Prevalence of metabolic syndrome and cardio-metabolic risk factors in the adolescents of Rural Wardha

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Abstract
Objective: To study the magnitude of Cardio-Metabolic abnormalities and metabolic syndrome among the adolescent in rural population of Wardha.
Methods: A cross sectional study was carried out among the adolescents (10-19 years) of Anji P.H.C. Sample size studied was 400, selected by random sampling. The sampling frame available with department of Community Medicine was used for drawing the sample. We collected the data on their socio-demographic variables and other cardio metabolic risk factors. Fasting blood sample was collected and result for lipid profile and blood sugar was obtained.
Results: Prevalence of metabolic syndrome was found to be 9.9% in the study population and highest prevalence of lower level of HDLc 58.3% was found. Among the study subjects, 24.4% had high blood pressure levels, i.e. ≥90th percentile for age, sex and height and the prevalence of hypertriglyceridemia was found to be 27.9%. Only 2.2% of the subjects were found to have waist circumference more than the cut off (> 90th percentile) and 13.8% of subjects had impaired fasting glucose.
Conclusion: we conclude that there is definitely alarming situation as per prevalence of cardio metabolic abnormalities and metabolic syndrome are concerned, even in rural communities. The early identification of cardio metabolic risk factors can help with an attempt to prevent or delay metabolic syndrome, diabetes and cardiovascular disease.
Keywords: Cardio metabolic risk factors, metabolic syndrome

1. Introduction
The metabolic syndrome has been called by several other names, including syndrome X, insulin resistance syndrome, dysmetabolic syndrome X, Reaven syndrome, and metabolic cardiovascular syndrome. The constellations of risk factors including abdominal obesity, hypertension, dyslipidemia, and hyperglycemia are responsible for metabolic syndrome.
A recent study showed a high prevalence of cardio metabolic abnormalities among the healthy adolescent. The presence of cardio metabolic abnormalities are more common in higher socioeconomic group which is related with difference in lifestyle. Ludwig et al have shown that reduced physical activity and unhealthy diet habit have major role in causation of childhood obesity. Also television viewing has been linked to the childhood obesity. Weiss et al has reported increasing trend of obesity among children & adolescent leading to increased prevalence of insulin resistance. High insulin and sugar level promote the condition of inflammation in body. The coronary lesions or plaques are building up of fat, cholesterol and cell debris. These material stick to the inside of the arteries that have become rough due to inflammation and cause hardening of arteries which ultimately lead to heart attacks and strokes.
The lifestyle changes and urbanization is mainly responsible for the prevalence of cardio metabolic changes in rural areas. But very little information is available in this regard from rural area. Hence we studied the prevalence of metabolic syndrome and cardio metabolic abnormalities among rural adolescents in area of Primary Health Centre.

2. Material & Methods
A cross sectional study was carried out in rural area of Primary Health Centre. All adolescent in the age group of 10-19 years of Primary Health Centre Anji, were included in study. The subjects who were not willing to remain fasting or were not willing to participate in the study were excluded. The subjects were selected by using simple random sampling. The sampling frame available with department of Community Medicine was used for drawing the sample.
The study was commenced after obtaining clearance from the Institutional Human Ethical Committee. The subjects were selected after obtaining written informed consent from them. Detailed history was taken including past and present status of health of parent, occupation, education, dietary intake and addiction of subjects etc. Using pre-designed proforma anthropometric measurement, and laboratory investigation like fasting blood glucose level, lipid panel compromising total cholesterol, triglyceride, high density lipoprotein, low density lipoprotein, and very low density lipoprotein were noted in the pretested proforma.
The subjects underwent anthropometric measurement, in where height and weight were measure by measuring tape and weight machine to the nearest 0.1cm and 0.1kg respectively. Waist circumference was measure by measuring tape in horizontal plane at the midpoint between the bottom of the rib cage and above the top of the iliac crest with person breathing silently and BMI was calculated by dividing weight(kg) by height squared (m²). Blood
pressure was recorded with sphygmomanometer in right arm, in sitting position, three times in subjects after giving rest for 10 minutes between each recording. The systolic and diastolic high blood pressure is defined by blood pressure value >90th percentile for age, sex and height.\(^6\)

Morning blood sample samples were taken from subjects, after an overnight fast (10-12 hr). Fasting plasma glucose was measured by glucose oxidase peroxidase method. Total cholesterol by CHOD-PAP method, Triglyceride by GPO-Trinder method and HDLc by phosphotungstic acid method using XL-300 autoanalyser.

The National Cholesterol Education Program (ATP III) definition modified for age will be used to define abnormal level of cardio-metabolic risk factors in adolescent.\(^4,14\)

The criteria are as follows:
1) Waist circumference at or above the 90th percentile value for age and sex from sample population classified as having abdominal obesity
2) Triglyceride level >110mg/dl.
3) HDL cholesterol level <40mg/dl.
4) Systolic or diastolic high blood pressure was defined by blood pressure value >90th percentile for age and height.\(^8\)
5) Fasting blood glucose levels >100mg/dl.\(^12\)

Presence of any three of five risk factor mentioned above were consider as metabolic syndrome. Statistical analysis was conducted by using EPI-INFO software. Chi square test was applied to test the significance of difference between two group and p value < 0.05 considered as significant.

3. Results

In study population, we found 9.9% prevalence of metabolic syndrome (Table 1). Only 2.2% of the subjects were found to have waist circumference more than the cut off (> 90th percentile). Among the study subjects, 24.4% had high blood pressure levels, i.e. >90th percentile for age, sex and height and the prevalence of hypertriglyceridemia was found to be 27.9%. Also, we found high prevalence (58.3%) of low level of HDLc and 41.7% of subjects had impaired fasting glucose and 86.2% of subject had normal glucose level (Fig. 1).

![Fig 1: Distribution of cardio metabolic risk factors and metabolic syndrome in study population](image)

When comparing metabolic syndrome with sociodemographic variables, we found metabolic syndrome differ significantly in subjects with family history of obesity and hypertension (Table 2). However, the prevalence of obesity (WC) differ significantly (p<0.05) with caste and in subjects with family history of obesity and diabetes, also the prevalence of overweight differ significantly in subjects with family history of obesity and hypertension (Table 3). The prevalence of high blood pressure, high triglyceride level, and low level of High density lipoprotein didn’t found significant association with sociodemographic variables. However, the prevalence of Impaired fasting glucose differ significantly (p<0.05) with family history of hypertension.

<table>
<thead>
<tr>
<th>Metabolic syndrome</th>
<th>Number of subjects</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>40</td>
<td>9.9</td>
</tr>
<tr>
<td>Absent</td>
<td>365</td>
<td>90.1</td>
</tr>
<tr>
<td>Total</td>
<td>405</td>
<td>100</td>
</tr>
</tbody>
</table>

| Table 2: Comparison of socio-demographic variables with metabolic syndrome |
|---------------------------|------------------|------------|
| Variable                  | Overall (%)      | Metabolic syndrome (40(9.9%)) | p-value |
| Age (years)               |                  |                        |         |
| <15                       | 159              | 17(10.7)               | 0.658   |
| ≥15                       | 246              | 23(9.3)                |         |
| Sex                       |                  |                        |         |
| Male                      | 182              | 14(7.7)                | 0.183   |
| Female                    | 223              | 26(11.7)               |         |
| Type of Family            |                  |                        |         |
| Joint                     | 39               | 7(17.9)                | 0.352   |
| Nuclear                   | 366              | 33(9.0)                |         |
| Education                 |                  |                        |         |
| < 7th class               | 158              | 20(12.7)               | 0.133   |
| > 7th class               | 247              | 20(8.1)                |         |
| Physical Activity         |                  |                        |         |
| Light                     | 291              | 25(8.6)                | 0.165   |
| Moderate                  | 114              | 15(13.2)               |         |
| Family history of obesity |                  |                        |         |
| Yes                       | 43               | 8(18.6)                | <0.05\(^7\) |
| No                        | 362              | 32(8.8)                |         |
| Family history of HT      |                  |                        |         |
| Yes                       | 24               | 6(25.0)                | <0.05\(^7\) |
| No                        | 381              | 34(8.9)                |         |
| Family history of Diabetes|                  |                        |         |
| Yes                       | 13               | 2(15.4)                | 0.838   |
| No                        | 392              | 38(9.7)                |         |

(p<0.05 is consider as significant)
Table 3: Comparison of cardio metabolic risk factors with sociodemographic variables

<table>
<thead>
<tr>
<th>Cardio metabolic risk factors</th>
<th>Age</th>
<th>Sex</th>
<th>Caste</th>
<th>Family income</th>
<th>Physical activity</th>
<th>Family history of obesity</th>
<th>Family history of HT</th>
<th>Family history of diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBP</td>
<td>0.658</td>
<td>0.729</td>
<td>0.151</td>
<td>0.268</td>
<td>0.583</td>
<td>0.350</td>
<td>****</td>
<td>0.636</td>
</tr>
<tr>
<td>WC</td>
<td>0.981</td>
<td>0.712</td>
<td>&lt;0.05</td>
<td>***</td>
<td><strong>0.05</strong></td>
<td>****</td>
<td><strong>0.05</strong></td>
<td><strong>0.05</strong></td>
</tr>
<tr>
<td>BMI</td>
<td>0.870</td>
<td>0.089</td>
<td>0.457</td>
<td>****</td>
<td>0.925</td>
<td>0.05</td>
<td><strong>0.05</strong></td>
<td><strong>0.05</strong></td>
</tr>
<tr>
<td>HDLc</td>
<td>0.169</td>
<td>0.536</td>
<td>0.708</td>
<td>0.486</td>
<td>0.054</td>
<td>0.197</td>
<td>0.38</td>
<td>0.415</td>
</tr>
<tr>
<td>HTG</td>
<td>0.549</td>
<td>0.399</td>
<td>0.562</td>
<td>0.957</td>
<td>0.200</td>
<td>0.999</td>
<td>0.54</td>
<td>0.936</td>
</tr>
<tr>
<td>IFG</td>
<td>0.558</td>
<td>0.595</td>
<td>0.054</td>
<td>0.337</td>
<td>0.093</td>
<td>0.058</td>
<td><strong>0.05</strong></td>
<td>0.163</td>
</tr>
</tbody>
</table>

[HBP: High blood pressure, WC: Waist circumference, BMI: Body mass index, HDLc: High density lipoprotein, HTG: High triglyceride level, IFG: Impaired fasting glucose, p<0.05 is considered significant]

4. Discussion

4.1 Metabolic syndrome

In present study, we found overall prevalence of metabolic syndrome was 9.9%. The overall prevalence of metabolic syndrome in a study by Singh et al. in adolescents aged between 12-17 years from India was 22%.15 In Turkey, prevalence of metabolic syndrome was reported to be 2.2% among adolescents. A study by Esmaillzadeh et al., in the capital city of Iran reported a prevalence of 10.1% for the metabolic syndrome in adolescents aged 10-19 years (10.3% in boys and 9.9% in girls).14 The prevalence of the metabolic syndrome among Korean adolescents, was found 5.5% in 12-13 years of age group.

Cook et al.16 also reported 4.2% of prevalence of metabolic syndrome in adolescents 12-19 years of age group and it increased to 6.4% in the NHANES study during 1999-2000. A comparatively higher prevalence of metabolic syndrome reported in our study can be attributed to difference in study setting and population. It can also be due to difference in definition used for metabolic syndrome.

In the present study, metabolic syndrome was significantly associated with family history of obesity was 25% among those with family history of hypertension as against 8.9% among those without family history of hypertension (p<0.05). Similarly, the prevalence of metabolic syndrome was significantly higher being 18.6% among those with family history of obesity as against 8.8% among those without family history of obesity (p<0.05).

The prevalence of metabolic syndrome was higher in females (11.7%) than in males (7.7%). However, the higher prevalence among females was not statistically significant. There were considerable number of report suggesting no significant difference in prevalence of metabolic syndrome with age and sex. The cross sectional survey in adolescents in Ho Chi Minh City, showed overall the prevalence of metabolic syndrome was 4.6% and there was no difference by sex (p=0.9) but prevalence of metabolic syndrome slightly higher in female (4.7%) than in male (4.6%).17 In contrary to our finding, Cook et al. showed higher prevalence in males (6.1%) than in female (2.1%).18

4.2 Hypertension

In the present study, we found overall prevalence of high blood pressure to be 24.4% (Fig. 1). Another study from the same area found the prevalence of hypertension in rural area to be 5.8%.19 Goel et al in their study on students aged 14–19 years in New Delhi found 6.4% of adolescents to be hypertensive.20

In the present study, prevalence of high blood pressure was 25.1% in females as against 23.6% in males. Similarly, Ximena et al. found higher prevalence of hypertension in females (22.3%) as compared to males (18.9%).18 In contrary to several other studies, present study didn’t find any significant association of family history of hypertension with adolescent high blood pressure (Table 3). A population-based study of students aged 14–19 years in New Delhi found hypertension to be positively correlated with family history of hypertension.17

Also, Soudarssanane et al. found that the prevalence of hypertension was higher among subjects with positive family history of hypertension.19

4.3 Obesity & Overweight

In the present study, we found only prevalence of obesity was 2.2% by waist percenttile and that of overweight was 5.4% by body mass index (Fig. 1). Our finding was comparable to finding of a study carried out by Bharti et al.22 They reported 4.3% prevalence of overweight and obesity among school going children of Wardha city.

Similarly, James et al. also showed that the prevalence of overweight was 17% and of obesity was 3% in 9 to 15 year of age group subjects.21 A recent report from Karachi, showed 6% was obese and 8% overweight in school going children.22 However, study conducted in Pune, Maharashtra, found that nearly 19.9% were overweight, whereas 5.7% were obese.23

In the present study (Table3.3), the prevalence of overweight was found to be significantly higher in subject with family history of obesity, hypertension and diabetes (p<0.05). Also the prevalence of obesity was found to be differ significantly in subjects with family history of obesity and diabetes (p<0.05). Similarly, Nasreddine et al showed the positive association of obesity with family history of obesity and higher economic group.24

4.4 Dyslipidemia

In the present study, the prevalence of hyperglycemia was increased lower level of high density lipoprotein cholesterol were found being 27.9% and 58.3% respectively (Fig. 1). The prevalence of lower level of high density lipoprotein cholesterol was found high 59.6% in females. The prevalence of hyperglycemia was found to high in females (29.6%) than in males (25.8%). Similarly, Krishna et al found that prevalence of hyperglycemia was observed in 62.1% of girls and 47.8% of boys.25 In the present study, the prevalence of dyslipidemia was found to be higher among other backward class. Possibility of dyslipidemia in upper caste may because of they were from higher socioeconomic group, over eating dietary habit, low physical activity and sedentary lifestyle.

We found prevalence of dyslipidemia to be higher in the subjects with family history of obesity, hypertension and diabetes. Thus, the subjects from these families were at more risk for developing disease including cardiovascular and diabetes in future.

4.5 Impaired Fasting Glucose

In the present study, the prevalence of impaired fasting glucose was 13.8% (Fig 1). The prevalence of impaired fasting glucose differs significantly with family history of hypertension (p<0.05).

Thus, the present study reveals that clustering of cardio metabolic abnormalities and metabolic syndrome is a major health problem in rural area, indicating that cardio metabolic risk factors and metabolic syndrome is not necessarily condition of urban area.

5. Conclusion

Therefore, we conclude that as per prevalence of cardio metabolic abnormalities and metabolic syndrome there is definitely alarming situation in rural communities. The early identification of cardio metabolic risk factors can help with an attempt to prevent or delay metabolic syndrome, diabetes and cardiovascular disease. The adolescent from affluent family, family history of obesity, hypertension and diabetes are at high risk, thus, need to modify their lifestyle to prevent non-communicable diseases, particularly heart disease, stroke and diabetes in future.

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References


