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# Evaluation of Prevalence of Metabolic Syndrome in Corporate School Children at Nellore District andhra Pradesh, India

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**Abstract:** Field Surveys of diabetes and other non communicable disease (NCD) (Hypertension, coronary heart disease) are increasingly being performed in both developed and developing countries. Recent studies have shown that the prevalence of diabetes is very high among migrant Asian Indians and is also rising very rapidly within the Indian sub continent the major cause of which is nothing but metabolic syndrome. Its prevalence in the child hood has been increasing very rapidly. In the present study an attempt has been made to evaluate the prevalence of metabolic syndrome in corporate school children. The results have shown that the prevalence in girls is more than boys. When the glucose is taken as screening parameter the prevalence of MS is 9% in boys. But with all most all other parameters like triglycerides, HDL cholesterol was considered the prevalence of MS is approximately 6% in girls. With reference to the hypertension the prevalence is almost nil in girls.

**Key words:** Insulin Resistance · Prevalence · Triglycerides · HOMA · Central Obesity

## INTRODUCTION

Metabolism syndrome is a defect in the biochemical processes and pathways in the body. Enzymes play a key role in many of these processes and changes in their function, as a result, of genetic mutation can lead to problems in these pathways. The major metabolic pathways for proteins, carbohydrates and lipids are closely integrated with key molecules, such as acetyl co-enzyme A via complex mechanisms. A genetic defect in any part of the major metabolic pathways is known as an inborn or congenital error of metabolism. ATP III (The third National Cholesterol Education Program Adult Treatment Panel) [1] defines the metabolic (or insulin resistance) syndrome as the presence of at least three of the following five risk factors in an individual i.e. central or abdominal obesity, hypertriglyceridemia, hypertension, low HDL cholesterol and high fasting glucose levels. The metabolic syndrome is a major risk factor for and type 2 diabetes cardiovascular diseases (CVD). Although insulin resistance is also a key risk factor for CVD and type 2 diabetes, hyperinsulinemia is not included as a potential risk factor by the ATP III, its definition was designed for use in clinical practice with adults and insulin levels are not usually assessed in clinical practice.

The prevalence of the metabolic syndrome varies by the definitions used for the components and by the weight status of the subjects. Cook *et al* [2] who studied children and adolescents 12-19 years of age in the third National Health and Nutrition Examination Survey (NHANES III) data set reported a prevalence of 4.2%. Investigators from the Bogalusa Heart Study [5] reported a prevalence of 3.6% in youth 8-17 years of age. However, researchers reported much higher prevalence rates in children who are overweight or obese.[2,3]. In a study of 490 subjects aged between 4-20 years, who had a BMI ≥ 97th percentile the prevalence of MS is approximately 89%, the prevalence of the metabolic syndrome in moderately obese subjects (defined as a BMI *z*-score of 2.0-2.5) was 38.7%, whereas almost half (49.7%) of severely obese subjects (defined as a BMI *z*-score > 2.5) had the syndrome. In another study among children and adolescents 8–19 years of age, the prevalence was 6.8% in those who were at risk for overweight (85–95$^{th}$ percentile of BMI) and 28.7% in those who were overweight (BMI ≥ 95th percentile) [4] The prevalence of

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the metabolic syndrome in young adolescents may vary by sex and ethnicity, as it does in adults, but data on this are conflicting. In a national multiethnic study, the metabolic syndrome was significantly more prevalent in males (6.1%) than in females (2.1%), but other researchers reported no significant sex differences [4]. Cook *et al* [2] reported the prevalence of the metabolic syndrome was higher in whites (4.8%) and Mexican Americans (5.6%) than in African Americans (2.0%). Weiss *et al*. also found that white children were at greater risk for metabolic syndrome than African-American children when they used the same cut points for lipids.

However, when they used race-specific norms for lipids, the prevalence of the metabolic syndrome risk did not differ between African-American and white youth, likely because the African-American youth had better lipid profiles. More large, multiethnic studies with boys and girls are needed to learn whether the ethnic and sex differences seen in the metabolic syndrome in adults are also present during childhood and adolescence. Due to changes in childhood lifestyle characterized by the lack of physical activity and an energy dense diet, the worldwide epidemic of obesity represents a significant challenge in public health and pediatric medicine [3]. Increasing prevalence of obesity in both adults and children has been observed in many countries throughout the world [6, 7]. China as well has experienced marked increases in the prevalence of childhood overweight/ obesity over the last few decades.

## MATERIALS AND METHODS

**Collection of Samples:** 400 (200 male and 200 female) samples from corporate school children of age 7-14 years were collected in the morning time. The experimental procedures were clearly explained both to the students and to their parents and individual consent was obtained from each student. Central obesity was assessed by using a tailor tape. Hypertension was assessed by smignomanameter with the help of a local medical practitioner.

**Analysis of Biochemical Parameters:** The collected samples were subjected for centrifugation and serum was separated. The biochemical parameters like Triglycerides was estimated according to the method of Buckley *et al*. [8]. HDL was measured using the method of Kostner [9] and Lopes *et al*. [10]. Glucose was estimated using Semi auto analyzer (Model CHEM 400), Electronics India, India. Plasma insulin level was measured by AxSYM Insulin assay. Previous studies demonstrated that HOMA-IR has been validated in children and adolescents to correlate strongly with insulin resistance [11]. In clinical practice or epidemiologic studies, insulin resistance is often measured by the homeostasis model assessment, not by the euglycemic insulin glucose clamp. In this study, insulin resistance was assessed by the homeostasis model assessment according to the formula: fasting insulin (ìU/ml) × fasting glucose (mmol/L)/22.5 [11, 12].

## RESULTS AND DISCUSSION

The metabolic syndrome refers to a clustering of most dangerous heart attack risk factors, such as insulin resistance, abdominal obesity and impaired glucose, elevated blood pressure, elevated triglycerides and reduced high-density lipoprotein cholesterol. Since the process of atherosclerosis begins during early childhood, the metabolic syndrome has been widely studied in pediatrics [13]. Genetics, physical inactivity, ageing, a proinflammatory state and hormonal changes may also have a causal effect, but the role of these may vary depending on ethnic group. However, it is difficult to compare or contrast the prevalence of metabolic syndrome because it has been defined differently by various investigators, including De Ferranti [14], Goodman E [15], Weiss R [16], Cruz [17], Ford [18] and IDF [19]. In this study we adopted ATP-III and FDI criterion to assess the prevalence of MS in corporate school children of Nellore district as most of their day time life is restricted to closed class rooms without physical exercises.

The study was conducted as a cross sectional study in Nellore district in different corporate schools. The study evaluated high prevalence of MS in almost all age groups of children with reference to different parameters. When ATP-III definition was considered the prevalence of MS in girls is almost double than in the boys and even higher when considered under FDI when the central obesity is studied parameter. Similar results were also obtained based on the IOTF definition of overweight/obesity for children [20] that showed that the overall prevalence rates of overweight, obesity and normal weight were 13.4%, 3.6% and 83.0%, respectively. Recent studies suggest that obesity is associated within insulin resistance in both adults and children. Our study is comparable with previous reports in children [21,22]. Except hyper tension all other parameters incorporated in the selected definitions had shown that the prevalence with each parameter is slightly higher in girls than boys.

Table 1: Parameter definitions of Metabolic Syndrome

| Parameter | ATP-III | FDI |
|---|---|---|
| Central obesity | M > 102 cm | M ≥90 cm |
| | F> 88 cm | F ≥ 80 cm |
| Triglycerides | ≥ 150 mg/dl | ≥ 150 mg/dl |
| HDL | M< 40 mg/dl | M<40 mg/dl |
| | F< 50 mg/dl | F< 50 mg/dl |
| Hyper tension | ≥ 130/≥85 mm Hg | ≥ 130/≥85 mm Hg |
| Fasting glucose | ≥ 110 mg/dl | ≥ 100mg/dl |

Table 2: Distribution of MS in the Selected Population

| Parameter | ATP-III | FDI |
|---|---|---|
| Central obesity | M- 2% (108.12 cm) | M- 2% (99.24 cm) |
| | F- 4% (94 cm) | F- 5% (92.22 cm) |
| Triglycerides | M- 4% (157 mg/dl) | M- 4% (157 mg/dl) |
| | F- 6% (154.25 mg/dl) | F- 6% (154.25 mg/dl) |
| HDL | M- 5% (36.40 mg/dl) | M- 5% (36.40 mg/dl) |
| | F- 6% (44.43 mg/dl) | F- 6% (44.43 mg/dl) |
| Hyper tension | M- 2% | M- 2% |
| | (135/90 mm of Hg) | (135/90 mm of Hg) |
| | F- NIL | F- NIL |
| Fasting glucose | M- 9% (117.32 mg/dl) | M- 12% (112.44 mg/dl) |
| | F- 6% (112 mg/dl) | F- 7% (109.99 mg/dl) |

*Values mentioned in the parenthesis represent the average values of each parameter recorded in MS children.

Table 3: Distribution of Insulin Resistance

| | With MS | Without MS |
|---|---|---|
| Insulin (uM/ml) | M- 7.6 | M- 5.4 |
| | F- 7.4 | F- 5.0 |
| HOMA- IR | M- 1.90 | M- 1.22 |
| | F- 1.86 | F- 1.02 |

When fasting glucose is taken the prevalence of MS in boys is 9% and 12 % with respective to ATP-II and FDI respectively. But in girls the prevalence is slightly low than boys i.e. 6 and 7% respectively and were depicted in Table 2.

Table 1 showeds that central obesity ATP III levels were high in males (102 cm) when compared with females (88 cm), HDL also showed high level when compared to the females. The average levels of selected parameters under both definitions in Ms Children were given in table 2. With respective to triglycerides and HDL cholesterol the prevalence in boys and girls is more or less similar. The prevalence of MS with respective to triglycerides is 4% and 6% in boys and girls respectively under both definitions when same is considered with HDL the percentage of prevalence is 5 and 6 under both definitions. Hypertension is recognized as an important component of the metabolic syndrome in adults, but its role in the syndrome in children and adolescents is not clear. Also our study has shown that the hypertension is not a considerable factor to asses the prevalence of MS in school children. Few studies of youth have examined the relationship of blood pressure and insulin values and their results are conflicting. Some investigators found a positive association between insulin levels and blood pressure [21, 22]. Definitions of the metabolic syndrome often include impaired glucose tolerance or high fasting glucose, now called prediabetes [23]. However, in several studies, overweight children had low HDL cholesterol and high triglycerides and insulin, but normal glucose levels suggesting that glucose intolerance may develop later than other syndrome abnormalities. Thus, it may be important to assess insulin levels as well as glucose in children, because many of the clusters of metabolic syndrome factors will have normal glucose levels. Table 3 illustrate that there is no much correlation of insulin resistance with development of MS and glucose intolerance. Several longitudinal studies of adults have demonstrated that hyperinsulinemia can precede the development of type 2 diabetes by > 10 years [24, 25]. American Heart Association (AHA) recommendations add the assessment of fasting insulin to the evaluation of children at risk for insulin resistance [26]. The AAP Expert Committee on Evaluation and Treatment of Obesity in Children recommends measurement of both fasting glucose and insulin [27]. In addition, measurement of glucose and insulin may also be warranted in girls who enter puberty early. Girls with early menarche tend to have excess body fat and higher insulin starting in early childhood and have a higher prevalence of the metabolic syndrome in young adulthood [28].

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