Review

Cardiovascular diseases in Saudi Arabia

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Cardiovascular diseases (CVD) involve cardiac arteries and veins. Although the term is technically applied to any disorders affecting cardiovascular system, it is usually referred to those related to atherosclerosis or arterial disease. These conditions have similar causes, mechanisms and treatments. Most countries face high and increasing rates of cardiovascular disease. Each year, mortality due to heart diseases exceeds that of cancer around the world. It is the principal cause of death and disability in the United States and most European countries. According to the latest WHO statistics, the vast majority of killer diseases in the Kingdom of Saudi Arabia (KSA) are non-communicable, chronic diseases. Of the 413 deaths per 100,000 in 2002, 144 (35 percent) were due to cardiovascular disease. Coronary heart disease constitutes one of the main health problems in Saudi Arabia, representing the third most common cause of hospital-based mortality second to accident and senility. By the time heart problems are detected, their underlying cause (atherosclerosis) is usually quite advanced, and had been progressed for decades. Vascular injury accumulates in adolescence, making it necessary for primary preventive measures to be taken from childhood. There is therefore increasing emphasis on preventing atherosclerosis by modifying risk factors, such as healthy diet, exercise and avoidance of smoking.

CVD symptoms

Cardiovascular disease is caused by narrowed, blocked or stiffened blood vessels such that the heart, brain or other parts of the body don't receive enough blood. Cardiovascular disease symptoms can include chest pain (angina), shortness of breath, pain, numbness, weakness or coldness in the legs or arms. Cardiovascular disease due to narrowing of blood vessels might not be diagnosed until underlying condition worsens to the point of heart attack, chest pain (angina), stroke, heart failure or sudden cardiac death. It is therefore important to watch for cardiovascular symptoms.

CVD risk factors

Of the numerous causes of CVD, the predominant ones identified are as follows: Obesity, hypercholesterolemia, diabetes mellitus, excessive food intake, smoking, hypertension and lack of physical activities. Herein, we review the contribution of each of these factors towards the existence of CVD in Saudi Arabia.

OBESITY

Obesity is an excessive accumulation of body fat and in its gross manifestation poses a real threat to health. It is the most prevalent, chronic medical condition in the developed, as well as in developing countries. It is well established that directly or indirectly obesity is associated with a wide variety of diseases such as non-insulin-dependent diabetes mellitus (NIDDM), cardiovascular diseases (CAD), hypertension, gall bladder diseases and certain types of cancer. The prevalence of obesity varies in different populations and further variations depend on age and sex. There are a number of etiological factors producing obesity and these include both genetic and environmental factors and hence it is classified as a 'multifactorial disorder'. Genetic susceptibility is necessary for the environmental factors to precipitate the development of obesity. Endocrine alterations are also an important cause of obesity but are rare, even though obesity influences the functions of the endocrine system. In addition, the distinct and changing economic, social, cultural and environmental factors play a significant role in the onset of obesity. A few recent studies have been carried out in Saudi Arabia and the prevalence of obesity, and overweight in the general population has been reported to be high both in Saudi males and females. A study by Malki et al. in 2003, showed that overweight and obesity are frequently encountered in Saudi females of childbearing age. The prevalence of overweight and obesity was higher.
amongst a group of married than among a group of single women.

This study was conducted on randomly recruited adult Saudi females of childbearing age. The results showed that the frequency distribution histogram of height, weight and BMI showed normal Gaussian distribution with skewness of 0.46, 0.62 and 0.82, respectively and having respective kurtosis of 0.77, 0.107, 0.862. When the females were grouped according to different ages, an increase in weight occurred from 56.3±12.2 kg in the 16–20 years to 77.4±11.4 kg in the 40–45 y age groups. A similar pattern was observed in females with BMI, which increased from 22.9±4.5 kg/m² in the 16–20 years to 30.96±4.57 kg/m² in those 40–45-years-old, and the correlation between age and BMI was statistically significant.

Interestingly, a significant difference was observed in regard to the single and married females especially those who were students. Among the single females only 20.5% were overweight, 9.12% were obese and 0.97% had morbid obesity, though in their married counterparts the frequency increased to 43.0%, 29.0% and 3.75%, respectively. The single females were younger than the married ones but still the difference between the prevalence of overweight and obesity was highly significant. Possible causes leading to overweight and obesity in the housewives may be due to the lack of physical activity, overeating, certain depressive states which are known to lead to eating disorder and hence obesity. Control of obesity is essential in order to prevent the development of other chronic diseases such as diabetes mellitus, hypertension and cardiovascular disease.

A study by Madani KA in 2000, highlighted the situation of obesity in Saudi Arabia. The prevalence of obesity ranged from 14% in children less than 6 years to about 83% in adults. Women were more prone to be overweight or obese than men. Several factors were reported to be associated with obesity in this country such as age, sex, socio-economic status, employment, education and parity. A survey carried out in this country utilizing the National Centre for Health Statistics Standards revealed 14% childhood obesity among newborn to six years of age. The tracking of body mass and obesity from childhood through adulthood implied that the genetic, behavioral and cultural factors involved in obesity operate early in life, can be identified in youth, and be intervened upon. The challenge for early identification and intervention has important public health implications.

In another study, Al-Nuaim et al., 1997, conducted a community-based national epidemiological household survey to estimate the prevalence of overweight and to examine its association with the socio-demographic characteristics for 10,657 Saudi subjects aged 20 years and over. The mean age was 35.8 ± 14.27 and 50.8% of the sample were males. The overall prevalence of overweight was 31.2%; it was 33.1% for males and 29.4% for females. For obesity, the overall prevalence was 22.1% (males 17.8% and females 26.6%). The multiple logistic regression analysis showed that age, residential area, region, income, gender, and education are statistically significant predictors of obesity. The prevalence of obesity was higher in females than males, lower in subjects living in rural areas with traditional lifestyles than those in more urbanized environments, and elevated with increasing age. The observed prevalence and pattern of overweight and obesity with age and gender is similar to those observed in the Arab community and some Western nations.

**HYPERCHOLESTEROLEMIA**

Hypercholesterolemia is the presence of high levels of cholesterol in the blood. It is not a disease but a metabolic derangement that can be secondary to many diseases and can contribute to many forms of disease, most notably cardiovascular disease. It is closely related to the terms “hyperlipidemia” (elevated levels of lipids) and “hyperlipoproteinemia” (elevated levels of lipoproteins), Durinngton 2003.

Elevated cholesterol in the blood is due to abnormalities in the levels of lipoproteins, the particles that carry cholesterol in the bloodstream. This may be related to diet, genetic factors (such as LDL receptor mutations in familial hypercholesterolemia) and the presence of other diseases such as diabetes and an underactive thyroid. The type of hypercholesterolemia depends on which type of particle such as low density lipoprotein is present in excess (Girard-Mauduit 2010).

The objective of the study of Al Nuaim et al., 1996 was to look at the pattern of serum total cholesterol concentration (TCC) distribution and the prevalence of hypercholesterolemia (HC) in Saudi Arabia. A cross-sectional national epidemiological household survey was carried out, consisting of 4539 Saudi subjects, over the age of 15 years. The sample was adjusted for gender, age, regional and residency, and urban versus rural population distribution. Height, weight, calculation of body mass index (BMI) and random blood samples for total cholesterol measurements were determined for each subject. It was found that the mean TCC for all females was significantly higher than for males (4.24 versus 4 mmol/l). The mean TCC of females, aged 40-59 years was higher, but not significantly so, than for males (4.5 versus 4.4 mmol/l). There was a progressive increase in TCC with age, reaching a maximum at the fifth and sixth decades for males and females, respectively. There was a progressive rise in mean TCC with increasing BMI values for males and females with higher mean TCC for females for any given BMI value. The prevalence of HC, 5.2-6.2 mmol/l, was 9% and 11% for all males and females respectively (P = 0.74), whereas in regard to HC, > 6.2 mmol/l the respective values were 7% and 8% for males and females (P = 0.52). The prevalence of HC 5.2-6.2 mmol/l for those aged 40-59 years was 14% and 10%
for males and females respectively (P = 0.67), whereas the prevalence of HC> 6.2 mmol/l was 9% and 11% for males and females respectively (P = 0.6). There was a progressive increase in HC prevalence with age for males and females. The prevalence of HC > 5.2 mmol/l rose with increasing BMI values. The prevalence of HC in females was significantly higher than for males among normal weight groups. The prevalence of HC for females was higher, however, not significant than that for males among overweight and obese groups. The prevalence of HC, whether for males or females, was higher among diabetics when compared with non-diabetic subjects. The prevalence of HC (> 6.2 mmol/l) among males was higher for smokers compared with non-smokers. It was concluded that Saudi subjects have lower prevalence of HC than the European and American populations. This can partially be explained by the younger age of the population. The prevalence of HC is likely to increase in the near future with increasing age in Saudi Arabia, and longer exposure to the acquired western lifestyle and nutritional habits, evidenced by rising trend of obesity. The cause of coronary heart disease is multifactorial, with HC being one of the main contributors. Therefore, there is a need to study, in detail, the prevalence of other risk factors, including obesity, smoking, hypertension. There is a need to promote health awareness among the population with an emphasis on controlling weight and periodic monitoring of cholesterol levels.

DIABETES MELLITUS

Abundant evidence shows that patients with type 1 diabetes or type 2 diabetes are at high risk for several cardiovascular disorders including coronary heart disease, stroke, peripheral arterial disease, cardiomyopathy and congestive heart failure. Cardiovascular complications are now the leading causes of diabetes-related morbidity and mortality (Grundy et al., 1999). The public health impact of CVD in patients with diabetes is already enormous and is increasing. Several explanations are as follows. First, the incidence of diabetes rises with advancing age, and the number of older people in the United States is growing rapidly. Second, insulin treatment for persons with type 1 diabetes has prolonged their lives significantly, and by each year comes an increased risk for CVD complications. Third, type 2 diabetes occurs at an earlier age in obese and overweight persons, and the prevalence of obesity is rising in the United States. The risk for diabetes in overweight persons is heightened by physical inactivity; unfortunately, the majority of Americans engage in little regular or sustained physical activity. Fourth, the populations that are particularly susceptible to diabetes—African Americans, Hispanics, Native Americans, Pacific Islanders and Asians are growing in the USA (Diabetes mellitus 1999). Fifth, improved medical care, particularly when extended to susceptible populations, will bring an increasing number of patients with type 2 diabetes into the medical care system. All of these factors will lead to an absolute increase in the number of patients who will require medical intervention to prevent the complications of diabetes.

Diabetes has long been recognized to be an independent risk factor for CVD. The adverse influence of diabetes extends to all components of the cardiovascular system including the microvasculature, the larger arteries and the heart, as well as the kidneys. Because of the increasing prevalence of diabetes in the society, it now rivals cigarette smoking, hypertension and cholesterol disorders as major risk factors for CVD. It is a particularly strong risk factor among women and the growing elderly population. In recent years, the National Institutes of Health, through programs of the National Heart, Lung and Blood Institute and the National Institute of Diabetes and Digestive and Kidney Diseases, has substantially increased research on cardiovascular complications of diabetes (Grundy et al., 1999).

An important reason to become more aggressive about the cardiovascular complications of diabetes resides in the positive results achieved in recent clinical trials. Recent controlled trials of cholesterol-lowering therapy, particularly secondary prevention trials, showed that reducing low-density lipoprotein cholesterol levels results in a striking decrease in major coronary events in patients with type 2 diabetes. Blood pressure-lowering trials, such as the Systolic Hypertension in the Elderly Program (SHEP) and the United Kingdom Prospective Diabetes Study (UKPDS), likewise has shown a reduction in cardiovascular events in patients with diabetes comparable to benefits found in those without diabetes. The Diabetes Control and Complication Trial (DCCT) showed that improved glycemic control can prevent or reduce microvascular disease and may reduce macrovascular disease in patients with type 1 diabetes. The UKPDS demonstrated similar benefits in decreasing microvascular disease by controlling hyperglycemia in patients with type 2 diabetes and also reported that glycomic control probably reduces macrovascular disease. These positive results call for the cardiovascular community to aggressively treat the cardiovascular risk factors often seen in people with diabetes as well as to ensure that their patients with diabetes are supported in their efforts to maintain tight control of their blood glucose. Overall, results of these trials provide strong evidence that comprehensive risk factor control with drugs and other methods available today will substantially reduce the macrovascular complications of diabetes. (Diabetes mellitus 1999).

Closely linked to type 2 diabetes is the metabolic syndrome, the clustering of several metabolic risk factors. These risk factors are associated with insulin resistance, which is related to coronary heart disease and diabetes. Cardiovascular risk factors often seen in conjunction with the metabolic syndrome include hypertension,
Cigarette smoking is the most important preventable cause of premature death in the United States. It accounts for more than 440,000 of the more than 2.4 million annual deaths. Cigarette smokers have a higher risk of developing several chronic disorders. These include fatty buildups in arteries, several types of cancer and chronic obstructive pulmonary disease (lung problems). Atherosclerosis (buildup of fatty substances in the arteries) is a chief contributor to the high number of deaths from smoking. Many studies detail the evidence that cigarette smoking is a major cause of coronary heart disease, which leads to heart attack (World Health Organization 2010).

Cigarette smoking increases the risk of coronary heart disease by itself. When it acts with other factors, it greatly increases risk. Smoking increases blood pressure, decreases exercise tolerance and increases the tendency for blood to clot. Smoking also increases the risk of recurrent coronary heart disease after bypass surgery. Cigarette smoking is the most important risk factor for young men and women. It produces a greater relative risk in persons younger than and in those over 50 years. Women who smoke and use oral contraceptives greatly increase their risk of coronary heart disease and stroke compared with nonsmoking counterparts who use oral contraceptives. Smoking decreases HDL cholesterol.

Studies show that cigarette smoking is an important risk factor for stroke. Inhaling cigarette smoke produces several effects that damage the cerebrovascular system (World Health Organization 2010). Women who take oral contraceptives and smoke increase their risk of stroke many times. Smoking also creates a higher risk for peripheral arterial disease and aortic aneurysm. The link between secondhand smoke (also called environmental tobacco smoke) and disease is well known, and the connection to cardiovascular-related disability and death is also clear. About 22,700 to 69,600 premature deaths from heart and blood vessel disease are caused by other people’s smoke each year. (World Health Organization 2010).

According to a study by Jarallah et al., in 1999 in a Jordanian population, the overall prevalence of smoking was 21.1% for males and 0.9% for females. Most smokers (78%) were young to middle-aged (21–50 years-old). Smoking prevalence was higher among married couples, among uneducated, and in those of certain occupations such as manual workers, businessmen, army officers and office workers. A recent study by Abu Baker et al., 2010, compared the frequency of cigarette smoking before and after diagnosis of coronary heart disease (CHD). They found the reasons for not quitting smoking, resources of advice about quitting, and investigating the relationship between smoking behavior and demographic variables. The study comprised a total of 300 CHD patients from cardiac outpatient clinics. Before disease occurred, non-smokers included 40%, former smokers 11.7%, and current smokers 48.3% of all participants. Surprisingly, after disease developed only 29.7% of the patients quit smoking, while 60.7% did not, and 9.6% resumed smoking. The most frequent answers given by 25.6% of smokers were “not willing to stop” and by 25% “craving for a cigarette”. Doctors had most frequent impact on individual's decision to quit smoking (19.0%). The results of this study provide important baseline information about frequency of smoking before and after diagnosis of (CHD) and detect the reasons for discouraging the patients from smoking and the resources available to patients that might help them quit smoking. Smoking prohibition programs among CHD patients should be introduced in both medical and nursing curricula in Jordan. The mass media should be reinforced in their role regarding health promotion in general and smoking prohibition programs in particular. Also, strategies and strict policies should be introduced to
maintain hospitals and medical centers as non-smoking environment, a measure to further encourage a smoking-free society.

**HYPERTENSION**

Hypertensive heart disease is the prime cause of death associated with high blood pressure and is actually a group of disorders that include heart failure, ischemic heart disease and left ventricular hypertrophy (excessive thickening of the heart muscle). Heart failure does not mean the heart has stopped working. Rather, it means that the heart's pumping power is weaker than normal or the heart has become less elastic. With heart failure, blood moves through the heart and body less effectively and pressure in the heart increases. As a result, the heart cannot pump enough oxygen and nutrients to meet the body's needs. The chambers of the heart respond by stretching to hold more blood to pump through the body. This helps to keep the blood moving, but in time, the heart muscle walls weaken and are unable to pump as strongly. As a result, the kidneys often respond by causing the body to retain fluid (water) and sodium. If fluid builds up in the arms, legs, ankles, feet, lungs, or other organs, the body becomes congested, and congestive heart failure is the term used to describe the condition. High blood pressure brings on heart failure by causing left ventricular hypertrophy, making it difficult to fill the heart (Sowers et al., 2001).

High blood pressure can also cause ischemic heart disease. This means that the heart muscle is not getting enough blood. Ischemic heart disease is usually the result of atherosclerosis or hardening of the arteries (coronary artery disease), which impedes the blood flow. This can progress to a heart attack.

Ironically, despite the increased prevalence of hypertension and its associated complications, studies have shown that control of the disease is far from adequate. It is important for health care providers to know that adequate control of hypertension is a target that is likely to be difficult to achieve. Enforcing compliance with dietary restrictions and pharmacological therapy is a pivotal step in the management of hypertension. However, the knowledge of hypertension is derived mainly from studies conducted outside KSA, hence, the need for local data is vital in evaluating hypertension as a health problem in KSA.

Previous studies on the prevalence of hypertension in KSA have demonstrated persistently increasing figures. This increase is attributed to several reasons such as lifestyle change in KSA towards urbanization, adopting dietary eating habits that are likely to result in hypertension and increasing prevalence of obesity (Statistical Yearbook, 2004).

The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC VII) identifies hypertension if blood pressure (BP) is ≥140/90 mmHg. Furthermore, individuals with a systolic blood pressure (SBP) of 120-139 mmHg or a diastolic blood pressure (DBP) of 80-89 mmHg should be considered as prehypertensive and require health-promoting lifestyle modifications to prevent CVD as indicated by JNC VII (The Sixth Report of the Joint National Committee on Detection, Evaluation, and Diagnosis of High Blood Pressure (JNC VI) 1997).

A study by Mansour et al., 2007, showed that the prevalence of IS, ID and CSD hypertension was 5.3%, 8.3% and 12.5% respectively, in crude terms, while after age adjustment, it was 4.9% 7.9% and 11.2% respectively. The prevalence of hypertension defined as either IS, ID, or CSD was 26.1% in crude terms and 24% after age adjustment. For males, the prevalence of IS, ID and CSD hypertension was 5.7%, 9.6% and 13.4%, respectively. For females, the respective values were 5.0%, 7.1% and 11.8%, which were significantly lower than males (p<0.001). However, after age adjustment the prevalence of IS, ID and CSD for male subjects was decreased to 4.5%, 9.2% and 10.7% respectively, while females adjusted figures remain almost unchanged. The prevalence of IS hypertension doubled for each 10 years with increment in age for both men and women. The prevalence of ID hypertension increased for younger age groups (30-39, 40-49 years) and decreased for the eldest age group (60-70 years). The prevalence of CSD hypertension showed a progressive increase corresponding with increasing age. The urban population showed significantly higher prevalence of hypertension (27.9%), compared with that of rural inhabitants (22.4%, p<0.001). Eastern region's subjects showed significantly higher level of hypertension prevalence (34.6%) compared with other regions. Furthermore, subjects from the southern region showed the lowest prevalence of blood pressure (20.3%).

Twenty-nine percent of low income (<Saudi riyal 2,500) group showed significantly higher prevalence of hypertension reaching 29%, whereas, higher income level (Saudi riyal 5,000 – 7,499) group showed the lowest prevalence of hypertension (22.1%). These differences were statistically significant (p<0.001).

With respect to educational level, the highest prevalence of hypertension (30%) was found among illiterate subjects, while among those with higher education, the prevalence of hypertension was significantly lower at 20% (p<0.001). Subjects living in sumptuous places had the highest prevalence of hypertension (29.3%), while those living in mud houses had prevalence of 20.8%; the difference was statistically significant (p<0.001). Seventy-five percent of people who gave history of hypertension and on regular treatment were found to have BP ≥140/90 during data acquisition; this indicates that only 25% were having controlled hypertension. However, 66.9% of hypertensive patients who denied history of having hypertension were actually found to be hypertensive.

The reported prevalence of hypertension in Saudi
Arabia is in keeping with increasing prevalence of hypertension worldwide. Studies from various parts of the world showed that adult hypertension was found in 26.6 - 28.5% in Kuwait, 16.1 - 16.3% in Jordan (according to old definition of hypertension ≥160/90) and 24% in Haiti. Among 314 subjects aged 40-60 years in India the reported prevalence of hypertension of 54.5% is rather striking (56.3% among men and 52.3% among women) demonstrating the increasing prevalence of hypertension worldwide? Another study from Hungary on 21,800 individuals aged 30-65 years, reported an overall prevalence of hypertension of 37%. In nearby state of Qatar, the overall prevalence of hypertension was reported to affect 32.1% of studied population aged 25-65 years.

Overall, 26.4% of the world’s adult population in 2000 had hypertension (26.6% of men and 26.1% of women), and it is expected that by the year 2025, approximately 1 in 3 adults aged over 20 years will have hypertension, based on data from 30 surveys that reported the prevalence of hypertension between the years 1980 and 2002. Moreover, Egyptian National Hypertension Project reported 26.3% estimated prevalence of hypertension in Egypt. A more recent survey from China on 15540, subjects aged 35 - 74 years, revealed 27.2% hypertension prevalence in Chinese adult population.

The eastern region of Saudi Arabia showed the highest prevalence of hypertension compared with other regions. Furthermore, hypertension is more prevalent among urban population that is probably explained by lifestyle and eating habits compared with rural population. It is likely that urbanization carries with it sedentary lifestyle with less physical activity that leads to an increase in prevalence of obesity as well as hypertension prevalence in a linear relationship (Bener et al., 2004). Several studies strongly support the concept that multiple dietary factors affect BP and adopting healthier dietary habits can substantially reduce hypertension. Moreover, it has been shown that comprehensive lifestyle modification is feasible and has beneficial effects on BP reduction.

The nutritional problems in Saudi Arabia are mainly due to a change in eating habits, illiteracy and ignorance, rather than a shortage of food supply or low income. Therefore, it is essential for all people to consume a balanced diet which will provide the dietary requirements of all nutrients. Perhaps behavior modification with respect to food intake will be effective in the treatment of obesity, especially in Saudi Arabia. Strenuous physical activity should be encouraged as a strategy directed towards weight reduction in the obese, as well as prevention of obesity in the Kingdom. Studies are needed to determine the cultural influences in developing obesity. Knowledge of the social factors associated with obesity will help identify high risk groups. Certainly public health measures should focus on all members of society (i.e. in schools, via newspapers, TV, radio, etc.) to discuss the health hazards of being overweight.

REFERENCES