Profile of coronary heart disease risk factors in first-year university students

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Abstract

There is substantial evidence that coronary heart disease risk factors are present in people of all ages. The extent to which the problem exists in university students in South Africa has not been confirmed in the literature and needs further investigation. The aim of the study was to profile the coronary heart disease risk factors in first year university students who are at moderate risk for coronary heart disease. A quantitative, cross-sectional study design was used wherein 173 first year students aged 18 – 44 years were identified as being at moderate risk for coronary heart disease according to ACSM guidelines. Descriptive statistics were used in the analysis of the data. Among first year students screened for coronary heart disease risk factors, 28.4% of the subjects were found to be at moderate risk. A sedentary lifestyle constituted the most prevalent coronary heart disease risk factor at 31.19%, with smoking (17.97%), obesity (14.24%), family history and dyslipidemia (13.56%), hypertension (9.15%), and impaired fasting glucose (0.34%) also present. The prevalence of multiple coronary heart disease risk factors showed two risk factors to be the most prevalent among the subjects at 45.66%, with three, four, five and six risk factors prevalent at 30.06%, 16.18%, 7.51% and 0.58%, respectively. The majority of first year university students presented with multiple risk factors that place them at moderate risk for coronary heart disease, with physical inactivity constituting the most prevalent risk factor.

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Introduction

Cardiovascular disease (CVD) is currently considered an epidemic that is rapidly evolving globally (World Health Organization, 2002). CVD causes twice as many deaths in developing countries than in developed countries (Gaziano, 2005; Lopez, Mathers, Ezzati, Jamison & Murray, 2006). The growing incidence of CVD in developing countries is thought to be primarily the result of coronary heart disease (CHD) (Lopez et al., 2006). CHD is a serious public health burden

in terms of life-years lost, reduced quality of life, reduced productivity and medical costs (Gaziano, 2005). The main causes of CVD can be attributed to conventional CHD risk factors, such as physical inactivity, cigarette smoking, hypertension and obesity (Thomas, Baker & Davies, 2003).

CHD risk factors are early indicators of future heart disease (McGill, McMahan & Zieske, 2000) and the presence of multiple risk factors in people is considered to be a reflection of poor community health and wellbeing (Pearson, 1999). Since most of the risk factors for heart disease are modifiable, it would be expedient to identify individuals who are at risk at the earliest possible opportunity, so that appropriate preventive measures can be implemented to avert the risk. Strategic efforts in this regard that are community-wide, economically cost-effective, and educationally sound certainly have the potential to impact favourably on public health. The potential benefits can be direct, as seen in the reduced morbidity and mortality statistics, or indirect, through improved quality of life and reduced medical costs for the public at large (Baruth, Wilcox, Sallis, King, Marcus & Blair, 2011).

A compelling body of evidence shows that CHD risk factors are present in people of all ages (Barker, 1995; Bayne-Smith, Fardy, Azzollini,, Magel, Schmitz & Agin, 2004; Ebrahim, Taylor, Ward, Beswick, Burke & Davey-Smith, 2011). However, the extent to which this problem exists in university students in South Africa (SA) has not been adequately investigated (Porter, Johnson & Petrillo, 2009; Kazi & Coopoo, 2010). Therefore, the aim of this study was to profile the CHD risk factors in first year university students who are at moderate risk for CHD.

Methodology

A quantitative, cross-sectional study design was used. The study population comprised full-time, non-repeating first-year university students. Participation in the study was voluntary and subject to obtaining informed consent. Subjects were informed that they could withdraw at any stage with impunity. Ethical approval for the study was obtained from the Institutional Ethics Committee.

A total of 610 subjects, 109 males and 501 females, were screened for CHD risk factors. From this group, 437 (71.6%) subjects were found to be at low risk and excluded from the study, and the remaining 173 (28.4%) subjects were found to be at moderate CHD risk and retained for the study.

CHD risk factor measurements consisted of seven risk factors, namely, a family history (FH) of CHD, cigarette smoking, obesity, hypertension, dyslipidemia, impaired fasting glucose, and a sedentary lifestyle (SL). Older age (males $\geq$ 45 years and females $\geq$ 55 years), as a risk factor, was one of the exclusion criteria

of the study. Clinical measurements were taken according to standardized protocols and included the following, namely, resting heart rate (by radial pulse palpation), resting systolic and diastolic blood pressures (by auscultation), lipoprotein profile (using invasive procedures and automated enzymatic precipitation methods), impaired fasting glucose (by invasive procedures and analyzed by enzymatic colorimetry) and the physical measurements (height and weight using a calibrated Seca balance beam scale with a mounted stadiometer, and waist and hip circumferences (using a Gulick metal tape measure) in order to determine obesity and, specifically, CHD risk. All measurements adhered to international standards for anthropometric assessment (American College of Sports Medicine, 2006; Marfell-Jones, Olds, Stewart & Carter, 2006). Risk stratification was reported according to the guidelines of the American College of Sports Medicine with two or more risk factors stratified as moderate risk for CHD (ACSM, 2006). Additional personal information, such as, gender, marital status, race/ethnicity, previous and current physical injury status, and prescribed medication was also recorded.

Descriptive statistics were used to analyze the data, with the results reported as means, standard deviation and frequencies.

Results

From the total of 173 subjects who participated in the study, females constituted the majority of the sample (79.2%; 137), compared with males (20.8%; 36). Most of the subjects were unmarried (90.2% or 156), with a small percentage married (9.2% or 16) or widowed (0.6% or 1). Most of them (81.5%) were also injury-free, while some (13.9%) complained of chronic orthopedic conditions, such as shoulder, knee, back or other joint pain, and a few (4.6%) had chronic medical conditions, such as asthma, sinusitis, allergies, hypercholesterolemia and/or hypertension. None of these conditions, however, were sufficiently debilitating to affect their participation in the study.

Table 1 presents the findings on the physical characteristics and selected CHD risk factors of the subjects expressed as mean±SD. Age was excluded as a risk factor in the study, therefore, the subjects were all relatively young with a mean age of 21.35±6.34 years with the females slightly older than the males (21.54±6.30 vs. 20.64±6.05 years). The mean value for height was 162.73±8.49 cm and for body mass 76.38±19.24 kg with the males being generally taller and heavier. The mean values for body composition, as indicated by BMI, waist circumference, hip circumference and waist-hip ratio were 28.92±7.30 kg·m^{-2}, 82.21±14.85 cm, 106.15±13.91 cm, and 0.77±0.09, respectively, and were considered relatively low for CHD risk.

The mean values for systolic and diastolic blood pressure for both males and females fell into the pre-hypertensive category, but was relatively low for CHD risk.

Table 1: Physical characteristics and selected CHD risk factors of subjects

Physical characteristics and selected CHD risk factors*	Measurement (mean±SD) Total (n = 173)	Measurement (mean±SD) Males (n = 36)	Measurement (mean±SD) Females (n = 137)
Age (years)	21.35±6.24	20.64±6.05	21.54±6.30
Height (cm)	162.73±8.49	174.21±6.07	159.72±6.14
Body mass (kg)	76.38±19.24	79.24±21.82	75.63±18.52
Body mass index (kg·m^{-2})	28.92±7.30	25.96±6.29	29.70±7.36
Waist circumference (cm)	82.21±14.85	82.65±14.16	82.10±15.07
Hip circumference (cm)	106.15±13.91	99.60±11.95	107.86±13.92
Waist-hip ratio (WHR)	0.77±0.09	0.83±0.06	0.76±0.09
Resting heart rate (bpm)	78.42±10.73	79.64±11.02	78.09±10.67
Resting systolic BP (mm Hg)	123.40±12.05	126.67±11.84	122.54±12.00
Resting diastolic BP(mm Hg)	80.45±9.55	80.69±9.84	80.39±9.51
Family history (FH) of CHD (%)	40.37±49.22	47.2±51.63	35.0±30.57
Cigarette smoking (cpd)	2.72±4.03	3.97±4.82	2.39±3.75
Sedentary lifestyle (SL) (%)	91.95±27.40	88.90±26.42	92.7±27.63

CHD = CHD; BP = blood pressure; bpm = beats per minute; mm Hg = millimetres of mercury; cpd = cigarettes per day.

A family history of CHD was present in 40.37±49.22% of the group, and reflected the heightened extent to which the CHD risk factor was prevalent amongst this group, especially in males.

The mean number of cigarettes smoked per day for the total group was relatively low at 2.72±4.03 cigarettes per day (cpd) and fell into the category of occasional smoking, but nevertheless constituted an important risk factor in this relatively young adult population.

A sedentary lifestyle was by far the most prevalent CHD risk factor for the group and was particularly high at 91.95±27.40%. This risk factor reflected the single most important risk for CHD amongst this group of young adults.

Table 2 shows the results for blood biochemistry, expressed as mean±SD. LDL cholesterol concentration is the recommended measurement for indicating CHD risk, and in its absence, TC and HDL cholesterol. The mean concentrations for all cholesterol measurements fell within the normal range with the mean concentrations for TC, HDL cholesterol and LDL cholesterol at 4.28±0.78, 1.20±0.26, and 2.61±0.73 mmol·L^{-1}, respectively. Although triglyceride does not represent a CHD risk factor, the mean triglyceride concentration was 0.82±0.45 mmol·L^{-1}, and also fell within the normal range. As a consequence, the mean concentrations for the cholesterol ratios, i.e., TC:HDL, LDL:HDL and T:HDL,

were all within normal healthy limits. In general, TC, HDL cholesterol, LDL cholesterol and triglycerides, together with the ratios and IFG did not indicate substantial CHD risk for the subjects.

Table 2: Blood biochemical results of subjects

Blood Biochemical Parameters	Normal Thresholds*	Measurement (mean±SD) Total (n = 173)	Measurement (mean±SD) Males (n = 36)	Measurement (mean±SD) Females (n = 137)
Total Cholesterol (TC) mmol$^.$L^{-1})	5.20	4.28±0.78	4.13±0.78	4.33±0.78
HDL Cholesterol (mmol$^.$L^{-1})	1.03	1.20±0.26	1.22±0.34	1.19±0.23
LDL Cholesterol (mmol$^.$L^{-1})	3.40	2.61±0.73	2.45±0.70	2.65±0.73
Triglycerides (T) (mmol$^.$L^{-1})	1.71	0.82±0.45	0.94±0.61	0.79±0.40
Impaired Fasting Glucose (IFG)(mmol$^.$L^{-1})	5.60	4.42±0.44	4.35±0.49	4.44±0.43
TC:HDL Cholesterol Ratio	5.05	3.78±1.31	3.69±1.45	3.81±1.27
LDL:HDL Cholesterol Ratio	3.30	2.34±1.04	2.22±1.07	2.37±1.03
T:HDL Ratio	1.66	0.75±0.55	0.92±0.87	0.70±0.42

LDL = low density lipoprotein; HDL = high density lipoprotein; *Normal thresholds according to ACSM (2006).

As shown in Figure 1, the seven CHD risk factors investigated in the study were ranked according to prevalence or frequency of occurrence in the subjects. IFG was least prevalent at 0.34 % (1), whereas SL was most prevalent at 31.19% (92).
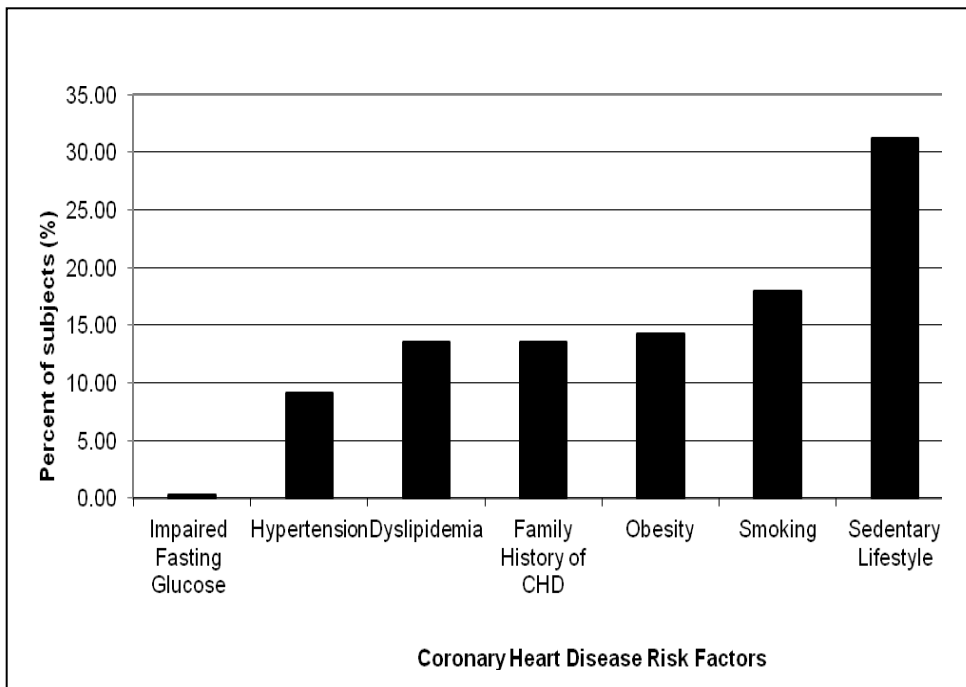

Figure 1: Prevalence of CHD risk factors in subjects.

Cigarette smoking, obesity, a family history of CHD, and dyslipidemia all had similar prevalence rates of 17.97% (53), 14.24% (42), and 13.56% (40) for the last two, respectively. Hypertension was present in 9.15% (27) of the subjects.

Figure 2 presents the findings for subjects with multiple CHD risk factors, i.e., the number of subjects with a prevalence of two or more CHD risk factors. All subjects screened for the study had a minimum of two (2) CHD risk factors, hence the absence of subjects with zero (0) or one (1) risk factor. Also noteworthy is that none of the subjects presented with a frequency of all seven (7) CHD risk factors. The percentage of subjects with two, three, four, five and six risk factors were 45.66% (79), 30.06% (52), 16.18% (28), 7.51% (13) and 0.58% (1), respectively. Quite interestingly, more than half the subjects, (54.34%; 94), had three or more risk factors present.
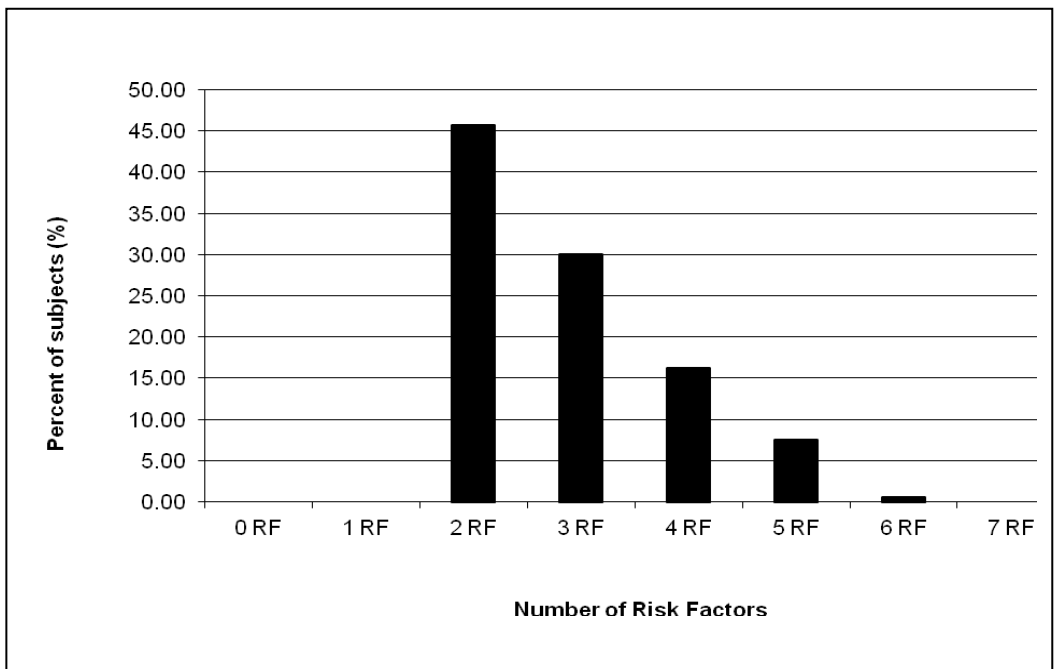

Figure 2: Prevalence of multiple CHD risk factors in subjects.

Discussion

The findings of this study show the subjects to be all relatively young and physically healthy individuals, although they were classified as moderately at risk for CHD. The subjects were mostly unmarried and largely injury-free. Some complained of chronic orthopedic conditions, while others had seasonal complaints such as allergies and sinusitis and a few had chronic medical conditions such as asthma, hypercholesterolemia and hypertension. However, this profile of medical history was typical of university students (Patrick, Grace & Lovato, 1992).

Cigarette smoking, together with dyslipidemia, obesity and hypertension have all been documented as independent risk factors for the development of CHD (Sabra, Taha, Al-Sebiany, Al-Kurashi & Al-Zubier, 2007). Dyslipidemia is reported as raised serum concentrations of total cholesterol, LDL cholesterol and triglycerides, and attenuated levels of HDL cholesterol (Wood et al., 1983; Näslund, Fredrikson, Hellenius & de Faire, 1996).This study found that the prevalence of cigarette smoking, obesity, family history, dyslipidemia and hypertension were all relatively low. Likewise, the lipid profile when expressed as a ratio of LDL to HDL cholesterol concentration fell within normal limits (Wood & Stefanick, 1990). These results support the findings of other similar studies (Calabro, Radcliffe & Baden, 1999; Sabra et al., 2007). The prevalence of systolic hypertension was more common than diastolic hypertension (Sabra et al., 2007). Both types of hypertension nevertheless require urgent attention because of its insidious progression into chronic disease in later life (McArdle, Katch & Katch, 2001). Similarly, a family history of CHD is one of the non-modifiable risk factors and, like hypertension, is relatively asymptomatic for many years (Barker, 1995). Cigarette smoking, specifically, is identified as one of the most preventable causes of morbidity and mortality in SA (Norman, Bradshaw, Schneider, Pieterse & Groenewald, 2006; Steyn & Fourie, 2007). It is therefore necessary to identify these risk factors early in order to target the intervention to specific needs.

Impaired fasting blood glucose was characteristically uncommon amongst the subjects in this study and constituted the lowest of all the CHD risk factors. This phenomenon should be regarded within the context of the age-related nature of the disease of glucose intolerance, as the subjects were all relatively young (Sabra et al., 2007). However, the various risk factors implicated in advancing glucose intolerance, such as poor diets, physical inactivity, and inordinate amounts of stress that is common amongst university students, is still cause for concern and warrants immediate attention.

Physical inactivity constituted the main CHD risk factor in the group and is also shown as a common risk factor in other studies (Calabro et al., 1999; Haase et al., 2004; Sabra et al., 2007; Keller et al., 2008; Kazi & Coopoo, 2010). However, unlike other studies, this study showed a greater prevalence of physical inactivity among its subjects. This was primarily due to the stringent criteria used to classify physical inactivity which was based on the US Surgeon General's Report (ACSM, 2006). In addition, the large number of female subjects in the study also contributed to the high prevalence of inactivity, because females are generally shown to be more physically inactive than males (Calabro et al., 1999).

The results show that all subjects in this study presented with at least two CHD risk factors. In addition, more than half of them had three or more risk factors. Viewed collectively, the occurrence of multiple risk factors in this group reflects an elevated potential burden of disease.

The results further show that subjects who presented with smoking as a CHD risk factor were more likely to be sedentary and obese. These results concur with the findings of previous studies which show that smokers, in particular, are more likely to have a clustering of risk factors such as physical inactivity, hypertension and dyslipidemia (Ward et al., 2003). This is cause for concern as the subjects are relatively young and represent a well-educated sector of the society.

When addressing the issue of prevention, except for family history, these risk factors are all modifiable and preventable, as they are lifestyle-related (Baruth et al., 2011). Furthermore, many individuals with multiple risk factors have the false preception that they are relatively healthy and disease-free (Pearson, 1999). This is because most of the CHD risk factors remain "silent" and asymptomatic for many years (Barker, 1995). Therefore, in addressing the issue of false perceptions as a means to primary prevention, there is a need to raise awareness that CHD is a steadily rising global epidemic in all age groups. More especially, raising awareness among university students is of particular importance as this population has a preference for fast foods, cigarette smoking, binge drinking and maintaining sedentary lifestyles (Haase et al., 2004; Rozmus, Evans, Wysochansky, Mixon, 2005; Kazi & Coopoo, 2010). The consequences of these poor behaviours are also evident in their changing physical characteristics. Many of them are shown to have higher BMI's and larger waist circumferences, predisposing them to obesity more frequently (Kazi & Coopoo, 2010). These risk factors require pre-emptive intervention in order to address them comprehensively, because they tend to track consistently from childhood to adulthood (McGill, McMahan & Zieske, 2000).

Previous studies have shown that strategic health interventions amongst individuals presenting with multiple CHD risk factors stand to benefit the most (Ebrahim et al., 2011). Such strategic intervention can also help improve risk perceptions, increase intention to initiate behaviour change, and develop self-efficacy in sustaining lifelong behaviour change that is targeted at reducing CHD risk (Pearson, 1999). For the purpose of the present study, emphasis is placed upon early CHD risk identification, and the correct communication of that information as an important public health initiative, especially in this at-risk population. Having an optimal risk-factor profile (≤ 1 CHD risk factors) confers a low risk for CHD, and is an important concept to inculcate, especially early in life.

Conclusion

The present study shows that close to one third of first year university students present with multiple CHD risk factors that place them at moderate risk for CHD, with physical inactivity constituting the most prevalent CHD risk factor. Consequently, CHD presents a major public health burden as significant numbers in all age groups invariably succumb to this condition by engaging in behaviours that place them at risk. Urgent intervention that is proactively planned, strategically designed, timeously implemented and sustained throughout life, is strongly advocated for at-risk individuals particularly in the university setting. The prevailing health burden is an indictment against our current systems of public education and health practice.

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