Full Length Research Paper

Social stratification predicts the risk of ischemic heart disease: A cross sectional study in Pakistani population above 40 years

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This study was designed to investigate risk of ischemic heart disease in different social classes of healthy Pakistani population above 40 years of age. We stratified healthy Pakistani population into 5 social classes according to their lifestyle and work profile. Different baseline parameters and serum markers were measured to investigate risk factors and to determine the risk of ischemic heart disease (IHD) over next 10 years in different social classes. Baseline measurement of IHD risk factors were obtained from 100 healthy volunteers (age range >40 years). Physical and biochemical parameters namely fasting blood sugar (FBS) levels, total cholesterol (TCH), high density lipoprotein (HDL), triglycerides (TG), low density lipoprotein (LDL), body mass index (BMI), systolic and diastolic blood pressure were investigated. The volunteers were divided into five social classes on the basis of their job profile and lifestyle. IHD risk calculation was done with risk prediction chart for non-diabetic patients as recommended by British heart association. The mean value of serum cholesterol in healthy volunteers was 195.43± 5.22 mg/dl, mean TG, 250.4± 12.4 mg/dl, mean HDL, 83.63± 5.32 mg/dl, mean LDL, 113.88± 4.42 mg/dl, mean FBS, 85.66± 2.98 mg/dl and for the mean BMI was 24.61 ± 0.410 Kg/m². Our data shows that social class IV (labors and hard workers) has significantly lower BMI as compared to class I, II and III and significantly lower FBS as compared to class I. Social class V (farmers) has significantly lower total cholesterol as compared to class I and II and TG in class III were lower as compared to class I. Cumulative IHD risk >30% over next 10 years was significantly lower in class V as compared to class I (p-value <0.05). Cumulative IHD risk >30% over next 10 years was 10% in Pakistani population. Social class V has significantly lower IHD risk >30% over next 10 years.

Key words: Ischemic heart disease, body mass index, lipid profile, social classes.

INTRODUCTION

Ischemic heart disease (IHD) is a general term, which refers to narrowing of the major coronary arteries leading to ischemia in the region of supply. Ischemic heart disease is also known as coronary artery disease (CAD) or atherosclerotic coronary artery disease (McPhee et al., 2011). Ischemic heart disease is a form of heart disease

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with primary manifestations that result from myocardial ischemia and may lead to myocardial infarction and abnormal functioning of the heart. This term encompasses a spectrum of conditions, ranging from the asymptomatic preclinical phase to acute myocardial infarction and sudden cardiac death (Liu et al., 2011).

IHD is responsible for 1 out of every 4.8 deaths in the United States. Each year in the USA, more than 1 million patients suffer an acute myocardial infarction. The IHD is among those diseases that are causing the most economic burden. Increasing prevalence of urban cardiovascular disease (CVD) risk factors are reported in many countries with emerging economies (Aziz et al., 2004). South Asian countries are faced with the double burden of infectious diseases, infant mortality, under nutrition and emerging epidemic of CVD, linked in part with obesity (Donin et al., 2010). In United Kingdom, the population and migrants from south Asian subcontinent has higher incidence of cardiovascular problems (Jonnalagadda et al., 1996). The overall mortality risk of IHD in different social classes in Pakistani population has not been investigated yet. We stratified healthy Pakistani population into 5 social classes according to their life style and work profile (Table 1) and analyzed serum IHD risk factors to predict risk of IHD over the next 10 years in different social classes. Our data show that about 10% of subjects were at IHD risk >30% over next 10 years, 27% people at IHD risk 15-30% over next 10 years, 26% people at IHD risk of <15% over next 10 years. Out of these 10% subjects having IHD risk >30% over next 10 years (Figure 7), there are 18% smokers and 4% non-smokers reflecting that smoking as a known risk factor of IHD applies similarly to Pakistani population.

### Table 1. Stratification of social classes.

<table>
<thead>
<tr>
<th>Social class</th>
<th>Job profile</th>
<th>Life style</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social class-I</td>
<td>Office workers</td>
<td>Sedentary life style and working in tense environment</td>
</tr>
<tr>
<td>Social class-II</td>
<td>House wives</td>
<td>Sedentary life style, work and live at homes</td>
</tr>
<tr>
<td>Social class-III</td>
<td>Shop keepers</td>
<td>Passing their life without any exercise, work within their shop premises</td>
</tr>
<tr>
<td>Social class-IV</td>
<td>Labors and hard workers</td>
<td>Work very hard and perform vigorous exercise during their work, in less tense environment</td>
</tr>
<tr>
<td>Social class-V</td>
<td>Farmers</td>
<td>Work hard in the fields by keeping their body in exertion.</td>
</tr>
</tbody>
</table>

**MATERIALS AND METHODS**

**Subjects and Methods**

**Subjects**

We enrolled prospectively 100 healthy volunteers above age of 40 years in our study. The volunteers were divided into five social classes on the basis of their job profile and life style (Table 1). The study was approved by local ethical committee and the volunteers have given informed consent accordingly.

**Methods**

In each social class, 20 healthy volunteers with age above 40 years were selected (Table 1). Volunteers with chronic disease including IHD, diabetes, hepatitis and HIV were excluded. Data from each social class was combined. Blood pressure measurements, weight and height were measured twice and recorded in a Performa, anthropometric measurements were taken and fasting blood specimens were taken for plasma sugar and lipid determination. Subjects were considered to have high blood pressure if they had a DBP ≥ 90 mm Hg and SBP ≥ 140 mm Hg. (Carlos Lorenzo et al., 2007). The subjects with a BMI of 25 – 30 kg/m² were considered overweight (World Health Organization criteria). IHD risk calculation was done by measuring systolic blood pressure (SBP) and serum total cholesterol to high density lipoproteins ratio (TC: HDL) and then comparing these values on risk prediction chart for non-diabetic patients, recommended by British heart association.

**Statistical analysis**

Data were analyzed using one-way ANOVA (analysis of variance) followed by Newman - Keuls Multiple Comparison posthoc test. For the prediction of IHD risk over next 10 years, we used IHD risk prediction chart recommended by Joint British Societies Coronary risk prediction charts. A probability value of ≤0.05 was taken as significant.

**RESULTS**

Our study shows that in different social classes of Pakistani population above 40 years of age show differences in risk of ischemic heart disease, and hence social stratification of Pakistani population may be helpful to predict the IHD risk and hence to take preventive measure for specific social class. Our data show that about 10% of subjects were at IHD risk >30% over next 10 years, 27% people at IHD risk 15-30% over next 10 years, 26% people at IHD risk of <15% over next 10 years. Out of these 10% subjects having IHD risk >30% over next 10 years (Figure 7), there are 18% smokers and 4% non-smokers reflecting that smoking as a known risk factor of IHD applies similarly to Pakistani population.

**Body mass index of five social classes**

The mean values of BMI of five social classes were μ1 = 25.175, μ2 = 25.450, μ3 = 26.830, μ4 = 21.610, μ5 = 24.020. There is a significant difference between the social classes 4 and 1, 4 and 2, 4 and 3 (Figure 1).
Social class-IV has least BMI that reflects the social class of labors and hard workers have comparatively low BMI. However, BMI was still in normal range. Farmers had also lower BMI than social class I, II and III that was not significantly different. Social class I, II and III with similar lifestyle had similar BMI (Figure 1).

Analysis of fasting blood sugar (FBS) in five social classes:

The mean values of FBS of five social classes were \( \mu_1=100.65 \), \( \mu_2=79.75 \), \( \mu_3=91.90 \), \( \mu_4=77.10 \), \( \mu_5=78.90 \) (Figure 2). There is a significant difference between the social classes-I and -IV (\( \mu_4 \) and \( \mu_1 \)) Figure 2. Social class-IV has significantly lower fasting blood glucose levels. Low normal range glucose reflects the vigorous exercise of social class IV. Social class-V showed lower FBS that was not significantly different from other classes. In short, BMI reflects better metabolism and better range of FBS.

Analysis of total cholesterol in five social classes

The mean values of total cholesterol of five social classes were \( \mu_1=214.6 \), \( \mu_2=207.7 \), \( \mu_3=198.7 \), \( \mu_4=198 \), \( \mu_5=171.2 \) (Figure 3). There is a significant difference between the social classes I, II and class-V (\( \mu_1 \), \( \mu_2 \) and \( \mu_5 \)) (Figure 3). The results show that the social class-V has least cholesterol levels that might be due to vegetarian food style of most of Pakistani farmers. Total cholesterol in class I and II was higher reflecting their lifestyle.

Analysis of triglycerides in five social classes

The mean values of TG of five social classes were \( \mu_1=316.7 \), \( \mu_2=259.0 \), \( \mu_3=201.0 \), \( \mu_4=245.1 \), \( \mu_5=230.6 \). Subjects of social class-III had significantly lower triglycerides than class I (Figure 4). However, the BMI and total cholesterol levels of social class-I and -III were similar. Social class-III has lowest level of triglycerides as compared to other social classes.

Analysis of HDL-cholesterol in five social classes

The mean values of HDL-cholesterol levels of the five social classes were \( \mu_1=80.65 \), \( \mu_2=74.85 \), \( \mu_3=86.6 \), \( \mu_4=84.2 \), \( \mu_5=91.85 \). There is no significant difference in serum HDL levels between the social classes (Figure 5).

Analysis of LDL-cholesterol in five social classes

The mean values of LDL-cholesterol levels of five social classes were \( \mu_1 = 110.8 \), \( \mu_2 = 107.8 \), \( \mu_3 = 135.1 \), \( \mu_4 = 109.9 \), \( \mu_5 = 105.95 \). There is no difference in LDL serum levels between the social classes (Figure 6). Interestingly, serum LDL levels do not reflect BMI.

Analysis of IHD- risk over the next 10 years in five social classes:

15% of social class-I is at IHD risk > 30% over next 10 years which is the highest percentage among all classes, while only 5% of social class-V is at IHD risk > 30% over next 10 years (Figure 7). Our data demonstrates that social class-V is at significantly lower risk of IHD in the next 10 years as compared to social class-I. Farmers with regular hard exercise show lower IHD disease risk that confirms the known beneficial effect of exercise in Pakistani population.

DISCUSSION

Ischemic heart disease is a major public health problem. It contributes to mortality and morbidity in both westernized economics and in countries undergoing economic transition. IHD affects 3.5% of the UK adult population. Worldwide, Asian people are at highest risk for cardiovascular disease as compared to European inhabitants. Jafar et al. (2005) have shown that the prevalence of overweight was 25% and the prevalence of obesity was 10.3% in Pakistani population. Our study showed that the prevalence of overweight was 25% and the prevalence of obesity was 13% in healthy volunteers that is in accordance with the literature. Slight difference in obesity (13 %) might be due to presence of more volunteers living with a sedentary life style with higher BMI. Furthermore, in the former study the subjects were selected between 15 and 65 years of age. But in this study healthy volunteers of age above 40 years were selected.

South Asians have a 40% higher mortality from IHD than Europeans and diabetes is a major risk factor for IHD in south Asians (Jolly et al., 1994). Mortality from IHD increases about 3 to 10 fold and 2 to 4 fold in patients with type-1 and type-2 diabetes, respectively (Gibbons et al., 1999). Chowdhury and Lasker (2002) showed that the mean FBS level of south Asian cohort was 143.24 mg/dl. According to our data on Pakistani population, mean FBS level was 85.67 mg/dl. The difference is because in the present study, all the patients were non-diabetic and healthy volunteers.

Community prevention focusing on primary prevention of CVD risk factors such as hypertension, hyperlipidemia, and obesity is considered the most efficient use of limited resources in South Asia. Nishtar (2002) showed that 12.6% of people in Pakistani population have highest level of total cholesterol. Our data showed the prevalence
Figure 1. Body mass index (BMI) of 100 healthy volunteers of five (I-V) different social classes. Class-I, Office workers; Class-II, housewives; Class-III, shopkeepers; Class-IV, labors and hard workers; Class-V, farmers. Level of significance was at P<0.05.

Figure 2. Fasting blood sugar (FBS) of 100 healthy volunteers of five (I-V) different social classes. Class-I, Office workers; Class-II, housewives; Class-III, shopkeepers; Class-IV, labors and hard workers; Class-V, farmers. Level of significance was at P<0.05.

Figure 3. Total cholesterol (T.Ch) of 100 healthy volunteers of five (I-V) different social classes. Class-I, Office workers; Class-II, housewives; Class-III, shopkeepers; Class-IV, labors and hard workers; Class-V, farmers. Level of significance was at P<0.05.

Figure 4. Triglyceride (TG) level of 100 healthy volunteers of five (I-V) social classes. Class-I, Office workers; Class-II, housewives; Class-III, shopkeepers; Class-IV, labors and hard workers; Class-V, farmers. Level of significance was at P<0.05.

of hypercholesterolemia of 11% in Pakistani population. Our study focused on social classes and hence included healthy individuals with variety of lifestyle and hence heterogeneity in total cholesterol levels in serum. In our study social class-I with sedentary life style had the highest mean value and the percentage of hypercholesterolemia was 30% while the social class-II and social class-IV have 10% hypercholesterolemia while the social class-V has the total cholesterol levels in normal range (<200 mg/dl). Moreover, in previous studies, the study objects were similar to social class-II or social class-IV of our study. In the Copenhagen male study (CMS) 1997, presence of high fasting plasma triglycerides (TG) concentration and low HDL-cholesterol concentration, the characteristic dyslipidemia in the meta-
bolic syndrome, was associated with a 2-fold higher prevalence of IHD and a 2-fold higher incidence of IHD in men without symptoms of CVD at baseline (Jeppesen et al., 1997). The prevalence of low plasma HDL-cholesterol, hyper-triglyceridemia and diabetes has been reported among South Asians and may be more important than conventional risk factors such as smoking, high LDL-cholesterol and hypertension. In our study the TG levels of the five social classes were \( \mu_1 = 316.7 \text{mg/dl} \), \( \mu_2 = 259.0 \text{mg/dl} \), \( \mu_3 = 201.0 \text{mg/dl} \), \( \mu_4 = 245.1 \text{mg/dl} \) and \( \mu_5 = 230.6 \text{mg/dl} \), respectively (Figure 4). The social class-I has 80% volunteers with TG level > 200 mg/dl and in the IHD risk prediction analysis, the highest risk of IHD is in this social class.

In India prevalence of IHD has been reported as being 11% in 2001 (Mohan et al., 2001). However, sizeable population such as in Pakistan have no published data for the prevalence or incidence of IHD, and casual and temporal relations between risk factors and this disease have not been established (Geleijnse et al., 2004). Our study showed that in healthy Pakistani population above 40 years of age, 10% are at IHD risk > 30% over next 10 years (Figure 7). Out of these 10%, the social class-I is at 15% IHD risk > 30% over next 10 years. And this is the highest risk ratio found in these social classes. While the IHD risk in social class-V is 5% which is the least percentage of risk observed in five social classes of Pakistani population. Our data may be valuable to screen Pakistani individuals with higher IHD risk on the basis of social classification that reflects in majority the biochemical analysis.

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ABBREVIATIONS

IHD, Ischemic heart disease; CAD, coronary artery
disease; **CVD**, cardiovascular disease; **SBP**, systolic blood pressure; **TC**, total cholesterol; **HDL**, high density lipoproteins; **FBS**, fasting blood sugar; **TG**, triglycerides; **LDL**, low density lipoprotein; **BMI**, body mass index.

**REFERENCES**


