41.5% were moderate and 14.8% were heavy drinkers. 18.0% male in younger age group between 31-40 years were moderate consumers but the number of moderate alcohol consumers declines steadily with the passage of each decade up to the age of 80 years i.e. 0.8% only, similarly in the light alcohol drinkers.

4.8 % of the participants in age groups between 41-50 years and 3.5% in the age group between 51-60 years were indulged in the heavy alcohol drinking. 20.2% of the total and 19.2% male and 1.1 % of female participants consume whisky / rum as alcohol drink. 1.2% of participants consume wine and 3.9 % consume deshi (local made brand) while 3.9% consume any kind (brand) of alcohol (See Table No.47).55.1 % male in urban and 38.4% male in rural, while 5.0 % female in urban and 1.5% female in rural participants consumed alcohol. This shows that consumption of alcohol was high in men and urban participants.

Table No. 52: Prevalence of CVD risk factors among Alcohol Consumers

	Number (%)	**R. Risk**	**Odd Ratio (95% CI)**
Ischemic Heart disease	19 (2.9)	0.53	2.70(1.43 –5.09)
High Cholesterol	90 (13.7)	0.50	2.87(2.12 –3.89)
Blood Pressure	142 (21.5)	0.78	1.40(1.12 –1.75)
Diabetes	113 (17.1)	0.77	1.42(1.11 –1.81)
Obesity	37(5.6)	0.67	1.79(1.17 –2.73)
Family H/O CVD	263(39.9)	0.68	1.69(1.40 –2.04)

Figure in parentheses indicate percentages

The number of participants consume alcohol as well as smoke cigarettes is (60.5%) with (OR - 13.65, C.I 10.98 to 16.97) with the relative risk of 0.19.

Most studies have shown a lower occurrence of CHD among mild to moderate alcohol consumers while some have shown that this is not the case. However, all studies have shown that heavy –consumers of alcohol have a higher CHD morbidity as well mortality. In the present study, the data show the CVD is higher among drinkers and lower in non-drinkers. Long use of alcohol may directly cause certain organic diseases, may contribute to the development of heart disease, cirrhosis of the liver, cancer of the mouth, pharynx, esophagus and pancreas and result in increased risk of accidents and suicide. A history of simultaneous exposure to cigarette smoking, tobacco and the habit of heavy alcohol intake revealed a very high risk for developing CVD.

Studies on the prevalence of such risk factors are routinely being carried out in the developed countries. However only a few studies on the prevalence of behavioral risk factors have been carried out in India, most purely localized studies.

Table No.53: Comparison of prevalence of CVD risk factors among Male and female

Variable	**Male**	**Female**	**Cases**	**$\chi 2$**	**R. Risk**	**OR (95% CI)**	***P value***
Family History of Heart disease				0.00	1.002	0.997 (0.826 – 1.204)	0.977
Yes	562(22.5)	219(8.8)	781(31.2)				
Suffer From							
Ischemic Heart Disease				6.23	3.416	0.289 (0.102 – 0.815)	0.013*
Yes	35(1.4)	4(0.2)	39(1.6)				
High Cholesterol				0.65	0.884	1.143 (0.826 – 1.582)	0.418
Yes	129(5.2)	57(2.3)	186(7.4)				
High Blood Pressure				10.95	1.411	0.662(0.518-0.846)	<0.001**
Yes	347 (13.9)	96(3.8)	443(17.7)				

Variable	Male	Female	Cases	$\chi 2$	R. Risk	OR (95% CI)	*P value*
Diabetes				38.87	2.374	0.378 (0.275 – 0.518)	<0.001**
Yes	298(11.9)	49(2.0)	347(13.9)				
Obesity				1.95	0.745	1.358 (0.883 – 2.089)	0.162
Yes	63(2.5)	33(1.3)	96(3.8)				
Smoking Cigarettes				181.80	5.954	0.123 (0.087 – 0.175)	< 0.001**
Yes	549(22.0)	36(1.4)	585(23.4)				
Drinking Alcohol				205.88	5.593	0.125 (0.091 – 0.173)	< 0.000**
Yes	616(24.6)	43(1.7)	659(26.4)				
Consuming Extra Table Salt				0.38	1.048	0.939 (0.769-1.147)	0.538
Yes	475(19.0)	177(7.1)	652(26.1)				
Feel Anxious				2.92	1.095	0.856(0.717-1.023)	0.087
Yes	777(31.1)	277(11.1)	1054(42.2)				
Feel Depression				22.96	1.782	0.513(0.389-0.677)	<0.001**
Yes	314(12.6)	69(2.8)	383(15.3)				

Figure in parentheses indicate percentages, ** = Significant (P value <0.001), * = Significant (P value 0.05)

In comparison between male and female we could confirm an increase prevalence of the following CVD- related risk factors among persons with

i). Significant association with Ischemic heart disease 1.6% , P <0.013

ii). No significant association with High cholesterol 1.6 % , P <0.418

iii). Significant association with Blood pressure 17.7%, P <0.001

iv). Significant association with Diabetes 13.9%, P <0.001

v). No significant association with Obesity 3.8%, P < 0.162

Subgroup analysis among smokers and nonsmokers who did or did not consume alcohol has shown that smokers are at higher risk of hypertension and CVD, while alcohol consuming smokers are at higher risk of hypertension and CVD. Prospective studies in developing countries would further clarify this finding.

4.4 PHYSICAL ACTIVITY

Decreased physical activity and increase consumption of calories and saturated fat result in abdominal obesity, insulin resistance and high cholesterol.

This study shows that there was a significant association (P value was < 0.001) between men and women and types of exercises, number of days performing exercise and risk factors of CVD.

Table No.54: Association between exercise and CVD risk factors

	Male	**Female**	**Total**	**$\chi 2$**	**p value**
Involve in any exercise programme				41.179	< 0.001**
Never	982 (39.3)	322 (12.9)	1304 (52.2)		
Sometime	555 (22.2)	215 (8.6)	770 (30.8)		
Quite Often	129 (5.2)	58 (2.3)	187 (7.5)		
Mostly	132 (5.3)	107 (4.3)	239 (9.6)		
Total	1798 (71.9)	702 (28.1)	2500		
Kind of exercise				46.639	< 0.001**
Walking	486 (19.4)	207 (8.3)	693 (27.7)		
Cycling	154 (6.2)	45 (1.8)	199 (8.0)		
Machine	140 (5.6)	73 (2.9)	213 (8.5)		
Yoga	63 (2.5)	64 (2.6)	127(5.1)		
Total	843 (33.7)	389 (15.6)	1232 (49.3)		
No. of days per week performing exercise				27.413	< 0.001**
1-2 days per week	225 (9.0)	141 (5.6)	366 (14.6)		
3-4 days per week	261 (10.4)	106 (4.2)	367 (14.7)		
More5 days per week	288 (11.5)	117 (4.7)	405 (16.2)		
1-2 days per months	68 (2.7)	25 (1.0)	93 (3.7)		

Warm-up & Cool down before and after exercise				29.462	< 0.001**
Always	275 (11.0)	143 (5.7)	418 (16.7)		
Sometimes	339 (13.6)	115 (4.6)	454 (18.2)		
Never	211 (8.4)	123 (4.9)	334 (13.4)		
Currently Not	18 (0.7)	8 (0.3)	26 (1.0)		

Figure in parentheses indicate percentages, ** = Significant (P value <0.001), * = Significant (P value 0.05)

32.7% of men and 15.2% of women take part in any kind of the physical activities. However, 19.0% of the younger group between 31-40 years and only 4.6% among the age group 61-80 years participants were involved in any kind of physical activity, shown a decreasing trend in the involvement of physical activity as higher the age. (See table no. 54, 55).

The frequency of physical activity among male and females were '1-2 days per week' (14.6%), '3-4 days per week'(14.7%), 'More than 5 days per week'(16.2%) while '1-2 days in month'(3.7%). The declared number of days and frequency of physical activity per week are presented in Table no. 54.

19.9 % participants from urban take part in exercise sometime or mostly, while 28.0% from rural perform more physical exercise. A reduced physical activity was also deducted among urban women, but the contrast was small due to the already low physical activity of women living in villages where electricity, piped water, transportation and other facilities were available.

The question asked from the participants, the type of physical activities or exercise such as walking, cycling, by machine, yoga in the past month or presently performing. 27.7 % participants reported walking, 8.0% said cycling and 8.5% machine and 5.1% participants reported yoga. Walking was commonly used as a physical activity among both men and women. All age groups consistently reported that they exercised.

Participant's of age between 31-50 years were highly involved in exercise than other age groups. More than 16.2 % respondents were doing exercise more than 5 days a week and 18.2% sometime do warm-up and cool down before and after exercise.

Table No. 55: Association between age groups involved in any kind of exercise.

Age group	Never	Sometime	Quite Often	Mostly	Total
25-30	54(2.2)	87(3.5)	16(0.6)	26(1.0)	183(7.3)
31-40	296(11.8)	287(11.5)	87(3.5)	100(4.0)	770(30.8)
41-50	420(16.8)	251(10.0)	48(1.9)	84(3.4)	803(32.1)
51-60	265(10.6)	73(2.9)	14(0.6)	18(0.7)	370(14.8)
61-70	179(7.2)	50(2.0)	18(0.7)	11(0.4)	258(10.3)
71-80	90(3.6)	22(0.9)	4(0.2)	0(0.0)	116(4.6)
Total	**1304(52)**	**770(31)**	**187(7)**	**239(10)**	**2500**

Figure in parentheses indicate percentages

Many rural men worked in non-mechanized agriculture; most rural women did household chores and undertook child care. Most men had a higher physical activity level than women. Mostly rural men (28.0%) had a physically moderate or heavy lifestyle, and only (16%) had very light activity. The reverse was seen among urban men and women.

4.5 DIET HABITS

Attitudes toward diet seem to be more complex. Eating diet is considered as one of the main factors of heart disease. Dietary change could reduce risk. Large differences existed between sexes, with obese women more likely to believe that their diet is harmful then obese men. A diet high in saturated fat includes not only meat but also whole milk as well as high-fat dairy product and certain vegetable oils.

Data (1961-1996) indicate a 104% increase in wheat consumption, vegetables (43%), and fruits (32 %) in India (200). Diet of 17% of rural poor does not include any edible oil and about 5% of the population consumes nearly 40% of the available fat, hence the increase in the fat consumption is mainly in urban middle and upper classes where CVD is rampant(201).

In this study we have studied the dietary habits and relation to CVD with regards to daily intake

breakfast, meal per day, green vegetable per day, fruits per day dairy products per day, type of oil and dairy products, egg consumption. The focal point of interest in the dietary habits has been the relationship to CVD.

Of the 2500 participants 65.2 % were vegetarians and 34.8% were non-vegetarians. The relationship between the inadequate intake of high-fiber food such as vegetable and fruits and the occurrence of CVD is well documented in Table No. 56.
The majority of the respondent 60.5% were having their regular breakfast while 23.8% said they were having breakfast 1-2 time per week, due to working habits or not having habit for breakfast.

When the respondent questioned for consuming meals per day, 52.7% of the respondents 39.1% males and 13.6% females reported taking two meals with healthy snacks, 25.4% having 2 meals only per day, while 16.6% respondents, 12.7% males and 3.9% females said they don't have regular meal eating habit.

Table No.56: Risk factors – Dietary

Risk factors	**Male (1798)**	**Female (702)**	**Total (N=2500)**	**$\chi 2$**	***P value***
Breakfast				8.57	0.035*
Regular eating (7 days)	1085 (43.4)	428 (17.1)	1513 (60.5)		
1-2 times/week	433 (17.3)	162 (6.5)	595 (23.8)		
3 times/week	113 (4.5)	28 (1.1)	141 (5.6)		
4-5 times/week	167 (6.7)	84 (3.4)	251 (10.0)		
Number of meals consuming per day				24.54	< 0.001**
2 Meals "healthy" snacks	978 (39.1)	339 (13.6)	1317 (52.7)		
2 Meals Only	419 (16.8)	217 (8.7)	636 (25.4)		
1 Meals "healthy" snacks	84 (3.4)	49 (2.0)	133 (5.3)		
No regular eating pattern	317 (12.7)	97 (3.9)	414 (16.6)		

Risk factors	Male (1798)	Female (702)	Total (N=2500)	χ^2	*P value*
Green vegetables per day				17.03	< 0.001**
1 time/day	659 (26.4)	315 (12.6)	974 (39.0)		
2 time/day	544 (21.8)	190 (7.6)	734 (29.4)		
3-4 times/Week	271 (10.8)	103 (4.1)	374 (15.0)		
Rarely consume	324 (13.0)	94 (3.8)	418 (16.7)		
Fruit per day				2.96	0.397
1 time/day	307 (12.3)	138 (5.5)	445 (17.8)		
2 time/day	296 (11.8)	106 (4.2)	402 (16.1)		
3-4 times/Week	479 (19.2)	176 (7.0)	655 (26.2)		
Rarely consume	716 (28.6)	282 (11.3)	998 (39.9)		
Dairy products per day				54.00	< 0.001**
1 time/day	361 (14.4)	237 (9.5)	598 (23.9)		
2 time/day	583 (23.3)	173 (6.9)	756 (30.2)		
3-4 times/Week	299 (12.0)	107 (4.3)	406 (16.2)		
Rarely consume	555 (22.2)	185 (7.4)	740 (29.6)		
Type of dairy products you consume				51.97	< 0.001**
Non-fat only	272 (10.9)	41 (1.6)	313 (12.5)		
Both low-fat and non-fat	902 (36.1)	368 (14.7)	1270 (50.8)		
Low fat	321 (12.8)	182 (7.3)	503 (20.1)		
High fat	303 (12.1)	111 (4.4)	414 (16.6)		
Non-vegetarian per day				16.54	0.005*
Occasionally consume	192 (7.7)	86 (3.4)	278 (11.1)		
≤ 200 gms of poultry/fish	149 (6.0)	86 (3.4)	278 (11.1)		
≤200 gm of red meat	40 (1.6)	6 (0.2)	46 (1.8)		
≥200 gm of poultry/ fish	241 (9.6)	63 (2.5)	304 (12.2)		
≥200 gm of red meat	27 (1.1)	8 (0.3)	35 (1.4)		
Not consume Non-veg	1149 (46.0)	481 (19.2)	1630(65.2)		

Risk factors	Male (1798)	Female (702)	Total (N=2500)	χ^2	*P value*
Eggs Consume per day				20.14	< 0.001**
Occasionally	375 (15.0)	188 (7.5)	563 (22.5)		
1-2 eggs	399 (16.0)	117 (4.7)	516 (20.6)		
≥3 eggs	121 (4.8)	31 (1.2)	152 (6.1)		
No egg	903 (36.1)	366 (14.6)	1269 (50.8)		
Glasses of water per day				24.77	< 0.001**
8 glasses	759 (30.4)	228 (9.1)	987 (39.5)		
5 - 6 glasses	777 (31.1)	342 (13.7)	1119 (44.8)		
3 - 4 glasses	238 (9.5)	112 (4.5)	350 (14.0)		
1 - 2 glasses	24 (1.0)	20 (0.8)	44 (1.8)		

Figure in parentheses indicate percentage, ** = Significant (P value <0.001), * = Significant (P value 0.05)

In this study there was significant association between males and females and dietary risk factors i.e. regular breakfast eating (P value was 0.035), consuming meal per day (P value was < 0.001), consuming green vegetables per day (P value was < 0.001), dairy products per day (P value was 0.001), types of dairy products (P value was < 0.001), Non-vegetarian consumption (P value was 0.005), Eggs consumption per day (P value was < 0.001), Glasses of water per day (P value was 0.001), while fruit consumption is not significant among males and females (P value was 0.397).

Table no. 57 shown the consumption of vegetable, fruits and dairy product per day. Majority 39 % of male 26.4% and female 12.6% respondents consume 1 time vegetable per day while 29.4% of 21.8% males and 7.6% females consume 2 times vegetable per day.

39.9% of respondents male and females consume fruits rarely per day. 26.2% said they consume fruits 3-4 times in a week.

Table No.57: Association between Vegetable, Fruit and dairy product consumption per day

	Vegetables/day		Fruit/day		Dairy /day	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
1 Time	659 (26.4)	315(12.6)	307 (12.3)	138 (5.5)	361 (5.5)	237 (9.5)
2 times	544 (21.8)	190 (7.6)	296 (11.8)	106 (4.2)	583 (4.2)	173 (6.9)
3-4 /week	271 (10.8)	103 (4.1)	479 (19.2)	176 (7.0)	299 (7.0)	107(4.3)
Rarely	324 (13.0)	94 (3.8)	716 (28.6)	282 (11.3)	554 (11.3)	185 (7.4)

Figure in parentheses indicate percentage

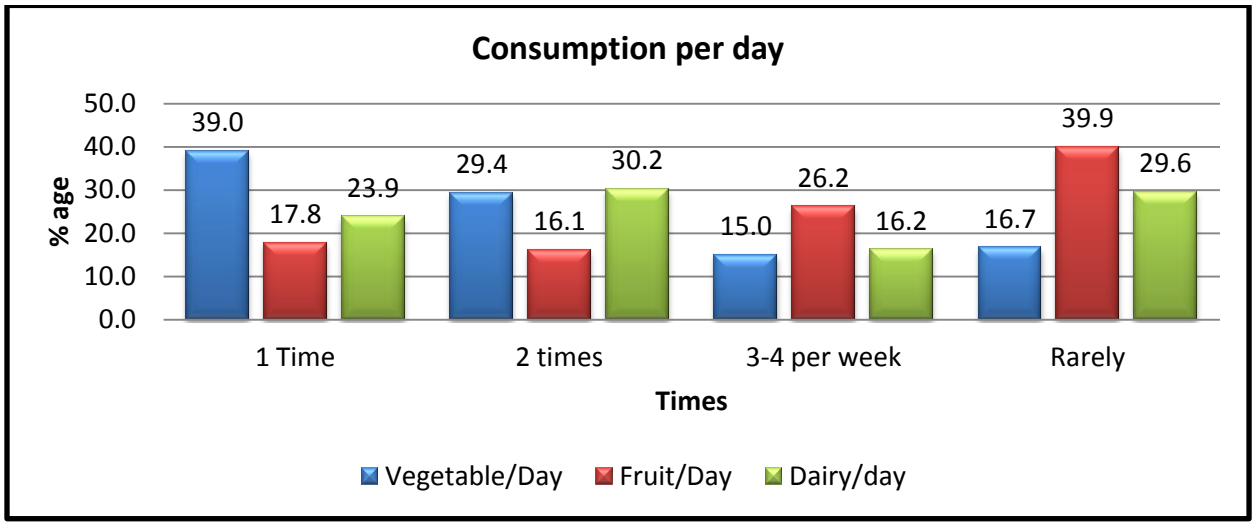


Figure No.19: Vegetable, Fruit & dairy product consumption per day

Kind of Fat or Oil Consumption

India is a leading player and world's third largest consumer in edible oils. In India different regions consume different type of edible oil. The total consumption of the edible oil among the participants in this study were - 31.2% groundnut oil, 24.8% sunflower oil, 21.8% cotton oil, 14.4% vegetable oil and 6.6% kachi dhani oil.

High potassium intake is associated with reduced BP. Potassium derived from foods is also accompanied by a variety of other nutrients, the preferred strategy to increase potassium intake is to consume foods such as fruits and vegetables that are rich in potassium, rather than supplements. In the DASH trial, the 2 groups that increased fruit and vegetable consumption

both lowered BP(202). Trans-fatty acids in the Indian diets are mostly derived from the hydrogenated vegetable oil, a type of cooking medium from hydrogenated vegetable oil, a type of cooking medium frequently used to prepare snacks and vegetable. You need a small amount of fat in your diet for healthy functioning. Oils and fats supply calories and essential fats and help your body absorb fat-soluble vitamins such as A, D, E and K. Foods high in saturated fat include fatty meats, full-fat dairy products, butter, coconut oil, ghee (clarified butter), vegetable ghee, and palm oil. Saturated fat can raise unhealthy LDL cholesterol(203).

Studies on diets including mustard oil and vegetables (especially green leafy vegetables) could contribute to lower risk of heart disease among Indians. Mustard oil, which is rich in alpha-linolenic acid (an essential fatty acid which has been shown to reduce cholesterol levels, reduce risk of heart diseases), was linked with 2 fold lower risk compared to sunflower and other oils.

The researchers also said that people who use mustard oil for frying reduce their risk of heart attack by almost 71%. Mustard oil was widely used in Indian homes earlier but in modern times has been replaced by the so called heart-friendly oils (204).

Table No.58: Obesity and any kind of oil consumption

BMI		**Sunflower**	**Ground Nut**	**Vegetable**	**Kachi Dani**	**Cotton**
Underweight	<18.5	49(8)	44(5)	32(9)	19(12)	15(3)
Normal	18.5 - 22.9	324(52)	391(49)	174(46)	111(66)	141(26)
Overweight	23.0 - 24.9	145(23)	195(25)	110(29)	27(16)	193(35)
Obese 1	25.0 - 29.9	71(11)	125(16)	45(12)	9(5)	127(23)
Obese2	≥ 30.0	31(5)	36(4)	14(4)	3(2)	69(12)
Total		620	791	375	169	545

Figure in parentheses indicate percentage

Very few studies show the consumption of different types of oil and heart disease in India. India is diversified country with different kind of food habits in every state. Even every state has different type of oil consumption according to the food habits. In this study coconut oil, palm kernel, ghee/ butter , vanaspati are not very much used by the most of the participants which

provide saturated fatty acid and known to increase serum total and LDL cholesterol levels, reduce insulin sensitivity and enhance thrombo genicity and increase CVD risk. Diets rich in vegetables and use of mustard oil (Kachi Dani) could contribute to the lower risk of IHD among Indians(205).

Studies shows that an ideal quality cooking fat/oil for good health is one which maintains a balance so as to give a ratio of polyunsaturated/ saturated (PUFA/SFA) of 0.8-0.0, and linoleic/ α -linolenic (n-6/n-3) of 5-10 in total diet(146).

Participants who were suffered from any kind of disease and type of oil they used for cooking or frying, maximum participants 11.9% consumes sunflower oil, 10.5 % consumes ground nut oil and 5.9 % consumes vegetable oil, 5.1 consumes cotton seed oil while less percent 3.4% those who consume kachi dhani oil.

Oils from sources such as groundnut, cottonseed are rich in monounsaturated fatty acids as compared to other oils. Linoleic (n-6) and α-linolenic (n-3) acids are the simple PUFA which are present only in plant foods. All vegetable oils (except coconut) are good sources of linoleic (n-6) acid. Mustard oils are the only vegetable oils which contribute significant proportion of α–linolenic (n-3) acid and if not reused then less risk of CVD. (Table No. 59)

Table No. 59: Different type of oil consumption and suffer from CVD

Oil / Consumption	Yes	Total
Sunflower	298 (11.9)	620 (24.8)
Groundnut	263 (10.5)	781 (31.2)
Vegetable	148 (5.9)	388 (15.5)
Kachi Dhani	84 (3.4)	166 (6.6)
Cotton seed	128 (5.1)	545 (21.8)

Figure in Parentheses indicate percentage

In this study, we had not divide oil consumption in rural and urban, as different cities in India have different type of oil consumptions habits. 55.9% of cotton seed oil and 42.1% of groundnut oil is consumed among the participants of Ahmedabad and Bhavnagar regions while 56.5% of

kachi dhani (Mustard oil) get consumed in Tonk and approx. 41.0% of sunflower, vegetable and kachi dhani oil consumed in Kolkata (Table No.60).

Table No.60: Consumption of kind of fat or oil in urban and rural

Region	City	Sun flower	Ground Nut	Vegetable	Kati Dhani	Cotton seed
Urban	**Ahmedabad**	107 (16.9)	334 (42.1)	50 (13.8)	5 (1.5)	129 (34.3)
	Kolkata	260 (41.1)	63 (7.9)	150 (41.4)	135 (40.2)	17 (4.5)
Rural	**Tonk**	170 (26.9)	135 (17.0)	110 (30.4)	190 (56.5)	20 (5.3)
	Bhavnagar	96 (15.2)	261 (32.9)	52 (14.4)	6 (1.8)	210 (55.9)

Figure in Parentheses indicate percentage

MEAT CONSUMPTION

As reviewed by Stone, three prospective epidemiological studies within populations reported that men who ate at least some fish weekly had a lower coronary heart disease (CHD) mortality rate than that of men who ate none(206). In the EURAMIC Study, only survivors of MI were evaluated, and it is conceivable that individuals who did not survive ate less fish. Another explanation, based on a rigorous analysis of 11 prospective cohort studies, is that the protective effect of fish consumption relates to the CHD risk status of the population studied; this analysis concluded that fish consumption reduced CHD mortality (RR=0.4 to 0.6) in high-risk but not low-risk populations(207).

Table No. 61: Meat consumption

Meat Consumption	Number
Not consume	1630 (65.2)
Occasionally	278 (11.1)
< 200 gm fish	207 (8.2)
> 200 gm fish	304 (12.1)
< 200 gm red meat	46 (1.8)
> 200 gm red meat	35 (1.4)

Figure in Parentheses indicate percentage

Around 65.2% participants don't consume non-vegetarian, 11.1% consume red meat occasionally, while 1.8% consume less than 200 gm of red meat daily and 1.4% consume more than 200 gm of red meat daily. 12.1% participants were consuming more than 200 gm of fish and 8.2% participants were consuming less than 200 gram of fish daily. (See table No. 61).

26% male participants were non-vegetarian than 8.7% of female participants, Male were found higher in percentage of non-vegetarian than female. (Table no. 62).Consumption of vegetables and fruit was higher among vegetarian than among non-vegetarians. Thus, if high intake of meat had an adverse effect and high intakes of fruit and vegetables had a beneficial effect.

Table No.62: Non-Veg. consumption among male and female, urban and rural

Gender & Region		**Not consume**	**Occasionally**	**< 200 gm Fish**	**> 200 gm fish**	**< 200 gm red meat**	**> 200 gm red meat**
Male		1149 (46.0)	192 (7.7)	149 (6.0)	241 (9.6)	40 (1.6)	27 (1.1)
Female		481 (19.2)	86 (3.4)	58 (2.3)	63 (2.5)	6 (0.2)	8 (0.3)
Ahmedabad	**Urban**	565 (22.6)	14 (0.6)	17 (0.7)	27 (1.1)	0 (0)	2 (0.1)
Kolkata		119 (4.8)	113 (4.5)	106 (4.2)	231 (9.2)	31 (1.2)	25 (1.0)
Bhavnagar	**Rural**	546 (21.8)	32 (1.3)	32 (1.3)	9 (0.4)	2 (0.1)	4 (0.2)
Tonk		400 (16.0)	119 (4.8)	52 (2.1)	37 (1.5)	13 (0.5)	4 (0.2)
Total		1630 (65.2)	278 (11.1)	207 (8.3)	304 (12.2)	46 (1.8)	35 (1.4)

Figure in Parentheses indicate percentage

Consumption of non-vegetarian was more 22.6% in urban participants then in 12.2% among rural participants. This study shows that the Kolkata metropolitan city participants consume higher 20.2% red meat and fish while the Ahmedabad metropolitan city was 2.4% participants only. This is due to food habits and cultural view. 37.8% participants of rural participants and 27.4% of urban participants said they don't consume red meat of fish.

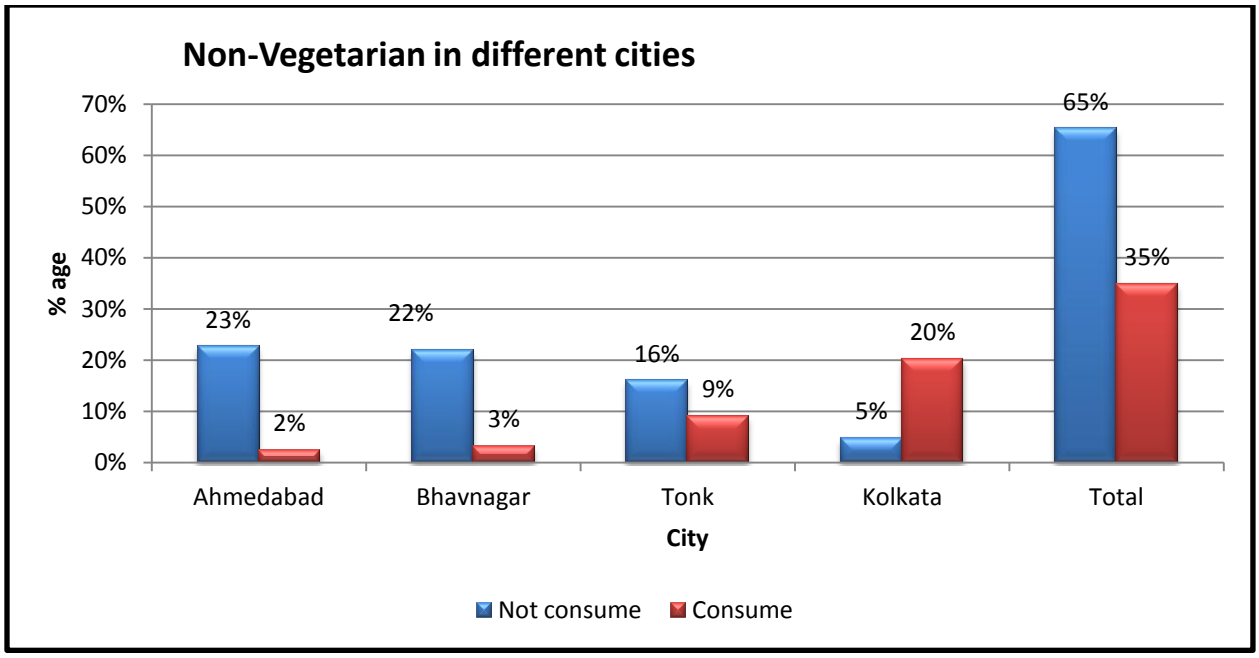


Figure no. 20: Non Vegetarian participants among different cities

This study has shown a significant association (P value was 0.005) between male and female and consumption of red meat and fish.

Researches also demonstrated that compared to the non-vegetarians, vegetarians had lower cholesterol levels and blood pressures, which is believed to be the primary reason they experienced a lower risk of heart disease.

EGG CONSUMPTION AND CVD

A reduction in dietary cholesterol is recommended to prevent CVD. Although eggs are important sources of cholesterol and other nutrients. Serum cholesterol has been established as a modified risk factor for CVD. Experimental feeding study shows that saturated fat and cholesterol increase serum cholesterol level; thus dietary recommendations for lowering risk of heart disease proscribe the intake of both substances. Recommendations have also included limits on the intake of eggs because of their high cholesterol content.

This study shows that 16.0% males and 4.7% female consume 1-2 egg consumes per day. Male consume more egg than female participants. 4.8% male and 1.2% female consume 3 or more than 3 eggs per day. The consumption of eggs was more in urban 13.5% for 1-2 egg and 5.2%

for 3 or more than 3 egg, while in rural area 7.1% for 1-2 egg and 0.9% for 3 or more than 3 egg, which shows that the risk of higher cholesterol level in urban population than in rural population, which may lead to higher chance for CVD. (Table No.63)

Table No.63: Average egg consumed per day among male and female, urban and rural

Number of eggs per day	Male	Female	Urban	Rural
No egg	903 (36.1)	366 (14.6)	511(20.4)	758(30.3)
Occasionally	375 (15.0)	188 (7.5)	272(10.9)	291(11.6)
1-2 eggs per day	399 (16.0)	117 (4.7)	338(13.5)	178(7.1)
>3 eggs per day	121 (4.8)	31(1.2)	129(5.2)	23(0.9)

Figure in parentheses indicate percentage

In the Nurses' Health Study and Health Professionals Follow-up Study, heart disease risk was increased among men and women with diabetes who ate one or more eggs a day. For people who have diabetes and heart disease, it is best to limit egg consumption to no more than three eggs per week (157).

In this study 6.1% of total and 5.2% of the urban participants were at high risk of CVD. 10.1% participants consume 1-2 eggs per day while 3.1% consume 3 or more than 3 eggs per day and reported that they were suffering from IHD, High cholesterol, high B.P and diabetes. This study shows the significant association between egg consumption and risk of CVD (χ^2 – 66.85, df -3 , p value < 0.01). It has been recommended to limit egg consumption unless the intake of other foods high in cholesterol is restricted. The study shows that the consumption of egg was higher among urban in Kolkata group than in Ahmedabad and among rural higher in Tonk and rarely in Bhavnagar group.

The major portion of the fat in the diet comes form either refined vegetable oils as seen in the lacto vegetarian Indian diet or in combination with storage animal fats as seen in the western type of diet. All these fats are deficient in omega 3 fats and have elevated omega 6/ omega 3 ratios. To avoid this toxicity, it would be prudent to resort to the low fat dietary Pattern. Cooking fat may be limited to ½ kg/month/person. The diet may be supplemented with a small intake of

fish or fish oil or flax oil, which provides omega 3 fat. This simple approach can save from the present day epidemics.

EXTRA SALT INTAKE

Many of us, adding salt (sodium chloride) to our cooking or the food on dinner, lunch plate were an automatic reflex-even before we've tasted it. Too much salt intake contributes to high blood pressure, which is one of the major risk factors for heart disease and stroke. For congestive heart disease, it is essential to restrict the salt in diet.

25.9% of the total participants, 18.9% male and 7.1% females said that they add extra salt in their diet during lunch, dinner or breakfast time. 12.0% urban participants were using extra salt then in 14.0% rural participants. This study shows that male and rural participants add extra salt in their diet than female and urban participants so chances of high blood pressure among male and rural is higher and may lead to CVD. (Table No.64).

Table No.64: Extra salt intake among male & females, urban and rural

Extra Salt Intake	Male	Female	Urban	Rural
Yes	474(18.9)	178(7.12)	301(12.0)	(351(14.0)

Figure in parentheses indicate percentage

GLASSES OF WATER CONSUMPTION PER DAY

Drinking more water may be marked with higher physical activity or those with higher energy intake. Studies show that drinking six to eight glasses of water a day can improve your overall health. Preliminary studies suggest that drinking water regularly can reduce your risk of heart disease.

In this study compared with those who drink 8 glasses to 1-2 glasses of water, shows that 31.0% of male and 13.7% of female consumed 5-6 glasses of water per day. Women consume less quantity of water daily than men. Compare to men, the drinking of 5-6 glass to 8 glasses or overall drinking water in women was lower. 24.7% of rural participants consumed 8 glasses of water per day while urban consumed only 14.8%.

Table No.65: No. of glass water consumption per day among male and female, urban and rural

Water consumption	Male	Female	Urban	Rural
8 glasses per day	759 (30.4)	229 (9.1)	369(14.8)	618(24.7)
5-6 glasses per day	776 (31.0)	342 (13.7)	649(26.0)	470(18.8)
3-4 glasses per day	238 (9.5)	112 (14.0)	209(8.4)	141(5.6)
1-2 glasses per day	24 (1.0)	20 (1.8)	23(0.9)	21(0.8)

Figure in parentheses indicate percentage

Moreover, the association between water consumption were significant ($p<0.00$) in both male and females.

FAST FOOD

Radical dietary shifts in developing countries are supplanting traditional patterns of eating high saturated fat, high in animal products and refined carbohydrates and low in grains, fruit and vegetables. Fueled by urbanization and the advent of the global economy, these changes in eating patterns are the most rapid and dramatic in the course of human history.

Fried foods have been associated with various cardiovascular risk factors in cross sectional studies. In Spain, the Pizarra study showed that consumption of food fried with reused oils was associated with a higher prevalence of arterial hypertension (208).

Eating outside the home was a significant risk factor in this study. It was attributable to increased eating of high calorie food as many varieties available in the restaurant. Junk food and snacks are denser and higher fat intake, eating outside and junk food increase the risk of obesity and overweight as it increased the chances of CVD.

30.6% of male and 13.4% female participants consume occasionally fast food. 17.9% male eats fast food more than 4 times per week as compare to 4.6% female. 25.9% of rural and 18.1% of urban participants eat fast food occasionally. 17.4% of urban participants while only 5.1% rural participants eat fast food more than 4 times per week. Fast food eating more than 4 times per

week increase obesity and source of CVD, so men and urban participant were more prone to risk of CVD in this study.

Table No. 66: Fast food consumption among male and female, urban and rural

Fast food eating	Male	Female	Urban	Rural
Occasion	765 (30.6)	336 (13.4)	453 (18.1)	648 (25.9)
1-2 times per week	438 (17.5)	181 (7.2)	385 (15.4)	234 (9.4)
3 times per week	147 (5.9)	70 (2.8)	89 (3.6)	128 (5.1)
4 or more than 4 times per week	448 (17.9)	115 (4.6)	436 (17.4)	127 (5.1)

Figure in Parentheses indicate percentage

The ratio of CVD for the highest versus the lowest of fast food consumption was 2.10 (95% confidence interval 2.05 to 2.14; P value was < 0.001) (Table No. 66)

SOFT DRINK (Carbonated Drinks)

People who consume diet carbonated -soft drinks (Pepsi, coco cola, Thumps up, etc) on a daily basis have an increased risk for CVD events such as MI compared with non consumers, various studies suggested. Consumption of carbonated drinks was independent significant risk factors for overweight and obesity and cause CVD. Studies which showed that decreasing consumption of carbonated drinks decreased weight in obese and overweight (209).

Table No.67: Consumption of soft (carbonated) drink among gender per week

Carbonated drinks	Male	Female	Urban	Rural
Occasionally	838 (33.5)	416 (16.6)	454(18.2)	800(32.0)
1-2 time /week	729 (29.2)	220 (8.8)	610(24.4)	339(13.6)
3 time/week	169 (6.8)	52 (2.1)	138(5.5)	83(3.3)
> 4 times / week	62 (2.5)	14 (0.6)	48(1.9)	28(1.1)

Figure in Parentheses indicate percentage

71.9% of male and 28.1% female participants were consuming soft drinks, which shows that chances for higher number of obese and overweight people which may lead to CVD. The consumption of carbonated drinks was higher among men than women. 6.8% male and 2.1%

female consume 3 times soft drink per week. Consumption of 1-2 times soft drinks per week was higher, 24.4 % in urban than in rural participants 13.6%, while 32.0% of rural and 18.2% of urban participants consume soft drinks occasionally (See table no. 67).

In this study consumption of soft drink is higher among men and urban participants, which may risk of overweight and lead to CVD.

4.6 BEHAVIORS AND HABITS

Prevention is the only vaccination available for heart disease. So those who are having highly stressful life, or above the age of 30, must undergo regular heart checkup scheme to monitor risk factors closely.

A health check up is a routine examination usually done annually or once every two to three years with a recommendation of once every five years as a method of analyzing the body current condition. It is performed so you can find problems or symptoms of abnormality with the body before they develop into severe conditions. Patients suffering from diseases like diabetes, blood pressure, high cholesterol, obesity, thyroid disorders, past history of heart disease, strong family history and persons having the habit of smoking or alcohol intake should undergo these heart checks annually.

The mean value of the health checkup done on men and women was 2.85 and the $\chi 2$ value 4.60 with the significance of p value was 0.20. Health checkup with 95% CI was 2.80 to 2.89.

Table No.68: Association between gender, rural and urban and health checkup

Health checkup	Male	Female	Urban	Rural
Annually	390 (29.5)	137 (10.4)	229(9.2)	298(11.9)
2 Years	371 (28.1)	140 (10.6)	264(10.6)	247(9.9)
5 Years	189 (14.3)	93 (7.0)	108(4.3)	174(7.0)
Never	848(33.9)	332(13.3)	649(26.0)	531(21.2)

Figure in Parentheses indicate percentage

52.8% of total participants answered whether their heart checkup done or not. The percentage of health checkup participants constantly declines from annually to five years. 72.0% males and

28.0% females responded had done their health checkup either annually, 2 years or 5 years. Only 29% of male and 11% female participants were getting their annual health checkup done.

Table No.69: Association between age group and yearly health check up

Age Group	Annually	2 years	5 years	Never
25-30	60 (2.4)	38 (1.5)	14 (0.6)	71 (2.8)
31-40	184 (7.4)	184 (7.4)	102 (4.1)	300 (12.0)
41-50	154 (6.2)	158 (6.3)	98 (3.9)	393 (15.7)
51-60	63 (2.5)	80 (3.2)	42 (1.7)	185 (7.4)
61-70	51 (2.0)	31 (1.2)	21 (0.8)	155 (6.2)
71-80	15 (0.6)	20 (0.8)	5 (0.2)	76 (3.0)
Total	527 (21.1)	511 (20.4)	282 (11.3)	1180 (47.2)

Figure in parentheses indicate percentage

This study has shown a high relationship between occupation and health check up. 60.2% participants those who do the service get their health check up done annually, in 2 years or 5 years. Health checkup was higher 18.9%, in the age group of 31-40 years than trend of health check up was decreasing in other age groups. The result shows that as the age increase there is a decrease in numbers of heath check up (Table No.69). The majority of participants those who were doing service were a doing regular healths check up; otherwise percentage of heath checkup participants with other occupation was very less.

Table No.70: Association between occupation and yearly health checkup

Occupation	Annually	2 years	5 years	Total
Service	346 (26.2)	282 (21.4)	167 (12.7)	795 (60.2)
Business	95 (7.2)	107(8.1)	43(3.3)	245(18.6)
Farmer	17 (1.3)	30 (2.3)	20(1.5)	67(5.1)
House Wife	54 (4.1)	69 (5.2)	46(3.5)	169(12.8)
Retired	15(1.1)	23 (1.7)	6 (0.5)	44(3.30)
Total	527(39.9)	511(38.7)	282 (21.4)	1320

Number in parentheses indicate percentage

Pre-employment health checkup is done for the new recruits of various companies, may be one of the reason that shows there is a high percent of health checkup in service doing participants (Table No.70).

TELEVISION / COMPUTER WATCHING AND CVD

Every hour spent watching television each day increases the risk of dying from heart disease by almost a fifth, say scientists. Evidence from a spate of recent studies suggests that more TV you watch, the more likely you are to develop a host of health problems and to die at an earlier age.

Watching TV and computer are very common among both genders, which cause sedentary lifestyle. When the respondents questioned about the numbers of hours they were spending working on computer or watching television daily, majority (41.8%) were spending 2-3 hours per day followed by (20.2 %) more than 6 hours. Spending 4-5 hours or more than 6 hours is main cause of sedentary life lead to obese or overweight and cause CVD. Majority of participants 37.3% were spending more than 4 hours in front of computer or TV, which was major cause of sedentary life ($\chi 2$ -13.57, P value was 0.004).

Table No. 71: Average number of hours spent per day on TV/ computer among genders, urban and rural

Hours spending	Male	Female	Urban	Rural
<1 Hr per day	373 (14.9)	151 (6.0)	188 (7.5)	336(13.4)
2-3 Hrs per day	736 (29.4)	310 (12.4)	527(21.1)	519(20.8)
4-5 Hrs per day	294 (11.8)	132 (5.3)	190(7.6)	236(9.4)
> 6 Hrs per day	395 (15.8)	109 (4.4)	345(13.8)	159(6.4)

Figure in parentheses indicate percentage

Urban population (13.8%) were watching TV or worked on computer more than 6 hours, while rural population were (20.8%) spending 2-3 hours by watching or computer working. Results show that urban populations were more prone to the sedentary lifestyle and behaviour than rural population (See Table No. 71) .

Participants age group 31-40 (13.3%) and 41-50 (14.4%) were spending 2-3 hours daily, as the age increasing they were spending several hours on in-front of TV or computer. 4.5% of participants from age group 41-70 were spending more than 6 hours per day.

ACTIVENESS ON DAILY BASIS

Question was asked from the respondents on rate how active they were on daily basis. 53.8 % of participants said that their lifestyle were active while 15.0% of participants felt that they were very active on daily basis. From total 39.0 % male and 14.8 % female participants said they were active. Most of rural respondents 13.9% self reported that they were very active in their day-to-day activity while urban 28.3% were active than 7.6% very active in their work (See table 72).

Table No. 72: Activeness among male & female, Urban & Rural

Activeness	Male	Female	Urban	Rural
Very Active	278 (11.1)	98 (3.9)	191 (7.6)	347 (13.9)
Active	975 (39.0)	370 (14.8)	707 (28.3)	559 (22.4)
Moderate	497 (19.9)	224 (9.0)	310 (12.4)	313 (12.5)
Not Active	48 (1.9)	10 (0.4)	42 (1.7)	31 (1.2)

Figure in parentheses indicate percentage

Age groups 31-50 were found more active (16.4%) than other age groups, therefore increasing their CVD risk.

NUMBER OF HOURS SLEEPING

Early humans were likely to have gotten more sleep per night on average, since their circadian rhythms were more closely synchronized to the rising and setting of the sun. Today we have artificial light to extend our active phases and many other distractions that prevent us from getting adequate sleep.

Gangwisch et al(210) observed an increased in the prevalence of obesity with the day time sleep and inadequate sleep during nights. Subjected age between 25 and 75 years with self-reported

sleep duration at baseline less than 8 hours. Sleep duration less than 5 hours as inadequate sleep as a risk factor for obesity and weight gain and may lead to CVD.

Table No. 73: Average number of sleeping hours per day among male and female

Sleeping hour per day	Male	Female	Urban	Rural
2-4 hrs per day	59 (3.3)	24 (3.4)	44(1.8)	39(1.6)
5-6 hrs per day	496 (27.6)	207 (29.5)	412(16.5)	291(11.6)
6-8 hrs per day	821 (45.7)	341 (48.6)	467(18.7)	695(27.8)
> 8 hrs per day	422 (23.5)	130 (18.5)	327(13.1)	225(9.0)

Figure in parentheses indicate percentage

48.6% of the female and 45.7 % male were sleeping 6-8 hours daily, 23.5% of the males were sleeping more than 8 hours per day then females, while 27.6% male and 29.5% female take ≥ 6 hours of sleep, which is considered as inadequate sleep and cause obesity and overweight. 27.8% rural were sleeping 6-8 hours daily than urban participants.

Table No. 74: Percent of participant obese and sleeping hours daily.

BMI Status	2-4 Hrs	5-6 Hrs	6-8 Hrs	More 8 Hrs
Underweight (<18.5)	11%	10%	5%	4%
Normal (18.5-22.9)	48%	49%	43%	47%
Overweight (23.0-24.9)	16%	21%	32%	24%
Obese class I (25.0 -29.9)	18%	16%	15%	15%
Obese class II (≥ 30.0)	7%	5%	5%	9%

In an analysis of data from the Wisconsin Sleep Cohort Study, a population-based longitudinal study of sleep disorders, short sleep duration was found to be associated with reduced leptin levels, elevated ghrelin levels, and increased BMI in subjects between the ages of 30 and 60 years. A U-shaped relationship between BMI and sleep duration was also observed in men and women between the ages of 30 and 60 years(211) .

Consuming Non-vegetarian Cigarettes smoking Strong cross-sectional associations were found between sleep durations less than 6 hours and obesity at ages 27, 29, and 34 years. They found a virtually monotonic trend toward lower BMI and lower weight gain over the follow-up period among those with longer sleep durations.(212)

POLLUTION AND STRESS

Air pollution is a heterogeneous, complex mixture of gases, liquids, and particulate matter. Epidemiological studies have demonstrated a consistent increased risk for cardiovascular events in relation to both short- and long-term exposure to present-day concentrations of ambient particulate matter.

Short-term exposure to air pollution, ranging from just a few hours to weeks, can trigger cardiovascular-disease-related mortality and nonfatal events, including MI, heart failure, arrhythmias, and stroke, according to a new updated scientific statement from the American Heart Association (213).

Total participants said they were exposed to pollution from which 17.6% male and 6.4% females. 40.8% of the urban respondents were exposed whereas only 14.8 % rural were exposed to the pollution. Male and urban population were more exposed to pollution and can trigger to CVD related mortality including MI, heart failure, arrhythmias and stoke (Table No. 75).

Although stress cannot be directly measured, scientists have found a connection between stress and behavior. When you are under stress you are more likely to support habits like smoking, drinking or overeating. Stress can also lead to high blood pressure, which contributes to heart disease. The emotional tempo of life has gone up considerably during the last two decades, and this is more evident in the big cities. Indian rural community is quite removed from this tension and relaxes more completely when away from his work; that may partly explain his relative protection from CVD.

25.8% of men and women said that they consider themselves quite-often under stress while 42.0% said they rarely felt stress and 32.1% participants said that they hardly felt any type of stress.

Table No.75: Exposure to pollution among male & female, urban & rural

Region	Exposure to Pollution	Male	Female
Urban	Yes	186 (7.4)	42 (1.7)
Rural	Yes	253 (10.1)	119 (4.8)

Figure in parentheses indicate percentage

Being physically active helps keep us healthy and protect against heart disease, type -2 diabetes and some kind of cancer. For jobs, many of us take the car, bike, vehicle on short journey and vehicle, shift work is recognized as an occupational risk factors of CVD. Moreover rapid unplanned urbanization and a large increase in motor vehicles has resulted inadequate development of the public transport infrastructure and hazardous conditions for walking and cycling in most Indian towns and cities.

Job strain is a form of psychological stress that involves having a demanding job but no power to make decisions or exercise creativity, and earlier studies have found that combination of restraints increases blood pressure and the likelihood of heart disease.

Table No. 76: Participants travelling per day for job work

Travel per day	Male	Female	Urban	Rural
< 5 K.M per day	635 (25.4)	389 (15.6)	469 (18.8)	456 (18.2)
< 10 K.M per day	586 (23.4)	225 (9.0)	447 (17.9)	364 (14.6)
11 to 14 K.M per day	275 (11.0)	302 (12.1)	216 (8.6)	173 (6.9)
>15 K.M per day	63 (2.5)	25 (1.0)	211 (8.4)	164 (6.6)

Figure in parentheses indicate percentage

The clear patterns of the response emerged, there was number of kilometer travelling increase among men than women. 3.5 % of participants travel more than 15 kilometers per day by private or public transport. 13.5% of men travel more than 10 kilometer for job related work per day. 17% of urban participants travel more than 10 kilometer per day. Study shows a significant

association between participants suffers from disease related to CVD and kilometer travel per day for job work($\chi 2$ – 23.4, P value was <0.001) (Table No.76) .

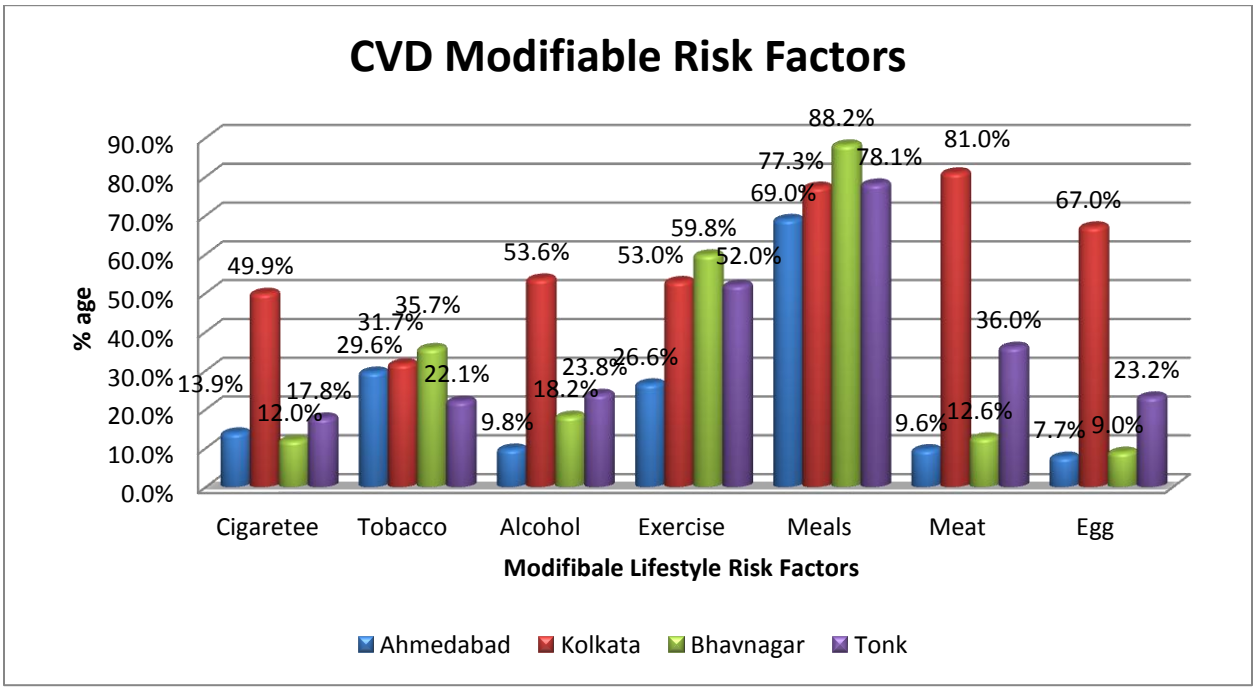
Risk factors for CVD in study areas

When compared the selected areas included in the study, whether there was any significant association with all modifiable lifestyle risk factors, modifiable risk factors and modifiable other factors, non-modifiable risk factors like age, sex were not considered as according the studies their results are known. The results shows that lifestyle risk factors like were in higher percentage in Kolkata then in Ahmadabad, while Bhavnagar had higher than Tonk area.

Table No: Association of CVD risk factors among different cities

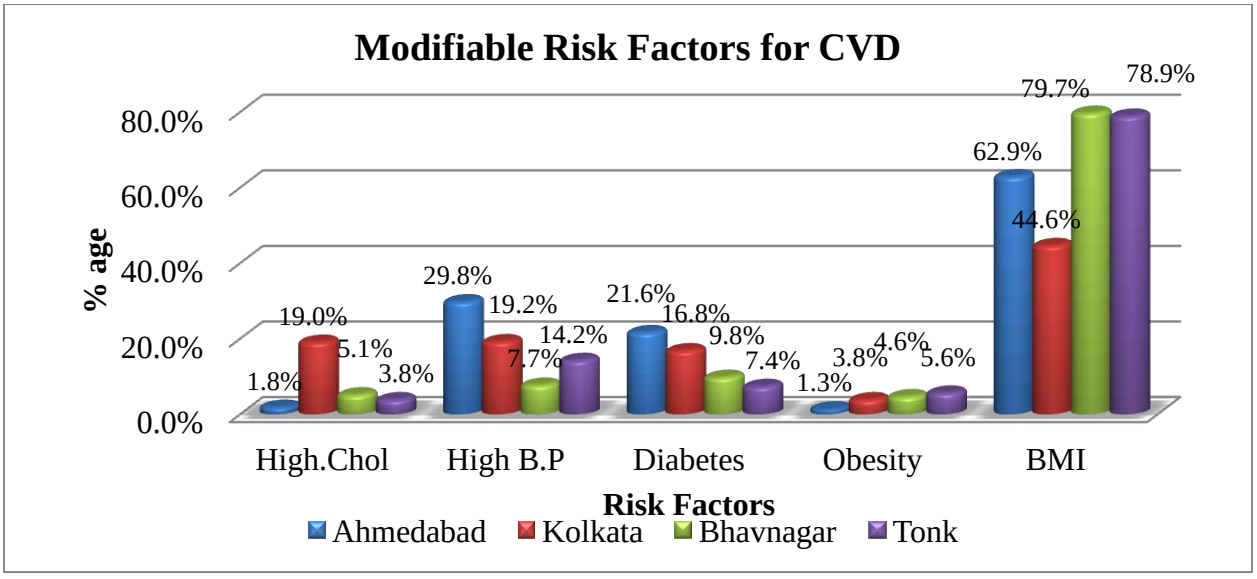
Modifiable Lifestyle Risk Factors	**Ahmedabad**	**Kolkata**	**Bhavnagar**	**Tonk**
Cigarette Smoking	87(13.92)	312 (49.92)	75 (12.00)	111 (17.76)
Tobacco Chewing	185(29.60)	198 (31.68)	223 (35.68)	138 (22.08)
Alcohol Consumption	61(9.76)	335 (53.60)	114 (18.24)	149 (23.84)
Exercise	166(26.56)	331 (52.96)	374 (59.84)	325 (52.00)
Meals	431(68.96)	483 (77.28)	551 (88.16)	488 (78.08)
Vegetable per day	330(52.80)	604 (96.64)	583 (93.28)	565 (90.40)
Fruit per day	265(42.40)	447 (71.52)	438 (70.08)	352 (56.32)
Meat per day	60(9.60)	506 (80.96)	79 (12.64)	225 (36.00)
Egg per day	48(7.68)	419 (67.04)	56 (8.96)	145 (23.20)
Modifiable Factors				
Family History of CVD	157 (25.12)	274 (43.84)	162 (25.92)	188 (30.08)
High Cholesterol	11 (1.76)	119 (19.04)	32 (5.12)	24 (3.84)
Hypertension	186 (29.76)	120 (19.20)	48 (7.68)	89 (14.24)
Diabetes	135 (21.60)	105 (16.80)	61 (9.76)	46 (7.36)
Obesity	8 (1.28)	24 (3.84)	29 (4.64)	35 (5.60)
BMI	393 (62.88)	279 (44.64)	498 (79.68)	493 (78.88)
Modifiable Other Factors				
Table Salt	61 (9.76)	240 (38.40)	156 (24.96)	195 (31.20)
Junk Food	503 (80.48)	526 (84.16)	106 (16.96)	149 (23.84)
Hour TV	390 (62.40)	526 (84.16)	159 (25.44)	236 (37.76)
Sleep	181 (28.96)	275 (44.00)	174 (27.84)	156 (24.96)
Stress	160 (25.60)	188 (30.08)	106 (16.96)	121 (19.36)
Pollution Exposure	88 (14.08)	140 (22.40)	184 (29.44)	188 (30.08)

Figure No.21: CVD Modifiable lifestyle risk factors among four selected cities



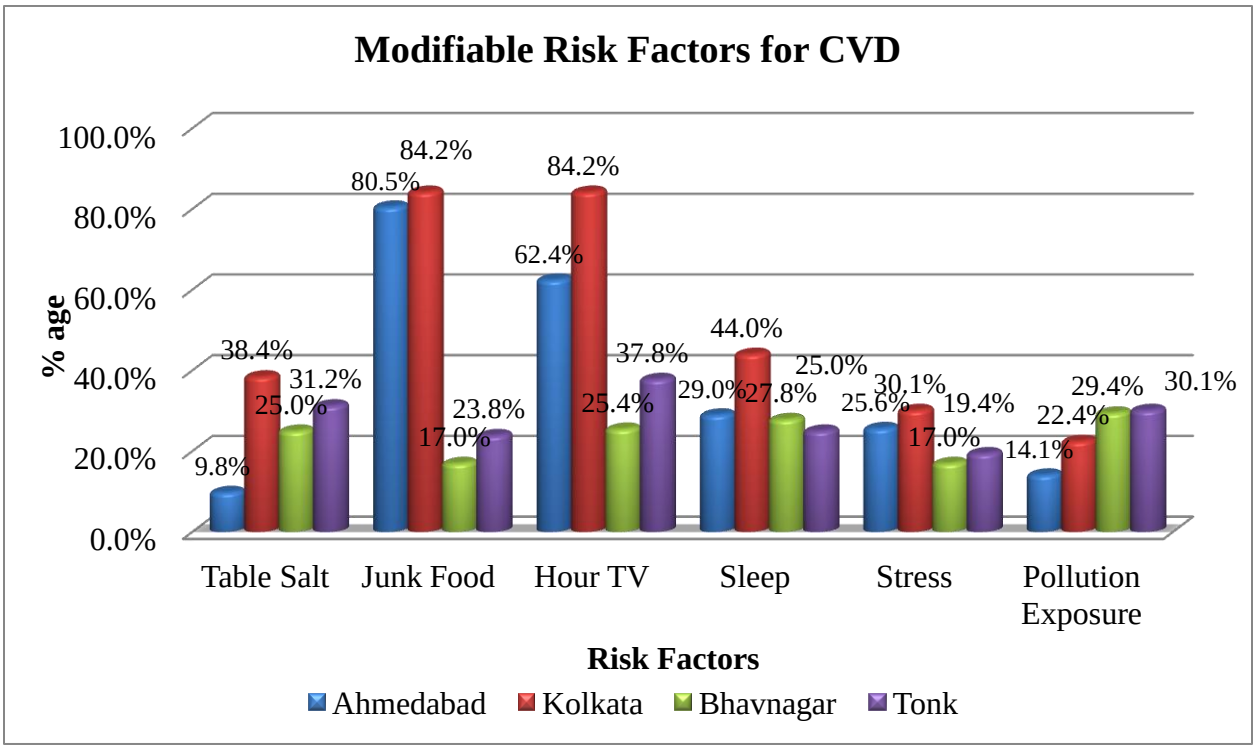
Study shows (Figure No. 21) that among all four cities Kolkata participants were following more lifestyle risk factors which leads to CVD those can be modified like more cigarette, alcohol, meat and egg eating , also less physical activity then other cities. The prevalence of overall tobacco use among Bhavnagar was 35.7 % and that among Kolkata area nearly 31.7% and 29.6% in Ahmedabad. The consumption of Cigarette, alcohol , Exercise, Meat and Egg consumption was very higher so chances of having CVD are more than other three cities.

Figure No.22: CVD Modifiable risk factors among four selected cities



The study reported that the prevalence in the eastern India (Kolkata) was 19.0% ; compare to western part 1.8% in Ahmadabad. High B.P. (29.8 %) and Diabetes(21.6) were one fourth in Ahmadabad.

Figure No.23: CVD Modifiable other risk factors among four selected cities



When compared all four cities for the CVD related modifiable other risk factors, it was found that kolkata participants were following more sedentary lifestyle than any other city. This shows that Urban cities are following more sedentary lifestyle and behavior then the rural cities (Figure No. 23).

In this study population of Indian men and women, we observed a strong association between lifestyle behaviour and CVD. Risk for CVD decreased across levels of leisure-time exercise, with people exercising per day having less than half the risk of non-exercisers.

We also found an association between increased sedentary activity and CVD risk, the equivalent of 2.4 hours per day of sedentary activities such as television or computer viewing was associated with nearly an 80% increase in risk. As well, we observed that increased duration of standing at work was associated with an elevation in risk. Physical inactivity levels in urban India, where CVD have become the leading cause of death, were now comparable with levels observed.

While reduced levels of physical activity lead to lower energy expenditure and lower lean body mass, physical inactivity or sedentary activities may be related to obesity and risk for chronic disease through increase in energy intake and not just lower energy expenditure. Work-related activity job or daily activity has generally not shown an association with risk.

The results of this study found a clear disparity in lifestyle and health behavior by participants causing CVD. Individuals achieve self-directed change when they understand how personal habits threaten their well-being, given information how to modify them, and believe in their capabilities to marshal effort and resources needed to exercise control.

Study shows that there is significant association between CVD and most of the associated risk factors related to the lifestyle and behaviors - Family history of heart disease, cigarette smoking, Tobacco chewing, consuming alcohol, not doing exercise, non-vegetarian, consuming eggs, extra table salt consumption , drinking carbonated soft drinks with p value was < 0.001 except the risk factors - feels anxious and participant's exposure to pollution(Table No. 77).

Association between CVD and Lifestyle and Behaviors

Table No. – 77: Association between CVD and Risk Factors

Risk Factor	χ^2	p value
Modifiable Lifestyle Factors		
Family history of heart disease	55.06	<0.001*
Cigarettes Smoking	90.66	<0.001*
Tobacco Chewing	22.16	<0.001*
Consume Alcohol	71.63	<0.001*
Doing Exercise	54.35	<0.001*
Meat Consumption	1.17	<0.001*
Consume Egg	66.85	<0.001*
Feel Anxious	0.01	0.933
Modifiable Factors		
Suffer IHD	67.80	<0.001*
Suffer High Cholestrol	3.43	<0.001*
Suffer B.P	9.21	<0.001*
Suffer Diabetes	6.70	<0.001*
Suffer Obesity	1.70	<0.001*
Modifiable Other factors		
First Degree Relative	1.7	<0.001*
Meals consumption Per Day	29.14	<0.001*
Kind of Fat	93.54	<0.001*
Extra Table Salt consumption	18.48	<0.001*
Drinking Carbonated Drinks	39.96	<0.001*
Doing Routine Health Checkup	48.63	<0.001*
Hours spent in front of TV/Computer	40.19	<0.001*
Under Stress	46.82	<0.001*
Exposure to Pollution	0.30	0.594

Association between CVD and significantly associated risk factors

Binary logistic regression was use to check the association between CVD and significantly associated risk factors

Table No. 78: Binary logistic regression between CVD and significantly associated risk factors

Risk Factors	Sig.	Odds Ratio	95% CI	
			Lower	Upper
Modifiable Lifestyle Factors				
Family History	0.000	1.807	1.509	2.164
Cigarettes Smoking	0.000	1.636	1.293	2.070
Tobacco Chewing	0.380	0.918	0.758	1.112
Consume Alcohol	0.001	1.442	1.153	1.804
Doing Exercise	0.000	0.654	0.551	0.778
Meat Consumption	0.042	1.230	1.008	1.512
Consume Egg	0.000	1.514	1.238	1.852
Modifiable Factors				
Suffer High Cholestrol	0.990	4.825	0.000	0.000
Suffer B.P	0.986	5.427	0.000	0.000
Suffer Diabetes	0.000	5.841	0.000	0.000
Suffer Obesity	0.993	6.381	0.000	0.000
Modifiable Other factors				
Meals Per Day	0.002	0.496	0.321	0.767
Kind of Fat- High Fat	0.382	1.225	0.845	1.356
Extra Table Salt	0.003	1.342	1.104	1.631
Carbonated Drink	0.381	1.125	0.864	1.465
Routine Health Checkup	0.000	1.770	1.481	2.115
Hr. spent TV/Computer	0.000	1.778	1.476	2.142
Under Stress	0.076	1.191	0.982	1.443

The association between CVD and significantly associated risk factors was further analyzed using binary logistic regression show sharp increase double folds with family history and cigarettes smoking and participants spending long hours in front of TV or computer and not doing regular health check .

It can be seen that obesity was an odds of developing CVD was more than 6 folds among the CVD(6.381).

It was also seen that Diabetes(5.841), Blood pressure(5.427), High cholesterol(4.825) and (2.226) shows more than double folds and up to 5 time folds of developing CVD.
The participants consuming High fat, extra table salt, carbonated drink (Soft, cold Drinks) and under stress are single fold significantly associated with the risk factors of CVD.
While the tobacco chewing, exercise and per day meal consumption were not showing any association with the CVD.

CHAPTER – 5

CONCLUSION AND RECOMMENDATIONS

Although, the absence of well-established disease surveillance mechanisms prevents a precise estimation of the size of cardiovascular disease burdens, the direction of change clearly indicates that – "The Burden is Rising". The magnitude of the problem is enormous and demands urgent attention and action.

5.1 CONCLUSION

Conceptually, the contribution of this study was several:

- ❖ It offers a general conceptual framework that can be applied to CVD risk factors – Non-modifiable, Modifiable and Other modifiable factors. The study revealed that there is association between all these risk factors and can lead to CVD, if follows sedentary lifestyle and not modified these risk factors strategically.
- ❖ The research have been consistently supported the positive relationship between the major risk factors for CVD ; these include hypertension, diabetes, obesity, cigarette smoking, alcohol, sedentary lifestyle, lack of physical exercise, eating habits, habits (addicted to TV, computer), stress.
- ➢ Studies show that CVD becomes increasingly common with advancing age. Most powerful independent risk factor for CVD; risk of stroke doubles every decade after age 55 and family's history of CVD indicates a person's risk. The risk increased, if a first-degree blood relative has had CHD or stroke before the age 55 years (for a male relative) or 65 years (for a female relative). Higher rates of CHD among men compared with premenopausal age women. Risk of stroke, however, is similar for men and women.
- ❖ It identifies the bottlenecks lifestyle and behavioral risk factors that are not very noticeable, going by usual methods or due to the urbanization and changing lifestyle and behaviors and lead to CVD.
- ❖ The study clearly shows that urban populaces were more at risk of CVD due to

modifiable lifestyle and other- modifiable risk factors, then the rural populace. It shows that urban were leading more sedentary life than rural and that's sedentary lifestyles are the primary cause of increasing obesity, B.P. which was leading to increased rate CVD.

- BMI shows increasing trend with the increase in age. Age group 41-50 participants were more moderate obese and severe obese among all age groups, which was highest among all age groups. It an alarming sign and primary risk factor leading to CVD in future, if action being not taken to change sedentary lifestyle and behavioral pattern. An average increase of weight a year, as people aged caused total cholesterol to rise and HDL levels to drop.
- The number of adult men engaged in smoking was more in comparison to women smokers and smokers is reported to be higher in urban(16.0%) as compared to rural areas (7.4%). The average consumption of cigarettes was 5.47 ± 2.4 per person per day. For smokers, cigarette smoking was more in the age group 31 – 40 years and highest between 51-70 years among male and female in all age groups. Smoking and tobacco consumption are increasing slowly from urban to rural, which may cause a higher risk of CVD in rural population. Tobacco consumption was low in both men and women then smoking, but tobacco chewing was higher in rural than in urban participants.
- The prevalence of overall tobacco use among males was 26.9 % and that among females is 2.8 %. Nearly (14.4%) adults in rural areas and (15.3%) adults in urban areas use tobacco in some form.
- Study shows a significant association between heavy (more than 4 drinks per day) alcohol consuming and suffers from the CVD. Alcohol consumption was higher among males(24.6%) than female(1.7%) and also higher in urban(15.8%) than in rural(10.5%) populations.
- The study indicates notably decrease in physical activities with increase in age. Age group between 31- 40 years were performing more (more than 30 minutes) physical activities in comparison to other age groups. Men were performing more involved in physical activities like exercise, walking, cycling comparison to women. Morning or evening walk or walking was very common in all age groups. Regular aerobic exercises like walking, cycling, etc are the best forms of exercise for lowering LDL and rising HDL levels. A lack of physical activity can worsen other CHD risk factors, such as high

blood cholesterol and triglyceride levels, high blood pressure, diabetes and prediabetes, and overweight and obesity.

- Diet behavior of male participants were better than females. Study shows there was significant association that vegetarians were less predisposed to CVD than non-vegetarians. Study shows there was significant association between different types of oil or fat consumption may lead to CVD. An unhealthy diet can raise your risk for CHD. For example, foods that are high in saturated and *trans* fats and cholesterol raise your LDL cholesterol level. A high-sodium (salt) diet can raise your risk for high blood pressure.
- Males and urban were sleeping 5-6 hours daily which may cause obesity and overweight due to inadequate sleeping and may go ahead to CVD.
- Male and urban participants were more exposed to pollution and can trigger to CVD related mortality including MI, heart failure, arrhythmias and stoke. Urban and male participant were travel more than 10 kilometer per day for job work. Study shows a significant association between participants suffers from disease related to CVD and kilometer travel per day for job work .
- Study results shows that there is significant association between the CVD and Non-modifiable, Major modifiable and other- modifiable risk factors -
  - Male, Higher the Age
  - First degree relative / family history of heart disease
  - Suffer from diabetes, hypertension, BMI more than 23.0, Obesity
  - Physically In-active
  - Cigarettes smoking
  - Tobacco consumption
  - Alcohol consumption
  - Diet habits - Non-vegetarian
  - Stress and Sedentary lifestyle – due to long traveling and sitting more than 4 hours in front of TV or computer.
- Study was not showing association between the tobacco chewing, regular exercise, regular per day meal consumption, feels anxious and exposure to pollution risk factors with the CVD.

The association between CVD and significantly associated risk factors was further analyzed using binary logistic regression show

- Sharp increase double folds with family history and cigarettes smoking and participants spending long hours in front of TV or computer and not doing regular health check .
- It was seen that obesity was an odds of developing CVD was more than 6 folds among the CVD (6.381).
- It was also seen that Diabetes (5.841), Blood pressure(5.427), High cholesterol(4.825) shows more than double folds and up to 5 time folds of developing CVD.
- The consumption of High fat, extra table salt, carbonated drink (Soft, cold Drinks) and under stress are single fold significantly associated with the risk factors of CVD.

Thus multiple risk factors were present in CVD. Monitoring the lifestyle risk factors could go a long way in reducing the prevalence of CVD. In India with advance of modernization and urbanization, the dietary habits of people have also changed significantly during the last decade or two and people are exposed to greater stress and strain. They may be important factors in increasing incidence of CVD.

This study reported that standard risk factors such as smoking, hypertension, diabetes, high BMI, sedentary lifestyle, stress and less consumption of vegetables and fruits explained significant association with CVD. Finally, research on lifestyle and behaviour change among individuals will be beneficial in improving the physical health of the population.

Thus, the current study findings highlight the need for policy makers to develop strategies for cost-effective screening of the general population for high blood pressure, diabetes and implement smoking cessation programmes , and if necessary, offer affordable treatment to reduce the burden of CVD deaths. Additionally, policies to promote prevention strategies in India such as regulation against tobacco use and promotion of protective lifestyle factors such as leisure time physical activity and regular intake of fruits and vegetables which are markedly lower among population.

5.2 RECOMMENDATION

1. The awareness to be created in all adults for their Blood Pressure, diabetes and blood cholesterol levels, avoid smoking, intake of salt and fatty food intake, and to be engaged at regular moderate exercise regime. There is a need to promote CVD preventive exercise behaviors'. Many people may be aware of the benefits of exercise, but they may not be aware of how much time or how often they need to exercise. Regular light to moderate intensity physical exercise is recommended for all participants to prevent from CVD.
2. To prevent CVD, those who are overweight or obese are being advised for weight loss with the combination of a reduced energy diet and increased physical activity.
3. Telemedicine can be useful tool for the awareness in the rural area for CVD related education series. Tele-medicine screening may be undertaken to screen patients. Thus, the absolute need to develop cost-effective methods for the timely diagnosis and management of manifested disease has been met through this study.
4. CVD screening camps – The screening camps could be organized for viewing modifiable risk factors with a focus to enhance awareness of CVD at primary level. Screening camps for CVD related modifiable risk factors could be organized by the Primary health care centers, General hospitals, cardiologists and local NGO's. High-risk screening to be promoted and patients to be educated with positive family history of CVD.
5. Community participation is the key to success for health screening. Local village groups like women's self help groups and volunteers play an important role in motivating people to attend CVD screening camps. Home based training helps to inculcate positive health behavior, lifestyle changes, including diet and also helpful for person with disability or with socio-cultural barriers. People with early symptoms can be encouraged by their family members to attend CVD screening services.
6. There is a need to make use of multiple communication channels and use them frequently, specifically emphasizing on few practical messages. Also, health messages should be broadcasted on TV and radio during prime time without relying on free public announcement that are rarely broadcasted at late hours.

7. At a time when multinational companies such as tobacco, junk food manufacturers have enormous amount of funds at their disposal to promote their products, particularly targeting the youth, it is imperative that adequate financial resources should be available for the educational /promotional programmes to counter these activities through mass media.
8. Health care providers should seize every opportunity to encourage patients to practice CVD related healthy behaviour. Smoking rate has not decreased and is still high among the respondents, despite there being campaigns and IEC programmes. A strict public policy in restricting its use and distribution of tobacco and its products may be considered.
9. There is a need for advocacy, communication and community mobilization focusing on behavioral change. The health programmes should be more focused on behavioral and lifestyle change.
10. Since, mass media is being the main source of health promotion, policy makers and other relevant sectors to be engaged for implementing mass media health promotion activities and networking and also to strengthen capacity at all sectors to develop and implement NCD prevention programmes.

5.3 LIMITATIONS:

1. The strength of the study is that it includes a large sample. The cross-sectional nature of the study precludes us making statement of hypertension, diabetes and heart disease, and cannot give information about the individual diagnosed reports, which can give correct figure of presence of the disease. Ideally, corroborating evidence, such as objective medical and screening and an examination of earlier medical records should be checked.
2. No major studies have been conducted in Indian scenario on relationship between different types of oil consumption in major part of country and its effects on CVD. Obtaining valid answer on the question asked on oil consumption is dependent on the social and cultural context. Regional habits may influence responses.
3. Many emerging risk factors [lipoprotein (a), triglycerides, lipid subtypes, insulin resistance, C-reactive protein, inflammatory factors] or genetic markers that leads to premature CVD were not studied.
4. Looking into time and resource constraints selection of four areas urban and rural were done purposively, data collected from different states may have different results.
5. Data related to socioeconomic status was not collected for individual participants, so it is unknown how socio-economic status affects lifestyle and behavior related to CVD.
6. Finally, as the number of women in this study was small, the risk factors in women could not be generalized.

5.4 FUTURE SCOPE OF STUDY

Future research could be conducted in relation to modifiable risk factors of CVD with the corroborating evidence. Although a large nation-wide prospective cohort study might be the ideal, one would need to enroll a very large sample in view of the relatively low incidence of CHD in the general population, and the challenges of the long follow-up required would be considerable. A more efficient approach will be to use a matched case-control design, in which patients (cases) admitted to hospital with MI, such as medical screening and an examination of previous medical records from the health care institution, where the data could be collected with interventions who all have suffered from CVD, and other such as unstable angina could be interviewed and examined for possible risk factors, and results compared with a control population matched for age, sex and socio economic status. Furthermore, future studies on lifestyle and behaviour change among individuals and the general population will be benefited from using a more powerful statistical analysis, which will allow predictors of sedentary behaviors', poor or healthy diet and smoking to be made between different populations.

REFERENCES

1. Mackay J, Mensah, A.: The atlas of heart disease and stroke; Geneva, World Heath Organization,1995.
2. Wasir HS.: Preventive Cardiology: An Introduction. India: Vikas Publishing House; 1991.
3. Murray CJ, Lopez AD.: Evidence-based health policy--lessons from the Global Burden of Disease Study. Science., 1996 Nov 1;274(5288):740-3.
4. Cardiovascular disease in India, Challenges and way ahead. New Delhi: International Heart Protection Summit.2011.
5. WHO. Prevention of Cardiovascular Disease ; Guidelines for assessment and management of cardiovascular risk Geneva: World Health Organization, 2007 http://www.who.int/cardiovascular_diseases/guidelines/Prevention_of_Cardiovascular_Disease/en/index.html.
6. Davis S, Bartlett H.: Healthy ageing in rural Australia: issues and challenges. Australas Journal of Ageing. 2008 Jun;27(2):56-60.
7. WHO: Preventing chronic disease: a vital investment; Geneva: World Health Organization,2005.
8. Jayaraman M, Ansell SM, Mui BL, Tam YK, Chen J, Du X, et al.: Maximizing the potency of sirna lipid nanoparticles for hepatic gene silencing in vivo; Angew Chem Int Ed Engl, 2012 Aug 20;51(34):8529-33.
9. Burden of disease in India. Background papers for the National Commission on Macroeconomics New Delhi: Ministry of Health and Family Welfare, Government of India; 2005.
10. Report on Causes of Death : 2001-03 in India [database on the Internet]. Office of Registrar General, India. 2001-03 [cited 10/02/2012]. Available from: http://www.cghr.org/wordpress/wp-content/uploads/Causes_of_death_2001-03.pdf.
11. Gupta R.: Burden of Coronary heart disease in India; Indian Heart Journal, 2005 Nov-Dec;57(6):632-8.
12. Walker CB, Redding-Johanson AM, Baidoo EE, Rajeev L, He Z, Hendrickson EL, et al.: Functional responses of methanogenic archaea to syntrophic growth. ISME Journal. 2012 Nov;6(11):2045-55.

13. India RGo: Report on causes of deaths in India, 2001-2003. New Delhi: Registrar General of India, Ministry of Home Affairs,2009.
14. Census of India. Govt. of India; 2011 [cited 2012]; Available from: http://www.census2011.co.in/.
15. Gopinath N, Chadha SL, Jain P, Shekhawat S, Tandon R. : An epidemiological study of coronary heart disease in different ethnic groups in Delhi urban population, Journal Assoc Physicians India. 1995 Jan;43(1):30-3.
16. Patel J.V, Vyas A, Cruickshank JK, Prabhakaran D, Hughes E, Reddy KS.Impact of migration on Coronary Heart Disease risk factors: comparison of Gujaratis in Britain and contemporaries in villages of origin in India. Atherosclerosis, 2006, Apr;185(2):297-306.
17. Gowarikar V.: India has done it: demographic transition already underway in India. IIPS Newsletter, 1995 Oct;36(3-4):2-8.
18. Sharma S. : Ageing in India: Demographic Background and analysis based on census materials; Occasional paper No. 2 of 1992. New Delhi: Office of the Registrar General and Census Commissioner, 1992.
19. Rajeev S, Ilha M.R, Harrison J.M, Clifton WG, Grooters A.M, Wickes B.L, Pathology in practice, Lagenidium infection, Journal. American Veterinary Medical Association., 2012 Aug 15;241(4):447-9.
20. Gupta M, Brister S. : Is South Asian ethnicity an Independent Cardiovascular risk factor. Canadian Journal Cardiology. 2006, Mar 1;22(3):193-7.
21. Rajasthan Voluntary Health Association. RVHA.1993:3-13.(Status of health in Rajasthan, Jaipur,Rajasthan, India).
22. Gupta R, Gupta V.P, Ahluwalia N.S. : Educational status, Coronary Heart Disease, and Coronary risk factor prevalence in a rural population of India. BMJ, 1994 Nov 19;309(6965):1332-6.
23. National Family Health Survey (NFHS-3) : 2005-06. Mumbai. India: International Institute for Population Sciences, Macro International, 2007.
24. Profile. Available from: http://en.wikipedia.org/wiki.
25. World Heart Day: Kolkata Tops Metros in Heart Disease Risk. The Times of India, 2011.
26. Young Hearts High on cholesterol: Health survey. The Times of India, 2011.

27. Hetal Pandya JL. The Prevalence and Pattern of Dyslipidemia among Type 2 Diabetic Patients at Rural Based Hospital in Gujarat, India. Indian Journal of Clinical Practice. 2011;22(12):36-9.
28. Marmot M. Coronary Heart Disease: Rise and fall of a modem epidemic. London: Oxford University Press. 1992;3:19.
29. Colditz G.A. : Economic costs of obesity and inactivity. Medicine and Science Sports and Exercise,1999 Nov;31(11 Suppl):S663-7.
30. Pate RR, Pratt M, Blair SN, Haskell WL, Macera CA, Bouchard C, : Physical activity and public health- A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. JAMA, 1995, Feb 1;273(5):402-7.
31. Vaz M, Bharathi A.V.: Practices and Perceptions of Physical activity in Urban, Employed, middle-class Indians. Indian Heart Journal, 2000 May-Jun;52(3):301-6.
32. An enquiry into the social determinants of health through healthy urbanization learning circles. Ittamadugu colony, Bangalore: Bangalore Healthy Urbanization Project; 2008 [updated 16-03-2012]; Available from: www.whoindia.org/LinkFiles/Health_Promotion_bhupannex1c.pdf.
33. Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F: Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (The INTERHEART study): Case-Control study. Lancet. 2004, Sep 11-17;364(9438):937-52.
34. Albert M.A, Glynn RJ, Buring J, Ridker P.M.: Impact of Traditional and Novel risk factors on the relationship between Socioeconomic status and incident Cardiovascular events. Circulation, 2006, Dec 12;114(24):2619-26.
35. Wennberg P, Philips B, De Jong K.: The Swedish version of the Outcome Questionnaire (OQ-45): Reliability and Factor structure in a substance abuse sample. Psychology Psychother. 2010, Sep;83(Pt 3):325-9.
36. Norberg M. : Identifying risk of Type-2 Diabetes, Epidemiologic Perspectives from Biomarkers to lifestyle Umeå, Sweden: Umeå University, Sweden; 2006.
37. Graham I, Atar D, Borch-Johnsen K, Boysen G, Burell G, Cifkova R, et al. European Guidelines on cardiovascular disease prevention in clinical practice. Fourth Joint Task Force of the European Society of Cardiology and other societies on cardiovascular disease

prevention in clinical practice (constituted by representatives of nine societies and by invited experts). Eur J Cardiovasc Prev Rehabil. 2007 Sep;14 Suppl 2:S1-113.

38. Micallef S.J, Janes M.E, Knezevic K, Davis R.P, Elefanty A.G, Stanley EG: Retinoic acid induces Pdx1-positive endoderm in differentiating mouse embryonic stem cells. Diabetes, 2005, Feb;54(2):301-5.
39. Kannel W.B, Eaker E.D. : Psychosocial and Other Features of Coronary Heart Disease: insights from the Framingham Study. American Heart Journal, 1986 Nov;112(5):1066-73.
40. Topaz O, Lippincott R, Bellendir J, Taylor K, Reiser C.: "Optimally spaced" excimer laser coronary catheters: performance analysis. Journal Clin Laser Medicine Surgery. 2001 Feb;19(1):9-14.
41. Vamadevan.S.Ajay : Coronary Heart Disease in Indians: Implications of the INTERHEART study. Indian Journal Medicine Research. 2010,(132):561-6.
42. Goldberg L, Elliot DL.: Strength Training in men at risk for CHD. Medicine and Science in Sports and Exercise's, 1992 May;24(5):619-21.
43. Lloyd-Jones D.M, Larson M.G, Beiser A, Levy D: Lifetime Risk of Developing Coronary Heart Disease. Lancet, 1999, Jan 9;353(9147):89-92.
44. Keys A, Fidanza F, Karvonen MJ, Kimura N, Taylor H.L.: Indices of relative weight and obesity. Journal Chronic Disease. 1972, Jul 1;25(6):329-43.
45. Physical Status: The use and Interpretation of Anthropometry. Geneva: World Health Organisation, 1995.
46. WHO.: Global Database on Body Mass Index. World Health Organization; 2004 [cited 2010 02/12/2010]; BMI classification]. Available from: http://apps.who.int/bmi/index.jsp?introPage=intro_3.html.
47. IASO.: The Asia-Pacific Perspective:Redefining Obesity and its treatment. World Health Organization, 2000.
48. Marwaha R.K, Tandon N, Singh Y, Aggarwal R, Grewal K, Mani K.: A study of Growth Parameters and Prevalence of Overweight and Obesity in school children from Delhi. Indian Pediatrics. 2006, Nov;43(11):943-52.
49. Nandy S, Miranda J,J. : Overlooking undernutrition- Using a composite index of anthropometric failure to assess how underweight misses and misleads the assessment of undernutrition in young children. Social Science Mededicine, 2008, May;66(9):1963-6.

50. Flegal KM, Graubard BI, Williamson DF, Gail MH.: Excess Deaths Associated with Underweight, Overweight, and Obesity. JAMA, 2005 April 20;293(15):1861-7.
51. Brussels. : Diabetes Atlas., International Diabetes Federation, 2006.
52. WHO.: Development and Updation of Diabetes Atlas in India ; Chennai, Madras Diabetes Research Foundation, 2007.
53. Alcohol Related Harm in India - a fact sheet. Indian Alcohol Policy Alliance; 2006 [cited 2010 20-10-2010]; Available from: http://www.addictionindia.org/images-ttkh/alcohol-related-harm-in-india-a-fact-sheet.pdf.
54. Moore RD, Pearson TA. : Moderate Alcohol Consumption and Coronary Artery Disease. A review. Medicine (Baltimore), 1986, Jul;65(4):242-67.
55. Gururaj G.: Alcohol and road traffic injuries in South Asia: Challenges for Prevention. Journal College Physicians Surgery, Pakistan, 2004 Dec;14(12):713-8.
56. Joshi P, Islam S, Pais P, Reddy S, Dorairaj P, Kazmi K, et al.: Risk factors for early Myocardial Infarction in South Asians compared with individuals in other countries. JAMA, 2007 Jan, 17;297(3):286-94.
57. Tobacco use in India: An evil with many faces. American Cancer Society- Cancer Patient Aid Association; 2009, [updated 06/10; cited 2012]; Available from: http://www.cpaaindia.org/infocentre/acs/eng/Tobacco%20Abuse.pdf.
58. Key T.J, Fraser G.E, Thorogood M, Appleby P.N, Beral V, Reeves G, et al.: Mortality in Vegetarians and Non-Vegetarians: A Collaborative analysis of 8300 deaths among 76,000 men and women in five prospective studies. Public Health Nutrition,1998 Mar;1(1):33-41.
59. Drewnowski A, Popkin B.M.: The Nutrition Transition: New trends in the Global Diet. Nutrition Review, 1997, Feb;55(2):31-43.
60. WHO: Global Strategy on Diet, Physical Activity and Health. Geneva.2010; Available from: www.who.int/dietphysicalactivity/pa/en/index.html.
61. WHO.: NCD RF surveillance 2003-04. 2009; Available from: www.whoindia.org/ncd_surveillance_ncd_rf_surveillance_report.pdf.
62. Misra A, Khurana L. Obesity and the Metabolic Syndrome in Developing Countries. Journal Clinical Endocrinology Metabolism. 2008, Nov;93(11 Suppl 1):S9-30.
63. Yajnik C.S.: The Insulin Resistance Epidemic in India: Fetal origins, Later lifestyle, or both. Nutrition Review. 2001, Jan;59:1-9.

64. Prabhakaran D, Singh K.: Premature Coronary Heart Disease risk Factors & reducing the CHD burden in India. Indian Journal Medicine Research, 2011, Jul;134:8-9.
65. Pearson TA.: Cardiovascular Diseases as a growing health problem in Developing Countries: The role of nutrition in the Epidemiologic Transition. Public Health Review, 1996;24(2):131-46.
66. Mohan V, Sandeep S, Deepa R, Shah B, Varghese C.: Epidemiology of Type-2 diabetes: Indian scenario. Indian Journal Medicine Research, 2007, March;125(3):217-30.
67. Srinath Reddy K, Shah B, Varghese C, Ramadoss A.: Responding to the Threat of Chronic Diseases in India. Lancet, 2005, Nov 12;366(9498):1744-9.
68. Reddy K.S.: India Wakes up to the Threat of Cardiovascular Diseases. Journal American College of Cardiology. 2007, Oct 2;50(14):1370-2.
69. Kearney P.M, Whelton M, Reynolds K, Muntner P, Whelton P.K: Global Burden of Hypertension: Analysis of Worldwide Data. Lancet, 2005, Jan 15-21;365(9455):217-23.
70. Joshi R, Cardona M, Iyengar S, Sukumar A, Raju CR, Raju K.R. : Chronic Diseases now a leading cause of death in rural India--mortality data from the Andhra Pradesh Rural Health Initiative. International Journal of Epidemiology, 2006, Dec;35(6):1522-9.
71. Rosengren A, Hawken S, Ounpuu S, Sliwa K, Zubaid M, Almahmeed WA : Association of psychosocial risk factors with risk of acute myocardial infarction in 11119 cases and 13648 controls from 52 countries (The INTERHEART study): Case-Control study. Lancet. 2004, Sep 11-17;364(9438):953-62.
72. Mathers CD, Iburg KM, Salomon JA, Tandon A, Chatterji S, Ustun B : Global Patterns of Healthy Life Expectancy in the year- 2002. BMC Public Health. 2004, Dec 24;4:66.
73. WHO : The World Health Report 2002: Reducing risks, Promoting Healthy life. Geneva, World Health Organization, 2002.
74. Murray C.J, Ezzati M, Lopez A.D, Rodgers A, Vander Hoorn S.: Comparative Quantification of Health Risks Conceptual Framework and Methodological issues. Population Health Metr, 2003, Apr. 14;1(1):1.
75. WHO : Global Health Risks -Mortality and burden of Disease Attributable to selected major risks. World Health Organization, 2009 [cited 2011]; Available from: www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf.

76. Reddy KK, Rao AP, Reddy TP. Socioeconomic status and the prevalence of coronary heart disease risk factors. Asia Pacific Journal of Clinical Nutrition. 2002;11(2):98-103.
77. Reddy KS, Prabhakaran D, Jeemon P, Thankappan KR, Joshi P, Chaturvedi V. Educational status and Cardiovascular risk profile in Indians. Proceedings of the National Academy of Sciences, U S A. 2007 Oct 9;104(41):16263-8.
78. Gupta R, Rastogi P, Sarna M, Gupta VP, Sharma SK, Kothari K. Body-mass index, waist-size, waist-hip ratio and cardiovascular risk factors in urban subejcts. Journal of the Association of Physicians, India. 2007 Sep;55:621-7.
79. Chow C, Cardona M, Raju PK, Iyengar S, Sukumar A, Raju R, et al. Cardiovascular disease and risk factors among 345 adults in rural India--the Andhra Pradesh Rural Health Initiative. International Journal of Cardiology. 2007 Mar 20;116(2):180-5.
80. Prabhakaran D, Shah P, Chaturvedi V, Ramakrishnan L, Manhapra A, Reddy KS. Cardiovascular risk factor prevalence among men in a large industry of northern India. The National Medical Journal of India. 2005 Mar-Apr;18(2):59-65.
81. Hazarika NC, Narain K, Biswas D, Kalita HC, Mahanta J. Hypertension in the native rural population of Assam. The National Medical Journal of India. 2004 Nov-Dec;17(6):300-4.
82. Gupta R, Gupta VP, Sarna M, Bhatnagar S, Thanvi J, Sharma V, et al. Prevalence of coronary heart disease and risk factors in an urban Indian population: Jaipur Heart Watch-2. Indian Heart Journal. 2002 Jan-Feb;54(1):59-66.
83. Kaur P, Rao TV, Sankarasubbaiyan S, Narayanan AM, Ezhil R, Rao SR. Prevalence and distribution of Cardiovascular risk factors in an urban industrial population in south India: a cross-sectional study. Journal of Association Physicians, India. 2007 Nov;55:771-6.
84. Thankappan KR, Sivasankaran S, Sarma PS, Mini G, Khader SA, Padmanabhan P. Prevalence-correlates-awareness-treatment and control of Hypertension in kumarakom, kerala: Baseline results of a community-based intervention program. Indian Heart Journal. 2006 Jan-Feb;58(1):28-33.
85. Anand K, Shah B, Yadav K, Singh R, Mathur P, Paul E. Are the urban poor vulnerable to non-communicable diseases, A survey of risk factors for non-communicable diseases in urban slums of Faridabad. National Medical Journal of India. 2007 May-Jun;20(3):115-20.
86. Shah B, Mathur P. Surveillance of cardiovascular disease risk factors in India: the need & scope. Indian Journal Medicine & Research. 2010 Nov;132(5):634-42.

87. Gupta R, Joshi P, Mohan V, Reddy KS, Yusuf S. Epidemiology and causation of Coronary Heart Disease and stroke in India. Heart. 2008 Jan;94(1):16-26.
88. Gaziano T, Reddy KS, Paccaud F, Horton S, Chaturvedi V. Cardiovascular Disease. 2006.
89. Murray CJ, Lopez AD. Alternative projections of mortality and disability by cause 1990-2020: Global Burden of Disease Study. Lancet. 1997 May 24;349(9064):1498-504.
90. Ghaffar A, Reddy KS, Singhi M. Burden of non-communicable diseases in South Asia. BMJ. 2004 Apr 3;328(7443):807-10.
91. Leeder SR. Ethics and public health. Intern Med Journal. 2004 Jul;34(7):435-9.
92. Xavier D, Pais P, Devereaux PJ, Xie C, Prabhakaran D, Reddy KS, et al. Treatment and outcomes of acute coronary syndromes in India (CREATE): A Prospective analysis of registry data. Lancet. 2008 Apr 26;371(9622):1435-42.
93. Gupta SP, Malhotra KC. Urban--rural trends in the Epidemiology of Coronary Heart disease. Journal of the Association of Physicians of India. 1975 Dec;23(12):885-92.
94. Chadha SL, Radhakrishnan S, Ramachandran K, Kaul U, Gopinath N. Epidemiological study of Coronary Heart Disease in urban population of Delhi. Indian Journal of Medical Research. 1990 Dec;92:424-30.
95. Kutty VR, Balakrishnan KG, Jayasree AK, Thomas J. Prevalence of coronary heart disease in the rural population of Thiruvananthapuram district, Kerala, India. International Journal of Cardiology. 1993 Apr;39(1):59-70.
96. Gupta R, Sharma S, Gupta VP, Gupta KD. Smoking and alcohol intake in a rural Indian population and correlation with hypertension and coronary heart disease prevalence. Journal of the Association of Physicians of India. 1995 Apr;43(4):253-8.
97. Pinto VG FA, Kulkarni MS. Prevalence of Coronary heart disease in an urban community of Goa. South Asian Journal of Preventive Cardiology. 2004;8:5.
98. Kannel WB, Cobb J. Left ventricular hypertrophy and mortality--results from the Framingham Study. Cardiology. 1992;81(4-5):291-8.
99. Yamasaki N, Kitaoka H, Matsumura Y, Furuno T, Nishinaga M, Doi Y. Heart failure in the elderly. International Medicine. 2003 May;42(5):383-8.
100. Gupta R. Trends in hypertension epidemiology in India. Journal of Human Hypertension. 2004 Feb;18(2):73-8.

101. Beckett NS, Peters R, Fletcher AE, Staessen JA, Liu L, Dumitrascu D, et al. Treatment of hypertension in patients 80 years of age or older. The New England Journal of Medicine: Research & Review. 2008 May 1;358(18):1887-98.
102. Gupta R. Defining Hypertension in the Indian population. The National Medical Journal of India. 1997 May-Jun;10(3):139-43.
103. Gupta R, Guptha S, Gupta VP, Prakash H. Prevalence and determinants of hypertension in the urban population of Jaipur in western India. Journal of Hypertension. 1995 Oct;13(10):1193-200.
104. WHO. The Atlas of Heart Disease and Stroke. Geneva: World Health Organization2004 23 September 2004
105. Hajjar IM, Grim CE, George V, Kotchen TA. Impact of diet on blood pressure and age-related changes in blood pressure in the US population: analysis of NHANES III. Archives of Internal Medicine. 2001 Feb 26;161(4):589-93.
106. Forman JP, Stampfer MJ, Curhan GC. Diet and lifestyle risk factors associated with incident hypertension in women. JAMA. 2009 Jul 22;302(4):401-11.
107. Mahamat A, Richard F, Arveiler D, Bongard V, Yarnell J, Ducimetiere P, et al. Body mass index, hypertension and 5-year coronary heart disease incidence in middle aged men: the PRIME study. Journal of Hypertension. 2003 Mar;21(3):519-24.
108. Sinha R, Cross AJ, Graubard BI, Leitzmann MF, Schatzkin A. Meat intake and mortality: A prospective study of over half a million people. Archives of Internal Medicine. 2009 Mar 23;169(6):562-71.
109. Perkovic V, Huxley R, Wu Y, Prabhakaran D, MacMahon S. The burden of blood pressure-related disease: A Neglected priority for global health. Hypertension. 2007 Dec;50(6):991-7.
110. Padmavati S.: Epidemiology of cardiovascular disease in India. II. Ischemic Heart Disease. Circulation. 1962 Apr;25:711-7.
111. Wasir HS, Ramachandran P, Nath LM. Prevalence of hypertension in a closed urban community. Indian Heart Journal. 1984 Jul-Aug;36(4):250-3.
112. Dash SC, Swain PK, Sundaram KR, Malhotra KK. Hypertension epidemiology in an Indian tribal population. Journal Assocation of Physicians of India. 1986 Aug;34(8):567-70.

113. Puri DS, Pal LS, Gupta BP, Swami HM, Dasgupta DJ. Distribution of blood pressure and hypertension in healthy subjects residing at high altitude in the Himalayas. Journal of the Association of Physicians of India. 1986 Jul;34(7):477-9.
114. Hussain SA, Nayak KC, Gupta A. A study of prevalence of hypertension with reference to economic, educational, environmental and hereditary factors in general population of north-west Rajasthan. Indian Heart Journal. 1988 May-Jun;40(3):148-51.
115. Kumar R, Singh A, Kumar V. Survey of village informants--an alternate method to estimate paralytic poliomyelitis prevalence in rural area. Indian Jounal Pediatrics. 1991 Mar-Apr;58(2):239-43.
116. Joshi PP, Kate SK, Shegokar V. Blood pressure trends and life style risk factors in rural India. Journal of the Association of Physicians of India. 1993 Sep;41(9):579-81.
117. Jajoo UN, Kalantri SP, Gupta OP, Jain AP, Gupta K. The prevalence of hypertension in rural population around Sevagram. Journal of the Association of Physicians of India. 1993 Jul;41(7):422-4.
118. Gilberts EC, Arnold MJ, Grobbee DE. Hypertension and determinants of blood pressure with special reference to socioeconomic status in a Rural South Indian community. Journal Epidemiology Community Health. 1994 Jun;48(3):258-61.
119. Dwivedi S, Agarwal MP. The prevalence of hypertension in rural population around Sevagram. Journal of the Association of Physicians of India. 1994 Feb;42(2):176.
120. Mathur K, Wahi PN, Gahlaut D. Blood pressure studies in the adult population of Agra, India. American Journal of Cardiology. 1963 Jan;11:61-5.
121. Dalal JJ, Sheridan DJ, Bloom AL, Henderson AH. Platelet Aggregates and Coronary spasm. Lancet. 1980 Nov 22;2(8204):1146-7.
122. Gupta R, Sharma AK. Prevalence of hypertension and subtypes in an Indian rural population: clinical and electrocardiographic correlates. Journal of Human Hypertension. 1994 Nov;8(11):823-9.
123. Deedwania PC. The changing face of hypertension: Is systolic blood pressure the final answer. Archives of Internal Medicine. 2002 Mar 11;162(5):506-8.
124. Gupta PC, Gupta R, Pednekar MS. Hypertension Prevalence and Blood pressure trends in 88653 subjects in Mumbai,India. Journal of Human Hypertension. 2004 Dec;18(12):907-10.

125. Joseph A, Kutty VR, Soman CR. High risk for coronary heart disease in Thiruvananthapuram city: a study of serum lipids and other risk factors. Indian Heart Journal. 2000 Jan-Feb;52(1):29-35.
126. Anand MP. Prevalence of hypertension amongst Mumbai executives. Journal of the Association of Physicians of India. 2000 Dec;48(12):1200-1.
127. Mohan V, Deepa R, Rani SS, Premalatha G. Prevalence of coronary artery disease and its relationship to lipids in a selected population in South India: The Chennai Urban Population Study (CUPS No. 5). Journal American College of Cardiology foundation. 2001 Sep;38(3):682-7.
128. Malhotra P, Kumari S, Kumar R, Jain S, Sharma BK. Prevalence and determinants of hypertension in an un-industrialised rural population of North India. Journal of Human Hypertension. 1999 Jul;13(7):467-72.
129. Li SC, Schoenberg BS, Wang CC, Cheng XM, Bolis CL, Wang KJ. Cerebrovascular disease in the People's Republic of China: Epidemiologic and Clinical features. Neurology. 1985 Dec;35(12):1708-13.
130. Anand K, Chowdhury D, Singh KB, Pandav CS, Kapoor SK. Estimation of mortality and morbidity due to strokes in India. Neuroepidemiology. 2001 Aug;20(3):208-11.
131. Banerjee T. Epidemiology of stroke in India. Neurology Asia. 2006(11):1-4.
132. Pandian JD, Jaison A, Deepak SS, Kalra G, Shamsher S, Lincoln DJ. Public awareness of warning symptoms, risk factors, and treatment of stroke in northwest India. Stroke. 2005 Mar;36(3):644-8.
133. R P Eapen JHP, N.T Patel. A Study of Clinical Profile and Risk Factors of Cerebrovascular Stroke. Gujarat Medical Journal. 2009;64(2).
134. Prasad K, Singhal KK. Stroke in young: an Indian perspective. Neurology of India. 2010 May-Jun;58(3):343-50.
135. Report of the National Commission on Macroeconomics and Health. New Delhi: Ministry of Health & Family Welfare, Government of India2005.
136. Barengo NC, Hu G, Lakka TA, Pekkarinen H, Nissinen A, Tuomilehto J. Low physical activity as a predictor for total and cardiovascular disease mortality in middle-aged men and women in Finland. European Heart Journal. 2004 Dec;25(24):2204-11.

137. WHO. Which are the known causes of and consequences of obesity, and how can it be prevented? Geneva: World Health Organization, Regional Office for Europe2004.
138. Hayes C, Kriska A. Role of physical activity in diabetes management and prevention. Journal of the American Dietetic Association. 2008 Apr;108(4 Suppl. 1):S19-23.
139. Caspersen CJ, Powell KE, Christenson GM. Physical activity, Exercise and Physical fitness: Definitions and distinctions for health-related research. Public Health Reports. 1985 Mar-Apr;100(2):126-31.
140. Rodgers A, Ezzati M, Vander Hoorn S, Lopez AD, Lin RB, Murray CJ. Distribution of major health risks: findings from the Global Burden of Disease study. PLoS Med. 2004 Oct;1(1):e27.
141. Myers J. Cardiology patient pages. Exercise and cardiovascular Health. Circulation. 2003 Jan 7;107(1):e2-5.
142. LaPorte RE, Montoye HJ, Caspersen CJ. Assessment of physical activity in epidemiologic research: problems and prospects. Public Health Reports. 1985 Mar-Apr;100(2):131-46.
143. Ginsberg BH. Blood glucose monitoring: necessary and sufficient. Journal Diabetes Science Technology. 2007 Sep;1(5):612-3.
144. Bhopal R, Hayes L, White M, Unwin N, Harland J, Ayis S. Ethnic and Socio-economic inequalities in Coronary Heart disease, diabetes and risk factors in Europeans and South Asians. Journal Public Health Medicine. 2002 Jun;24(2):95-105.
145. Kalache A, Aboderin I. Stroke: The global burden. Health Policy Plan.1995 Mar;10:1-21.
146. Rao R. Dietary Guidelines for Indians - A Manual. Hyderabad: National Institute of Nutrition 2010.
147. Gupta R, Misra A, Pais P, Rastogi P, Gupta VP. Correlation of Regional Cardiovascular disease Mortality in India with lifestyle and nutritional factors. Interntional Journal of Cardiology. 2006 Apr 14;108(3):291-300.
148. Daniel CR, Prabhakaran D, Kapur K, Graubard BI, Devasenapathy N, Ramakrishnan L, et al. A cross-sectional investigation of regional patterns of diet and cardio-metabolic risk in India. Nutrition Journal. 2011;10:12.
149. Connor SL, Connor WE. Are fish oils beneficial in the prevention and treatment of coronary artery disease? American Journal Clinic Nutr. 1997 Oct;66(4 Suppl):1020S-31S.

150. Potter JD. Cancer prevention: Epidemiology and Experiment. Cancer Lett. 1997 Mar 19;114(1-2):7-9.
151. Pande R. Cardiovascular disease in India and the Impact of Lifestyle and food habits. Express Health Care Management. 2004 15th December, 2004.
152. Lichtenstein AH, Appel LJ, Brands M, Carnethon M, Daniels S, Franch HA. Summary of American Heart Association Diet and Lifestyle Recommendations revision 2006. Arterioscler Thromb Vasc Biol. 2006 Oct;26(10):2186-91.
153. Van Dam RM, Willett WC, Rimm EB, Stampfer MJ, Hu FB. Dietary fat and meat intake in relation to risk of type 2 diabetes in men. Diabetes Care. 2002 Mar;25(3):417-24.
154. Bazzano LA, Serdula MK, Liu S. Dietary intake of Fruits and Vegetables and risk of cardiovascular disease. Curr Atheroscler Rep. 2003 Nov;5(6):492-9.
155. Hung HC, Joshipura KJ, Jiang R, Hu FB, Hunter D, Smith-Warner SA. Fruit and vegetable intake and risk of major chronic disease. Journal of National Cancer Institute. 2004 Nov 3;96(21):1577-84.
156. Foran JA, Carpenter DO, Hamilton MC, Knuth BA, Schwager SJ. Risk-based consumption advice for farmed Atlantic and wild Pacific salmon contaminated with dioxins & dioxin-like compounds. Environment Health Perspect. 2005 May;113(5):552-6.
157. Hu FB, Stampfer MJ, Rimm EB, Manson JE, Ascherio A, Colditz GA. A prospective study of egg consumption and risk of Cardiovascular disease in men and women. JAMA. 1999 Apr 21;281(15):1387-94.
158. Djousse L, Gaziano JM. Egg consumption and risk of heart failure in the Physicians' Health Study. Circulation. 2008 Jan 29;117(4):512-6.
159. Radhika G, Sathya RM, Sudha V, Ganesan A, Mohan V. Dietary salt intake and hypertension in an urban south Indian population--[CURES - 53]. Journal of the Association of Physicians of India. 2007 Jun;55:405-11.
160. Strazzullo P, D'Elia L, Kandala NB, Cappuccio FP. Salt intake, stroke, and cardiovascular disease: meta-analysis of prospective studies. BMJ. 2009;339:b4567.
161. Rudolph TK, Ruempler K, Schwedhelm E, Tan-Andresen J, Riederer U, Boger RH. Acute effects of various fast-food meals on vascular function and cardiovascular disease risk markers: the Hamburg Burger Trial. American Journal Clin Nutr. 2007 Aug;86(2):334-40.

162. Pednekar MS, Hakama M, Hebert JR, Gupta PC. Association of body mass index with all-cause and cause-specific mortality: findings from a prospective cohort study in Mumbai (Bombay), India. International Journal of Epidemiology. 2008 Jun;37(3):524-35.
163. Gupta S, Kapoor S. Sex differences in blood pressure levels and its association with obesity indices: who is at greater risk. Ethn Dis. 2010 Autumn;20(4):370-5.
164. Garg C, Khan SA, Ansari SH, Garg M.: Prevalence of obesity in Indian women. International Journal of Obesity, Revision. 2010 Feb;11(2):105-8.
165. Ramachandran A, Snehalatha C. : Rising burden of obesity in Asia. J Obes. 2010;2010.
166. Kelly T, Yang W, Chen CS, Reynolds K : Global burden of obesity in 2005 and projections to 2030. International Journal of Obesity (Lond). 2008 Sep;32(9):1431-7.
167. Huxley R, James WP, Barzi F, Patel JV, Lear SA, Suriyawongpaisal P : Ethnic comparisons of the cross-sectional relationships between measures of body size with diabetes and hypertension. International Journal of Obesity. 2008 Mar;9 Suppl 1:53-61.
168. Yadav K, Krishnan A.: Changing patterns of diet, physical activity and obesity among urban, rural and slum populations in north India. Journal Obesity. 2008 Sep;9(5):400-8.
169. Gupta P.C, Sinha DN.: Tobacco research in India. Indian Journal of Public Health. 2004 Jul-Sep;48(3):103-4.
170. Reddy K.S, Arora M.: Tobacco use among children in India: A Burgeoning epidemic. Indian Pediatrics. 2005 Aug;42(8):757-61.
171. Gupta R. : Smoking, educational status and health inequity in India. Indian Journal of Medicine and Research. 2006 Jul;124(1):15-22.
172. Shah B. : Assessment of burden of non-communicable diseases. New Delhi: Indian Council of Medical Research, 2006.
173. Report on Tobacco control In India. New Delhi: Ministry of Health and Family Welfare , Government of India, 2004.
174. Jha P, Chaloupka FJ, Moore J, Gajalakshmi V, Gupta PC, Peck R. Tobacco Addiction. 2006.
175. Rani M, Bonu S, Jha P, Nguyen SN, Jamjoum L. : Tobacco use in India: prevalence and predictors of smoking and chewing in a national cross sectional household survey. Tob Control. 2003 Dec;12(4):e4.

176. Srivastav A.K.: National Household Survey of drug and alcohol abuse in India (NHSDAA). New Delhi: Ministry of Social Justice and Empowerment, Government of India and UN Office for Drug and Crime2004.
177. Pearson T.A. : Alcohol and Heart disease. Circulation. 1996 Dec 1;94(11):3023-5.
178. McGinnis J.M, Foege W.H. : Actual causes of death in the United States. JAMA. 1993 Nov 10;270(18):2207-12.
179. Dorschner J.: Rajput alcohol Use in India. Journal Studies Alcohol. 1983 May;44(3):538-44.
180. Sundaram KR, Mohan D, Advani GB, Sharma HK, Bajaj JS.: Alcohol abuse in a rural community in India. Part I: Epidemiological study. Drug Alcohol Depend. 1984 Sep;14(1):27-36.
181. Mohan D, Sharma HK, Darshan S, Sundaram KR, Neki J.S.: Prevalence of drug abuse in young rural males in Punjab. Indian J Med Res. 1978 Oct;68:689-94.
182. Wild S, Roglic G, Green A, Sicree R, King H. : Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care. 2004 May;27(5):1047-53.
183. Mohan V, Mathur P, Deepa R, Deepa M, Shukla DK, Menon G.R : Urban rural differences in prevalence of self-reported diabetes in India--the WHO-ICMR Indian NCD risk factor surveillance. Diabetes Res Clin Pract. 2008 Apr;80(1):159-68.
184. Cuzzola F, Mallamaci F, Tripepi G, Parlongo S, Cutrupi S, Cataliotti A.: Urinary adrenomedullin is related to ET-1 and salt intake in patients with mild essential hypertension. Salt Sensitivity Group of Italian Society of Hypertension. American Journal Hypertension. 2001 Mar;14(3):224-30.
185. Ahmad N, Bhopal R.: Is coronary heart disease rising in India- A systematic review based on ECG defined coronary heart disease. Heart. 2005 Jun;91(6):719-25.
186. Dewan BD, Malhotra KC, Gupta SP.: Epidemiological study of coronary heart disease in rural community in Haryana. Indian Heart Journal. 1974 Apr;26(2):68-78.
187. Chadha SL, Gopinath N, Shekhawat S.: Urban-rural differences in the prevalence of Coronary Heart Disease and its risk factors in Delhi. Bull World Health Organ. 1997;75(1):31-8.

188. Grøntved A. : Television Viewing and Risk of Type 2 Diabetes, Cardiovascular Disease, and All-Cause Mortality - A meta analysis. Journal of the American Medical Association 2011;305(23):8.
189. Aadahl M, Kjaer M, Jorgensen T.: Influence of time spent on TV viewing and vigorous intensity physical activity on cardiovascular biomarkers. The Inter 99 study. Eur J Cardiovasc Prev Rehabil. 2007 Oct;14(5):660-5.
190. Saelens BE, Sallis JF, Nader PR, Broyles SL, Berry CC, Taras HL. Home environmental influences on children's television watching from early to middle childhood. J Dev Behav Pediatr. 2002 Jun;23(3):127-32.
191. Dennison BA, Erb TA, Jenkins PL. Television viewing and television in bedroom associated with overweight risk among low-income preschool children. Pediatrics. 2002 Jun;109(6):1028-35.
192. Harnack L, Stang J, Story M. Soft drink consumption among US children and adolescents: nutritional consequences. J Am Diet Assoc. 1999 Apr;99(4):436-41.
193. Cappuccio FP, Cooper D, D'Elia L, Strazzullo P, Miller MA. Sleep duration predicts cardiovascular outcomes: a systematic review and meta-analysis of prospective studies. European Heart Journal. 2011 Jun;32(12):1484-92.
194. Eckel R.H.: Obesity and Heart disease: A statement for healthcare professionals from Nutrition Committee, American Heart Association. Circulation. 1997, Nov4;96(9):3248-50.
195. Benjamin AL. : Community screening for high blood pressure among adults in urban and rural Papua New Guinea. P N G Med J. 2006 Sep-Dec;49(3-4):137-46.
196. Family history and Cardiovascular Disease. World Heart Federation; 2011 [cited 2011 04 /05/2011]; Family history]. Available from: http://www.world-heart-federation.org/cardiovascular-health/cardiovascular-disease-risk-factors/family-history/.
197. Rose G.: Ancel Keys Lecture. Circulation. 1991 Sep;84(3):1405-9.
198. Glantz SA, Parmley WW.: Passive smoking and heart disease. Epidemiology, physiology, and biochemistry. Circulation. 1991 Jan;83(1):1-12.
199. Mackay J, Mensah, G. : The Atlas of Heart Disease and Stroke. World Health Organization, 2004.
200. WHO. : Diet, nutrition and prevention of chronic diseases. Geneva: World Health Organisation 1990.
201. Gulati VP P.S. :Oilseeds and Edible Oil Economy of India. Delhi: Vikas Publishing House; 1994.

202. Sacks FM, Svetkey LP, Vollmer WM, Appel LJ, Bray GA, Harsha D.: Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. DASH-Sodium Collaborative Research Group. New England Journal Medicine. 2001 Jan 4;344(1):3-10.
203. Dietary fats, Oils and Cholesterol. 2011 [02/05/2011]; Available from: http://www.heartandstroke.com/site/c.ikIQLcMWJtE/b.3484237/k.4695/Dietary_fats_oils_and__cholesterol.htm.
204. Mustard oil good for Indian Hearts. 2011 [cited 2011 04/05/2011]; Available from: http://bestonhealth.com/articles/articles.asp?som=upd&artType=0904_3.
205. Rastogi T, Reddy KS, Vaz M, Spiegelman D, Prabhakaran D, Willett WC.: Diet and risk of Ischemic Heart disease in India. American Journal Clinical Nutrition. 2004 Apr;79(4):582-92.
206. Kromhout D, Bosschieter EB, de Lezenne Coulander C. : The inverse relation between fish consumption and 20-year mortality from Coronary Heart Disease. New England Journal Medicine. 1985 May 9;312(19):1205-9.
207. Marckmann P, Gronbaek M.: Fish consumption and Coronary Heart Disease mortality. A systematic review of prospective cohort studies. Europeaon Journal Clinical Nutrition. 1999, Aug;53(8):585-90.
208. Soriguer F, Rojo-Martinez G, Dobarganes MC, Garcia Almeida JM, Esteva I, Beltran M, et al.: Hypertension is related to the degradation of dietary frying oils. American Journal Clinical Nutrition, 2003, Dec;78(6):1092-7.
209. James J, Thomas P, Cavan D, Kerr D.: Preventing childhood obesity by reducing consumption of carbonated drinks: cluster randomised controlled trial. BMJ. 2004, May 22;328(7450):1237.
210. Gangwisch JE, Malaspina D, Boden-Albala B, Heymsfield SB.: Inadequate sleep as a risk factor for obesity: Analyses of the NHANES I, Sleep, 2005, Oct;28(10):1289-96.
211. Taheri S, Lin L, Austin D, Young T, Mignot E.: Short sleep duration is associated with reduced leptin, elevated ghrelin, and increased body mass index, PLoS Medicine, 2004 Dec;1(3):e62.
212. Hasler G, Buysse DJ, Klaghofer R, Gamma A, Ajdacic V, Eich D: The Association between short sleep duration and obesity in young adults: A 13-year prospective study, Sleep, 2004, Jun 15;27(4):661-6.
213. Brook RD, Rajagopalan S, Pope CA, 3rd, Brook JR, Bhatnagar A, Diez-Roux A.V. : Particulate matter air pollution and cardiovascular disease; An update to scientific statement from American Heart Association. Circulation. 2010, Jun 1;121(21):2331-78.

Publications:

1. Raghuvanshi, V.P. "**Study on healthy lifestyle behaviour and cardiovascular mortality among urban and rural populations in India."** International Journal of life sciences Biotechnology and Pharma Research. 2013 Jan; Volume – 2, No. 1:175-182. ISSN 2250-3137
   http://www.ijlbpr.com/jlbpradmin/upload/ijlbpr_50e45ab077fcb.pdf

2. Raghuvanshi, V.P, Agarwal, Rajkishore " **Diet, Lifestyle and Cardiovascular Disease"**.
3. International Journal of Pharmaceutical Science and Health Care.2012 June; Issue 2, Volume -3: 22-32. ISSN 2249-5738
   http://rspublication.com/ijphc/june12/3.pdf

4. Raghuvanshi, V.P, Agarwal, Rajkishore **"Cardiovascular risk behvaiour and lifestyle: a population based study among men and women."** International journal of research in Management.2011 Aug; 08;2011:1.
   http://rspublication.com/ijrm/August/ijrm-A-11-005.pdf

5. Raghuvanshi, V.P. **"Telemedicine –Making Healthcare Accessible to Rural Areas in India"**. Natural health. 2008, July.
   www.natural-health-journals.com)/442/telemedicine-making-healthcare-accessible-to-rural-areas-in-india

6. **"Medication Turnaround Time in Hospital Pharmacy Department".** International Journal of Research and Development in Pharmacy and Life Sciences.2013 Sep; Volume-2,Issue 05: 626-630. ISSN 2278-0238. Impact factor :3.027 =SJIF
   http://www.ijrdpl.com/docs/currentissue%20aug%20sept%202013/15.pdf

Annexure – 1

Questionnaire used for Study –

(Translated into English, Hindi, Gujarati, Bengali)

Annexure -2

Bio Profile of Supervisor

- Dr. RajKishore Prasad Agarwal

Bio profile of self

- Vijay Pratap Raghuvanshi

Annexure – 1

Questionnaire used for Study - (Translated into English, Hindi, Gujarati, Bengali)

Study on Lifestyles and their Behavioural Determinants leading to Cardiovascular Disease among Different Population Groups.

Confidential Health Questionnaire ***Please Tick the Appropriate Answer***

Name:_____ **Sex :** ☐ Male ☐ Female **Age:** _____ years

Address: _____ **City:**_____ **State:** _____**Tel:**_____

Occupation:_____ **Marital Status:** ☐ Single ☐ Married ☐ Divorced

Height _____, **Weight** _____Kgs,

Section – 1 Non – Controllable Risk Factors

1. Have **you or do you** suffer from any of the following :

☐ Ischemic Heart Disease ☐ High Cholesterol ☐ High Blood Pressure ☐ Diabetes

☐ Obesity ☐ Dyslipidemia (low-density lipoprotein cholesterol) ☐ None of the Above

2. Is there a **family history** of heart disease in your family? ☐ Yes ☐ No

3. Have any of your **first-degree relative (Parents)** experienced the following conditions?

☐ Heart attack ☐ Heart operation/ Stenting/ Bypass ☐ Congenital heart disease

☐ High cholesterol ☐ None of the Above

4. Have you ever had surgery of any Kind? ☐ Yes ☐ No (If yes) Give details._____

5. Number of members of your direct family those

A. Who have died or been diagnosed with Coronary Heart Disease **before** age of 55.

☐ None ☐ One Person ☐ More than one

B. Who have died or been diagnosed with Coronary Heart Disease **after** age of 55.

☐ None ☐ One Person ☐ More than one

C. Who have been diagnosed with Diabetes.

☐ None ☐ One Person ☐ More than one

D. Who have died or been diagnosed with Strokes or Cerebral Vascular Disease.

☐ None ☐ One Person ☐ More than one

Section – 2 Alcohol/ Caffeine/ Tobacco Consumption

6. Do you smoke Cigarettes Now ? ☐ Yes ☐ No **{ If No – Skip to Question No. 6B}**

6. A. On the average, how many cigarettes per day

☐ 1-2 cigarettes occasionally ☐ 2 - 5 ☐ 6-10 ☐ 10 or more cigarettes

6. B. If No, ☐ Never smoked ☐ Quit smoking **less** than 5 years ☐ Quit smoking **more** than 5 years

7. Do you use tobacco? ☐ Almost Never ☐ Rarely ☐ Sometime ☐ Quite Often ☐ Most of the Time

If **yes,** what form (Direct Chewing -Gutka,Hook-ah, Snuff(inhaled/ kept lower lid & gum)? _____

8. Are you a Passive Smoker? ☐ Yes ☐ No **{If No – Go to Question No. 9}**

8A. Lived with a smoker: ☐ >1 Year ☐1-5 yrs ☐ 5 + yrs

8B. Worked with a smoker: ☐ >1 Year ☐1-5 yrs ☐ 5 + yrs

9. Do you consume alcohol? ☐ Yes ☐ No **{If No Skip to Question No. 12}**

9A. How often Consume alcohol

☐ Occasionally ☐ 2 days or less per week ☐ 3 days per week ☐ 4 days or more per week

10. On the days that you drink (alcohol Neat/ alcohol with water/ alcohol with soda), on the average how many drinks do you have? ☐ 1 -2 drink ☐ 3 - 4 drinks ☐ 5 drinks ☐ 6 or more drinks

11. What type of alcohol you usually consume?

☐ Whisky, Rum, Brandy, Vodka ☐ Wine (Red/ White)

☐ Arrack, Desi Sharab, Tari, Tharra ☐ Not known / any form

Section – 3 Exercise Program

12. How often do you involved in any exercise programme?

☐ Almost Never ☐ Sometime ☐ Quite Often ☐ Most of the Time

{If Almost Never – Go to Question No. 16}

13. What form of exercise ?

☐ Walking ☐ Cycling / Running ☐ Machine Exercise ☐ Yoga

14. On the average, how many days per week do you exercise ? ☐ 1-2 days per week

☐ 3 -4 days per week ☐ More than 5 days per week ☐ 1-2 days per Month

15. Do you warm-up and cool-down before and after exercising?

☐ Always ☐ Sometimes ☐ Never ☐ Currently not exercising

Section – 4 Nutrition Habits

16. Do you sometimes skip breakfast?

☐ Regular eating ☐ 1-2 Times per week ☐ 3 Times per week ☐ 4-5 times per week.

17. On the average, how many meals do you consume per day?

☐ 2 Meals with "healthy" snacks ☐ 2 Meals Only

☐ 1 Meals with "healthy" snacks ☐ No regular eating pattern

18. On the average, how many times do you consume green vegetables per day?

☐ 2 times per day ☐ 1 times per day

☐ 3-4 times per Week ☐ Rarely consume vegetables

19. On the average, how many times do you consume fruit per day? *{1 piece of fruit -1 apple, 1 Banana, etc}*

☐ 2 times per day ☐ 1 times per day

☐ 3-4 times per Week ☐ Rarely consume fruit

20. On the average, how many times do you consume dairy products per day?

☐ 1 times per day ☐ 2 times per day

☐ 3 -4 times per Week ☐ Rarely consume dairy products

21. Indicate the type of dairy products you consume.

☐ Non-fat selections only ☐ Both low-fat and non-fat about the same

☐ Low fat only ☐ Usually High fat selections

22. What Kinds of fat or Oil do you usually use in Cooking (to fry, Stir-Fry, Saute)? *(Tick only one or two)*

☐ Don't Know or Don't Cook ☐ Sunflower Oil ☐ Butter ☐ Ground Nut oil

☐ Vegetable Oil ☐ Kachi Dhani Oil ☐ Cotton Seed Oil ☐ No Oil

23. Indicate the type of meat you consume.

☐ Do not consume meat or meat products ☐ Occasionally consume meat products

☐ **Less** than 200 gms of poultry/ fish per day ☐ **More** than 200 gms of poultry or fish per day

☐ **Less** than 200 gms of red meat per day ☐ **More** than 200 gms of red meat per day

24. Do you Consume Eggs

☐ Do not consume eggs ☐ Occasionally ☐ 1-2 eggs per day ☐ 3 or more than 3 eggs per day

25. Do you add extra table salt in your food? ☐ Yes ☐ No

26. On the average, how many glasses of water do you consume per day?

*{**NOTE:** A serving is one glass of water only; do not include Tea, coffee, soda or other beverages}*

☐ At least 8 glasses per day ☐ 5 - 6 glasses per day

☐ 3 - 4 glasses per day ☐ 1 - 2 glasses per day

27. On the average, how many times do you eat fast food? (e.g. Pizza, Samosa, French Fries, etc)

☐ Occasionally ☐ 1-2 time per Week

☐ 3 time per Week ☐ More than 4 times per Week

28. How many times have you been on a diet or attempted to lose weight?

☐ Never attempted ☐ 1 - 2 times ☐ 3 - 4 more times ☐ 5 or more times

29. How many individuals in your direct family have a weight problem?

☐ None ☐ 2 or fewer ☐ More than 3 ☐ More Than 4

30. How many Soft Drink or Diet Colas, etc you drink ?

☐ Occasionally ☐ 1 -2 in a week ☐ 3 – 5 in a week ☐ More Than 5

Section – 5 Personal Health History and Habits

31. Do you consider yourself to be healthy? ☐ Yes ☐ No

32. How often do you see your physician for routine check-ups or health screenings?

☐ On an annual basis ☐ At least every 2 years

☐ Not within the past 5 years ☐ Never

33. How many hours per day do you spend in front of a computer or Watching Television?

☐ Less or 1 Hours ☐ 2-3 Hours ☐ 4-5 Hours ☐ More Than 6 Hours

34. Please rate how active you are on a daily basis?

☐ Very Active ☐ Active ☐ Moderate ☐ Not Active

35. Do you often feel anxious ☐ Yes ☐ No

36. Do you consider yourself to be under stress?

☐ Almost Never ☐ Rarely ☐ Quite Often ☐ Most of the Time

37. Do you take any form of medication prescribed by a physician directly or indirectly related to stress in your life or a psychological disorder (Depression)? ☐ Yes ☐ No

38. Thinking about your job in general would you say that you are

☐ Very Active ☐ Fairly Active ☐ Not Very Physically Active ☐ Not at all Physically Active

39. How many hours sleep do you get everyday?

☐ 2-4 Hrs ☐ 5-6 Hrs ☐ 6-8 Hrs ☐ More Than 8 Hrs

40. Do you live or work in an environment which you consider to expose you to pollution, either air, water or from your food? ☐ Yes ☐ No

41. How many Km per day do you drive an automobile or ride as a passenger?

☐ Less than 5 ☐ Less than 10 ☐ Between 11 and 14 ☐ More than 15

All information on this form is correct to the best of my knowledge.

Signature:_____ Date:_____ *Sample No. ____(Please Leave Blank, For Office Use)*

Vijay Pratap Raghuvanshi, Ph.D, Scholar (BITS, Pilani)

The Information of this schedule will be kept Confidential and will be used only for the study purpose.

कार्डीओवैस्क्यलर (हृदवाहिनी) रोग संबंधित जीवन शैली

एवं व्यवहार पर अध्ययन

विश्वसनीय स्वास्थ्य प्रश्नावली **कृपया योग्य उत्तर/ बॉक्स पर (☑)सही करे**

नाम : _____ **लिंग :** पुरुष /स्त्री **उम्र:**_____ वर्ष **नौकरी :** _____

पता:_____ **शहर :**_____ **फ़ोन:**_____

विवाह संबंधी : अविवाहित/ विवाहित **लम्बाई :**_____**वजन :** _____किलोग्राम

भाग -1 अनियन्त्रणीय जोखिम कारण

1. क्या आप इन बीमारी में से किन्ही से पीड़ित है ?

☐ इस्चेमिक हृदय रोग ☐ उच्च कोलेस्टेरोल ☐ उच्च रक्तचाप (हाइ ब्लड प्रेशर)

☐ मधुमेह (डाइअबीटिस) ☐ मोटापा (ओबीसिटी) ☐ दिस्लिपिडमिया ☐ कोई भी नहीं

2. क्या आप के परिवार में कोई हृदय रोग से पीड़ित है ? ☐ हां ☐ नहीं

3. क्या आप के माता-पिता/ भाई-बहन में कोई इन रोग से पीड़ित है या थे ?

☐ हार्ट अटैक ☐ हार्ट ऑपरेशन / बाइपास सर्जरी ☐ जन्मजात (कन्जेनिटल) हृदय रोग

☐ उच्च कोलेस्टेरोल ☐ कोई भी नहीं

4. क्या आप की किसी प्रकार की सर्जरी हुई है ? ☐ हां ☐ नहीं {यदि **हां** तो कौन सी_____}

5. आप के परिवार के सदस्य जो :

5. क) 55 वर्ष से पहले कॉरनेरी हृदय रोग मरे है या पीड़ित है ?

☐ कोई नहीं ☐ एक सदस्य ☐ एक से ज्यादा

5. ख) 55 वर्ष के बाद कॉरनेरी हृदय रोग से मरे है या पीड़ित है ?

☐ कोई नहीं ☐ एक सदस्य ☐ एक से ज्यादा

5. ग) मधुमेह (डाइअबीटिस) से पीड़ित है

☐ कोई नहीं ☐ एक सदस्य ☐ एक से ज्यादा

5. घ) दौरा (स्ट्रोक) या दिमाग़ी नाड़ी रोग से मरे है या पीड़ित है?

☐ कोई नहीं ☐ एक सदस्य ☐ एक से ज्यादा

भाग -2 ऐल्कहाल/ कैफीन/ तम्बाकू

6. क्या आप अब सिगरेट पीते है? ☐ हां ☐ नहीं { यदि **नहीं** तो सवाल नं. 6B पर जाये}

6. क) औसतन आप रोज़ कितने सिगरेट पीते है? ☐1-2 कभी-कभी ☐ 2-5 ☐ 6-10 ☐10-ज्यादा

6. ख) यदि नहीं ☐ कभी नहीं पीते थे ☐ छोडे 5 साल हुआ ☐ छोडे 5 साल से ज्यादा हुआ

7. क्या आप तम्बाकू खाते है? ☐ कभी-नहीं ☐ कभी -कभी ☐ ज्यादातर ☐ हमेशा

यदि **हां** तो किस तरह (गुटका, हूका, सादा तमाखू)_____

8. क्या आप निश्चेष्ट धूम्रपान (पैसिव स्मोकर) है ? ☐ हां ☐ नहीं

8. क) सिगरेट पीने वाले के साथ रहते है? ☐ 1 साल से कम ☐ 1-5 वर्ष ☐ 5 से ज्यादा

8. ख) सिगरेट पीने वाले के साथ काम करते है? ☐ 1 साल से कम ☐ 1-5 वर्ष ☐ 5 से ज्यादा

9. क्या आप शराब पीते है? ☐ हां ☐ नहीं {यदि **नहीं** तो सवाल नं.12 पर जाये}

9.क) आप सप्ताह में कितने बार शराब पीते है?

☐ कभी-कभी ☐ 2 दिन हर सप्ताह ☐ 3 दिन हर सप्ताह ☐ 4 दिन या ज्यादा दिन

10. जिस दिन आप पीते है, औसतन कितने पैक/गिलास पीते है?

☐ 1-2 पैक ☐ 3-4 पैक ☐ 5 पैक ☐ 6 या ज्यादा

11. आप किस प्रकार की शराब पीते है?

☐ रम/विस्की/ ब्रांडी/वोदका ☐रेड / वाइट वाइन ☐ देसी शराब, ताड़ी ☐ हर तरह/ पता नहीं

भाग -3 व्यायाम संबधी

12. आप कितने बार व्यायाम करते है?

☐ कभी नहीं ☐ कभी-कभी ☐ अधिकतर ☐ हमेशा {यदि **नहीं** तो सवाल नं.16 पर जाये }

13. किस प्रकार का व्यायाम करते है?

☐ टहलना/पैदल चलना ☐ साइकिल चलाना/ दौड़ना ☐ मशीन व्यायाम ☐ योगा

14. आप सप्ताह में कितने दिन व्यायाम करते है?

☐1-2 दिन प्रति सप्ताह ☐ 3-4 दिन प्रति सप्ताह ☐ 5 दिन से जयादा ☐1-2 दिन प्रति माह

15. क्या आप व्यायाम से पहले एवं बाद में वार्मअप और कूल-डाउन करते है?

☐ हमेशा ☐ कभी-कभी ☐ कभी-नहीं ☐ जरूरी-नहीं

भाग -4 भोजन संबधी

16. क्या आप हमेशा नाश्ता करते है?

☐ हमेशा ☐1-2 दिन प्रत्येक सप्ताह ☐ 3 दिन प्रत्येक सप्ताह ☐ 3 दिन से ज्यादा प्रत्येक सप्ताह

17. सामान्य, आप दिन में कितने बार भोजन करते है?

☐ 2 बार भोजन + 1 नाश्ता ☐ 2 बार भोजन सिर्फ ☐ 1 बार भोजन + 1 नाश्ता ☐ कोई नियमित नहीं

18. सामान्य, आप दिन में कितने बार हरी सब्जी खाते है?

☐1 बार प्रति दिन ☐ 2 बार प्रति दिन ☐ 3-4 बार प्रति दिन ☐ कोई नियमित नहीं

19. आप दिन में कितने बार फल खाते है ?(१ सेब, १ केला,अन्य)

☐1 बार प्रति दिन ☐ 2 बार प्रति दिन ☐ 3-4 बार प्रति दिन ☐ कोई नियमित नहीं

20. आप दिन में कितने बार डेयरी/ दूध मक्खान, आदि वाली वस्तु खाते है?

☐1 बार प्रति दिन ☐ 2 बार प्रति दिन ☐ 3-4 बार प्रति दिन ☐ कोई नियमित नहीं

21. आप किस तरह के डेयरी/ दूध मक्खन आदि वाली वस्तु खाते है?

☐ बिना-चर्बी की वस्तु ☐ दोनों कम-चर्बी एवं बिना-चर्बी ☐ सिर्फ कम-चर्बी ☐ अधिकतर ज्यादा चर्बी

22. किस तरह के घी या तेल आप खाना पकाने का कार्य में (भूनना, मिलाने, हलके से तलने) लेते है?

☐ पकाते नहीं/ पता नहीं/ कोई भी ☐ सूर्यमुखी ☐ मक्खन/ वनस्पति-घी ☐ मूँगफली वनस्पतितेल

☐ कच्ची-धानी/ सरसों ☐ कपास तेल ☐ कोई तेल नहीं

23. आप किस तरह का माँस/ मीट खाते है?

☐ माँस नहीं खाते ☐ माँस कभी-कभी खाते है ☐ 200 ग्राम से कम मुर्ग/मछली प्रति दिन

☐ 200 ग्राम से ज्यादा मुर्ग/मछली प्रति दिन ☐ 200 ग्राम से कम लाल मांस प्रति दिन

☐ 200 ग्राम से ज्यादा लाल मांस प्रति दिन

24. आप प्रति दिन, कितने अंडा खाते है ? ☐ अंडा नहीं खाते ☐ कभी-कभी ☐1-2 अंडे ☐ 3 या 3 से ज्यादा

25. क्या आप अतिरिक्त नमक खाने में डालते है ? ☐ हां ☐ नहीं

26. प्रति दिन, आप कितने गलास पानी पीते है ? ☐ कम से कम 8 गलास ☐ 5-6 ☐ 3-4 गलास ☐ 1-2 गलास

27. सामान्य, आप कितने बार फास्ट फूड प्रति दिन खाते है? (उदाहरण - पिज्जा, समोसा, फ्रेंच फ्रिएस,)

☐ कभी-कभी ☐ 1-2 बार हर सप्ताह ☐ 3 बार हर सप्ताह ☐ 4 बार से ज्यादा हर सप्ताह

28. अभी तक आप कितने बार (डाइटिंग) अल्पाहार या वजन कम करने का प्रयास कर चुके है ?

☐ कभी कोशिश नहीं की ☐ 1-2 बार ☐ 3-4 बार ☐ 5 बार से ज्यादा

29. आप के परिवार में कितने लोगो को मोटापे की समस्या है ?

☐ किसी को नहीं ☐ 2 या कम ☐ 3 से ज्यादा ☐ 4 से ज्यादा

30. आप कितने कोल्ड ड्रिंक (पेप्सी, कोला,...) पीते है ?

☐ कभी-कभी ☐ 1-2 प्रति सप्ताह ☐ 3-4 प्रति सप्ताह ☐ 5 से ज्यादा

भाग -5 व्यक्तिगत स्वास्थ्य विवरण एवं व्यवहार

31. क्या आप अपने को स्वस्थ समझते है ? ☐ हां ☐ नहीं

32. कितने बार आप चिकित्सक या स्वास्थ्य-परीक्षण (हेल्थ चेक-अप) करते है?

☐ वार्षिक ☐ प्रत्येक 2 साल में ☐ 5 साल में एक बार ☐ कभी नहीं

33. हर दिन आप कितने घंटे कम्प्यूटर या टेलीविजन देखने में बिताते है ?

☐ 1 घंटे या कम ☐ 2-3 घंटे ☐ 4-5 घंटे ☐ 6 घंटे से ज्यादा

34. आप अपने आप को दिन-क्रिया में कितना सक्रिय/फुर्तीला समझते है?

☐ ख़ूब-फुर्तीला ☐ फुर्तीला ☐ सामान्य/मध्यम ☐ मन्दा

35. क्या आप चिन्तित/बेचैन होते है? ☐ हां ☐ नहीं

36. क्या आप अपने को तनाव/तनावग्रस्त होते है?

☐ कभी नहीं ☐ बहुत कम ☐ कभी-कभी ☐ अधिकतर

37. क्या आप किसी तरह की उदासी/ तनाव/तनावग्रस्त की दवाई लेते है? ☐ हां ☐ नहीं

38. अपनी नौकरी (को सोचते हुए, आप अपने को सामान्य) में कितना फुर्तीला समझते है?

☐ ख़ूब-फुर्तीला ☐ फुर्तीला ☐ सामान्य/मध्यम ☐ मन्दा

39. आप प्रतिदिन कितने घंटे सोते है? ☐ 2-4 घंटे ☐ 5-6 घंटे ☐ 6-8 घंटे ☐ 8 घंटे से ज्यादा

40. क्या आप प्रदूषित वातावरण में रहते है या काम करते है? ☐ हां ☐ नहीं

41. सामान्य आप कितने किलोमीटर प्रति दिन गाड़ी चलते है?

☐ 5 क.मी. से कम ☐ 10 क.मी. से कम ☐ 11 से 14 के बीच ☐ 15 से ज्यादा

सैम्पल नं..... (कृपया इसे न भरे) दिनांक .....

HNL HNL J:TGF ;DC JrR SFl0lMJ:Sl ,Z ZMU DF8 HLJG HLJJFGL ZLT VG TGL JT6S 5Z VelF;

BFGUL TNZ:TL 5`GMTZL

sIMul HJFA 5Z 8LS SZMf

GFD 0		pDZ 0 JQF	HFIT 0 ☐ 5~QF ☐ :+L		
;ZGFD 0		XCZ 0	ZFHl 0	8,LOMG 0	
jlJ;Fl 0	JJFICS lMulTF 0 ☐ 5Zl6T ☐ V5Zl6T ☐ K8FK0F ☐ lJWJF,/lJWZ				
pRF. .R	JHG lS,M				

lJEFU v !

SFADF G,. XSFl TJF HMBDL 5ZLA/M

!f X TD GLRGFDFYL SM. ZMUYL 5L0FVM KM m

☐ .:SDLS CNlGL lADFZL ☐ DW5DC ☐ CF. S,M:8ZM, ☐ prR ZST NAF6

☐ DN:JLTF ☐ 0Fl:,L5L0LDLlF ☐ p5ZMSTDFYL VS 56 GCL

Zf X TDFZF S8ADF ALHL SM. jllSTG CNl ;AWL SM. lADFZL CTL m

☐ CF ☐ GF

#f X TDFZF GHLSGF ;UF sDFTFvl5TFf G GLRGFDFYL SM. lADFZLGM EMU AG, K m

☐ CF8 V8S ☐ CF8 VM5ZXGq:8g8GLUqAFl5F;

☐ HgDYL CNl;AWL lADFZL ☐ CF. S,:8ZM, ☐ p5ZMSTDFYL VS 56 GCL

$f X TD VS 56 HFTGL ;HZL SZFJ, K m

☐ CF ☐ GF **CF** TM DFlCTL VF5M _____

5f TDFZF S8AGF ;elMGL ;blF

sVf HDG 55 JQFGL pDZ **5C,F** SMZMGZL CF8 0L;L;G GLNFG Yl CMl VYJF TGFYL Dtl Yl CMl m

☐ VS 56 GCL ☐ VS jllST ☐ VS SZTF JWFZ

sAf HDG 55 JQFGL pDZ **5K**L SMZMGZL CF8 0L;L;G GLNFG Yl CMl VYJF TGFYL Dtl Yl CMl m

☐ VS 56 GCL ☐ VS jllST ☐ VS SZTF JWFZ

sSf HDG DW5DCG lGNFG Yl CMl TJF m

☐ VS 56 GCL ☐ VS jllST ☐ VS SZTF JWFZ

s0f HDG :8MS VYJF ;ZA, J:Sl,Z 0L;LhG GLNFG Yl CMl VYJF Dtl Yl CMl m

☐ VS 56 GCL ☐ VS jllST ☐ VS SZTF JWFZ

lJEFU v Z

NF~qSO.GqTDFS ;JG

&f X TD ;LUFZ8 5LJM KM m

☐ CF ☐ GF sHM **CF** TM **& sVfG**M HJFA VF5M VG HM **GF** TM **&sAf** GM HJFA VF5M f

& sVf VS lNJ;GL ;ZZFX S8,L ;LUFZ8 m

☐ !vZ ;LUFZ8 SlFZS ☐ !v5 ☐ 5v!_ ☐ !_S TYL JWFZ

& sAf SIFZ 56 m ☐ ;LUFZ8 GYL 5LWL

☐ 5 JQF SZTF VMKF ;DI 5C,F KMOL NLWL ☐ 5 JQF SZTF JWFZ ;DI 5C,F KMOL NLWL

*f X TD TDFSG ;JG SZM KM m

☐ DM8 EFU ☐ SIFZI 56 GCL ☐ EFuIH ☐ SIFZS ☐ JFZJFZ DM8F EFU

HM CF TM SIF 5SFZ sU8BF BF.G4 CSSFYL4 KLS6L ;3LGfsGFSYL ;3LG S -FS6 YM0 B<, ZFBLGf _____

(f X TD 5ZM1F ZLT ;LUFZ8G ;JG SZM KM m ☐ CF ☐ GF

sVf ALOL 5LGFZF ;FY ZCM KM m

☐ ! JQF SZTF JWFZ ☐ ! YL 5 JQF ☐ 5 JQF SZTF JWFZ

sAf ALOL 5LGFZF ;FY SFD SZM KM m

☐ ! JQF SZTF JWFZ ☐ ! YL 5 JQF ☐ 5 JQF SZTF JWFZ

)f X TD TD S8,L JBT NF~ 5LWM KM m

☐ CF ☐ GF sHM **CF** TM 5`G GP **)sVf** GM HJFA VF5M HM **GF** TM 5`G GP **!Z** GM HJFA VF5Mf

Vf S8,L NF~ 5LWM CMI

☐ !vZ 5U 5;UM5FT ☐ V9JFOLIFDF Z INJ; S TGFYL VMK

☐ V9JFOLIFDF # INJ; ☐ V9JFOLIFDF $ INJ; S TGFYL JWFZ

!_f TD 5LVMKM tIFZ ;ZZFX S8,F 5L6F 5LJM KM m sVS,M NF~ q NF~ ;FY 5F6L q ;MOF ;FY NF~f

☐ ! YL Z 5L6F ☐ # YL $ 5L6F ☐ 5 YL & 5L6F ☐ & S TYL JWFZ 5L6F

!!f TD CDXF SIF 5SFZGM NF~ 5LJM KM m

☐ jCL:SL4 ZD4 AFg0L4 JM0SF ☐ JF.G s,F,q;ONf ☐ VZS4 NXL NF~4 TFZL4 YZX ☐ BAZ GYL q SM. 56

lJEFU v

S;ZT SFISD

!Zf S8,L JBT TD SM. S;ZT SFISDDF HM0FIF KM m

☐ DM8F EFU SIFZI 56 GCL ☐ SIFZS ☐ ,UEU JFZJFZ ☐ DM8F EFU

sHM DM8F EFU SIFZI 56 GCL TM 5`G GP !&GM HJFA VF5Mf

!#f S. 5SFZGL S;ZT m

☐ RF,J ☐ ;FIS,LU/SZJ ☐ NM0J ☐ DXLG S;ZT ☐ IMU

!$f V9JFOLIFDF ;ZZFX S8,L JBT TD S;ZT SZM KM m

☐ V9JFOLIFDF ! INJ; ☐ V9JFOLIFDF #v$ INJ;

☐ V9JFOLIFDF 5 YL JW INJ; ☐ DCLGFDF !vZ INJ;

!5f X TD S;ZT SZTF S;ZT 5C,F JMDV5 VG S;ZT SIF 5KL S,0FpG SZM KM m

☐ CDXF ☐ SIFZS ☐ SNL GCL ☐ CD6F GYL SZTF

lJEFU v $

VFCFZ v VFNTM

!&f X TD SIFZI GF:TM GYL SZTF m

☐ CDXF IGIIDTTF SZM ☐ V9JFOLIFDF ! YL Z INJ;

☐ V9JFOLIFDF # JBT ☐ V9JFOLIFDF # YL JW JBT

!*f TD INJ;DF ;ZZFX S8,L JBT EMHG ,MKMm

☐ jIJl:YT GF:TF ;FY Z JBT ☐ Z JBT S TGFYL VMK

☐ jIJl:YT GF:TF ;FY ! JBT ☐ BFJFGL IGIIDTTF GYL

!(f TD INJ;DF ;ZZFX S8,L JBT ,L,F XFSEFHL ,MKMm

☐ INJ;DF VMKFDF VMKF A JBT ☐ INJ;DF ! SZTF VMKL JBT

☐ INJ;DF VMKFDF VMKF #v$ JBT ☐ EFuIH XFSEFHL ,MKM

!)f TD INJ;DF ;ZFZFX S8,L JBT O/M ,MKMm sGMW0 VNFHLT VS O/ sVS ;OZHG4 VS S/ IJUZf

☐ INJ;DF VMKFDF VMKL Z JBT ☐ INJ;DF Z YL VMKL JBT

☐ V9JFOLIFDF VMKFDF VMKL #v$ JBT ☐ EFuIH 0ZLGL J:TVM ,MKM

Z_f TD INJ;DF ;ZFZFX S8,L JBT 0ZLGL J:T ,MKMm sGMW0 VNFHLT VS S5 NW VYJF 5_ UFD RLhf

☐ INJ;DF VMKFDF VMKL Z JBT ☐ INJ;DF Z YL VMKL JBT

☐ V9JFOLIFDF VMKFDF VMKL #v$ JBT ☐ EFuIH 0ZLGL J:TVM ,MKM

Z!f TD H 0ZLGL 5M0S8 JF5ZTF CM T H6FJM

☐ DF+ RZAL JUZGL ☐ AG VMKL RZAL VG ,UEU RZAL JUZGL

☐ DF+ VMKL RZALJF/L ☐ DM8FEFU RZALJF/L

ZZf S. 5SFZGL RZAL S T, TD DM8EFU Z;M.DF JF5ZM KMm sBAZ GYL VYJF AGFJTF GYLf

☐ T, JUZ ☐ DFB6 ☐ EMIXLU T, ☐ JHL8A, T,

☐ SFRL 5F6L T, ☐ ;IDBL T, ☐ S5F;LIF T,

Z#f TD H 5SFZG DF; BFTF CM T H6FJM sGMW0 DF; S DF;GL J:T JF5ZTF GYLf

☐ Z__ UFD SZTF VMKF DZ3F S DFK,L NZZMH JF5ZM KM

☐ Z__ UFD SZTF JWFZ DZ3F S DFK,L NZZMH JF5ZM KM

☐ Z__ UFD SZTF VMK ,F, DF; NZZMH JF5ZM KM

☐ Z__ UFD SZTF JWFZ ,F, DF; NZZMH JF5ZM KM

Z$f X TD .0F BFJ KMm ☐ CF ☐ GF

Z5f X TD TDFZF EMHGDF pZYLJWFZ DL9 GFBM KMm ☐ CF ☐ GF

Z&f INJ;DF D ;ZZFX S8,Fu,F; 5F6L 5LJM KMm

☐ INJ;DF VMKFDF VMKF (u,F; ☐ INJ;DF ,UEU 5YL &u,F;

☐ INJ;DF $u,F; ☐ INJ;DF Z SZTF VMKFu,F;

Z*f TD ;ZZFX S8,L JBT OF:800 BFJ KMm sNFPTP5LhF4;DM;F4 OR OF.; IJUZf

☐ 5;UM5FT ☐ V9JFOLIFDF ! vZ YL VMKL JBT

☐ V9JFOLIFDF #v$ JBT S TYL JW ☐ DCLGFDF !vZ YL JW JBT

Z(f TD BFJFDF S8,L JBT 5ZHL ZFBM KM S JHG 38F0JF DF8 5IF; SZM KMm

☐ SIFZI 56 5IF; SIM GYL ☐ !vZ JBT ☐ #v$ JBT S TYL JW ☐ 5 JBT S TYL JW

Z)f TDFZF S8ADF jIISTUT S8,F H6G JHGGL TS,LO K m

☐ VS 56 GCL ☐ Z S TYL JWFZ ☐ # SZTF JWFZ ☐ $ SZTF JWFZ

#_f TDS8,F ;MO8 0LS; S 0F.8 SM,F 5LJM KM m

☐ 5;UM5FT ☐ V9JF0LIFDF ! vZ ☐ V9JF0LIFDF #v5 ☐ 5 SZTF JWFZ

IJEFU v 5

VUT TALIT .ITCF; VG VFNTM

#!f X TD TDFZL HFTG TNZ:T DFGM KM m ☐ CF ☐ GF

#Zf TD S8,L JBT OLhLxIG 5F; ~8LG RSV5 SZFJM KM S TALITGL HF6SFZL D/JM KM m

☐ JFIQFS ☐ VMKFDF VMKF NZ Z JQF ☐ K<,F 5 JQFYL JWFZ GCL ☐ SIFZI GCL

##f INJ;GF S8,F S,FS TD SMd%I8Z ;FD SF-M KM VYJF 8LJL HVM KM m

☐ ! S,FS S TGFYL VMKM ☐ Zv# S,FS ☐ $v5 S,FS ☐ 5 S,FSYL JWFZ

#$f TD ZMH AZMHGF SFIMDF S8,F ;SLI KM T H6FJM

☐ BA ;SLI ☐ ;SLI ☐ 5C,F SZTF VMKF ☐ ;SLI GYL

#5f TD 36L JBT IRTFTZ ZCMKM m ☐ CF ☐ GF

#&f TD TDFZL HFTG NAF6DF DFGM KM m

☐ DM8 EFU SIFZ GCL ☐ EFuI ☐ JFZJFZ ☐ ,UEU CDXF

#*f TD ;LWF S VF0STZL ZLT TDFZL HLNULDF NAF6DF CMJFG ,LW S T6FJDF OLhLxIG 5F;YL SM. 56 5SFZ NJF ,LWL K m ☐ CF ☐ GF

#(f TDFZF SFD IJX IJRFZL TD H6FJL XSM KM S TD

☐ XFIZZLS ZLT BA ;SLI KM ☐ XFIZZLS ZLT 9LS 9LS ;SLI KM

☐ XFIZZLS ZLT AC ;SLI GYL ☐ XFIZZLS ZLT HZF 56 ;SLI KM

#)f TD NZZMH S8,F S,FS ;JM KM m

☐ Zv$ S,FS ☐ 5v& S,FS ☐ &v(S,FS ☐ (S,FS SZTF JWFZ

$_f X TD DFGM KM S TD H JFTFJZ6DF ZCMKM S SFD SZM KM tIF CJF4 5F6L S TDFZF EMHGDF YL 5NQF6 YFI K m

☐ CF ☐ GF

$!f TD ZMHGF S8,F SL,MDL8Z DM8Z R,FJM KM S D;FOZL SZM KM m

☐ 5 SZTF VMKF ☐ !_ SZTF VMKF ☐ !!v!$ ☐ !5 SZTF JWFZ

DFZL HF6 DF8 VF OMDDF AWL IJUTM ;FRL CMI V ;FYL ;F~ K VG C HM DG SF. NJF ;AWL ;,FC VF5JFGL H~Z ,FUX TM VF5LXP

;CL PPPPPPPPPPPPPPPPPPPPP TFZLB PPPPPPPPPPPPPPPPPPPPP;d5, GAZ PPPPPPPPPPPPPPPPPPPsDF+ VMOL; J5ZFXf

Annexure -2

Brief Profile of Supervisor and Self

Bio Profile of Supervisor

- Dr. RajKishore Prasad Agarwal

Bio profile of self

- Vijay Pratap Raghuvanshi

Bio- Data

Name of Supervisor	**:**	**Dr. Raj Kishore Prasad Agrawal**
Father's Name	**:**	S/o Late M.L.Agrawal
Date of Birth	**:**	01-05-1950
Present Address	**:**	Plot No. 1016, C/o Mr. Arbind Dabe Ambavadi (Behind Santinath Apartment) Bhavnagar
Office Address	**:**	Wockhardt Hospital, Bhavnagar Plot No. 1139, Sirpattani Road, Near Meghani Circle Bhavnagar – 364001 Tel : 0278 -6644444 Fax : 0278 6644242
Contact No.	**:**	**0278- 6644103, 09909940950**
Qualification	**:**	**Matriculation** in 1964 **MBBS**, Calcutta University in November,1973. Passed all examination in First Attempt. **MS General Surgery** (Patna University) Patna Medical College & Hospital in 1976 to 1978 and passed in August in 1978 in First Attempt.

Experience :

- Joined Health services in Govt. of Bihar in 1979 and worked in various hospitals & Medical Colleges and got **voluntary retirement** on 31st May, 2006
- Worked as a resident surgeon in Patna Medical College & Hospitals in 1976 to 1978.
- Worked as a resident surgical officer in Patna Medical College & Hospital in Sep,1986 to may, 1990.
- Worked as a specialist Surgeon referral hospital, 1999 to 2005
- Worked as a senior resident surgeon from April, 2005 to May, 2006 at Nalanda Medical College and Hospital, Patna.
- Have experience of running 30 bedded surgical hospital (own) since 1980 to 2006 as a consultant surgeon.
- During residency in Medical College used to teach under graduate medical students.
- Presently working as a **Senior Consultant Surgeon** in **Wockhardt hospital, Bhavnagar** from April, 2008

Work Experience : More than 30 Years

Dr. Raj Kishore Prasad Agrawal

PERSONAL DETAILS

Name **: Vijay Pratap Raghuvanshi**

Fathers Name **:** Shri Ram Charan Singh

Date of Birth, Sex, Nationality **:** 09th November 1978, Male, Indian

Permanent Address **:**House No –151 Sector- 2, Shastri Nagar, Meerut, U.P, India

Contact Telephone Number **: 998200 0025**

E-mail **:** vpraghuvanshi@gmail.com

Total Experience in Years : 12.0 years

PROFESSIONAL QUALIFICATION

Ph.D- Hospital & Healthcare Management- Pursuing (Thesis submitted, viva awaited) 12/2014 - BITS (Birla Institute of Technology), Pilani, India

M.Phil -Hospital & Healthcare Management-03-2007 -BITS (Birla Institute of Technology), Pilani, India

PGDHM- Hospital & Healthcare Administration-06-2002- IIHMR (Indian Institute of Health Management & Research), Jaipur, India

B.Sc.- (Chemistry, Zoology, Botany)- 06 – 1998- Ch. Charan Singh University, Meerut

XII - Physics, Chemistry, Biology, English -06 – 1995-St. Johns Senior Sec. School, Meerut

OTHER QUALIFICATION

1. Certified Quality Management System **Auditor/Lead Auditor** for ISO 9001 -2008 Standards Course No. A17024, requirement of IRCA QMS Auditor from Bureau Veritas Certification. Certificate No.LA2/09/IN/28425
2. NABH – 3 Days Implementation Course, Certificate No. H-3D-2010-24-0672.

PROFESSIONAL EXPERIENCE

Organization - Wockhardt Hospitals, Bhavnagar, Gujarat , India

Duration - July,2008 to till date

Designation - Manager Hospital Administration

Job Responsibilities

- To administer, direct and co-ordinate all activities, Support services, Utility services and Clinical of the 120 bedded multispecialty hospital.
- Corporate marketing, including seminar, advertising, public relation, direct marketing and sales promotions.Work with consultants to analyzing business system, consultant reviews, business expansion and other issues. Responsibility of the P &L for the hospital , Prepare departmental budget with the support of key managerial team members to the management for approval.
- Handling vendor and negotiating for ensuring long term cost-effective contracts for non-medical items, medical supplies and equipment. Accountable for complying with all laws and regulations that are associated with hospital.
- Coordinate recruiting and selection process and ensures timely filling up of vacancies.
- Continuously reviews all factors affecting the cost of administration and operation of hospital.
- To conduct regular interdepartmental and departmental meeting where appropriate.
- To maintain liaison between medical staff and other departments.
- To conduct a continuing program of formal and informal education in health care administrative and management areas. Handling all HR training activities.
- To conduct Daily/weekly administrative rounds of all the departments
- Responsible for quality service, accreditation (NABH,JCI) of hospitals and continuous improvement of hospital Systems. Actively Involved, Knowledge of JCI, Conduct and attend training and hospital tour during JCI Implementation in Wockhardt, Rajkot
- NABH Quality coordinator Coordinate the Quality i.e. NABH certification – Training , SOP's, etc. for the Hospital. Access all work of Pre and Post Audit for certification.

Organization - Narayana Hrudalaya Hospitals, Kolkata

Duration - Feb 2006 to July,2008

Designation - Sr. Executive Administration

Job Responsibilities

- Training for the Executives, Critical Care Assistants, HK, Security.
- Coordination for all new Hospital projects
- Coordinate new Up-coming Hospitals projects
    - ✓ Proposal writing (EOI, Pre qualification documents)
    - ✓ Planning – Equipment , Manpower, etc
    - ✓ Financial planning – cost to completion projections
    - ✓ Monitoring and Implementation of the projects.
    - ✓ Coordinating for Purchase equipments with vendors
- Supervising and Interdepartmental coordination for the day to day operations and problem solving of these departments - In-patient and Out patient service, Dialysis Unit, Housekeeping & Laundry, Dietary, Maintenance & Security

Organization - Narayana Hrudalaya (Rabindranath Tagore International Institute of Cardiac Sciences), Kolkata

Duration - July 2002 to Feb 2006

Designation – Management Trainee/ Resident Administrator

Job Responsibilities

- Preparation of monthly pay roll reports, wages , final settlement .
- Preparation of Employment Advertisement, Offer / Appointment letters.
- Maintain & Supervise Time Office Records, Monthly report of Manpower status
- Updating & Maintenance of Leaves Records, Personal Files and Other Records.
- Responsible for functioning and activities for Pathology & Blood Bank.
- Organized camps, Conferences, Seminars. Manage continuing training program, events, welfare activities at system and levels.
- Help in on time Interview process and recruitment
- Manager on Duty at night-time. Submitting and evaluate monthly/ annually reports.
- Having charge and custody of and being responsible for all operating funds of the hospital.
- Representing the hospital in its relationship with other agencies.
- OPD – Facilitate the smooth functioning of the OPD, patient scheduling, appointments, coordinating with other departments, etc.
- IPD – Facilitate the surgical scheduling, bed management, OR scheduling, smooth admission, and discharge.
- Purchase of Inventory & managing of Stores, Medical Records Department, HIS

- ❖ Coordinating activities of Bio Medical Electrical & Civil Engineering Department & Housekeeping Department, Real Estate activities

M.Phil Thesis Topic - *"Cost Analysis of Cardiac Interventional Procedures – CAG,PTCA,BMV,PPI"* of a Super Specialty Cardiac Hospital RTIICS Hospital, Kolkata".

Dissertation / Thesis topic during MHA

"Job Analysis & Job Description" of a Super Specialty Cardiac Hospital RTIICS Hospital, Kolkata".

Major Studies:

- ❖ Study of the Outpatient Department with Time Motion Study.
- ❖ Estimation of Sterilization Capacity in Super-specialty Tertiary Care Hospital
- ❖ Patient Satisfaction - A Comparative Study
- ❖ Customer Relationship Management (CRM) in Health Care Sector - A Case Study on Heart Checkup.
- ❖ Patient Care Management in Healthcare

Paper Published :

1. **Telemedicine – Making Healthcare Accessible to Rural Areas in India** *http://www.natural-health-journals.com/442/telemedicine-making-healthcare-accessible-to-rural-areas-in-india*
2. **Cardiovascular risk behaviour and lifestyle: a population based study among men and Women.** International journal of Research in Management *http://rspublication.com/ijrm/AUGUST/ijrm-A-11-005.pdf*
3. **Diet, Lifestyle and Cardiovascular Disease.** International journal of Pharmaceutical Science and healthcare http://rspublication.com/ijphc/june12/3.pdf
4. **"Medication Turnaround Time In Hospital Pharmacy Department".** International Journal of Research and Development in Pharmacy and Life Sciences. http://www.ijrdpl.com/docs/currentissue%20aug%20sept%202013/15.pdf
5. **Study on healthy lifestyle behaviour and cardiovascular mortality among urban and rural populations in India.** International Journal of life sciences Biotechnology and Pharma Research. http://www.ijlbpr.com/jlbpuploadradmin//ijlbpr_50e45ab077fcb.pdf

Projects Completed:

1. Conducted **3 months training for doctors, administrators and other hospital** staff under Health Management project of Ministry of Public Health in **Kabul, Afghanistan**.
2. Planning and designing and preparing for NABH – Kothari hospital, Bikaner
3. Preparing the hospital for Implementation of NABH standards.