Risk factor distribution for cardiovascular diseases among high school boys and girls of urban Dibrugarh, Assam

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ABSTRACT

Introduction: Chronic noncommunicable diseases (NCDs) including cardiovascular diseases (CVDs) are the leading cause of death in the world, and their incidence is rising rapidly due to increasing rates of risk factors such as hypertension, dyslipidemia, diabetes, obesity, physical inactivity, and tobacco use. These risk factors track from childhood to adulthood, and their distribution varies among males and females; hence, there is a need to determine risk factor prevalence among adolescent age group so as to plan preventive strategies. Objective: To determine the distribution of risk factors of CVDs amongst high school boys and girls of urban Dibrugarh, Assam. Subjects and Methods: A cross-sectional study was conducted from October 2012 to June 2013 in the schools of urban Dibrugarh, Assam wherein data was collected from 1000 students of Class 8–10 using multistage random sampling and risk factors were assessed using WHO steps methodology. Statistical Analysis: Statistical analysis was done using SPSS 16 software and test of differences used were Chi-square test and t-test. Results: The prevalence of ever tobacco use was 32.3% among boys and 6.6% among girls (P < 0.001) while ever alcohol use was reported by 11.9% boys and 1% girls (P < 0.001). Prevalence of overweight and hypertension was found to be higher among girls (11.7% and 24.1%) as compared to boys (6.8% and 18.1%). Prevalence of hypercholesterolemia was higher among boys while high triglycerides levels were more prevalent among girls. Conclusion: The study revealed a high prevalence of various risk factors among boys and girls. There is a need to reduce the risk factor prevalence of CVD among this group of the population to address the future epidemic of NCD. Different health promotional activities need to be implemented to target boys and girls as the risk factor distribution among these groups is different.

Keywords: Cardiovascular disease, high school students, hypertension, risk factor

Introduction

Chronic noncommunicable diseases (NCDs) are the leading cause of death in the world accounting for around 60% of all deaths[1] and 44% of premature deaths worldwide. Among them, cardiovascular diseases (CVD) are a major contributor to the global burden with 29.3% of global deaths and 9.9% of total disease burden, in terms of disability adjusted life years lost, being reported in 2003.[2] The burden of CVD is predicted to increase substantially in developing countries by the year 2020.[3] Major causes for the increase in disease burden are raising rates of hypertension, dyslipidemia, diabetes, obesity, physical inactivity, and tobacco use. WHO has drawn attention to the fact that coronary heart disease (CHD) is our “modern epidemic” a disease that affects populations, not an unavoidable attribute of ageing.[4] Atherosclerosis, the underlying cause of CVD, begins in early childhood and clinically manifests in adulthood. There is sufficient evidence that the risk factors, which were predicted in childhood, track to adolescence and adulthood.[5] Furthermore, behavioral risk factors for CVDs like dietary and physical activity habits are often established during childhood. As a result, poor dietary or physical activity habits in childhood could lead to elevated...
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Traditionally, CHD has been considered as a disease predominantly affecting men and for a long time, women were not included in research programs. In the early 1990s, more attention was focused on women with CHD. Although most risk factors contribute to CHD in both men and women, the impact of individual risk factors might be different for both sexes. Hence, there is a need to determine the distribution of risk factors for CVDs in both sexes so as to find out if there is any difference between these groups and accordingly plan interventions. Hence, this study was conducted with the objective of comparing the risk factor distribution among boys and girls studying in high schools of urban Dibrugarh, Assam.

Subjects and Methods

A cross-sectional study was conducted from October 2012 to June 2013 in the schools of urban Dibrugarh, Assam. The sampling frame was adolescents studying in 8th, 9th, and 10th standards in schools of urban Dibrugarh. Considering the prevalence of tobacco use among boys and girls of Class 8–10 of Assam to be 42.1% and 17% and taking 5% absolute error at 90% confidence interval, the required sample size was estimated to be 412.1. Considering a design effect of 2 (multistage sampling technique) and 20% nonresponse and rounding off, the final sample size calculated was 1000. Students from schools having enrolment <200 in Class 8–10 and students who did not give consent to participate in the study were excluded from the study.

Study design

The selection of study participants was done using two-stage stratified random sampling. A list of all schools having grade 8–10 was obtained from the office of Inspector of Schools in the urban area of Dibrugarh along with enrolment numbers for boys and girls. A total of 34 schools were found in the urban area of Dibrugarh with 8796 students studying in Class 8–10 out of which 25 were government and 9 were private schools. Stratification was done based on government and private categories, and they were further categorized into boys, girls’ and co-educational schools. Among government schools, there were 9 boys, 8 girls and 8 co-educational schools while, among private, there were 3 girls, 2 boys and 4 co-educational schools. From each stratum; one school was selected using random sampling and 170 participants were enrolled from each school. A list of all students studying in Class 8–10 was obtained for each school, and required number of participants was enrolled using random numbers table.

Ethical considerations

The study was conducted following approval from Institutional Ethical Committee and Inspector of Schools, urban Dibrugarh circle. Prior permission was obtained from the school principals, and a written informed assent was obtained from the students along with consent of their parents prior to the onset of the study.

Data collection tools and measurements

The data was collected using WHO stepwise methodology in which a predesigned and pretested questionnaire based on the WHO steps questionnaire and the Global School Health Survey questionnaire was used to collect information on socio-demographic and behavioral risk factors for CVD. Nutritional status was assessed by anthropometric measurements blood pressure (BP) was measured using mercury sphygmomanometer. For laboratory tests, a fasting venous blood specimen was taken to determine serum glucose, serum total cholesterol (TC), high-density cholesterol (HDL) and triglycerides.

From each school, 170 students were randomly selected to take part in the study. Students were divided into 6 batches of 30 students each. Two visits were conducted for each batch in which during the first visit, questionnaire was filled up by the students and anthropometric and BP measurements were taken and second visit was made for blood sample collection.

Socio-economic class of the students were assessed by the modified Kuppuswamy classification. For tobacco consumption, “current users” were defined as those smoking cigarettes, beedis and hookah as well as those chewing gutka, zarda and khaini. “Former users” were those who consumed tobacco products earlier at least for a year but discontinued them completely more than an year ago while “nonusers” were those who never used tobacco products in their life. The food intake and dietary habits were assessed using Food frequency questionnaire.

For BP measurement, the student was seated in a quiet and restful room for at least 5 min. BP was measured twice from the right arm with an interval >1 min in between the two measurements using a mercury sphygmomanometer and average of these two measurements was used in the analyses. Korotkoff phase I and phase V values were recorded as systolic and diastolic BP respectively. Hypertension was defined as Systolic and/or diastolic BP ≥95th percentile according to the reference values of the Update on the 1987 task force report on high BP in Children and Adolescents (Task Force, 1996), for corresponding age and sex, adjusted for the height percentile of the assessed individual while prehypertension in children is defined as average systolic BP or diastolic BP levels that are ≥90th percentile, but <95th percentile. To define the height percentile we used the National Center for Health Statistics growth charts.

Statistical analysis

The statistical analysis was done using SPSS (IBM SPSS, version 16). Descriptive analysis was done using percentages, mean and standard deviations. The distribution of risk factor variables between high school boys and girls was compared using Student’s t-test for continuous variables and Chi-square test and Fischer’s exact probability test for dichotomous variables. Statistical significance was considered at 95% confidence interval, i.e., P < 0.05.
Results

A total of 1000 students were approached, and all the students consented to take part in the study. The first and second steps of WHO steps methodology was conducted in all 1000 participants while the third step of laboratory assessment was covered in 10% of the sample, i.e., 100 participants. Of total 1000 students, 51.4% were girls, and 48.6% were boys. The mean age of boys and girls was 14.41 + 1.01 and 13.93 + 0.94 years respectively. The average family size among boys and girls was 5.81 + 3.23 and 5.74 + 3.27 (P = 0.715) respectively while average monthly family income was Rs. 19484.36 ± 45619.48 and Rs. 23124.12 ± 40011.92 (P = 0.179) respectively [Table 1].

The distribution of risk factors for CVDs among boys and girls is shown in Table 2. The proportion of ever tobacco users was 32.3% among boys and 6.6% among girls that was significant (P < 0.001). Current tobacco users, as well as ever alcohol users, were significantly higher among boys than girls. Ever alcohol use was found to be significantly higher among boys (11.9%) than girls (1%) (P < 0.001). Perceived stress was reported to be similar among boys (15.6%), and girls (15%), and the difference between the two groups was found to be statistically insignificant. Regarding dietary risk factors, intake of vegetables <times/week was 45.2% among girls and 42.3% among boys. Fast food items intake more than 3 times/week was 68.5% among girls and 67.3% among boys. However, this association was found to be statistically insignificant. Extra uncooked salt intake was reported to be higher among boys (35.6%) than girls (33.3%). However, this difference was found to be statistically insignificant. Regarding physical activity pattern, it was found that almost similar number of boys and girls undertook a moderate physical activity for 30 min for <3 days/week. Leisure time activity pattern of the participants reveal that higher number of girls (75.9%) was involved in sedentary activities during their leisure time than boys (63.2%) and this difference was found to be statistically significant (P < 0.001).

The anthropometric examination of the participants revealed that the mean height and waist-hip ratio was found to be significantly higher among boys than girls [Table 3]. However, the mean body mass index and hip circumference was found to be significantly higher among girls (19.97 + 3.99 kg/m²) than boys (19.02 + 3.26 kg/m²). The mean systolic BP was higher among boys (120.83 + 15.24 mm Hg) than girls (120.38 + 12.89 mm Hg) while no significant difference in the diastolic BP was found among boys and girls.

Table 4 shows the distribution of risk factors for CVDs based on anthropometry and BP among boys and girls. The proportion of overweight among girls (11.7%) was significantly higher than boys (6.8%) (P = 0.008) whereas the difference in the proportion of obese was found to be statistically insignificant. The proportion of students having hypertension was significantly higher among girls (24.1%) than boys (18.1%) whereas the proportion of students having prehypertension among both groups was almost similar.

The mean cholesterol and low-density lipoprotein levels were significantly higher among boys as compared to girls [Table 5]. However, mean triglycerides level was higher among girls as compared to boys. Prevalence of hypercholesterolemia was 24% in boys and 2% in girls while high TC: HDL ratio was found to be 52% among boys and 14% among girls. The difference in the prevalence of low DL (LDL), triglyceride and blood glucose was found to be statistically insignificant among boys and girls [Table 6].

Discussion

The current study assessed various risk factors of CVD among high school boys and girls. The prevalence of tobacco and

| Variable                        | Boys n (%) | Girls n (%) |
|---------------------------------|------------|-------------|
| Father's education              |            |             |
| Profession or post-graduate     | 32 (6.6)   | 51 (9.9)    |
| Graduate                        | 117 (24.1) | 150 (29.2)  |
| Intermediate                    | 45 (9.3)   | 58 (11.3)   |
| High school certificate         | 130 (26.7) | 143 (27.8)  |
| Middle school certificate       | 71 (14.6)  | 61 (11.9)   |
| Primary school certificate      | 55 (11.3)  | 36 (7.0)    |
| Illiterate                      | 36 (7.4)   | 15 (2.9)    |
| Mother's occupation             |            |             |
| Profession                      | 19 (3.9)   | 39 (7.6)    |
| Semi-profession                 | 84 (17.3)  | 115 (22.4)  |
| Clerical/skilled worker         | 59 (12.1)  | 72 (14.0)   |
| Semi-skilled worker             | 227 (46.7) | 309 (60.1)  |
| Unskilled worker                | 62 (12.8)  | 32 (6.2)    |
| Unemployed                      | 112 (23.0) | 44 (8.6)    |
| Homemaker                       | 59 (12.1)  | 20 (3.9)    |
| Socio-economic class            | 67 (13.8)  | 21 (4.1)    |

Table 1: Distribution of boys and girls based on demographic and socio-economic characteristics (n=1000)
Pre‑hypertensive
Waist‑height ratio >0.5
>0.9 (B)/0.85 (G)
>75
Obesity
Overweight
Risk factors
*Calculated using student’s t‑test. BMI: Body mass index; SD: Standard deviation
Table 2: Distribution of mean anthropometric indicators amongst boys and girls (n=1000)

Table 3: Distribution of mean laboratory parameters among boys and girls (n=1000)

Table 5: Distribution of mean laboratory parameters among boys and girls (n=1000)

Table 6: Distribution of risk factors for cardiovascular diseases based on laboratory measurements among boys and girls (n=1000)

Table 4: Risk factors for cardiovascular diseases based on anthropometry and blood pressure among boys and girls (n=1000)

Table 5: Distribution of risk factors for cardiovascular diseases based on laboratory measurements among boys and girls (n=1000)

alcohol use was higher among boys than girls. Furthermore, lipid profile abnormalities like high cholesterol and LDL levels were more prevalent among boys than girls. However, the prevalence of overweight and hypertension was higher among girls than boys. It was also found that girls had a more sedentary lifestyle as compared to boys.

In tobacco use, both ever users, as well as current users, were higher among boys than girls. This finding is corroborated by many other studies conducted across all over India. The global youth tobacco survey, 2000–2004 carried out all over India reported that the ever use of any tobacco product as well as current tobacco use was higher among males as compared to females. Similar findings were reported by Majra and Basnet, Narain et al, Madan Kumar et al and Tsering et al in their study among school students across the whole India. Alcohol use was also higher among boys than girls who may be due to risk‑taking behavior and peer pressure among boys. Similar findings were reported by Jain et al and Bralić et al. Regarding stress, its prevalence was similar among boys and girls. This implies that factors causing stress like academic pressure and familial factors are distributed equally among all the students irrespective of gender.

The dietary pattern among both boys and girls revealed high fast food intake (more than 3 times/week) and low intake of green leafy vegetables (more than 3 times/week). However, no difference was seen between boys and girls. More girls led
a sedentary lifestyle as compared to boys which may be due to more involvement of boys in outdoor physical activities such as football and basketball as compared to girls. About three-fourths of the girls preferred watching television during their leisure time.

In our study, the mean BMI of girls was found to be higher among girls compared to boys that was similar to the findings of Ahmad et al. among Nigerian school adolescents and Ghabrah et al. The prevalence of overweight and obesity was higher among girls than boys which may be due to the predominantly sedentary lifestyle of girls as compared to boys. Similar findings were reported by Mahajan et al. Marwah et al., Jain et al., Mahfouz et al. and Ghabrah et al. thus corroborating the findings of this study.

The prevalence of prehypertension and hypertension was quite high among high school students in our study. More girls were hypertensive as compared to boys which may be explained by higher prevalence of obesity among girls as compared to boys while other determinants of hypertension like extra salt intake was similar in both groups.

Prevalence of higher levels of cholesterol, LDL and TC: HDL ratio in boys as compared to girls can be attributed to higher levels of tobacco use among boys. Gupta et al. in their study, found that prevalence of high LDL (more than 130 mg/dl) was found to be higher among males than females that were similar to our study findings.

The present study had certain limitations. First, dietary history was assessed using food frequency questionnaire method that is a qualitative assessment and also subject to recall bias. Second, physical activity and stress was elicited through the oral questionnaire that may have a subjective error. Last, the estimates for prevalence of high fasting glucose and deranged lipid profile are from a sub-sample; however, care has been taken in the selection of the sub-sample to be representative.

**Conclusion**

From this study, it is seen that prevalence of various risk factors of CVDs was quite high among the students. Prevalence of substance use like tobacco and alcohol use as well as high cholesterol was higher among boys while the prevalence of inadequate dietary habits, sedentary activities, obesity, hypertension and high triglycerides was found to be higher among girls. Given that many CVD risk factors track through adolescence and into adulthood, it is vital that CVD risk is assessed as children progress through puberty and into early adulthood. There is a need to reduce the risk factor prevalence of CVD among this group of the population to address the future epidemic of NCD and since students spend most of their time in the school environment, so schools should promote positive health behavior. Different health promotional activities need to be implemented to target boys and girls as the risk factor distribution among these groups is different. To address increasing substance use, IEC activities in schools regarding various aspects of tobacco and alcohol use and its hazards must be geared up especially among boys. Knowledge regarding healthy lifestyle and healthy food habits needs to be inculturated to the school children through curriculum and to implement this; teachers can be trained to impart this education. At the school level, physical education must be compulsorily integrated into the curriculum and brisk walking/outdoor games involving aerobic, cardiorespiratory activity is to be encouraged especially among girls. Periodic health check-ups in the schools at least once a year should be made compulsory that is useful for early detection of various risk factors that are preventable.

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**Conflicts of interest**

There are no conflicts of interest.

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