**Prevalence of Cardiovascular risk factors among children in a rural school in Bangalore district, India**

Shailendra Kumar B. Hegde¹, Farah Naaz Fathima², Twinkle Agrawal², Deepthi N Shanbhag², Pratish R Kiran², Arvind Kasthuri³

**Abstract**

**Background:** Globally, Chronic non-communicable diseases are the leading causes of mortality globally. Among them, Cardiovascular disease is the single largest killer. Lifestyle habits formed during childhood have a profound impact on cardiovascular risk in later life. **Objective:** To assess the prevalence of risk factors for CVDs among children in a rural school. **Methods:** Design: Cross-sectional. Area: one school in a rural area, Anekal taluk, Bangalore. **Population:** All children studying in the 8th std were included in the study. Children absent on the day of our visit and those who did not give consent or assent were excluded from the study. **Tool:** A questionnaire was developed for the purpose of this study using the WHO STEPS questionnaire as the base. Data collected were analysed and presented using descriptive and inferential statistics. **Results:** Of the 283 children, 52.6% were girls and 47.3% were boys with a mean age of 12.9 yrs. A majority (58.3%) of the study population used extra salt in the diet while 50.9% did not consume adequate quantities of fruits and vegetables daily. A majority (60%) was involved in high physical activity. A higher proportion of boys (74.6%) were involved in high intensity physical activity as compared to girls (46.9%) but a higher proportion of boys (64.2%) also followed sedentary lifestyle as compared to girls (47.7%). A mere 2.5% of the children gave a history of tobacco use while 1.1% gave a history of alcohol use. Passive smoking was seen among 40.6% of the children. The prevalence of pre-hypertension was found to be 4.9% and that of hypertension was 5%. **Conclusions:** There is a high prevalence of modifiable cardiovascular risk factors among rural school children which needs to be addressed if we intend to prevent the epidemic of cardiovascular diseases in India.

**Key Words:** Risk factors, Cardiovascular, school, children

**Authors:** 1- Assistant Professor, Department of Community Medicine, SRM Medical College Hospital & Research Centre, SRM University, Kattankulathur, Kanchipuram, Tamil Nadu, 2- Assistant Professor, Department of Community Health, St. John’s Medical College, St. John’s National Academy of Health Sciences, Sarjapura Road, Koramangala, Bangalore – 560034, 3- Professor and Head, Department of Community Health, St. John’s Medical College, St. John’s National Academy of Health Sciences, Sarjapura Road, Koramangala, Bangalore – 560034, Email: Hegde.shailendra@gmail.com

**Introduction**

Globally, chronic non-communicable diseases (NCDs) are the leading causes of mortality and morbidity. Among NCDs, Cardiovascular disease (CVD) is the single largest killer and is a major public health problem. In the year 2008, NCDs contributed 63% of the 57 million global deaths; CVDs accounted for 17 million of those deaths (48% of the NCDs)¹. In India, NCDs accounted for 53% of all deaths in the year 2005 while CVDs contributed 29% of these deaths². Lifestyle habits such as smoking, dietary habits and physical activity are formed during childhood, which have a profound impact on later life of the individual. It has also been found that atherosclerotic and hypertensive disease process starts early in life³. Therefore, it has been postulated that intervention strategies must begin early in childhood to control the current epidemic of CVDs. The World Health Organization (WHO) promotes school health programmes as a strategic means to prevent important health risks among youth and to engage the education sector in the efforts to change the educational, social, economic and political conditions that affect risk⁴.
Traditionally, in India, the lifestyles of the urban societies had been different from that of the rural societies. The urban societies were closer to the western culture while the rural societies were more ‘Indian’. However, due to urbanization and globalization, the urban culture is rapidly infiltrating into the rural societies of India. This obviously has had an impact on the lifestyles of the populations which in turn might affect the prevalence of risk factors for CVDs. Also, over 70% of India’s population resides in rural area. So, this study was done with the objective of assessing the prevalence of risk factors for CVDs among children in a rural school.

**Methods**

This was a cross sectional study conducted in a selected school situated in a rural area in Anekal taluk, Bangalore district. All children studying in the 8th standard in this school were included in the study. Those children who were absent at the time of our visit were automatically excluded from the study. Written informed consent was obtained by the parents of every student while assent was obtained from each student. The study was approved by the institutional ethical review board of St. John’s National Academy of Health Sciences.

A questionnaire was developed for the purpose of this study using the WHO STEPS questionnaire as the base. The questionnaire had 2 sections; first section was used to collect the socio-demographic details of the children while the second section assessed the cardiovascular risk factor profile of each child. The questionnaire was administered in the local language.

With respect to the dietary factor assessment, the questionnaire captured data regarding the use of extra salt, cooked foods, servings of vegetables and fruits per day, the consumption of junk food in the form of chips, fried foods and aerated drinks as well as other food items. The quantity of fruits and vegetables was ascertained using standard measures in which one standard serving equals 80 grams. This was translated into cups of standard sizes. Standard cup measures available locally were shown to the children to estimate the servings of fruits and vegetables consumed. Consumption of other foods were measured as being ingested daily, three to five days a week, at least once a week, once a month, occasionally or rarely, and never.

Physical activity of the children was assessed using the Global Physical Activity Questionnaire (GPAQ) developed by the WHO for physical activity surveillance which collects information on physical activity based on participation in three domains: activity at work; travel to and from places and leisure time activities.

Family history of diabetes mellitus, hypertension, overweight and obesity, as well as the use of tobacco and alcohol by family members was collected. The questionnaire asked if the children had ever used tobacco and alcohol, as well as the frequency of use of specified tobacco products. Anthropometric measurements (weight, height and waist circumference) were taken using standard techniques.

Body mass index and central obesity were calculated. Based on their body mass index, children were classified into underweight (<5th percentile), normal (5th – 85th percentile), at risk of overweight (85th – 95th percentile) and overweight (>95th percentile).

If waist circumference of any child was more than the 90th percentile for his or her age and gender, then it was considered to be central obesity. Blood pressure was measured with the help of a mercury sphygmomanometer using standard techniques. Based on blood pressure recording for the corresponding height for age in months, children were classified into normal (<90th percentile), pre-hypertension (90 – 95th percentile), stage 1 hypertension (95th – 99th percentile).
Table 1: Risk factor profile for Cardiovascular Diseases

<table>
<thead>
<tr>
<th>Cardio Vascular Risk Factors</th>
<th>Boys (%)</th>
<th>Girls (%)</th>
<th>Total N = 283</th>
<th>‘p’ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 134 (47.3%)</td>
<td>N = 149 (52.7%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Dietary Factors**

- Use extra salt in food
  - Boys: 80 (59.7)
  - Girls: 85 (57)
  - Total: 165 (58.3)
  - p > 0.05

- Not consuming five servings of fruits & vegetables per day*
  - Boys: 57 (42.5)
  - Girls: 87 (58.4)
  - Total: 144 (50.9)
  - p = 0.01

**Physical Activity**

- Low & Moderate Physical Activity
  - Boys: 34 (26.1)
  - Girls: 79 (53.0)
  - Total: 113 (39.9)
  - p = 0.002

- High Physical Activity
  - Boys: 100 (74.6)
  - Girls: 70 (46.9)
  - Total: 170 (60.1)

**Sedentary Lifestyle**

- Sedentary activity <4hrs
  - Boys: 48 (35.8)
  - Girls: 78 (52.3)
  - Total: 126 (44.5)
  - p = 0.005

- Sedentary activity ≥4hrs
  - Boys: 86 (64.2)
  - Girls: 71 (47.7)
  - Total: 157 (55.5)

**Family History**

- Diabetes mellitus
  - Boys: 81 (60.4)
  - Girls: 104 (69.8)
  - Total: 185 (65.4)
  - p > 0.05

- Hypertension*
  - Boys: 58 (43.3)
  - Girls: 85 (57)
  - Total: 143 (50.5)
  - p = 0.02

- Obesity*
  - Boys: 75 (56)
  - Girls: 108 (72.5)
  - Total: 183 (64.7)
  - p = 0.004

- Tobacco use
  - Boys: 48 (35.8)
  - Girls: 44 (29.5)
  - Total: 92 (32.5)
  - p > 0.05

- Alcoholism
  - Boys: 60 (44.8)
  - Girls: 69 (46.3)
  - Total: 129 (45.6)
  - p > 0.05

**Tobacco and Alcohol Use**

- Tobacco use
  - Boys: 5 (3.7)
  - Girls: 2 (1.3)
  - Total: 7 (2.5)
  - p > 0.05

- Alcohol use
  - Boys: 2 (1.5)
  - Girls: 1 (0.7)
  - Total: 3 (1.1)
  - p > 0.05

- Passive smoking
  - Boys: 47 (30.1)
  - Girls: 68 (45.6)
  - Total: 115 (40.6)
  - p > 0.05
**Weight**

<table>
<thead>
<tr>
<th>‘At-risk’ of overweight / Overweight / Central Obesity</th>
<th>2(1.5)</th>
<th>2(1.3)</th>
<th>4(1.4)</th>
<th>p &gt; 0.05</th>
</tr>
</thead>
</table>

**Blood Pressure**

<table>
<thead>
<tr>
<th>Blood Pressure</th>
<th>Pre-hypertension</th>
<th>Stage 1 Hypertension*</th>
<th>Stage 2 Hypertension</th>
<th>p &gt; 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 (0)</td>
<td>10 (6.7)</td>
<td>14 (4.9)</td>
<td>p &gt; 0.05</td>
</tr>
<tr>
<td>Stage 1 Hypertension*</td>
<td>0 (0)</td>
<td>9 (6)</td>
<td>9 (3.2)</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Stage 2 Hypertension</td>
<td>0 (0)</td>
<td>5 (3.4)</td>
<td>5 (1.8)</td>
<td>p &gt; 0.05</td>
</tr>
</tbody>
</table>

* = Statistical significance was noted; ‘p’ value was found to be less than 0.05

---

At-risk’ of overweight / Overweight / Central Obesity were involved in high physical activity as compared to the girls (46.9%). Even though they were involved in high physical activity, a significantly higher proportion of boys (64.2%) also had a sedentary lifestyle (i.e. sitting for more than 4 hours every day) as compared to girls (47.7%).

Data were collected by trained doctors. They were entered on Microsoft excel and analysed. Results were presented using descriptive statistics initially. Chi square analysis was used to lend statistical support where appropriate.

**Results**

A total of 283 children were studied of which a majority (52.6%) were girls (47.3% boys). Mean age of the sampled children was 12.9 (±0.82) years. A majority (76.6%) of the children were in the age group of 13-16 years while 23.3% were in the age group of 10-12 years.

Table 1 depicts the risk factor profile of the students. It was found that 58.3% of the study population used extra salt in their diet while 50.9% did not consume adequate quantities of fruits and vegetables daily. A significantly higher proportion of girls (58.4%) did not consume adequate quantities of fruits and vegetables daily as compared to the boys (42.5%).

A high proportion of the study population (60%) was involved in high physical activity. A significantly higher proportion of boys (74.6%) were involved in high physical activity as compared to the girls (46.9%). Even though they were involved in high physical activity, a significantly higher proportion of boys (64.2%) also had a sedentary lifestyle (i.e. sitting for more than 4 hours every day) as compared to girls (47.7%).

A high proportion of children gave a positive family history of diabetes mellitus (65.4%), hypertension (50.5%), obesity (64.7%), tobacco use (32.5%) and alcohol use (45.6%). A small proportion of the study population gave a history of tobacco use (2.5%) and alcohol use (1.1%). Passive smoking was seen among 40.6% of the study population. Even though a higher proportion of girls (45.6%) were exposed to passive smoking as compared to the boys (30.1%), the difference was statistically not significant. A small proportion of the study population was found to be overweight (0.7%) and all of them were girls. The prevalence of pre-hypertension was found to be 4.9% and that of hypertension was 5% (3.2% was in stage 1 hypertension while 1.8% was in stage 2 hypertension). Only girls were found to be hypertensive.

**Discussion**

A total of 283 children in the age group of 10 – 16 yrs were included in the study. It was found
that a majority (58.3%) of the study population used extra salt in their diet. Addition of salt to food while eating enhances the taste of the food and is a common practice in India. Our finding of a high proportion of children consuming extra salt could still be an underestimate because children may not even know that extra salt has been added to the food that they are consuming, which may be done by their parents.

Our study found that half of the study population (50.9%) did not consume adequate quantities of fruits and vegetables daily. This could range from poor knowledge regarding the importance of fruits and vegetables in the diet to non availability of fruits and vegetables. It was also found that a significantly higher proportion of girls (58.4%) did not consume adequate quantities of fruits and vegetables daily as compared to the boys. It is a well known fact that when it comes to dietary intake, Indian rural girls have always been neglected. They have always consumed a diet that is deficient quantitatively and qualitatively.

Adequate physical activity is one of the main primary prevention strategies in the prevention of CVDs. A large majority of the children were physically active and travelling to school contributed maximum to being physical active. Buckelo et al. (2009), in their as yet unpublished study conducted among rural school children in a nearby area, observed that 69% of school children were physically active and 31% were minimally physically active, while none were totally inactive.

Sudeepa et al. also in their as yet unpublished study (2006) found inadequate physical activity among 63% of sampled school children. The difference in the methods used to measure physical activity probably has resulted in the difference in the results. Oliveira TC et al in their study conducted among Brazilian school children also reported that the most common activity contributing to physical activity among children was travelling to school followed by domestic chores which is similar to the findings in our study.

In our study we found that more than half of the students (55.5%) practiced a sedentary lifestyle outside of the school i.e. they spent more than four hours every day doing activities which involved sitting in one place like studying, playing computer and video games and chatting with friends. Involvement in sedentary activities may leave little time for physical activity. Oliveira TC et al reported that Brazilian school children on an average spent 2.66hrs/day in sedentary activities.

A high proportion of children had a family history of diabetes mellitus, hypertension, obesity, tobacco use and alcohol use. Over the past few years, along with an increase in the prevalence of Diabetes Mellitus and Hypertension there has been an increase in the awareness regarding Diabetes Mellitus, Hypertension and other associated NCDs. Hence, a high proportion of children have reported a family history of Diabetes and Hypertension. In the presence of family history (non-modifiable risk factor) the emergence of modifiable risk factors can lead to dangerous consequences. It is also well documented that the incidence of essential hypertension was higher among children that had a family history of essential hypertension.

In the present study the prevalence of tobacco use was found to be 2.5% among the study population. Other studies have also shown a prevalence ranging from 2.5% to 11% among Indian rural school children in the age group of 11 – 19 years. The difference can be attributed to the differences in the age groups included in the different studies.

In the present study, 1.1% of the sample had consumed alcohol. George A et al reported that 3% of the adolescents interviewed had a habit of drinking alcoholic beverages. The difference between the two studies can be attributed to the difference in the backgrounds i.e. our study was

NJRCM- ISSN - Print: 2277 – 1522, Online: 2277 - 3517
done in a school setting while their study was done among adolescents in a rural community not specifically in a school setting.

Even though the proportion using tobacco (2.5%) and alcohol (1.1%) in this study population is small, this proportion assumes significance, since the foundations for abuse of tobacco and alcohol are laid in childhood and adolescence. Also, since the participants are children, due to the fear and stigma associated with tobacco and alcohol, they may not have answered those questions truthfully and hence these results may be an underestimate.

It is also important to note that more than 40% of the sampled school children were exposed to passive smoking. It has been identified as an important determinant of health status of the population. Also, passive smoking indicates that children are seeing their parents or relatives or friends who are smoking, which might prompt these children to start smoking.

We all know that central obesity is a very strong predictor of cardiovascular risk especially among Asians. It has been reported that 50% - 80% of the overweight and obese children tend to become overweight / obese adults. In our study we found that 1.4% of the rural school children were either at-risk of overweight/overweight/obese. Other studies have reported an obesity/overweight prevalence ranging from 3% – 6%\textsuperscript{20-21}.

This could be attributed to the difference in the geographical locations. Our study was done in a school where all children come from a rural background and hence the prevalence is found to be lesser. However, it is still a cause for concern since obesity is a strong predictor of cardiovascular risk.

In our study, the prevalence of prehypertension, stage 1 hypertension and stage 2 hypertension was found to be 4.9%, 3.2% and 1.8% respectively. Buckelo et al. (2009) in their as yet unpublished study in the same area found that 6.7% of the rural school children had prehypertension and 5.7% had stage 1 or stage 2 hypertension. Other studies have also reported a prevalence of hypertension ranging from 3% to 6% among rural school children in India\textsuperscript{22-23}. High blood pressure in childhood is a precursor for hypertension and related complications in adulthood. Hence, this proportion assumes significance.

This study was conducted in one school in a rural area close to Bangalore. Even though children attending this school come from the surrounding villages, the place where the school is situated has a considerable urban / peri-urban influence. Hence, the school may not truly be a representative of rural India. However, over the past decade we have seen a very significant urban influence on rural India; hence we are not completely wrong in saying that our findings may not be very different from other schools in rural India. We did not calculate any sample size and included all children in the school in our study population. We included only 8\textsuperscript{th} standard children due to feasibility issues.

From the present study we can draw the following conclusions.

Firstly, the diet of a high proportion of the study population is unhealthy since the diet is rich in salt and poor in fruits and vegetables. The diet of a school girl is worse compared to a boy. Secondly, even though a high proportion of children were physically active, a significantly high proportion of children also had a sedentary lifestyle which does not augur well for their cardiovascular health. Thirdly, a high proportion of children reported a family history of diabetes mellitus, hypertension, obesity, tobacco use and alcohol use. As mentioned earlier, in the presence of family history (non-modifiable risk factor) the emergence of modifiable risk factors can lead to dangerous consequences. Fourthly, a small number of children had tasted tobacco and alcohol and this finding may be an underestimate. Also, this proportion assumes
significance, since the foundations for abuse of tobacco and alcohol are laid in childhood and adolescence. We also found that passive smoking was rampant.

Finally, we conclude by saying that there is a high prevalence of modifiable cardiovascular risk factors among rural school children which needs to be addressed if we intend to prevent the epidemic of cardiovascular diseases in India.

Acknowledgements

We sincerely acknowledge the contributions of the staff, postgraduate students and interns from the Department of Community Health, St. John’s Medical College, Koramangala, Bangalore to the overall conduct of the study at various stages.

Conflicts of Interest: None declared

Funding Agencies: The Department of Community Health, St. John’s Medical College, St. John’s National Academy of Health Sciences supported the conduct of this study.

References

13. de Oliveira TC, DaSilva AAM, Santos CJN, Silva JS, Oliveira daConceição SI. Physical activity and sedentary lifestyle among children from private and public schools in


