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Original Article

A study of cardiovascular risk factors and its knowledge among school children of Delhi

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ABSTRACT

Background: Data on the knowledge of cardiovascular risk factors among Indian school children are limited. Aim of the study was to assess the prevalence of cardiovascular risk factors and its knowledge among school children of Delhi.

Methods: We performed a cross-sectional survey among 485 school children studying in classes 6, 7 and 8 in two government and one private school in New Delhi using convenience sampling. Cardiovascular risk factors (physical activity, diet and smoking), knowledge about risk factors and family profile were assessed using a structured self report questionnaire. Weight, height and blood pressure measurements were taken.

Results: The mean age of the studied school children was 12.8 ± 1.6 years. The prevalence of overweight and obesity was 9.5% and 11.5% respectively. The prevalence of pre-hypertension, stage 1 hypertension and stage 2 hypertension was 12.4%, 6.8% and 1.4% respectively. Of the total, 43.8% were physically active for at least 1 hour per day on all 7 days of the previous week. Daily consumption of fruits and vegetables was reported by 42% and 76% of the school children respectively. Nearly 5% of the school children reported to have used any form of tobacco. One fifth of the school children had a family history of cardiovascular disease. Of the total, 25.4% had adequate knowledge regarding cardiovascular risk factors.

Conclusion: Cardiovascular risk factors are highly prevalent among school children. Importantly, school children lack adequate knowledge regarding cardiovascular risk factors. School based interventions are required for cardiovascular risk reduction in childhood.

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1. Introduction

The acceleration of cardiovascular diseases (CVD) has become an alarming health problem across the globe.[1] The Global Burden of Diseases study has reported that by the year 2025, CVD would be the major cause of death all over the world including the developing countries.[2] According to World Health Report 2002, CVD will be the largest cause of death and disability in India by 2020.[3] South Asians have a higher prevalence of coronary heart disease as compared to other ethnic groups.[4] Currently Indians experience CVD deaths at least a decade earlier than their counterparts in countries with established market economies. Whereas the rates of coronary artery disease have declined by 60% in the US, the rates have increased by 300% in India over the past 30 years. The Global Burden of Disease study estimates that 52% of CVD deaths occur below the age of 70 years in India as compared to 23% in countries with established market economies.[5]

The progressive atherosclerotic process begins in childhood and develops gradually under the influence of conventional risk factors including obesity, hypertension, dyslipidemia, cigarette smoking, family history of premature coronary artery disease, stress, and low levels of physical activity.[1] The atherosclerotic processes are initiated early in childhood and are modified over the life course by both genetic and environmental interactions.[4] The importance of atherosclerotic risk factors in children is increasingly being emphasized. The identification and prevention of risk factors for CVD among children and adolescents may prove to be the most cost effective way of prevention of premature CVD in India.

Knowledge of the predisposing risk factors is an important step in the modification of lifestyle behaviors conducive to optimal cardiovascular health. However, data on the knowledge of risk factors for CVD among Indian school children are limited. In a small study among Indian children studying in classes 6th–10th, awareness regarding non-communicable disease was found to be unsatisfactory with only 9.6% knowing that cardiovascular diseases are preventable.[6] We initiated this study to assess the prevalence of cardiovascular risk factors and its knowledge among school children of Delhi.

2. Methods

A cross-sectional study was conducted among school children studying in classes 6, 7 and 8 of three schools of New Delhi. A total of 485 school children were included in the study using convenience sampling. Two government schools and a private school were selected in order to obtain equal number of children from each school type as the number of children in the government school was less as compared to the private school. Permission was obtained from the school authorities. Assent was taken from the school children and a written informed consent was taken from the parents. The study was approved by Institute's ethics committee.

Data were collected by means of three questionnaires. Questionnaire 1 was a cardiovascular risk factor assessment questionnaire which consisted of three sections – (i) Demographic profile; related to demographic characteristics – age, sex and class. (ii) Risk factor profile; to assess various cardiovascular risk factors (physical inactivity, diet, smoking and tobacco use). (iii) Clinical Parameter profile; for assessment of clinical measurements (weight, height, BMI, blood pressure). Questionnaire 2 was a knowledge assessment questionnaire comprising 3 sections – (i) Meaning of cardiovascular disease (ii) Risk factors of cardiovascular disease and (iii) Preventive strategies for cardiovascular disease. Scoring of the questionnaire: Each right answer was awarded one score. No response was considered as incorrect response. The maximum score was 22 and minimum score was 0. The scoring was divided as follows:

<11 – inadequate (i.e. <50% correct response)
12–16 – moderately adequate (i.e. 50–75% correct response)
>17 – adequate (i.e. >75% correct response)

Questionnaire 3 was a parental questionnaire which assessed socio biographic data including total monthly family income, educational status of mother and father, occupational status of mother and father, and family history of cardiovascular disease. The questionnaires were initially developed in English and then translated to Hindi. The questionnaires were administered by one of the co-authors, who was trained in its use by the senior authors.

Data for the study were collected from June 2012 to December 2012. The parental questionnaire was given to the children with instructions to get it filled by their parents and these were collected the following day along with the consent forms from the parents. Demographic data was obtained from the school children. Structured questionnaire for collecting data was administered to school children. Measurements were taken from school children. Weight was measured using a digital weighing machine (Dr. Morepen Weight & Watch, model no: MS-8604, capacity: 0–150 kg, least count 0.1 kg). Height was measured using a non-elastic measuring tape with a least count of 0.1 cm and a cardboard. Blood pressure was measured using a digital blood pressure machine (CITIZEN, model no: CH432 new) with a least count of 1 mmHg. These instruments were calibrated for their accuracy by the Central Workshop at the Institute.

The school authorities were informed about students falling under 'at risk' categories of obesity and hypertension. An educational module for children was prepared for the school children. All information was collected by a single investigator.

2.1. *Definition of risk factors and diagnostic criteria*

2.1.1. *Obesity*

Body mass index (BMI): BMI is defined as the weight in kilograms divided by height in meter square (kg/m^2).

Overweight defined as weight or BMI >85th percentile for the age and sex as per the WHO BMI-for-age charts.[7,8]

Obesity defined as weight or BMI >95th percentile for the age and sex as per the WHO BMI-for-age charts.[7,8]

2.1.2. *Blood pressure*

According to the Fourth Report (2004) on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents.[9]

Blood pressure is considered normal when the systolic and diastolic values are less than the 90th percentile for the child's age, sex, and height.

Prehypertension is the stage when a child's systolic or diastolic blood pressure is above the 90th percentile but below the 95th percentile.

Stage I hypertension is diagnosed if a child's systolic or diastolic blood pressure is greater than the 95th percentile but less than or equal to the 99th percentile plus 5 mmHg.

Stage II hypertension is diagnosed if a child's systolic or diastolic blood pressure is greater than the 99th percentile plus 5 mmHg.

2.1.3. *Physical activity*

Self reported physical activities during the previous 7 days as assessed by a questionnaire developed by the researcher.

2.1.4. *Diet*

Dietary intake during the previous 7 days as assessed by a questionnaire developed by the researcher.

2.1.5. *Family history*

A positive family history is defined as a parent, grandparent, aunt, uncle, and/or sibling with a history of treated angina, myocardial infarction, percutaneous coronary catheter interventional procedure, coronary artery bypass grafting, stroke or sudden cardiac death before 55 years in men or 65 years in women.[10]

Data was analyzed using STATA software version 11.1. Inferential statistics including paired Chi square and Fisher's exact were used for finding association between various cardiovascular risk factors and selected demographic variables. Statistical significance was established at a level of $p < 0.05$.

3. Results

A total of 485 school children (237 from two government schools and 248 from a private school) were included in the study. Demographic characteristics of the study group are as outlined in Table 1. The mean age of the school children was 12.8 years ± 1.6 SD (9–18 years) in the government schools and 12.1 years ± 0.9 SD (10–14 years) in the private school. The proportion of boys vs. girls was similar to the proportion present in the respective schools. There was a nearly equal representation of school children from each class in both government and private schools as per the study design.

Table 1 also represents demographics related to the school children's family. Nearly 97% of the school children from the government schools had incomes less than Rs. 20,000 while 88.8% of school children from the private school had incomes greater than Rs. 20,000. Majority (57%) of school children's fathers in the government schools had a secondary school education while majority (70.7%) of school children's fathers in the private school were graduates. Nearly all fathers were employed (98.5% in government schools vs. 100% in the

Table 1 – Demographic characteristics of school children. N = 485.

Demographic characteristics	Category	Frequency (%)		
		Government $n_1 = 237$	Private $n_2 = 248$	Total $n = 485$
Age (in years)	Mean ± SD	12.8 ± 1.6	12.1 ± 0.9	12.42 ± 1.3
	Min–Max	9–18	10–14	9–18
Sex	Boys	161 (68.0)	134 (54.0)	295 (60.8)
	Girls	76 (32.1)	114 (46.0)	190 (39.2)
Class	6th	76 (32.1)	84 (33.9)	160 (33.0)
	7th	76 (32.1)	83 (33.5)	159 (32.8)
	8th	85 (35.9)	81 (32.7)	166 (34.2)
Monthly family income (in rupees)	≤5000	80 (41.0)	1 (0.6)	81 (21.7)
	5001–10,000	92 (47.2)	4 (2.2)	96 (25.7)
	10,001–20,000	17 (8.7)	15 (8.4)	32 (8.6)
	20,001–80,000	6 (3.1)	104 (58.1)	110 (29.4)
	>80,000	0	55 (30.7)	55 (14.7)
Father's education	Illiterate	36 (18.7)	0	36 (8.6)
	Primary	35 (18.1)	0	36 (8.6)
	Secondary	110 (57.0)	18 (8.0)	127 (30.4)
	Graduate	12 (6.2)	159 (70.7)	171 (40.9)
	Post graduate	0	48 (21.3)	45 (10.8)
Mother's education	Illiterate	87 (43.5)	0	87 (20.3)
	Primary	55 (27.5)	0	55 (12.8)
	Secondary	57 (28.5)	18 (7.9)	75 (17.5)
	Graduate	1 (0.5)	156 (68.1)	157 (36.6)
	Post graduate	0	55 (24.0)	55 (12.8)
Father's occupation	Employed	200 (98.5)	227 (100)	427 (99.3)
	Unemployed/housewives	3 (1.5)	0	3 (0.7)
Mother's occupation	Employed	45 (21.8)	124 (53.5)	169 (38.6)
	Unemployed/housewives	161 (78.2)	108 (46.6)	269 (61.4)

Table 2 – Prevalence of cardiovascular risk factors. N = 485.

BMI categories		Frequency (%)		
		Government $n_1 = 237$	Private $n_2 = 248$	Total $n = 485$
BMI				
Non-overweight non-obese	Boys	157 (97.5)	82 (61.2)	239 (49.3)
	Girls	75 (98.7)	69 (60.5)	144 (29.7)
	Total	232 (97.9)	151 (60.9)	383 (79.0)
Overweight	Boys	3 (1.9)	20 (14.9)	23 (4.7)
	Girls	1 (1.3)	22 (19.3)	23 (4.7)
	Total	4 (1.7)	42 (16.9)	46 (9.5)
Obese	Boys	1 (0.6)	32 (23.9)	33 (6.8)
	Girls	0	23 (20.2)	23 (4.7)
	Total	1 (0.4)	55 (22.2)	56 (11.5)
Blood pressure				
Normal	Boys	132 (82.0)	91 (67.9)	223 (46.0)
	Girls	69 (90.8)	93 (81.6)	162 (33.4)
	Total	201 (84.8)	184 (74.2)	385 (79.4)
Prehypertension	Boys	19 (11.8)	27 (20.2)	46 (9.5)
	Girls	3 (4.0)	11 (9.7)	14 (2.9)
	Total	22 (9.3)	38 (15.3)	60 (12.4)
Stage 1	Boys	8 (5.0)	11 (8.2)	19 (3.9)
	Girls	4 (5.3)	10 (8.8)	14 (2.9)
	Total	12 (5.1)	21 (8.5)	33 (6.8)
Stage 2	Boys	2 (1.2)	5 (3.7)	7 (1.4)
	Girls	0	0	0
	Total	2 (0.8)	5 (2.0)	7 (1.4)

private schools). As for the school children's mothers, 43.5% in the government school were illiterate while 68.1% in the private school were graduates. Among the mothers of the government school and private school children, 78.2% and 46.6% respectively were housewives.

3.1. *Prevalence of CV risk factors*

The study demonstrates that (Table 2) 1.7% and 0.4% of the school children in the government school came under the categories of overweight and obese respectively, while in the private school 17.5% and 22.9% of the school children were overweight and obese respectively. Among the total school children ($n = 485$), equal number of boys and girls (4.7%) were overweight while more boys (6.8%) than girls (4.7%) were obese.

It is also seen (Table 2) that 9.3%, 5.1% and 0.8% of the school children in the government school had their blood pressures in the categories of prehypertension, stage 1 and stage 2 hypertension respectively. Of the private school children, 15.3% were prehypertensive, 8.5% were in stage 1 and 2% had blood pressures in stage 2 hypertension categories respectively. Among the total school children ($n = 485$), the prevalence of prehypertension was 9.5% in boys and 2.9% in girls. Of the total, 3.9% of boys and 2.9% of girls had stage 1 hypertension. None of the girls and 1.4% of boys were in stage 2 hypertension. The study found a family history of cardiovascular disease in 19.3% of the school children (18.9% in the government vs. 19.7% in the private school).

Table 3 – Physical activity in school children. N = 485*.

No. of days		Frequency (%)		
		Government $n_1 = 237$	Private $n_2 = 247$	Total $n = 484$
No. of days in the last week the child was physically active for at least 1 hour per day	0 days	20 (8.4)	3 (1.2)	23 (4.8)
	1–3 days	60 (25.3)	43 (17.4)	103 (21.3)
	4–6 days	38 (16.1)	108 (43.8)	146 (30.2)
	7 days	119 (50.2)	93 (37.7)	212 (43.8)
No. of days in the last week the child performed stretching or strengthening exercises	0 days	101 (42.6)	47 (19.2)	148 (30.7)
	1–2 days	32 (13.5)	82 (33.5)	114 (23.7)
	≥3 days	104 (44.0)	116 (47.3)	220 (45.1)
Time spent in sedentary activities in a usual day (in hours)	Less than 1	9 (3.8)	59 (24.1)	68 (14.1)
	1–2	31 (13.1)	109 (44.1)	139 (28.8)
	3–4	93 (39.2)	49 (20)	143 (29.7)
	5–6	76 (32.1)	12 (4.9)	88 (18.3)
	7–8	21 (8.9)	8 (3.3)	29 (6.0)
	More than 8	7 (3.0)	8 (3.3)	15 (3.1)

*No response possible.

Table 3 represents physical activity levels of the school children. Of the total, 43.8% of the school children (50.2% in government vs. 37.7% in private school) were physically active for the recommended duration of at least 1 hour per day on all 7 days of the previous week. Forty five percent of the school children performed stretching or strengthening exercises for the recommended period of at least 3 days a week (44% in government vs. 47.3% in private school). Fifty seven percent of the school children spent 3 or more hours daily in sedentary activities (83.2% in the government vs. 31.5% in the private school).

As regarding physical education classes at school, most of the school children (89.0%) in the government school had physical education classes for 2 days per week (1 class per day), while most of the school children (41.2%) in the private school had physical education class for one day in a week (2 classes per day). Thus majority of the government and private school children had 2 classes per week. Most of the school children (68.9%) in the government school were physically active for 20–30 minutes per physical education class, while most of the school children (62.2%) in the private school were physically active for more than 40 minutes per physical education class.

Means of transport used to travel between home and school was also assessed and it was found that 46.2% and 46.6% of the school children walked from home to school and back from school to home respectively. One percent of the school children used bicycle as the mode of transport between school and home. More school children from both of the above categories belonged to the government school.

Table 4 shows that 42% of the school children consumed fruits daily. Vegetables were consumed by 76% of the school children daily. Daily consumption of milk and milk products was found in 45.5% of the school children. Nuts were consumed by 31.1% once or twice a week.

Soft drinks were taken by 44.8% of the school children once or twice a week. High salt containing foods were consumed by 21.6% of the school children on most days of the week. Sweets were consumed by 42.3% of the school children once or twice a week. Toffees, chocolates or ice creams were consumed daily by 20.6% of the school children. Fried foods and fast foods were consumed at least once a week by 65.7% and 49.2% of the school children respectively.

Tobacco consumption among school children was also ascertained in the study. It revealed that 2.4% of boys and 1.1% of girls reported ever having smoked tobacco. None of the girls and 2.4% of boys reported having used smokeless tobacco products. None of the girls and 1.7% of boys reported having used both forms. Two school children each from the government schools reported to have smoked on 1 or 2 days and 3 or 5 days respectively in the last month while 1 school child reported to having smoked on all 30 days of the last month and having smoked 35 packets of cigarettes. One school child from the government school reported to have used smokeless tobacco products on 20 to 29 days in the last month and one school child reported to having used smokeless tobacco products on all 30 days of the last month and having used 25 packets of tobacco products.

3.2. *Knowledge regarding CV risk factors*

Knowledge of the school children regarding cardiovascular risk factors was assessed and it was found that 15.3% of the school children (3.2% in the government school vs. 27.2% in the private school) knew the meaning of coronary heart disease to be blockage of the artery.

Table 5 presents the knowledge among school children regarding risk factors and preventive strategies of heart disease.

Considering the total knowledge scores, 25.4% school children (21.9% of the government school and 18.6% of the private school) had adequate total knowledge scores while 54.4% of the school children (57.4% of the government and 51.6% of the private school) had moderately adequate scores and 20.21% of the school children (20.7% of the government and 29.8% of the private school) had inadequate scores respectively.

Logistic regression analysis was done to find the factors associated with BMI and blood pressure. After univariate logistic regression analysis (Table 6), factors found to be significantly associated with BMI (at 95% confidence interval and without adjusting odds) were age, school type, total family

Table 4 – Frequency of consumption of various food items (no. of days in a week) among school children. N = 485*.

Food item		No. of days in a week			
	N	Never/almost never	Once/twice a week	Most days a week	Daily
Desirable foods					
Fruits	474	9 (1.9)	109 (22.9)	157 (33.1)	199 (42.0)
Vegetables	484	2 (0.4)	20 (4.1)	94 (19.4)	368 (76.0)
Milk products	481	38 (7.9)	113 (23.5)	111 (23.1)	219 (45.5)
Nuts	476	117 (24.6)	148 (31.1)	99 (20.8)	112 (23.5)
Undesirable foods					
Soft drinks	480	135 (28.1)	215 (44.8)	97 (20.2)	33 (6.9)
High salt	478	136 (28.5)	154 (32.2)	103 (21.6)	85 (17.8)
Sweets	473	176 (37.2)	200 (42.3)	82 (17.3)	15 (3.2)
Toffees, chocolates, ice creams	477	99 (20.8)	168 (35.2)	112 (23.5)	98 (20.6)
Fried foods	476	163 (34.3)	187 (39.3)	94 (19.7)	32 (6.7)
Fast food	474	241 (50.9)	153 (32.3)	60 (12.7)	20 (4.2)

*No response possible.

Table 5 – Knowledge regarding risk factors and preventive strategies of heart disease among school children. N = 485*.

Questions	N	Answered correctly *f* (%)		
		Government	Private	Total
Can heart diseases/heart attacks occur in children?	485	159 (67.1)	120 (48.4)	279 (57.5)
Are males more prone to get heart disease?	483	180 (76.6)	124 (50.0)	304 (62.9)
Does having a family member with heart disease make a person prone to develop heart disease?	481	92 (39.3)	68 (27.5)	160 (33.3)
Can exercise cause heart disease?	479	144 (62.3)	222 (89.5)	366 (76.4)
Can obesity cause heart disease?	479	137 (59.1)	143 (57.9)	280 (58.5)
Can eating more of fruits and vegetables cause heart disease?	481	171 (73.1)	223 (90.3)	394 (81.9)
Can smoking cause heart disease?	485	182 (76.8)	202 (81.5)	384 (79.2)
Can being worried and stressed for long periods cause heart disease?	479	176 (75.9)	158 (64.0)	334 (69.7)
Can eating lots of fast food cause heart disease?	478	144 (62.6)	151 (60.9)	295 (61.7)
Are heart diseases preventable?	483	184 (78.3)	200 (80.7)	384 (79.5)
Should measures to prevent heart disease be started in childhood?	480	126 (54.3)	157 (63.3)	283 (59.0)
How can you prevent getting heart disease?				
By maintaining a normal body weight	475	133 (57.6)	178 (73.0)	311 (65.5)
By exercising for less than 1 hour/day	475	80 (34.6)	137 (56.2)	217 (45.7)
By limiting time for watching TV, computer, sitting activities to less than 2 hours/day	472	115 (49.8)	97 (40.3)	212 (44.9)
By avoiding smoking	479	143 (61.4)	215 (87.4)	358 (74.7)
By avoiding use of tobacco products	477	161 (69.7)	209 (85.0)	370 (77.6)
What type of diet can prevent heart disease?				
More fruits and vegetables	484	202 (85.6)	204 (82.3)	406 (83.9)
More salt in diet	482	176 (75.2)	167 (67.3)	343 (71.2)
Less of fried foods	484	157 (66.5)	191 (77.0)	348 (71.9)
More sweets	483	185 (78.7)	198 (79.8)	383 (79.3)
Less of cold drinks	484	149 (63.1)	165 (66.5)	314 (64.9)

*No response possible.

income, positive family history and knowledge regarding CV risk factors.

After multiple regression analyses (Table 6), type of school and family history of CVD were found to be the independent predictors of overweight and obesity after adjusting the odds at 95% CI. There is a positive association of private school with overweight and obesity (OR = 61.17, 95% CI 8.95–418.11) and absence of family history is negatively associated with overweight and obesity (OR = 0.28 95% CI 0.13–0.60).

After univariate logistic regression analysis (Table 6), factors that were found to be significantly associated with blood pressure (at 95% confidence interval and without adjusting odds) were sex, school, total family income, family history and BMI.

After multiple regression analysis (Table 6), sex, positive family history of CVD and BMI are the independent predictors that have an effect on blood pressure after adjusting the odds at 95% CI. Sex was significantly associated with having hypertension (OR = 0.35, 95%CI 0.18–0.67), boys being more prone to have hypertension than girls. There is a negative association of absence of family history with having hypertension (OR = 0.48, 95%CI 0.25–0.91) and being overweight and obese is positively associated with having hypertension (OR = 2.99, 95%CI 1.44–6.20).

4. Discussion

We found a very high prevalence of risk factors for heart disease among school children of New Delhi. Further, knowledge of CV risk factors was appallingly low among school children. Out of the total school children, only 25.4% had adequate knowledge regarding cardiovascular risk factors. A few studies from India have documented a very high prevalence of CV risk factors among school children but data on the knowledge of CV risk factors among school children is limited.

Overall prevalence of overweight and obesity in the present study was 9.5% and 11.5% respectively. In a study by Sharma et al[11] (in 2007 among children aged 4–17 years in Delhi), it was found that 22% were overweight and 6% were obese. The prevalence of overweight and obesity combined was 11.6% in boys and 9.5% in girls in our study. The findings were lower than findings of a previous study[12] conducted among 12–18 year old students in Delhi in 2006 which reported a prevalence of 18.6% among boys and 16.5% in girls. However, this is unlikely to represent a true decline in prevalence of obesity among school children and is more likely to be due to differing population and different definitions. We found a higher prevalence of overweight and obesity in the private schools and more in boys as compared to girls. The prevalence was similar to those reported by Marwaha et al[13] in 2006. It is also similar to a study conducted by Raj et al[14] which revealed that private schools had a higher percentage of overweight children than government schools, both in the 2003 (5.17% *v.* 3.83% $p < 0.0003$) and 2005 datasets (7.17% v. 3.23% $p < 0.0001$).

In the present study, the prevalence of prehypertension, stage 1 hypertension and stage 2 hypertension among the school children was 12.4%, 6.8% and 1.4% respectively. Combined, the prevalence of hypertension was 8.2% (8.8% of boys and 7.4% in girls). This finding was lower than that found by Chadha et al[15] (in 1999 among 5–14 year olds in Delhi) where

Table 6 – Logistic regression analysis of the factors associated with BMI and Blood pressure. N = 485*.

Selected variables		Univariate odds ratio (95% CI)	p value	Adjusted odds ratio (95% CI)	p value
Factors associated with BMI					
Age	9–12 years	1	**0.003****	1	0.637
	13–18 years	0.48 (0.30, 0.78)		1.30 (0.44, 3.88)	
Sex	Boy	1		1	0.740
	Girl	1.36 (0.88, 2.12)	0.169	1.11 (0.59, 2.09)	
School	Government	1		1	**<0.001****
	Private	29.81 (11.86, 74.94)	**<0.001****	61.17 (8.95, 418.11)	
Class	6	1		1	0.186
	7	0.91 (0.54, 1.52)	0.715	0.59 (0.27, 1.29)	0.064
	8	0.60 (0.34, 1.04)	0.070	0.31 (0.09, 1.07)	
Total family income (monthly)	≤10,000	1		1	
	10,000–80,000	13.96 (5.34, 36.48)	**<0.001****	0.58 (0.11, 3.11)	0.524
	≥80,000	30.84 (10.96, 86.81)	**<0.001****	1.11 (0.19, 6.46)	0.907
Family history	Present	1		1	
	Absent	0.50 (0.88, 2.12)	**0.009****	0.28 (0.13, 0.60)	**0.001****
Knowledge	Inadequate	1		1	
	Moderately adequate	1.23 (0.66, 2.27)	0.515	1.43 (0.58, 3.52)	0.437
	Adequate	2.04 (1.05, 3.96)	**0.035****	2.28 (0.86, 6.01)	0.096
Factors associated with blood pressure					
Age	9–12 years	1	0.131	1	
	13–18 years	0.70 (0.45, 1.11)		0.52 (0.25, 1.10)	0.088
Sex	Boy	1		1	
	Girl	0.54 (0.33, 0.87)	**0.011****	0.35 (0.18, 0.67)	**0.001****
School	Government	1		1	
	Private	1.94 (1.23, 3.06)	**0.004****	0.89 (0.30, 2.69)	0.842
Class	6	1		1	
	7	1.47 (0.85, 2.52)	0.164	1.87 (0.89, 3.95)	0.098
	8	1.08 (0.62, 1.88)	0.790	2.26 (0.92, 5.56)	0.077
Monthly income	≤10,000	1		1	
	10,000–80,000	2.19 (1.22, 3.92)	**0.008****	2.11 (0.74, 6.03)	0.162
	≥80,000	2.51 (1.20, 5.25)	**0.014****	1.96 (0.54, 7.15)	0.310
Family history	Present	1		1	
	Absent	0.58 (0.34, 0.99)	**0.045****	0.48 (0.25, 0.91)	**0.025****
Knowledge	Inadequate	1		1	
	Moderately adequate	0.92 (0.51, 1.67)	0.793	0.93 (0.44, 1.97)	0.853
	Adequate	1.52 (0.80, 2.89)	0.197	1.30 (0.58, 2.92)	0.529
BMI	Non-overweight non-obese	1		1	
	Overweight and obese	4.17 (2.57, 6.76)	**<0.001****	2.99 (1.44, 6.20)	**0.003****

Univariate and multivariate logistic regression analysis (enter method), *no response possible, **$p < 0.05$.

the prevalence of hypertension (systolic, diastolic or both) was 11.9 percent in boys and 11.4 percent in girls. In another study by Singh et al[11] (conducted in 2006 among 12–18 year old students in Delhi), systolic hypertension (blood pressure >140) was found in 11.82% boys and 3.03% girls and diastolic hypertension (blood pressure >90) was prevalent in 3.58% boys and 0.43% girls. Hypertension was found in 42.4% of overweight and obese children as compared to 14.9% of remaining children in the present study. This was a much higher trend as compared with a study by Raj et al[14] in 5–16 years of Kerala in 2007 where systolic or diastolic incident hypertension was found in 17.34% of overweight children vs. 10.1% of the remaining students.

Our study revealed that 15.1% of the school children were not physically active for 60 minutes per day on at least three days in a week. This was lower than the findings in a study by Singh et al[11] (conducted in the age group of 12–18 years students in Delhi in 2006) where 40% (18.3% of boys and 22.2% of girls) responded as not being physically active for 60 minutes per day at least three days in a week. We found daily consumption of fruits and vegetables in 42% and 76% of the school children respectively. This was higher than the findings of Singh et al[11] (conducted in the age group of 12–18 years students in Delhi in 2006) who reported a low consumption of fruits and vegetables across all groups with only 39.4% of the children having fruits daily. Whether these differences are responsible for the higher prevalence of obesity found in the earlier study is not known.

In this study, soft drinks were consumed by 6.9% daily. This was found to be higher than findings from a study done by Galhotra et al[16] where 36.8% were taking carbonated drink ≥1 time/day. Fried foods and fast foods were consumed three or more times per week by 26.4% and 16.9% of the school children respectively. This was lower than the findings of Singh et al[11] (conducted in the age group of 12–18 years students in Delhi in 2006) where about a third of the school children (34.4% of boys and 29.4% of girls) ate fast food (burgers, pizzas, fried foods, etc.) more than three times a week. In another study by Galhotra et al,[15] 81.3% of the study subjects were eating fast food (samosa, patties, noodles, etc.)

in the past 7 days, out of which 5.1% were eating out on all seven days.

In our study, 4.66% of the school children reported having ever used any form of tobacco and they were from the government schools. Of these 9 were boys and 2 were girls. In a study by Singh et al[17] (conducted in 2007 among 10–18 year olds in Delhi), 9.8% of the study children had at least once experimented with any form of tobacco in their lifetime. The proportion of children who were current users of tobacco products was 5.4% (boys: 4.6%, Girls: 0.8%).

The study found that 79.5% of the school children knew that heart diseases were preventable. This was significantly higher than the findings by Divakaran et al[6] where only 9.6% knew that CVD were preventable. In another study by Banerjee et al,[18] only 42.6% of all students were of the opinion that CVD is preventable.

The study reveals a decrease in the prevalence of various cardiovascular risk factors from previous published studies. There is also an increase in the level of knowledge among school children regarding these risk factors and its prevention. A greater awareness about risk factors for cardiovascular disease among school children may be responsible for the better physical activity levels and healthier consumption of foods. However, school children are still short of accomplishing the recommended guidelines in physical activity and diet.

4.1. *Implications of the study*

The study indicates high prevalence of risk factors among Delhi school children. There are implications for: **Nursing education** – (i) Nursing students should be taught about screening for cardiovascular risk factors screening in school children (ii) Nursing students should be trained to provide education regarding the cardiovascular risk factors and its prevention to the school children. (iii) Ongoing in-service education programmes for nursing personnel should be in place regarding assessment of cardiovascular risk factors in school children and their related education. **Nursing practice** – (i) School health nurses need to conduct regular health screening of children especially with regard to cardiovascular risk factors such as BP measurements which are not part of the usual annual health checkups (ii) Health education is needed for children as knowledge regarding cardiovascular risk factors and their prevention is lacking. The parents as well as the school teachers should be involved in these educational activities. **Nursing research** – (i) Research needs to be conducted to assess reasons for the knowledge–practise gap found in this study. (ii) Research to find out attitudes of the school children regarding cardiovascular risk factors and its prevention would be useful. (iii) Parental knowledge, attitudes and practices regarding cardiovascular disease prevention may provide a better understanding of the situation in children.

4.2. *Limitations of the study*

Accuracy of the responses to the questionnaire cannot be estimated, however, standardized questionnaires are expected to provide more accurate data. The results may be influenced by social desirability. The study was limited to three schools of Delhi. Similar studies should be conducted in different geographical areas with a larger sample size to generalize the findings. We could not study other proven cardiovascular risk factors, such as stress, waist circumference, lipid profiles and blood glucose levels. Also, information regarding knowledge about the relationship between cholesterol, blood sugar and heart disease could also have been collected.

To conclude, the CV risk factors including obesity, hypertension and lack of physical activity are highly prevalent among school children of New Delhi. The awareness about CV risk factors among school children is low and the low awareness is associated with increased prevalence of CV risk factors.

Conflicts of interest

All authors have none to declare.

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