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Prevalence of lifestyle related cardiovascular risk factors among school-going female adolescents of an industrial town of West Bengal

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Abstract: *Background:* In India the prevalence of non-communicable diseases and related lifestyle behaviors are pervasive. Adolescent population at the transition of childhood and adulthood start to pick lifestyle related risk factors for cardiovascular diseases. The present study was undertaken to estimate the prevalence of lifestyle related risk factors and its socio-demographic correlates among school going adolescent girls in an industrial town in West Bengal, India. *Methods:* In this cross-sectional study total 415 girls from class VIII- X were participated. Data regarding socio-demographic, individual characteristics as well as physical activity and dietary practices were collected through self-administered questionnaire. Height, weight and blood pressure were measured following standard procedure. *Result:* Overall prevalence of hypertension/ severe hypertension and overweight was 31.6% and 3.6% respectively. 22.4% students did not have any regular leisure time physical activity. The likelihood of overweight was negatively associated with moderate or vigorous intensity physical activity (AOR 0.07, C.I. 0.01-0.71) and consumption of protective food (AOR 0.011, C.I. 0.002 - 0.058) whereas a positive association was found with intake of obesogenic food (AOR 17.92, C.I. 1.91-67.86). Similarly the chance of having hypertension was negatively associated with girls with perceived economic status (AOR 1.81, C.I. 1.11-2.95) and intake of more protective food (AOR 0.51, C.I. 0.30-0.88); whereas, the chance was positively associated with girls with overweight (AOR 4.05, C.I. 1.03-13.94). *Conclusion:* Appropriate strategies should be adopted involving school authorities, social media as well as parents to control those identified risk factors for reduction of the chance of CVD among today's adolescent school students.
Keywords: Adolescent girls, industrial town, lifestyle related CVD risk factor.

Introduction

India is passing through a phase of epidemiologic transition, where the principal disease burden and mortality of the country is gradually being shifted from communicable diseases to the non-communicable diseases [1]. The socio-economic, demographic and environmental factors are all responsible for the transition; but a few things are common in all that about nine well-known risk factors are responsible for occurrence of ninety percent of these diseases [2]. A few of these risk factors are non-modifiable e.g. Age, Gender and Ethnicity; but the majority others e.g. Obesity, sedentary lifestyle, intake of obesogenic food, diabetes and hypertension are either fully or partially modifiable, i.e. preventable. In our country, the non-communicable diseases occur a decade earlier compared to our western counterparts [3] and the incidences of major complications like stroke occurs earlier as well [4]. In the US, it was found that the any combination of the CVD risk factors was about three times in the obese or overweight adolescents compared to their normal-weight peers [5].

Similarly, Obesity, hypertension along with smoking, dyslipidemias, diabetes and metabolic syndrome show rapid escalation among urban Asian Indians [6]. Indian Council of Medical Research (ICMR) found that the determinants of the problem are rather heterogeneous in our country [7]. Area specific researches did find out high prevalence of the risk factors among the

adolescents [8]. Adolescence is the period to make individual choices and develop an explicit lifestyle. Industrial towns, in this regard pose a special threat because the children there are accustomed to an effortless daily life; the only strain being in academic achievements. So studies are possibly needed to enquire specifically how far the epidemic of these risk factors has spread among the adolescents here.

Objectives:

1) To identify the prevalence of lifestyle related cardiovascular risk factors among school-going female adolescents in Chittaranjan-Rupanarayanpur town in West Bengal.
2) To find out the socio-demographic factors associated with lifestyle related cardiovascular risk factors in the study population.

Material and Methods

A cross-sectional, descriptive study was conducted among adolescent school girls studying at class VIII - X of secondary and higher secondary co-education and girls' only schools in Chittaranjan-Rupnarayanpur town in Burdwan district of West Bengal from August to September 2015. There is scanty scientific published study on this issue in this part of the country. So, with the objective to include highest optimum sample size, prevalence of cardiovascular risk factors is assumed to be 0.5. Considering 95% confidence level and absolute precision of 0.05, the sample size is calculated according to the formula, Sample size (n) = $Z\alpha 2 * p * (1-p) / E2 = 384$ (Where $Z\alpha = 1.96$ at that 95% confidence level, p = assumed prevalence rate (0.5), E= Absolute precision=0.05). After correcting for non-response rate of 10%, the final sample size is 423.

Sampling technique: There were 10 secondary and higher secondary co-education and girls' only schools in the study area. Among all the enlisted schools, 50% i.e. 5 schools were selected randomly. There were multiple sections per class in almost all selected schools. Class-wise list of all sections along with the number of girl students in that section of all the selected schools was prepared. Total number of girl students of the selected schools was the sampling frame. Average number of girl students per section was calculated. Sample size was divided by the average students' strength per section to get the number of sections to be included in the study. The requisite number of sections was selected through probability proportional to size method. All girl students in the selected sections i.e. 440 students were the study participants.

Operational Definitions:

A. *Physical activity:* Any study participant who was performing running, brisk walking, cycling, dancing, playing any outdoor game like football, volley ball for at least 60 minutes/day on 5 or more days per week was considered as physically active [9]. Those who failed to meet the above mentioned criteria wereconsidered to be sub-optimally physically active.
B. *Dietary Practice:* The amount of consumption of obesogenic and protective foods (for cardiovascular diseases) in a week was expressed in terms of pre-defined servings.
C. *Overweight:* It was determined by calculation of Z scores for Body mass index (BMI). Overweight and obesity will be defined when the adolescents will have the z scores for BMI more than +2 and +3 respectively.
D. *Hypertension:* Hypertension was defined when the systolic and/ or diastolic blood pressure were above WHO cut-off for that age and/ or those who currently taking antihypertensive drugs or under lifestyle modification for diagnosed hypertension [10-11].

In a class-room setting students are briefed about the objectives of the study and procedure of filling-up the questionnaire. They were informed about the voluntariness of participation and confidentiality of the collected information. At first, after taking rest for 5 minutes, their blood pressure, height and weight were measured using standard procedure and recorded against the individual identification No. Information regarding socio-demographic, individual characteristics of the study participants as well as their leisure-time physical activity were collected with a pre-designed, pre-tested, structured, self-administered questionnaire. Dietary

practices were asked to record on a semi-quantitative food frequency questionnaire. They were asked to deposit the anonymous questionnaire in a box kept on a table near the exit door. Prevalence of individual risk factor was expressed in percentage. Chi-square and Fisher's exact tests were used to examine association between individual and family related characteristics of the participants and lifestyle related cardiovascular risk factors like overweight, hypertension and regular physical activity. To identify the risk factors of hypertension and overweight adjusted odds ratio (AOR) were calculated using binary logistic regression.

Ethics: The study followed all ethical guidelines for observational epidemiological study and obtained clearance from the Institutional ethics committee of the concert Medical College. Written informed consent and assent were obtained from legal guardian and the student respectively.

Results

Total enrolled girl students in the selected classes were 440. In spite of three consecutive visits to each class to include all enrolled girl students, 25 students could not be contacted. Final analysis of the present study was done with 415 girl students. Around one-fourth (25.3%) of the study participants were from class-8, while 37.3% from each of class-9 and 10 participated in the study (Table-1). The age range of the study participants was 12-18 years and more than 80% were of 14-15 years age group (Table-2). On further analysis, it was noted that the average (± SD) age of the girl students who participated in this study was 14.4 ± 0.9 years and around 50% aged 14 years or less. Only 5.2% aged more than 15 years. Maximum participants were Hindu (93.0%) and belonged to general caste (79.5%). Average duration of education of fathers and mothers of participants were 11.6 ±4.3 years and 10±5.3 years respectively. Median duration of education among fathers and mothers of the participants were 15.0 and 11.0 years respectively. Only 5.1% fathers and 12.5% mothers had no formal education while 12.0% fathers and 24.1 % mothers had primary education. 50.1% fathers and 36.9% mothers were either graduated or post graduated. Majority of the student's fathers had services (55.2%) while majority of mothers were homemakers (93%). Perceived economic status of majority of the families was fair (65.3%) according to the students followed by that of just getting by (25.5%). Only a small proportion of students thought their families as either affluent (1.0%) or poor (8.2%). Among these students only18.1% have restrictions imposed on them by their family members in doing physical activities why 66.0% families encouraged physical activities by their wards. Nearly 50% families imposed restriction in use of electronic gadgets.

Table 1 shows distribution of BMI for age and hypertension in the study population. It shows that 3.6% of the students were overweight and 9.4% adolescents had thinness. Hypertension was noted among 22.9% and severe hypertension among 8.7% adolescents. Prevalence of hypertension among adolescents of age group 12-14 years was 25.4% while that among age group of 15-18 years was 20.4%. The corresponding figures for severe hypertension were 7.7% and 9.7% respectively. More than one-fifth (22.4%) students did not practice any such activities while another 41.9% had sub-optimal leisure-time physical activities.

Table-1: Distribution of the participants according to BMI- for - age and Blood pressure (n=415)

BMI for age and Blood pressure Categories		No.	%
Z score for BMI Category	Overweight (Z score ≥ 2)	15	3.6
	Normal BMI (Z score -1.99 to + 1.99)	361	87.0
	Thinness (Z score ≤ -2)	39	9.4
	Total	415	100.0
Blood pressure Category	Normotension	284	68.4
	Hypertension	95	22.9
	Severe Hypertension	36	8.7
	Total	415	100.0

Table-2: Consumption of obesogenic and protective food by study participants (n= 415)				
Food Item	**Amount/ serving**	**No. (%)**		
Obesogenic Foods		**Good/Fair <2 servings/ wk**	**Average 2-3 servings/ wk**	**Poor ≥ 4 servings/ wk**
1. Red Meat	150 gm	218 (51.5)	176 (42.4)	21 (5.1)
2. Ice cream	2 scoops	281 (67.7)	105 (25.3)	29 (7.0)
3. Fast food	1 roll/ 1 cutlet/ 1 plate chowmin	173 (41.7)	119 (28.7)	123 (29.6)
4. Soft drinks	200 ml	299 (72.0)	87 (21.0)	29 (7.0)
Protective Foods		**Poor <2 days**	**Average 2-3 days**	**Good/Fair ≥ 4**
1. Green leafy vegetables	150 gm	31 (7.5)	31 (7.5)	353 (85.0)
2. Fruits	150 gm	76 (18.3)	128 (30.9)	211 (50.8)

Table-3: Risk factors associated with overweight among study adolescents (n=415)						
Variable	**Category**	**n**	**% of overweight**	**AOR**	**95% C.I.**	**P value**
Perceived economic status	High	275	5.1	8.45	0.81-88.80	0.075
	Low	140	0.7	1.00		
Optimum Physical Activity per week*	≥ 5 days	148	0.7	0.07	0.01-0.71	0.024
	< 5 days	267	5.2	1.00		
Servings per week of Obesogenic food	≥ 5	225	6.2	17.92	1.91-67.86	0.011
	< 5	190	0.5	1.00		
Servings per week of protective food	≥ 5	331	0.3	0.011	0.002-0.058	0.000
	< 5	84	16.7	1.00		
Constant				0.005		
* Optimum means at least 30 minutes of moderate intensity exercise						

Table-2 showed that almost half of the girl students (47.5%) consumed red meat and fast food 2 servings or more in a week. Consumption of ice cream and soft drink at a rate of 2 or more servings per week was noted among nearly one-third participants (32.3%). More than 80% participants consumed 4 or more servings of green leafy vegetables in a week while 50.8% took 4 or more servings of fruits per week.

It was noted through binary logistic regression (table-3) that the likelihood of overweight was reduced by more than 14 times with moderate or vigorous intensity physical activity for 30 minutes a day and five days a week among girl students. Consumption of five or more servings of fruit and vegetables a week reduced it by around 9 times while consumption of same amount of obesogenic food increased it by 17 times. Classification table (98.1% vs. initial 75.7%), Hosmer and Lameshow test (5.601; 0.469) and Nagelkerke's R square of 0.620 signified the fitness of model.

After adjusting for other variable, it was found (table-4) that the chance of having hypertension is almost half among girl students with low perceived economic status as well as among those who, on average, consumed five or more servings of vegetables and fruits a week. The chance of hypertension was four times more among girl students with overweight. Classification table (75.7% vs. initial 68.44%), Hosmer and Lameshow test (4.698; 0.402) and Nagelkerke's R square of 0.098 signified the fitness of model.

Table-4: Risk factors associated with hypertension among study adolescents (n=415)						
Variable	**Category**	**n**	**% of hypertension**	**AOR**	**95% C.I.**	**P value**
Perceived economic status	High	275	36.0	1.81	1.11-2.95	0.017
	Low	140	22.9	1.00		
Optimum Physical Activity per week*	≥ 5 days	148	26.4	0.80	0.50-1.28	0.351
	< 5 days	267	34.5	1.00		
Servings per week of Obesogenic food	≥ 5	225	35.1	1.51	0.97-2.37	0.070
	< 5	190	27.4	1.00		
Servings per week of protective food	≥ 5	331	27.2	0.51	0.30-0.88	0.016
	< 5	84	48.8	1.00		
Overweight	Yes	15	80.0	4.05	1.03-15.94	0.046
	No	400	29.8	1.00		
Constant				0.897		
* Optimum means at least 30 minutes of moderate intensity exercise						

Discussion

The prevalence of cardiovascular diseases (CVD) is rising worldwide and it accounts for 17% of the total mortality [12]. This escalation in the prevalence of CVD has been attributed to the paradigm shift in lifestyle including changes in dietary pattern particularly more consumption of obesogenic food like refined carbohydrates, saturated fats & empty calories and physical inertia associated with progressive economic growth and urbanization [13]. Many of these lifestyle behaviors start at adolescence [14]. South Asians are at unusually high risk for developing coronary artery disease (CAD) and diabetes. CAD occurs almost a decade earlier in South Asians as compared to western counterparts. CAD and Diabetes are preceded by constellation of risk factors which include obesity/ Overweight, hypertension, sedentary lifestyles and much more as shown in various epidemiological studies.

In the present study it was found that 3.6% of the students were overweight. Although an earlier study in West Bengal by Gupta et al. reported that almost one-tenth of female adolescents had overweight [15]. A similar study from Kerala observed that the proportion of overweight among school-going adolescents increased from 4.9% in 2003 to 6.6% in 2005 and more so among urban residents [16]. Another study from Kolkata showed that the overall prevalence rate of overweight and obesity were 28.5% and 4.2% respectively [17]. Low perceived economic status among nearly one-third families and burden of undernourishment (9.4%) partially explained the low prevalence of overweight in the study population.

In our study 22.9% of students were found to have hypertension whereas 8.7% had severe hypertension. A previous study from New Delhi [18] reported low prevalence of hypertension (3.03%) among school going adolescent girls while the corresponding figure reported by Gupta et al. [15] was 7.8%. More than one-fifth of study participants did not practice any regular leisure time physical activity while another 41.9% had suboptimal physical activity. Similar pictured was depicted by Singh et al [18] and Gupta et al [15]. In our study, almost half of the adolescents consumed ≥2 servings per week of red meat and fast food. Similar figures were reported in an earlier study from Kolkata [17]. In New Delhi, almost one-third of urban female school students consumed fast food ≥ 3 times per week [18]. Regular consumption of Ice-cream and soft drinks were found in almost one-third students in the present study which were much higher than the figures reported by Gupta et al [15].

In present study, majority of the participants consumed ≥ 4 servings per week of fruits and green leafy vegetables. Fruits consumption on

regular basis was found among 39.4% of school going girls a study in New Delhi [18]. In another study from Kolkata it was reported that 50-60% of the students moderately consumed fruits [17]. Similar findings were reported from the study among school children in Davangere City, Central Karnataka [19]. It was found in the present study that the chance of being overweight was significantly reduced with moderate/ vigorous intensity physical activity as well as with the consumption of protective food items like green leafy vegetables and fruits. Conversely, the risk was significantly increased with consumption of obesogenic food like red meat, fast food, ice cream etc. In a study conducted in urban adolescents of Kolkata it was found that the proportion of overweight was significantly higher among those who consumed cooked food from outside [20].

That study also reported consumption of soft drinks ≥3 times per week was significantly higher among overweight children. Similar findings were reported in the study conducted by Tewari et al [21]. One study from Kolkata and another from New Delhi found significant association of overweight/obesity with physically inactivity [18, 20]. Similar findings were reported in a French study [22]. Although our study failed to elicit any relationship between perceived economic status and overweight, two earlier studies across India noted significant association of overweight/ obesity with higher economic status [20, 23]. Contrast finding was reported in a French study showing relationship between obesity and low socioeconomic status [23] and the difference might be due to varied socio-cultural context of the concerned countries.

Our study found that the risk of hypertension was significantly reduced with low perceived economic status as well as with consumption of protective food, whereas, the risk of hypertension was significantly higher among participants with overweight. The linear relation of BMI with systolic and diastolic blood pressure was reported among adolescents by Singh et al. [18]. A study conducted by Mohan et al [24] found that BMI of hypertensive adolescents was higher than their normotensive counterparts.

Limitation: The findings of the study may be interpreted considering the cross-sectional study design covering a small geographical area.

Conclusion

The study population had been suffering from both under- and over-nutrition. One in every five school-going adolescents in the present study had hypertension and two in every three were physical inactive or sub-optimally active. Although majority of the study participants consumed protective food items regularly, a considerable proportion of them were also consuming obesogenic food items regularly. High burden of hypertension, physical inactivity and unhealthy diet made this population vulnerable for future cardiovascular risk.

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