2. REVIEW OF LITERATURE

The literature pertaining to the study entitled “Prevalence and Risk Assessment for Cardiovascular Diseases among Young Women and the Impact of Therapeutic Lifestyle Modification” was reviewed under the following headings.

2.1 CARDIOVASCULAR DISEASE – AN OVERVIEW

2.2 RISK FACTORS ASSOCIATED WITH CARDIOVASCULAR DISEASE

2.3 INTERVENTIONS FOR A HEALTHY HEART

2.1 CARDIOVASCULAR DISEASE – AN OVERVIEW

Cardiovascular disease is a broad term used to describe a range of diseases that affect heart or blood vessels. The various diseases that fall under the umbrella of cardiovascular disease include coronary artery disease, heart attack, heart failure, high blood pressure and stroke (Hayes, 2007).

Coronary artery disease is one of the major health problems responsible for increasing mortality and morbidity in Indian communities all over the world (Das et al., 2005). Heart failure occurs when the pumping action of the heart cannot provide enough blood to the part of the body as it is needed. Congenital heart disease is a problem with the structure of the heart because of a birth defect (Steinberger et al., 2003).

Hypertension describes high blood pressure levels and often occurs along with atherosclerosis. The heart works hard to pump blood around the body and causes blood to flow at increased pressure through the blood vessels, causing risk for a heart attack or stroke. High blood pressure is a major risk factor for coronary heart disease and stroke (Gibbs et al., 2000).

Stroke occurs when a blood vessel supplying blood to one part of the brain becomes blocked. As a result, no oxygen can get to this part of the brain and leads to
death. Symptoms of stroke include weakness in the arm, leg, hand or face, sudden blindness, difficulty in speaking and loss of balance (Schoenstad, 2008)

**Prevalence - Global Scenario**

Globally, cardiovascular diseases are the number one cause of death and are projected to remain so. An estimated 17.5 million people died from cardiovascular disease in 2005, representing 30 percent of all global deaths. Of these deaths, 7.6 million were due to heart attacks and 5.7 million due to stroke and 4.2 million due to hypertension and other heart conditions. About 80 percent of these deaths occurred in low and middle income countries. World Health Organisation, 2008 cautioned that by 2015, an estimated 20 million people will die from cardiovascular disease (Boutayeb, 2006).

Cardiovascular disease continues to be the leading cause of morbidity and mortality among women in westernised countries (Pette, et al., 2007). The United States ranks thirteenth and seventeenth among industrialised nations for the prevalence of cardiovascular disease in women and men, respectively. More than 71 million Americans have at least one form of cardiovascular disease. Each year over 2,50,000 women in the United States alone die as a result of coronary heart disease (Karger et al., 2007).

American Heart Association,(2007) reported that cardiovascular disease is the single largest cause of death among women in the United States and worldwide, accounting for one-third of all deaths. In fact, more women than men die every year of cardiovascular disease. In the United States, 38.2 million women live with cardiovascular disease and the population at risk is even larger.

In the United Kingdom, cardiovascular disease is the main cause of death with 2,38,000 deaths in 2002 accounting to 39 percent of all deaths in women (coronary heart disease - 17 per cent, stroke - 13 per cent , other cardiovascular disease - 9 per cent). There are about 4,600 babies born with congenital heart disease each year and
12 million people are currently affected by rheumatic fever and rheumatic heart disease. Two-thirds are children between 5 and 15 years of age (British Heart Foundation, 2007).

British Heart Foundation, (2007) stated that about 2,27,000 heart attacks occur annually in the United Kingdom (1,26,000 in men and 1,01,000 in women). It is estimated that about one million people older than 35, living in the United Kingdom have had a heart attack. It is estimated that over 1.5 million men and 1.1 million women who had coronary heart disease (either heart attack or angina) live in the United Kingdom.

In Europe and North America, 27 million people have Peripheral Arterial Disease (PAD) and the prevalence is estimated as high as 20 percent of the adult population (Belch, 2003).

In 2003, the prevalence of cardiovascular disease was highest in non-Hispanic blacks (41 per cent for men, 45 per cent for women), followed by non-Hispanic whites (34 per cent men, 32 per cent for women) and Mexican-Americans (29 per cent men and women). Non-Hispanic blacks are also more likely to have hypertension and stroke than non-Hispanic whites (Thom, 2006).

Maziak et al. (2007), reported that the Eastern Mediterranean region is recognised as a hot spot for cardiovascular disease, where projections of its burden exceed. Stroke is the fourth leading cause of death in Canada. Each year, about 16,000 Canadians die of stroke. Each year more women than men die of stroke. About 3,00,000 Canadians live with the effects of stroke (Katzmarzyk and Janssen, 2004).

Compared to 2000, the number of years of productive life lost to cardiovascular disease will have increased in 2030 by only 20 per cent in Portugal. For Brazil, the figure is 64 per cent, for China, 57 per cent and for India, 95 per cent (North et al., 2009).

According to National data from 2008, Nutrition and Health Survey in China, the prevalence of hypertension in adults was about 18.8 per cent or it involved
180 million Chinese. Now, hypertension has become a major public health problem that has severe impact on health status of the population (Jiu et al., 2010).

Goyal et al. (2007) stated that Ischemic heart disease and stroke are among the most common causes of death and disability in the world. The Indian subcontinent (including India, Pakistan, Bangladesh, Srilanka and Nepal) has the highest rates of cardiovascular disease globally.

About 15 million new acute stroke events arise every year and about 55 million people have had a stroke at sometime in the past, either without or with residual disability and two-thirds of these individuals live in low income and middle income countries (Changhua et al., 2005).

Gaziano, (2008) reported that in South Asia alone, stroke and ischaemic heart disease account for more than one in five deaths and a much higher proportion of adult death. Deaths among women than men are more (11 per cent versus 8.4 per cent) and among women, three million deaths from stroke occur annually.

**Prevalence – Indian Scenario**

Global burden disease study reported that of a total of 9.4 million deaths in India in 1990, cardiovascular disease caused 2.3 million deaths (25 percent), 1.2 million deaths were due to coronary heart disease and 0.5 million due to stroke. It has been predicted that by 2020, there would be a 111 percent increase in cardiovascular disease deaths in India. World Health Organisation estimated that lost productivity due to premature deaths and disability cost India nine billion dollars in 2005, which was projected to rise to 237 billion dollars by 2015 (Gupta, 2000).

According to Mitra et al. (2009), prevalence of cardiac disease is on the rise and is at alarming rate in the Indian subcontinent. With the epidemiologic transition, the cardiovascular disease burden continues to rise in developing countries including India. The projected rise in disease burden due to cardiovascular diseases is expected to make it the prime contributor of total mortality and morbidity. Almost 2.6 million Indians
are predicted to die due to coronary heart disease which constitutes 54.1 per cent of all cardiovascular diseases deaths in India by 2020.

Cardiovascular diseases are the major cause of mortality and disease in the Indian subcontinent, causing more than 25 per cent of deaths. It has been predicted that these diseases will increase rapidly in India and this country will be host to more than half the cases of heart diseases in the world within the next 15 years (Gupta et al., 2008).

The Indian subcontinent is home to 20 per cent of world’s population and have highest burden of cardiovascular disease in the world (Goyal and Yusuf, 2006). The alarming fact is that the incidence, prevalence, hospitalisation and mortality due to coronary artery disease among Asian Indian are three to four times greater than any American and European counterparts (Mohanty et al., 2004).

Coronary heart disease and stroke have increased in both urban and rural areas. Prevalence of coronary artery disease has been reported to be 14 per cent in urban parts of South India. Seven per cent in rural parts of South India and three per cent in rural parts of North India (Goyal et al., 2007).

Although prevalence rates in rural population remain lower they will continue to increase reaching around 13.5 per cent of the rural population in the age group of 60 to 69 years by 2015. The prevalence rates among younger adults are also likely to increase and the prevalence rates among women will keep pace with those of men across all groups (Chakravarthy et al., 2002).

The prevalence of stroke in India varies in different regions of the country and ranges from 270 per 100,000 population. Approximately, 12 per cent of all strokes occur in the population less than 40 years of age and approximately 50 per cent of them are women. The National Commission on Macroeconomics and Health has projected that cases of stroke would increase from 1,081,480 in 2000 to 1,667,372 in 2015.

Young Indians with coronary artery disease have extensive coronary atherosclerosis, with even premenopausal women having multiversal disease. Coronary
Artery Disease is projected to double by the year 2015. In India heart disease occurs five to ten years earlier with 50 per cent of heart attacks below the age of 55 and 25 per cent below the age 40 (Gupta, 2004).

2.2 RISK FACTORS ASSOCIATED WITH CARDIOVASCULAR DISEASE

Urbanisation is occurring rapidly in the Indian sub-continent. Lifestyle changes involving major deviations in diet pattern decreased physical activity due to improved transportation and availability of energy saving devices and high level of mental stress associated with modernisation are the important risk factor for coronary heart disease and existing insulin inertia (Ramachandran, 2004).

Favourable risk factors in middle age are associated with lower lifetime risk for cardiovascular disease death and markedly longer survival. These results encourage efforts aimed at preventing development of risk factors in younger individuals to decrease cardiovascular disease mortality and promote longevity (Lloyd-Jones et al., 2006).
Non modifiable risk factors are those risk factors that an individual cannot change, such as age, gender, ethnicity, and heredity. The incidence of cardiovascular disease increased as people age. Ethnicity and heredity play a role in the development of cardiovascular diseases. Individuals with a family history are at a greater risk for the development of elevated blood lipid levels, which has been associated with the early development of coronary artery disease (Knypl, 2001).

Family history of stroke in any first degree relative was an independent predictor of ischemic heart disease mortality in men and of stroke mortality in women after controlling for age, cholesterol, blood pressure and diabetes. These results suggest that family history of stroke may be used as a marker for high-risk subjects (Connor and Khaw, 2006).

Modifiable risk factors are those that an individual can change, including elevated serum cholesterol levels, a diet high in saturated fats, obesity, physical inactivity, hypertension, nicotine and alcohol use. Obesity is associated with a higher incidence of mortality from cardiovascular disease and physical inactivity increase the risk for developing cardiovascular diseases.

**Obesity**

Song *et al.*, (2006) reported that obesity is very often related with premature mortality because it leads to an increased risk of diabetes, stroke and other health
problems. According to Blacher (2005), Obesity and cardio-metabolic risk factors are highly prevalent among urban adults, which calls for urgent measures to avert the rise of diet related chronic disease. Coronary artery disease and coronary risk factors were two or three times higher among the urban compared with the rural subjects, which may be due to greater sedentary behaviour (Farwell et al., 2005).

A study among the industrial employees reported that 27 per cent of them were overweight and 41 per cent had abdominal obesity. The reason stated were sedentary lifestyle with a very light physical activity (Mohan et al., 2008).

The most reliable estimates to date the associations between Body Mass Index and cardiovascular disease in Asia-Pacific region was that a continuous positive association between baseline Body Mass Index and the risk of heart disease with each two kilograms per square metre increase in Body Mass Index (Wilson et al., 2003).

**Waist to Hip Ratio**

A one centimeter increase in a women’s waist measurement increases the risk of cardiovascular disease event, by two. According to Myint et al. (2001), waist to hip ratio greater than 0.92 could significantly identify women at increased risk of low high density lipoprotein-cholesterol concentration.

Women watching television more than three hours per day had a higher prevalence of abdominal obesity (waist circumference greater than or equal to 88 centimeters) compared with women watching less than or equal to three hours per day which increase risk of cardiovascular disease (Cletland et al., 2008).

**Dietary pattern**

Diet is a significant modifiable risk factor for cardiovascular disease (CVD). A diet high in saturated fats and trans fats leads to abnormal levels of fats in the blood is a risk factor for cardiovascular disease (Caterina et al., 2006).

Poor nutritional habits are associated with increased risk factors for cardiovascular disease. Hence, nutritional education and improving health status is very important (Zusta et al., 2007). Claude and Chang (2002) found out that the mortality
from cardiovascular disease to be 61 per cent lower in male vegetarians and 44 per cent lower in female vegetarian than the general population.

The higher intake of fats and oils also play an important role in determining the incidence of cardiovascular disease along with other risk factors (Murugesan and Ramadas, 2008).

Merchant et al. (2008) stated that for every ten grams per day increase in saturated fat intake, intima media thickness was 0.03mm higher after multivariate adjustment; one gram per day higher intake of transfat was associated with a 0.03mm higher intima media thickness.

Saturated fats are found in animal products. Trans fats are oils that have been hydrogenated to turn them into semi-hard fats. Intake of trans fatty acids is high in Iranian homes and contribute to a sizeable proportion of coronary heart disease events. Replacement of partially hydrogenated oils with unhydrogenated oil produce substantial reduction in coronary heart disease incidence (Mozaffarian et al., 2007).

The role of hydrogenated fat in the food supply, the metabolism of trans fatty acids, the scientific literature surrounding the effects of partially hydrogenated vegetable oils and trans fatty acids on blood cholesterol concentration increase cardiovascular disease risk (Mgintyre et al., 2001).

Trans fatty acids are geometrical isomers of unsaturated fatty acids that adapt a saturated fatty acid like configuration. Partial hydrogenation, the process used to increase shelf life of poly unsaturated fatty acids creates trans fatty acids (Katan, 2000).

Dietary salt is a significant factor in raising blood pressure in people with hypertension and in some people with normal blood pressure (Kim et al., 2010).

Western-style diets, sedentary lifestyle and cigarette smoking are key modifiable cardiovascular disease risk factors. Diet and lifestyle increase Cardiovascular disease risk both directly and Indirectly. Western diet boosts global heart attack risk by 30 percent. The fried foods, salty snacks and meats that are staples of the western diet amount for heart attack risk across the world (Forman and Bulwer, 2007).
Two-third of working women in India suffer from lifestyle diseases, 53 percent of them skip meals and go for junk foods due to work pressure and deadlines. Sixty eight percent of working women in the age of 21 to 52 years were found to be afflicted with lifestyle ailments such as obesity, depression, diabetes and hypertension stated Wenger (2004).

Chronic coffee consumption is associated with increased aortic stiffness and wave reflection in normotensive subjects. Augmentation index (non-invasive index of aortic stiffness and wave reflection) was found to be higher with increasing daily coffee consumption. Post analysis revealed that all groups of coffee consumption had higher augmentation index compared to no consumption and had 35 per cent higher relative risk (Vlachopoulos et al., 2007).

In recent years, the crucial role of nutrition education in improving nutritional status been recognized. Nutrition education offers a great opportunity to individuals to learn about the essentials to improve the quality of their diets and thus their well-being (Krishnan et al., 2007).

**Physical Inactivity**

Increasing physical inactivity raises the risk of high blood pressure, unfit women have up to a 55 per cent greater chance of developing high blood pressure than a moderately fit women of the same age (Barlow et al., 2006).

Physical inactivity increases the risk of developing heart diseases by 1.5 times partly because it raises the likelihood of developing significant risk factors. Nearly a quarter of all global ischemic heart disease is related to physical inactivity reported Rana and Manson (2007).

According to Weir et al. (2006), world wide, more than 60 per cent of adults do not engage in sufficient levels of physical activity that are beneficial to health. Physical inactivity is more prevalent among women, older adults and the disabled. Goyal and Yusuf, (2006) reported that the prevalence of leisure time physical activity was substantially lower among South Asians compared with the rest of the world.
Physical inactivity, now recognised as an increasingly important determinant of health, is the result of a progressive shift of lifestyle towards more sedentary pattern in developing countries as much as in industrialised ones (North et al., 2009).

Suri (2008) focused on unhealthy diet and physical inactivity that leads to obesity and overweight. The excess body fat accounts for about 60 percent and 20 percent of the global burden of diabetes and cardiovascular disease respectively.

**Hypertension**

Dragland, 2003 reported that elevated blood pressure in people less than 50 years old is associated with cardiovascular risk. Systolic blood pressure becomes a more important predictor of the risk of cardiovascular disease. Hypertension is a highly prevalent cardiovascular risk factor world wide because of increasing longevity and prevalence of contributing factor such as obesity. Whereas the treatment of hypertension has been shown to prevent cardiovascular disease to an extent and enhance life (Apple, 1998).

It is estimated that a five mmHg reduction in systolic blood pressure results in a 14 per cent reduction in stroke mortality and nine per cent reduction in coronary heart disease mortality and a seven per cent decline in all cause mortality. It is also estimated that a ten per cent decrease in serum cholesterol would result in a 15 per cent decrease reduction in coronary heart disease mortality (Dauchet et al., 2007).

When the blood pressure is too high, they are at greater risk for developing heart disease. Chronic stress can lead to cardiovascular disease as it causes a prolonged activation of the sympathetic nervous system. Personality factors such as anger, hostility, depression and anxiety have been related to an increased risk of cardiovascular disease. Studies have shown the men with a type A behaviour had a greater risk of coronary heart disease (Thomson et al., 2009).

**Serum biochemical markers**
Conventional lipid-related cardiovascular disease risk factors include high blood levels of total and low-density lipoprotein, low levels of high density lipoprotein and elevated triglycerides. Although the total amount of fat consumed is important, accumulating evidence places greater emphasis on the importance of the types of fatty acid in the diet and the partial replacement of saturated with unsaturated fatty acids. High levels of lipoprotein and remnant lipoproteins appear to increase cardiovascular disease risk (Lee et al., 2002).

A less favourable lipid profile was strongly associated with higher current Body Mass Index, greater waist circumference and greater absolute fat mass. Carotid intima media thickness was positively associated with current height and with low density lipoprotein cholesterol and apolipoprotein B levels and low density lipoprotein or high density lipoprotein cholesterol and apoplipoprotein or apolipoprotein ratio (Finken et al., 2006).

Serum total cholesterol, triacylglycerol, low cholesterol, lipoprotein (a), the ratio of total to high density lipoprotein cholesterol and the ratio of low density lipoprotein cholesterol to high density lipoprotein cholesterol were greater, whereas high density lipoprotein cholesterol values were lower in Indians and Pakistanis than in Americans (Bitner, 2006).

High levels of low density lipoprotein cholesterol levels are associated with carotid atherosclerosis in menopausal women with metabolic syndrome. Although it remains prudent to recommend an integrated control of all modifiable risk factors to prevent cardiovascular disease, decreasing low density lipoprotein levels should be considered a high priority (Montalcini et al., 2006).

Ethnicity, sum of central skin fold thicknesses, ratio of polyunsaturated to saturated fat and monounsaturated fat intake accounted for 43 per cent of the variance in triacylglycerol concentration reported Savitri et al. (2006).

Grundy (2007) reported that the newer predictive factors for cardiovascular disease may significantly increase the population benefiting from twenty first century diagnostics and treatment. The newer predictive factors are Fibrinogen, lipo protein (a)
and homocysteine, C-reactive protein. The serum concentration of the amino acid homocysteine is positively associated with the risk of ischaemic heart disease, deep vein thrombosis and pulmonary embolism, and stroke reported Wald et al. (2002).

Homocysteine is a sulphur containing aminoacid which is a new risk factor of cardiovascular disease and stroke. Homocysteine causes vascular damage by its deleterious effects on endothelial functions and its prothrombotic, pre-oxidant mitogenic effect. High homocysteine levels were inversely associated with cardiovascular fitness in women. The results suggest that homocysteine levels are more important indicators of exercise tolerance amongst women and may be useful in targeting female individuals requiring endurance intervention to prevent loss of cardiovascular fitness and functions (Kuo et al., 2006).

The lipoprotein (a) [Lp (a)] acts as a predictor of cardiovascular disease in patients with Heterozygous Familial Hypercholesterolemia (HFH). Lp(a) is a well recognised risk factor for myocardial infarction and CVD reported Holmes et al., 2005. C-reactive protein (CRP) is a sensitive marker of inflammation, and elevated levels have been associated with future risk of myocardial infarction. However, the measurement of CRP adds to the predictive value of total cholesterol (TC) and HDL cholesterol (HDL-C) in determining risk of cardiovascular disease claimed Ridker, 2000

**Menopause**

Menopause is a risk factor for cardiovascular disease because oestrogen withdrawal has a detrimental effect on cardiovascular function and metabolism. The menopause compounds, many traditional cardiovascular disease risk factors include changes in body fat distribution from a gynoid to an android pattern, reduced glucose tolerance, abnormal plasma lipids, increased blood pressure, increased sympathetic tone, endothelial dysfunction and vascular inflammation. Cardiovascular risks are poorly managed in women especially during the menopausal transition when susceptibility to cardiovascular events increases.
Clear gender differences exist in the epidemiology, diagnosis, symptoms, progression, prognosis and management of cardiovascular diseases risk. Key risk factors that need to be controlled in the premenopausal women are hypertension, dyslipidemia, obesity and other components of the metabolic syndrome as and one this in menopause has a detrimental risk for cardiovascular disease (Sudha et al., 2008).

After menopause, women's cholesterol levels are on average higher than those of men of about the same age. After the age of 60, women’s blood pressure is on average higher than men's. An obese woman increases her risk of dying of cardiovascular disease by 145 times, compared with normal weight women (Binkoski et al., 2005).

**Smoking**

According to AL-Deaimy et al. (2002), cigarette smoking is strongly associated with an increased risk of coronary heart disease among women with type 2 diabetes mellitus. Furthermore, quitting smoking seems to decrease this excess risk substantially, women with diabetes should be strongly advised against smoking.

**Pollution**

Pollution increases the risk for cardiovascular disease and may lead to inflammation thus greater blockage of the arteries, and changes in the nervous system, which could play a role in irregular heartbeats reported Sharma et al., 2009. Chronic exposure to air pollution contributes to the development of cardiovascular disease.

Brooke and Mastin (2004) stated that epidemiological studies conducted in the past ten years have shown a consistent, increased risk for Cardiovascular events, including cardiac and stroke deaths, related to short and long term exposure to present – day concentrations of pollution.

**Stress**

Stress is a natural reaction of the body and is necessary for survival and to motivate us into action. Long term stress can affect the immune system and develop a
serious illness. Short term stress include experiencing headache or migraine, feel tightness in shoulders, nauseous or dizzy, difficulty in concentrating on simple tasks, feel irritable and moody (Plutzky, 2001)

People from all occupation face stress in their life in one way or the other. Stress is usually a mental pressure exerted due to fatigue or excessive work. It is also caused from worrying about the work or happenings in the past, present or future.

Chronic stress can lead to cardiovascular disease, as it causes a prolonged activation of the sympathetic nervous system. In people with Coronary Artery Disease (CAD), mental stress is as dangerous to the heart as physical stress (Akinboboye et al., 2005).

Depression, social isolation and lack of quality social support are as risky to heart health as abnormal levels of blood fats, smoking and high blood pressure Depression plays a role in the development and progress of cardiovascular disease (Grundy, 2007).

The stresses of life have long been thought to increase a person’s risk of cardiovascular disease or a serious coronary or cerebral event. Chronic and prolonged stress affects our health and our mental and emotional well being. In Australia, an expert group concluded that there is strong and consistent link between depression, social isolation and lack of quality social support and heart disease. These factors were as risky to heart health as abnormal blood lipid levels, smoking and high blood pressure (Dragland, 2003).

The rising trends in coronary artery disease are with particular emphasis on prevalence of premature coronary artery disease and the associated risk factors in young Indian CAD patients. Action strategies to reduce the risk are suggested (Sharma and Ganguly, 2005).

**Other health disorders**

Thyroid insufficiency has been identified as a risk factor for heart disease, but treatment with thyroid hormone replacement does not necessarily improve the outcome (Berstein, 2002).
Uncontrolled diabetes cause damage to the blood vessels making them more prone to damage from atherosclerosis and hypertension. People with diabetes develop atherosclerosis at a younger age and more severely than people without diabetes (Howard et al., 2006).

Anaemia provokes a series of cardiovascular alternations that may result in a compensatory increase in cardiac output and blood flow in the short term. These initially favour adaptations and may lead to cardiac structural changes, which could predispose cardiovascular disease over a lime. For patients with cardiovascular disease, anaemia may be particularly problematic. Oxygenation that results in the provocation or acceleration of angina and anemia may worsen congestive heart failure (Pette et al., 2007).

2.3 INTERVENTIONS FOR A HEALTHY HEART

Lifestyle modification should be an important part of therapy for cardiovascular diseases. A greater effort is required to manage by lifestyle modification with or without antihypertensive medication (Neutel and Camphel, 2008).

National interventions such as increasing tobacco taxes, labeling unhealthy foods and trans fats, reduction of salt in processed foods and better urban design to promote physical activity may have a wide short term impact (Gupta et al., 2006).

Case control studies indicate that tobacco use, obesity with high Waist Hip Ratio, high levels of blood pressure, high levels of low density lipoprotein cholesterol, low levels of high density lipoprotein cholesterol, abnormal apolipoprotein A1-B ratio, diabetes, low consumption of fruits and vegetables, sedentary lifestyle and psychosocial stress are important determinants of cardiovascular diseases in India. These risk factors have increased substantially over the past 50 years and to control further escalation, it is important to prevent them at an earlier age.

Diet should be low in fat, cholesterol, red meat and sweets and include more fruits, vegetables, fish, nuts, whole grain products and low fat dietary products (Robert, 2004). A diet lower in carbohydrate and higher in monounsaturated fat could offer an
appropriate choice for non obese type I diabetic individuals with good metabolic and
weight control (Strychar et al., 2009).

Cereals

Whole grains are unrefined and do not have the bran or germ removed. They contain folic acid, B vitamins and fiber, all of which are important protectors against heart disease (Caterina et al., 2006).

The daily consumption of three portions of whole grains significantly reduced systolic blood pressure in middle-aged, healthy, overweight men and women. The two meta analyses concluded that an increase in fiber intake of 10 to 15 grams fiber per day for eight weeks was associated with a fall in systolic blood pressure between one and three mmHg and soluble fiber may be more effective than insoluble fiber stated Queenan and Stewart (2007).

The health advantages of whole grains are largely associated with consuming the entire whole-grain “package,” which includes vitamins (B vitamins, vitamin E), minerals (iron, magnesium, zinc, potassium, selenium), essential fatty acids, phytochemicals (physiologically active components of plants that have functional health benefits) and other bioactive food components. Most of the health-promoting substances are found in the germ and bran of a grain kernel and include resistant starch, oligosaccharides, inulin, lignans, phytosterols, phytic acid, tannins, lipids and antioxidants, such as phenolic acids and flavonoids. It is believed that these nutrients and other compounds, when consumed together, have an additive and synergistic effect on health (Jensen, 1997).

According to Mellen et al. (2007), potential mechanisms for this health effect have been proposed. Components of some whole grains, including soluble fibre, beta-glucan, alpha-tocotrienol and the arginine-lysine ratio are believed to play a role in lowering blood cholesterol. Whole grains decrease risk of heart disease through their antioxidant content.
According to Ghaffar et al. (2004) plant foods such as fruits, vegetables and whole grains contain many components that are beneficial to human health. Antioxidants are present in foods as vitamins, minerals, carotenoids and polyphenols. Many antioxidants are often identified in food by their distinctive colours - the deep red of cherries and of tomatoes, the orange of carrots, the yellow of corn, mangoes, and saffron, and the blue-purple of blueberries, blackberries, and grapes (Mitra et al., 2009).

**Pulses and legumes**

Legume like beans, peas and lentils are a good source of protein and contain less fat and beneficial of the heart and may be regularly substituted for animal protein (Pande, 2004).

Proteins exhibit unique functional properties in food systems and protein rich flours have been used to impart special characteristic properties to food products. Soy products have been a major source of vegetable protein in the diet, since this soya flour is incorporated for the formulation of the protein and fibre rich biscuits (Wilson et al., 2001).

Welty et al. (2007) reported that soynuts supplementation lowered systolic and diastolic blood pressure, 9.9 per cent and 6.8 per cent respectively in normotensive women. It also lowered low density lipoprotein cholesterol and apolipoprotein levels 11 per cent and eight per cent respectively in hypertensive women which can reduce the risk of cardiovascular diseases.

It is suggested that soyabean-derived pinitol may be beneficial in reducing cardiovascular risk in type II diabetes patients from Korea Republic. Peanuts contain many phytoestrogens and unsaturated fatty acids that can help protect the body against disease such as heart disease and stroke. They also contain vitamins and minerals, which may act as antioxidant to neutralise damaging free radicals (Kum et al., 2005).
In accordance to Lichtenstein,(1998), apparently there is a synergy among the components of intact soy protein, which provides the maximum hypocholesterolemic benefit. A variety of clinical trials have demonstrated that consuming 25 to 50 grams per day of soy protein is both safe and effective in reducing LDL cholesterol by four per cent to eight per cent. A daily consumption of 25 g of soy protein with its associated phytochemicals intact can improve lipid profiles in hypercholesterolemic humans. This effect was observed in clinical trials to be additional to the benefits of an NCEP Step I diet and is greater in more-hypercholesterolemic subjects.

The beneficial effects of soy are proportionally greater in people with hypercholesterolemia. The judicious substitution of soy for animal protein can result in lower saturated fat and cholesterol intakes, thereby indirectly resulting in a more favorable blood cholesterol level and potentially reducing coronary heart disease risk. It is prudent to recommend including soy protein foods in a diet low in saturated fat and cholesterol to promote heart health (Wilson, 2001).

Food and Drug Administration (FDA, 2006) has approved that soy protein reduces the risk of heart disease. The FDA states that, 25 gram soy protein should be consumed each day in conjunction with diet low in saturated fat and cholesterol.

C-reactive protein decreased 38 per cent in the whole gram group independent of weight loss but was unchanged in refined grain group, total low density lipoprotein and high density lipoprotein cholesterol decreased in both diet groups. Dietary fibre and magnesium intakes increased in the whole gram but not the refined group. There was a moderate weight loss and significantly greater decreases in the c-reactive protein and per cent body fat in abdominal region in participants consuming whole grain than in those consuming refined grain (Katches et al., 2008).

**Vegetables and fruits**

Low fruit and vegetables intake accounts for about 20 percent of cardiovascular disease worldwide. Adults should consume at least 500 grams of fresh fruit and vegetables a day or five to seven portion a day.
Tomato and its processed products may significantly support the medicinal therapies of the atherosclerotic patients and may also be useful for people at high risk. It is also suggested that grape may support the medicinal therapies of the atherosclerotic patients and the prevention of atherosclerotic process in people who are at high risk for cardiovascular diseases (Devrim et al., 2007).

A study by Duttaroy, 2008, identified potent anti-platelet factors in tomato extracts which inhibited platelet aggregation. There is increasing evidence that acute clinical manifestations of coronary atherosclerotic diseases are caused by plaque disruption and subsequent platelet thrombus formation. Platelet activity can influence the progression of disease as well as the stability of atherosclerotic plaques. The observed cardiovascular benefits attributed to the tomato could be linked to anti platelet activity and thus, suppression of platelet function. This type of natural anti-thrombosis agent could have an application in primary prevention of cardiovascular disease

**Fats**

Peanut oil appears to be heart healthy oil low in saturated fat, high in polyunsaturated and monounsaturated fats which help to lower cholesterol levels and have heart protective properties. The reason olive oil is highly regarded oil from a health standpoint is related to its high concentration of monounsaturated fats (Liang et al., 2011)

Defatted rich bran did not lower lipid concentrations, total cholesterol was significantly lower with consumption of the diet containing rice bran oil than with consumption of the control diet. Moreover, with consumption of the rice bran oil diet, low density lipoprotein cholesterol decreased by seven per cent (P<0.004), whereas high density lipoprotein cholesterol was unchanged (Most et al., 2005).

Masella et al. (2002) suggested that the daily intake of extra virgin olive oil in hyperlipidaemic patients could reduce the susceptibility of low density lipoprotein to oxidation, not only because of its high monounsaturated fatty acids content but probably also because of the antioxidative activity of the phenolic compounds.
In view of these effects, it would appear that when olive oil is the basic source of dietary alimentary fat it has a major anti atherogenic capacity, which is not shared to the same extent by other oils that are rich in oleic acid but lack its characteristic micronutrients (Jimenez et al., 2008).

A Mediterranean dietary pattern characterised by a high intake of olive oil (rich in oleic acid and antioxidants), fish [(rich in N-3 long chain poly unsaturated fatty acid)], vegetables and fruits has been associated with a lower coronary heart disease incidence and total mortality. A replacement of saturated fat by monounsaturated fatty acid and increase in the consumption of fruits and vegetables to achieve proper antioxidant and folate status lead to decrease of coronary heart disease risk (Carrero et al., 2007).

A dietary portfolio of plant-based cholesterol lowering foods reduced blood pressure significantly, related to almond intake and dietary portfolio approach of combining a range of cholesterol lowering plant foods may benefit cardiovascular disease risk both by reducing serum lipids and also blood pressure (Jensen et al, 2008)

**Fleshy foods**

Although meat, poultry and fish along with dairy products and eggs are some of the best source of protein, they are high in total fat, saturated fat and cholesterol. Skim milk rather than whole milk and skinless chicken breast rather than chicken with skin is recommended (Pande, 2004).

Among women, higher consumption of fish and omega-3 fatty acids is associated with a lower risk of coronary heart disease, particularly coronary heart disease deaths (Hu et al., 2002).

Among elderly individuals, consumption of tuna or other boiled or baked fish is associated with lower risk of ischaemic stroke, while intake a fried fish or fish sandwiches is associated with higher risk (Mozaffarian et al., 2005).

**Spices**
Garlic acts as a hypotensive, decreases fibrinogen, inhibits platelet aggregation, thins the blood, protects against LDL oxidation and arterial wall damage. It is suggested that garlic and its well prepared formulations including beverage, oil or juice and powder may significantly support the medicinal therapies of the atherosclerotic patients as well as the prevention of atherosclerotic process in people who are at high risk for coronary heart disease (Dervim and Durak, 2007).

The antioxidants in turmeric prevent damage to cholesterol, thereby helping to protect against atherosclerosis. The ability of the antioxidants in turmeric to decrease free radicals is similar to that in vitamins C and E. Since the antioxidant activities of turmeric are not degraded by heat (unlike most vitamins), even using the spice in cooking provides benefits. Curcumin, the principle active compound in turmeric has been proven for cholesterol-lowering effects. Spices such as fennel, oregano, black pepper, basil and tarragon contain active ingredients that are beneficial in treatment of hypertension (Olszanecki et al., 2005).

**Fibre**

A higher dietary fiber intake was associated with a lower risk of both coronary heart disease and all cause mortality. For long term intake, the strength of the association between dietary fibre and all cause mortality decreased with increasing age (Coulston, 2008).

Rice bran oil lowers cholesterol in moderately hypercholesterolemic adults. There were no substantial differences in the fatty acid composition of the diets, therefore, the reduction of cholesterol was due to other components present in the rice bran oil, such as unsaponifiable compounds (Most et al., 2005).

The moderate weight reduction in obese subjects decreased intrahepatic lipid and augmented splanchnic glucose uptake. This mechanism helps in improvement of glucose metabolism by moderate weight reduction in obese subjects (Sato et al., 2007).

Higher intake of fibre from all sources and from cereal were significantly associated with wider retinal arteriol caliber and narrower venular caliber. Participants in
the highest quintile of fibre intake from all sources had a 1.05 \( \mu \text{m} \) larger arteriolar caliber and 1.11 \( \mu \text{m} \) (milli microns) smaller venular caliber which is associated with lower risk of cardiovascular disease (Kan et al., 2008).

Six grams of concentrated oat beta-glucan per day for six weeks significantly reduced total and low density lipoprotein cholesterol in subjects with elevated cholesterol and low density lipoprotein cholesterol reduction was greater than the change in the control group. Thus, a practical dose of beta-glucan can significantly lower serum lipids in a high-risk-population and may improve colon health (Queenan and Stewart, 2007).

**Micronutrients**

Dietary intake of sodium from all source, influence blood pressure levels in populations and should be limited so as to reduce the risk of coronary heart disease. Limitation of dietary sodium intake to meet these goal should be restricting daily salt intake to less than five grams per day. The use of potassium enriched low sodium substitute is the one way to reduce sodium intake (Rasmussen et al., 2006).

A diet high in salt increases the risk of developing high blood pressure, a risk for cardiovascular diseases. A universal reduction of about 3 grams of salt a day would lead to a 50 per cent reduction in the number of people needing treatment for high blood pressure and 22 per cent drop in the number of deaths from Coronary Heart Disease (CHD). Sodium restriction shown to lower blood pressure may also reduce long term risk of cardiovascular events (Cook et al., 2009).

Adequate dietary intake of potassium lowers blood pressure and is protective against stroke and cardiac arrhythmias. Potassium intake should be at a level which will keep the sodium to potassium ratio close to 1.0. A daily potassium intake level of 70 to 80 mmol per day. This may be achieved through adequate daily consumption fruits and vegetable (Welty et al., 2007).

The Heart Outcomes Prevention Evaluation trial (HOPE), a definite clinical trial relating vitamin E supplementation of cardiovascular diseases outcomes, revealed no
Effect of vitamin E supplementation on myocardial causes in men and women (Yusuf, 2000).

Etherton (1999) claimed that several large epidemiological studies have demonstrated that consumption of nuts was associated with decreased risk of coronary heart disease.

The novel variables reflecting insulin resistance and dyslipidemia, together with a low beta-carotene level, were found to predict heart failure independently of established risk factors and offer new approaches in the prevention of heart failure (Ingelson et al., 2006).

Experimentally induced acute hyperhomocysteinemia significantly decreased Coronary Flow velocity Reserve (CFR) and this decrease was significantly reserved by vitamin C administration. Oxidative stress is suggested to play a major role in the deleterious effects of homocysteine on the coronary microcirculation (Yamashita et al., 2005).

Folic acid supplementation significantly reduced the risk of stroke by 18 per cent. In the stratified analysis, a greater beneficial effect was seen in those trials with treatment duration of more than 36 months, a decrease in the concentration of homocysteine of more than 20 per cent. Hence, folic acid supplementation can effectively reduce the risk of stroke in primary prevention (Wang et al., 2009).

According to Rahimi et al. (2008), hypertension specially grade I and high blood pressure can be prevented and treated by an increase in intake of calcium (1200 mg/day) and potassium (4000 mg/day).

**Antioxidants**

Most research indicates that there are over all health benefits from antioxidant rich foods consumed in the diet. The results of clinical trails with antioxidant supplements provide conclusive indication of health benefits. Women who ate a heart healthy diet had more favourable baseline cardiovascular disease risk factor profile (Zaloga et al., 2006).
In the recent years, grape, an antioxidant fruit has been tried in the prevention and treatment of atherosclerotic disease. It is suggested that grape may support the medicinal therapies of the atherosclerotic patients and the prevention of atherosclerotic process in people who are at high risk for cardiovascular disease (Devrim et al., 2007).

Almonds Provide double-barreled Protection against diabetes and cardiovascular disease. Lessening after-meal surges in blood sugar helps protect against diabetes and cardiovascular disease, most likely by lessening the increase in cholesterol damaging free radicals that accompanies large elevations in blood sugar. This is one reason why low glycemic index diets result in lower risk of diabetes and heart disease. Almonds appear to not only decrease after meal rises in blood sugar, but also provide antioxidants to mop up the smaller amounts of free radicals that still result (Jenkins et al., 2007)

The vegetarians have a higher antioxidant status and low levels of n-3 fatty acids. It remains to be seen whether this alteration in the oxidant and anti-oxidant status and n-3 concentrations explains the lower incidence of cardiovascular disease and lower blood pressure in vegetarians (Manjari et al., 2005).

Phytochemicals found in whole grains may directly or indirectly inhibit oxidative stress and inflammation. Other bioactive components are believed to play a role in vascular reactivity, clotting and insulin sensitivity. Studies have not isolated the exact mechanisms for the positive effect of whole grain on cardiovascular health and it is likely that (as for fruit and vegetables) the whole grain ‘package’ is more protective than its individual components.

It was suggested that consumption of nuts can be recommended for the prevention of elevated lipids and cardiovascular disease, however, attention should be paid to the high dietary energy content of nuts and the negative effects of substances such as aflatoxins and allergens (Brehme, 2002).
Supplementation of antioxidant has a significant fall in total cholesterol, triglycerides, low density lipoprotein cholesterol very low density lipoprotein cholesterol and uric acid. After antioxidant supplement, rise in high density lipoprotein-cholesterol levels was noted in both the study groups as compared to controls and significantly low levels of antioxidant enzymes superoxide dismutase and catalase before supplementation of antioxidant tablets were observed. Results of this study, show that appropriate antioxidant therapy could be useful for hypertensives and obese to prevent various cardiovascular complications (Meena et al., 2008).

According to Mitra et al. (2009) the dietary pattern, eating and method of cooking vary in different parts of India. Currently, here is much controversy over the best balance in carbohydrate, fat and protein. Although dietary approaches differ in important aspects, they have recommendation in common being fibre rich whole grains, legumes, fresh fruits and vegetables, and fats mainly monounsaturated and polyunsaturated.

**Physical activity**

Lifestyle modification should include weight reduction, dietary prudence, regular exercise, ban on smoking and relaxation techniques (Baba et al., 2009). Atleast 80 percent of premature deaths from cardiovascular heart disease and strokes could be prevented through a healthy diet, regular physical activity and avoiding the use of tobacco.

Health strategies are recommended to reduce the risk of cardiovascular disease and improve the quality of life through the lifestyle management (Abalkahi et al., 2007). Frequent and regular physical exercise boosts the immune system, and helps prevent disease affluence such as heart disease, cardiovascular disease and obesity (Donaltella and Rebecca, 2005).

Both aerobic and anaerobic exercise, increase the mechanical efficiency of the heart by increasing cardiac volume (aerobic exercise) and myocardial thickness. By
doing meditation, the stress might reduce and prevent the lifestyle diseases (Winkelmayer et al., 2006)

Physical Inactivity is prominent in the casual constellation for factors predisposing to cardiovascular disease particularly ischemic heart disease (Khol, 2001). According to Ranheim and Halvorson, 2005, exercise can help to control cholesterol, obesity, high blood pressure, and diabetes. As a result, American Heart Association recommends 120 to 160 minutes per week of activities such as brisk walking, jogging, swimming and tennis.

Being physically active reduces the risk of developing coronary heart disease, stroke and type II diabetes by up to 50 per cent and reduces the risk of premature death by about 20 to 30 per cent. Regular moderate physical activity and meditation, yogasanas and pranayama may be synergistic in controlling mind-body interactions that are important in the pathogenesis of Cardiovascular disease (Singh et al., 2003).

Study findings were consistent with current physical activity recommendations, but opportunities for future research include improvements in measurement of walking and other cardiovascular disease risk factors, more through control for pre-existing illness, examination of mediating or moderating conditions such as obesity and other analytical issues (Mishra et al., 2009).

This is the first objectively monitored Randomised Controlled Trial (RCT) to show that moderate exercise can be successfully incorporated into working hours, to significantly improve physical capacity and cardiovascular health (Kaur, 2005).

Despite the benefits demonstrated for managing cardiovascular risks, gaps remain in primary care practitioner’s management of risk according to guideline recommendations. Innovative educational approaches that address barriers may facilitate the implementation of guidelines based recommendations in cardiovascular disease risk management (Sriratanaviriyakul et al., 2010).
Self monitoring strategies such as weighing on self, planning meals, tracking fat and calories, exercising 30 or more minutes daily and adding physical activity to daily routine may be important in successful weight loss. Leisure time activities such as lifting weights or cooking/baking for fun are common strategies reported by those who were successful weight losers (Schroder et al., 2008).

**Stress management**

Stress is considered as a contributing risk factor for heart diseases. The effects of emotional stress, behavioural habits and socio-economic status on the risk of heart disease and heart attack have not been proven. Stress also increase the amount of blood clotting factors that circulate in blood and makes it more likely that a clot will form. Clots may then block an artery narrowed by plaque and cause a heart attack. Stress may also contribute to other risk factors (Rudolph et al., 2007).

“Stress” response describes the condition caused by a person’s reaction to physical, chemical, emotional or environmental factors. Stress can refer to physical effort and mental tension. It is hard to define a high level of emotional or psychological stress to measure in a precise way. All people feel stress, but they feel it in different amounts and reach to it in different ways. Acute and chronic stress may affect other risk factors and behaviours such as high blood pressure and cholesterol levels, physical inactivity and over eating (Heidemann et al., 2008).

Major studies on stress in the work place are particular factors such as job strain and shift work. The effect of social class and gender on the incidence of cardiovascular diseases is also explored. Stress is an independent risk factor for the incidence and the course of cardiovascular disease (Karanja et al., 2007).

People when they are under stress, healthy eating habits can be difficult to maintain whether eating to fill an emotional need or grabbing fast food simply because there is no time to prepare something healthy, a stressed–out lifestyle is rarely a healthy one (Burke et al., 2008).
Stress raises blood pressure and increase the risk of having heart attack, stroke or other disease. It can add to waist line as well as storing more fat around middle due to chronic stress at work or home. Women often also use food as a distract or to cope with feeling such as loneliness, depression or anxiety.

Yoga has been recommended for the prevention and treatment of many medical conditions. There is some preliminary evidence that yoga can be helpful when it is practiced in addition to standard treatments for several conditions. These conditions include anxiety disorders or stress, asthma, high blood pressure, heart disease and depression (Nelson et al., 2002).

People with cardiovascular disease often have depression too (Ferketich, 2005). Being happy protects against cardiovascular mortality. Exercise and stress management training can reduce emotional distress and improve heart health more than usual medical care alone (Blumenthal et al., 2005).

Stress increases the risk of heart attacks and other cardiovascular problems by pushing people towards bad habits. Depressive disorder also have a significant impact on the outcome of medical illness such as cardiac diseases, diabetes and cancer (Porter, 2007). Acute and chronic stress may affect other risk factors and behaviours such as high blood pressure and cholesterol levels, smoking, physical activity and overeating (Hill et al., 2004).

The modern Indian women is subjected to excessive stress at home and at work so that their quality of life were changed. Rapid economic development, along with urbanization and its attendant major lifestyle changes are contributing more to heart diseases (Parikh, 2009).

There is a therapy which is purely natural and is considered to be the best weapon against stress and that is “Yoga”. According to Dave Costill, Ph.D, Professor Emeritus at Ball State University, fitness is the “ability to live your life without feeling fatigued”. Yoga practice involved daily morning and evening sessions of 90 minutes each. In this group, the maximal workout increased by 21 per cent oxygen consumption
per unit of work decreased, demonstrating an increase in cardio respiratory efficiency (Raju, 1997).

Yoga is a way to get to the source of ourselves. The challenge is not to see yoga as a treatment for disease, but as an opportunity to see something deeper in the self. To reconnect with the body is one way of artfully facing the reality of pain our life and a means for accepting and being in our lives more deeply (Hata et al., 2002).

Non communicable diseases like cardiovascular diseases among Asian Indian population have gained rapid momentum, both at the national and regional level. It was against this background that the present study was undertaken with the aim to study the prevalence of cardiovascular diseases among women and promote intervention strategies to the young women at high risk for developing cardiovascular diseases.