Selected Risk Factors for Cardiovascular Disease among Saudi Men

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A total sample of 690 male Saudi faculty members of King Saud University were screened for blood parameters (total cholesterol TC, high density lipoprotein cholesterol HDL-C, low density lipoprotein cholesterol LDL-C, blood triglycerides (TG), blood sugar (BS)), and for systolic and diastolic blood pressure (SBP,DBP) in order to investigate the coronary heart disease risk factors (CHDRF) in a fairly sedentary affluent segment of the society. Mean values of these parameters were within normal ranges, however calculated mean body mass index (BMI,kg/m2) have indicated prevalence of overweight among the cohort. High blood pressure SBP > 160 mm Hg was not prevalent among younger participants age< 35, nor among normal weight BMI<25. About 4.3% of the total population studied showed this elevation. However, 14.5% of the group were with a raised DBP (>90mm Hg). Similar percentages of those with elevations in blood lipids and glucose were observed. The importance of public awareness, at all socio-economic levels, in regard to the cardiovascular (CVD) risk factors, related lifestyle, and food consumption patterns are therefore recommended.

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Cardiovascular disease (CVD) is the main cause of death in Saudi Arabia and other Arab Gulf countries[1]. Epidemiological studies showed various potential risk factors predisposing an individual to CVD; these include the predictable modifiable variables such as dietary habits, lifestyle, elevated serum lipids, lipoproteins, hypertension, glucose intolerance, obesity, cigarette smoking and physical inactivity, and the unmodifiable factors such as gender and age[2-5]. The differential effects of blood pressure and body weight on the risk of CVD have long been established[6]. Obesity has been incriminated as a risk factor in several chronic disorders such as CVD, diabetes mellitus (DM) and hypertension (HT)[7-11].

In the Arabian Gulf States the rapidly increasing wealth may have eliminated the manifestations of under-nutrition but at the same time, has resulted in what is termed as "malnutrition of affluence". Chronic disorders such as CVD, CHD, obesity, diabetes and certain types of cancer have become major causes of morbidity and mortality resulting from drastic changes in lifestyle and dietary habits of people of the region[12].

However,in the affluent Gulf countries measures against clinical metabolic disorders have not been developed in a national programme. Most programmes are hospital-based and are restricted to treatment, rehabilitation and to a lesser extent dietary counselling. In some Gulf countries like Saudi Arabia, Kuwait and Bahrain, nutrition focal points have been stepped up towards foundation of preventive programme at national level, as yet not established, to combat such disorders primarily by public awareness and education in regard to potential risk factors.

The present paper aims to find out some of the risk factors for CVD among Saudi men working in King Saud University.

METHODS

Participants

Six hundred and ninety (690) Saudi men who are staff members of King Saud University participated in the study. The participants were invited by mail to visit a mobile research unit stationed at different sites of King Saud University. Each participant completed a standardised questionnaire. The questionnaire included demographic background, health history and lifestyle information.

Anthropometric measurements

Standing height without shoes was measured to the nearest 0.1 cm using a stadiometer attached to the weighing scale. Body weight was measured with as few clothes as possible on a calibrated scale (10 x 0.5 kg, 260 x 116) (Dong Fang MC86, 00000275) accurate to 0.2 kg. Body mass index (BMI) was then calculated to find out the obesity among participants.

Biochemical measurements

All participants were requested to fast 12 hours before blood measurements. Total Cholesterol (TC), high density lipoprotein cholesterol (HDL), low density lipoprotein cholesterol(LDL), blood sugar (BS) and triglyceride (TG) were measured immediately at the screening sites using the Boehringer Mannheim Reflotron and the associated materials (2368802 Boehringer Mannheim Gmbh). The Reflotron procedure consist of collecting blood from volunteers using finger tip puncture. An autoclix was used to puncture the tip of thumb, after sterilizing with a swab containing 70%

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isopropnol. Blood was than drawn using special ring caps reflotron 32 ul capillary tubes; it was then applied on the special test strip, and later inserted into the reflotron measuring chamber for the determination of blood parameters. Blood pressure was measured using digital blood pressure meter (UA-751). The average of three readings taken from a 10 minute resting participant was considered for each of systolic and diastolic blood pressure (SBP and DBP).

Statistical analysis

Data were analysed at the main computer centre at King Saud University. Means, standard deviations and Duncan groupings as well as Pearson's Correlation coefficients were used for statistical tests[13].

RESULTS

Means and standard deviations (SDS) for selected risk factors for CVD are presented in Table 1. The mean age was 40.2 years (± 5.8). Weights of participants ranged from 50-135 kgs (mean +SD 78.9 ± 12.5) while their heights varied from 1.56 m to 1.9 m with an average of 1.72 ± 0.42 m. Mean calculated BMI (Kg/m2) was 26.7± 5.8; BMI was divided into two categories <25 and >25 defined as normal, and overweight and/or obese, respectively. Similarly age was classified into <35 and ≥35 years.

Table 1. **Mean values and standard deviations of selected cardiovascular risk factors among Saudi men**

Parameters	Mean (SD)
Age (yr)	40.2 ± 5.8
Weight (Kg)	78.9 ± 12.5
Height (m)	1.72 ± 0.42
BMI (Kg/m2)	26.7 ± 5.8
SBP (mm Hg)	127.4 ± 12.9
DBP (mm Hg)	82.1 ± 11.8
TC (mg/dl)	183.1 ± 41.4
HDL-C (mg/dl)	37.8 ± 10.1
LDL-C (mg/dl)	148.4 ± 16.8
TG (mg/dl)	156.4 ± 90.2
BS (mg/dl)	88.8 ± 28.4

age difference, in the same order. However, there were insignificant increases of SBP, DBP and BS as a result of increased BMI and advanced age, and there was a decrease in HDL.

Percent prevalence by BMI and age of selected risk factors are presented in Table 3. Participants with BMI <25 and those with age <35 years did not show any pronounced elevation in SBP (>160 mm Hg), while 4.3%, 5.6% and 7.1% of the whole population, of those with BMI ≥25 and of those aged ≥35 years were having this elevation, respectively. The percentages of participants with borderline high systolic blood pressure (160>SBP>140 mm Hg) in the whole population, in BMI <25 group, in BMI ≥25 group, in age <35 group and in the age ≥35 group, were 8.7%, 6.7%, 9.3%, 9.4% and 8.2% respectively. The proportion of those with DBP >90 mm Hg showed a similar trend of increases with increasing BMI and advanced age, the only difference being that, in both BMI <25 and age <35 years groups some participants were having elevated (>90 mm Hg) DBP (10% and 7.5%) compared to none with SBP elevations in these groups.

TC >220 mg/dl (<5.2mmol/L) was observed in 15.2% of the whole population, in 6.7% of BMI <25 group and in 9.4% of age <35 years group compared to 17.6% in BMI ≥25 and 18.8% in age ≥35 years groups.

TG > 150 mg/dl exhibit a similar trend in respective groups, the percentage of those with elevated TG doubling in some groups (41.7% in BMI >25 groups Vs. 20% in BMI <25 group). Age ≥35 years group had the highest percentage of those with elevated BS (>120 mg/dl) (14%) compared to 3.8% in age <35 years group. The proportion was 11.1% in BMI ≥25 group compared to 6.7% in BMI <25 group.

In Table 4 the overall simple linear correlation coefficients between the selected variables (SBP, DBP, TC, TG and BS) and BMI and age are calculated. SBP and DBP were not significantly correlated with BMI while they were highly positively correlated to age (r= 0.323, P< 0.0001). TC, TG and BS were significantly positively inter related with BMI at P-values <0.05, <0.01 and 0.008 respectively. However, though TC and BS were significantly correlated with age at P <0.05 and <0.03, respectively, TG was correlated with

Table 2. **Means and standard deviations of risk factors in male staff of King Saud University by BMI and age**

Risk Factors	BMI (Kg/m²) <25 No=150	BMI (Kg/m²) ≥25 No=540	P value	Age (yr)* <35 No=265	Age (yr)* ≥35 No=425	P value
SBP	122.8±10.8	127.3±14.9	NS	123.8±10.7	128.0±15.9	NS
DBP	79.2± 7.0	81.9±13.9	NS	78.9± 8.2	82.9±14.9	NS
TC	159.9±37.6	188.4±45.8	0.005	170.8±40.3	189.4±47.4	0.04
LDL-C	121.8±26.8	142.6± 8.0	0.006	132.7±23.7	153.7±17.2	0.005
HDL-C	38.1±14.2	35.0± 8.7	NS	38.1±17.8	35.7± 9.2	NS
TG	115.2±41.1	167.2±102.7	0.02	131.1±59.7	171.4±109.3	0.01
BS	95.1±21.2	100.2±29.0	NS	95.45±23.7	101.4±29.5	NS

NS - Not statistically significant

Means and SD values of the blood indices by BMI and age are shown in Table 2. SBP, DBP and HDL and BS did not show any significant differences with increased BMI or advanced age, while TC, HDL and TG have had significant differences at P-values <0.005, <0.006 and <0.02 with BMI, respectively, and at P-values <0.04, <0.005 and <0.01 with age, indicating that in this group dietary patterns and fat intake together with BMI may have been the determinant factors in triglyceride levels.

DISCUSSION

About 4.3% of our whole population possibly having elevated blood pressure (SBP >160 mm Hg) and/or just can be called

Table 3. **Percent prevalence of selected risk factors in male staff of King Saud University by BMI and age**

Risk factor	Whole population No. 690		BMI <25 No=150		BMI ≥25 No=540		Age <35 No=175		Age ≥35 No=425	
	No.	%	No.	%	No.	%	No.	%	No.	%
SPB (mm Hg)										
SBP>160	30	4.3	0	0.0	30	5.6	0	0.0	30	7.1
160>SBP>140	60	8.7	10	6.7	50	9.3	25	9.4	35	8.2
SBP<140	600	87.0	140	93.3	460	85.2	240	90.6	360	84.7
DBP (mm Hg)										
DBP>90	100	14.5	15	10.0	85	15.7	20	7.5	80	18.8
90>DBP>80	200	29.0	30	20.0	170	31.5	85	32.1	115	27.1
DBP<80	390	56.5	105	70.0	285	52.8	160	60.4	230	54.1
TC (mg/dl)										
TC<220	585	84.8	140	93.3	445	82.4	240	90.6	345	81.2
TC>220	105	15.2	10	6.7	95	17.6	25	9.4	80	18.8
TG (mg/dl)										
TG<150	580	84.1	120	80.0	315	58.3	195	73.6	240	56.5
TG>150	110	15.9	30	20.0	225	41.7	70	26.4	185	43.5
BS (mg/dl)										
BS<120	620	89.9	140	93.3	480	88.9	225	96.2	365	85.9
BS>120	70	10.1	10	6.7	60	11.1	10	3.8	60	14.1
SBP>160; DBP>90 mm Hg	30	4.3	-	-	-	-	-	-	-	-

Table 4. **Simple correlation coefficients coronary risk factors with BMI and age in male staff of King Saud University**

Risk factor	BMI r	BMI P	Age r	Age P
SBP	0.1409	NS	0.3230	<0.0001
DBP	0.1139	NS	0.2031	<0.02
TC	0.1642	<0.05	0.1694	<0.04
TG	0.2159	<0.010	0.1466	<NS
BS	0.2251	<0.008	0.1808	<0.03

NS = Not significant

hypertensive since they were 14.5% subjects with DBP >90 mm Hg, also defined as hypertensive. As concluded from the results in Table 3, prevalence of high blood pressure (SBP>160 and DBP >80) increased with increasing BMI and advanced age. The percentage of those with high blood pressure in our study were considerably higher than those for males studied by Al-Nozha et al[14] in Riyadh region in a community based epidemiological study. However, their population included 45.3% of those age <15 yr, half of which were females. Another factor that might have accounted for this difference was that our participants were from an affluent high income sedentary group of the society. On the other hand 9.1% (greater than in our study, 4.3%) of the total Kingdom of Saudi Arabia population sample (19,598 persons, 57% females) screened in the national nutritional survey[15] were shown to have SBP >160 mm Hg while those with DBP >95 constituted 8.73% compared to 14.5% in our study group. Al-Shammari et al[16] have found high blood pressure to be prevalent in 11% among 1005 attendants (aged <35 to >65 yr) of the family practice clinic of King Fahd Hospital screened for serum lipids and blood sugar. Al-Shagrawi and Al-Shayeb have found 1.2% and 4.1% male King Saud University students screened for total cholesterol, to have SBP >160 and DBP >90 mm Hg respectively[17]. Hakim et al[18] who have found hypertension prevalence in 16% of acute myocaridal infarctions (AMI) in Saudi patients, concluded that this disease occurs mainly in middle aged and elderly males, however they stated that young males are also afflicted[18]. Hypertension prevalence in Saudis in Assir region at the primary health care (PHC) level was found to be 2.5% (SBP >160 and/or DBP >95 mm Hg)[19]. It is worth mentioning that people of this region are still unchanged, living in a traditional society and may be remarkably free of risk factors.

It has been stated that unusual DBP is positively related to the risks of stroke and of CVD, not only among those who might be considered "hypertensive" but also among those who would usually be considered normotensive, thus the lower the level through out the range (70-110 mm Hg) the lower the risk of these diseases[20]. Therefore the hypertension prevalence, and/or the borderline high blood pressure observed in the above mentioned and compared studies emphasises the need for an effective assessment of the epidemiological information, as a potential tool for the prevention of CVD at the earliest stages.

In the population study "evaluation of the nutritional status of the people of Saudi Arabia", 38.4%, 28.2% and 12.9% of the sample were having TG >150 mg/dl, TC >200 mg/dl (5.2 mmol/l) and BS >110 mg/dl respectively[15]. Similarly

in the attendants of King Fahd Hospital, diabetics, hypertensive, diabetics and hypertensive, overweight and/or obese, and those with other health problems with TC >250 mg/dl (5.2 mmol/l) were 13.2%, 10.8%, 14.1%, 10.6% and 7.1% respectively[16]. Surprisingly and at the same time the percentage of our participants were not complaining of the above mentioned diseases, yet their cholesterol elevation (>220 mg/dl (5.2 mmol/l) was higher than the percentages of the above diseased groups. However, those with elevations TG (15.9%), TC (15.2%) and BS (10.1%) in our study, were lower than their corresponding groups in the national nutritional study[15].

Ahmed et al[20] have studied the incidence of coronary heart disease (CHD) risk factors in Saudis in Al-Madina Al-Munawwarah[21]. Their patients were with risk factors more frequently found than in controls (hypertension (HT) in 42%, diabetes mellitus in 41% and high TG in 32%). They concluded that in the Saudis they studied, hypertension, diabetes mellitus and smoking, were consistently associated with coronary heart disease (CHD). Of plasma lipids hypertriglyceridemia (a controversial independent risk factor)[22,23] was also consistently related to CHD whereas plasma levels of other lipids showed no such association.

Desirable blood cholesterol level is defined as 200 mg/dl (5.2 mmol/l), and those from 200 to 239 mg/dl (5.2 - 6.2 mmol/l) as border-line. The cut-off point that defines high blood cholesterol (240 mg/dl (6.2 mmol/l) is the value above which risk for CHD rises more steeply[24]. It was suggested that relative risk of CHD conferred by an elevated cholesterol is weaker in elderly than in young or middle aged adults, yet a high cholesterol level leads to more CHD events in the elderly[24]. Thus a high percentage of our participants may have been threatened in both situations being middle-aged advancing towards old age, and moreover afflicted by other risk factors, (overweight and/or obesity, hypertriglyceridaemia and hyperglycemia).

Regardless of the prevalence of obesity among our study group, the presence of a remarkable percentage of overweights (78.1%) constitutes an alarming signal of the possible dangers of this disorder and its complications, viewed with the high vulnerability to CHD enacted by the socioeconomical and lifestyle factors.

Al-obaid et al[24] have found the CHD deaths in the Eastern Province of Saudi Arabia to be 26% (proportionate mortality rate (PMR) of the total deaths), and male CHD deaths to be 27% of total male deaths. Similarly, Musaiger and Abdulla[25] found that diseases of the circulatory system were responsible for about 26.5% of the deaths in Bahrain with CHD and hypertension being the leading causes of these deaths. It has been reported that more than one third (37%) of the mortalities were due to CVD[26].

It was said that using blood pressure to screen for persons at high risk of stroke would be quite effective, as 57% of the incidence of atherothrombotic brain infarction at Framingham arises in the 19% of the population having a systolic blood pressure of 160 mm Hg or greater. The statistics of hypertensive heart disease were also similar. Overall, 36.2% cases of CVD occurring in a 2 year period arise in the group of persons whose SBP >160 mm Hg[27].

There is still however, greater need for better understanding of the dietary and other determinants of population blood pressure levels. Likewise prevention of disease entails accurate identification, diagnosis evaluation of co-existing controllable risk factors such as raised TC, raised LDL and/or decreased level of HDL.

Prevention of CHD and CVD requires intervention as early in life as possible. Reduction of risk factors in middle age may be too late to achieve maximal, or indeed any, benefit in terms of progression of underlying disease. Thus emphasis should be to promote good dietary habits and lifestyle (eg. diet low in animal fat, less total fat, exercise etc.) and preventing bad habits (eg. smoking etc).

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