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Body mass index, T2DM and Insulin Resistance

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Abstract: **The body mass index (BMI) is the metric recently in use for defining anthropometric height/weight characteristics in adults and for categorizing them into groups. The general construal is that it represents an index of an individual's fatness. It is also used as a risk factor for the development of or the pervasiveness of several health issues. In addition, it is widely used in determining public health policies. The BMI has been useful in population-based studies by virtue of its wide acceptance in defining specific categories of body mass as a health issue. However, it is increasingly clear that BMI is a rather poor indicator of percent of body fat and the BMI also does not capture information on the mass of fat in different body sites. The latter is related not only to untoward health issues but to social issues as well. Lastly, current evidence indicates there is a wide range of BMIs over which mortality risk is modest, and this is age related. All of these issues are discussed in this brief review.**

***Index terms -BMI, T2DM, insulin and population*.**

I. INTRODUCTION

Overweight and obesity among teenagers are very important, since most overweight teens remain overweight in adulthood [1]. Overweight and Obesity have increased globally among children, adolescents, The World Health Organization (WHO) designates obesity as one of the most important public health threats because of the significant impact of chronic conditions associated with obesity and adults.The literature shows that there are not many published papers on childhood obesity in India, considering 10 or more countries[6]. To date, only two papers have been published on overweight and obesity prevalence in children in India in at least 10 countries, including countries from the north, central, south, east, and west. The papers were those by both genders for Type 2 Diabetes Mellitus (T2DM) and insulin resistance parameters.

Reading the conclusion of the two parameters gives quite a different impression of the situation in India. The first consider in T2DM in male whereas the second found a more equal distribution of female[2]. Obesity is less prominently associated with morbidity in adolescence [4] but is a strong precursor of obesity and related morbidity in adulthood, with 50% to 80% of obese teenagers becoming obese as adults.

[5,6] During adolescence, overweight and obesity are often a burden that results in psychosocial problems [7,8] and a reduced capacity for physical activity[3]. [9] Adolescence is a critical period for the onset of obesity [10] and for obesity-associated morbidity in later life [11-13].Therefore, from a public health perspective, it is important to monitor overweight in adolescence[4].

Basically, reports on the prevalence of overweight and obesity are based on either single cross-sectional or repeated cross-sectional studies. From one cross-sectional dataset, we can learn about the prevalence of a certain outcome. From repeated cross-sectional studies, we can investigate the changes in the prevalence over time [5].

In adults, there is a consensus on the definition of overweight and obesity. The Body mass index (BMI) at or above 25 kg/m^2 denotes overweight. BMI at or above 30 kg/m^2 are classified as obesity. There is no agreed definition on child and adolescent overweight and obesity. In children, BMI increases from birth until 1 year of age. Then BMI decreases until 5–9 y of age[8-15]. The age at which the BMI begins to increase is the so-called adiposity rebound. Therefore, it is necessary to have age- and gender-specific cutoffs of BMI for children and adolescents up to the age of 17 year and above[16].

To overcome this problem, the International Task Force on Childhood Obesity (IOTF) published a paper with age- and gender-specific cutoffs of BMI. The purpose of the present paper was to compare the methods, results, and conclusions drawn in the two parameters.

Secular trends of body mass index (BMI) (weight in kilograms divided by the square of height in meters) in children nationally indicate that the average weight of children who are overweight is now heavier than previously. For adults, BMI values at or above 25 indicate overweight and a BMI at or above 30 defines obesity [17,18] No such generally accepted definitions exist for children and adolescents. Since BMI increases for youth on average from about age 6 or 7 years, through puberty19 to age 17 years, it is necessary to have age- and sex-specific definitions of overweight and obesity.

A recommendation by the International Obesity Task Force for BMI references averaged BMI-for-age data for measured children, adult aged, across Indian countries and projected the centile curves through the adult cutoff points (25 at the85th centile and 30 at the 95th centile) at age 18 years in an effort to produce new internationally appropriate references [17].

The United States, for children and adolescents, the term *obesity* is generally reserved for clinically diagnosed cases, and the comparable terms and definitions used for measured children in screening or for surveys are *at risk of overweight* (85th-94th centile) and *overweight* (95th centile) on the basis of BMI for age [18-20].

Even with no generally accepted current international definitions for overweight and obesity in children, both the Centers for Disease Control and Prevention [14,17] and the European Childhood Obesity Group have recommended the use of BMI both for clinical work and for epidemiologic research [22].Studies on overweight and obesity in children and adolescents are difficult to compare because of differences in methods (measured or self-reported heights and weights) and periods of data collection (secular trends) [23].Other problematic issues include the method used for the assessment and definition of obesity (cutoff points or adequate reference tables relevant to the population studied), nonrandom selection criteria for children and adolescents, representativeness of samples (area or national), sample size, age, and sex[23].The aims of this article are to (1) determine and compare country-specific BMI 85th and 95th centiles based on self-reported pooled data from adolescents across 15 countries and (2) estimate the prevalence of BMI at or above the 85th centile and the 95th centile (overweight) in adolescents across countries by means of the study reference standard.

II. DATA

The data from Indian country with special reference from Tamil Nadu were included in a national data and data on self-reported height and weight. Adolescents at ages less than 13, 14, or greater than or equal to 16 years were included to yield measures for age in months at 13 and 15 years. Adolescents were included from the international file if month or year of birth was unknown.

Two items measured height and weight: “How much do you weigh without clothes?” and “How tall are you?” The BMI was calculated from self-reported height and weight. Some countries allowed reporting in stones, pounds, ounces, feet, or inches, which were then converted to kilograms and centimeters, as appropriate.

III. STATISTICAL ANALYSIS

Univariate analyses of the mean, median and centile distributions of age, height, weight, and BMI were completed for each parameter. We present the country-specific 85th and 95th centile levels for BMI, since they are frequently recommended for the assessment of risk of overweight status. The Correlation coefficients between Anthropometric related to biochemical and insulin resistance parameters in male and female subjects.

To conduct survey in Tamil Nadu (India) used a common research protocol to standardize sampling methods, data collection, and measurements. In this state, a cluster sample design of Place within was used to obtain recommended self-weighting samples to meet the required precision for nationally representative estimates. The precision required was that the 95% confidence intervals (CIs) be no more than ±3% for each age group (11-, 13-, and 15-year-olds) and that the effect of each country’s sample design be no more than 1.4 times the expected variance for estimates that would be obtained if the survey were performed as a non-clustered simple random sample

In this state needed to submit about 65(Both Male and female) people for each age group to meet the minimum criteria for participation, although very small countries or regions may have required fewer people. Further descriptions of the sample designs, statistical requirements, and procedures in each country are available in a recent WHO publication. The anonymous and standardized questionnaire and measures were translated forward and backward from the Tamil and English-language standard version to the State and national languages. This analysis uses data from optional questions on height and weight as completed. Adolescents younger than 13 years were used in this analysis because of variability associated with puberty and lack of reliability in self-reported height and weight among young adolescents.

IV. RESULTS

Table 1:BMI and selected parameters related to T2DM

Table 1 describes BMI and selected parameter for T2DM. Weight for male ranged from the lowest in TC-HDL to the highest in total Cholesterol. The female ranged from the lowest in HDL to the highest in VLDL. Means and medians were very similar, usually with overlapping CIs. Data formean and median are not shown because the distributions at the 85th and 95th centiles address issues of data skewness.

Parameters	**Gender**	
	Male	**Female**
Total Cholesterol	0.9797	0.3803
HDL	0.2285	0.0770
Triglycerides	0.2230	0.3285
LDL	0.6532	0.2093
VLDL	0.7915	0.9034
TC-HDL	0.0663	0.0417
LDL-HDL	0.1448	0.0528

V. COMMENTS

The first main finding was the strong contrast between states, with the highest prevalence of BMI. Among total cholesterol and VLDL is significantly increased prevalence of BMI for male and female respectively, although comparisons within and among Tamil Nadu state by age and sex varied. The comparison with data based Tamil Nadu (India) adolescence that would be expected to be somewhat similar to those in neighboring districts included in this study. The best comparison may be a study on Tamil Nadu (India) adolescents, which also used district data.

Our results should be seen in light of the strengths and weaknesses of the study. The major strength of this study is the comparable BMI data on adolescents from various districts. The study is based on large representative national samples of adolescents with very high participation rates as recommended by an international work group. All districts performed the data collection within the same time span, providing a strong basis for international comparisons. Most adolescents answered the questions of height and weight properly.

One weakness is lack of physical examinations for measures of height and weight, although other studies to be relatively consistent.15, 20, 30 and 40 ages adolescents also consider their current height and weight or may know it as of several months ago. For the present Purpose, namely, to assess differences between the districts, it is probable that differences in reporting during rapid growth periods may average out in cross-country comparisons. To our knowledge, no other studies are available with height and weight from so many countries.

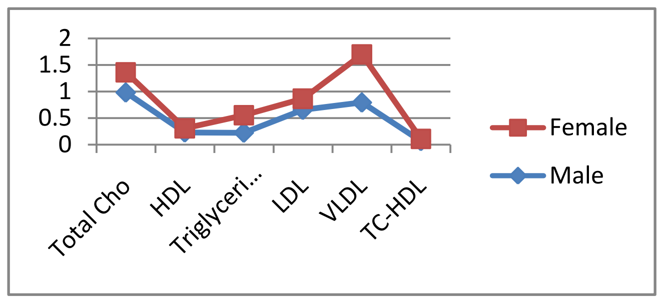
The problem with self-report is that the obese tend to underreport their weight, resulting in a lower prevalence of obesity. Prevalence therefore is probably higher than reported herein. Also, minor sex differences in reporting by adolescents may occur, with some boys overestimating their weight and some overweight girls providing underestimates. These reporting biases probably are consistent among countries.

The correlation between adolescents and measured BMI. Also, a later pilot study performed in Tamil Nadu (India) showed that adolescents aged 10 to 55 years could be accurately ranked according to BMI (correlation coefficient, 0.9) on the basis of Primary data of height and weight. This preliminary validations study showed that male reports are almost identical, while those of girls show more variance, especially in weight. Reported weights were slightly lower than those shown in measured male references. An additional limitation of this study is the lack of pubertal indicators to adjust the prevalence of overweight for inters district differences in the timing of maturation, an approach that has been recommended by the WHO. Adjustment for the timing of maturation may be important because overweight status in female is strongly associated with earlier maturation; while for male early maturation is associated with a low BMI.

Many country comparisons in prevalence of overweight and obesity that do not account for population differences in the timing of maturation in relation to the reference may be biased. We would likewise expect that maturity adjustment would have somewhat attenuated the differences in prevalence rates of overweight and obesity among countries, but would not have significantly affected their relative rankings. The cross-sectional design of this study does not allow for causal analysis of the mechanisms behind the differences.

Fig 1: Relation for BMI and selected parameters related to T2DM

Figures 1 shows the 85th and 95th centile values of BMI in Tamil Nadu state for 13- and 15- year-old and above adolescents of each sex. The highest 85th and 95th centiles



consistently were from in this state.

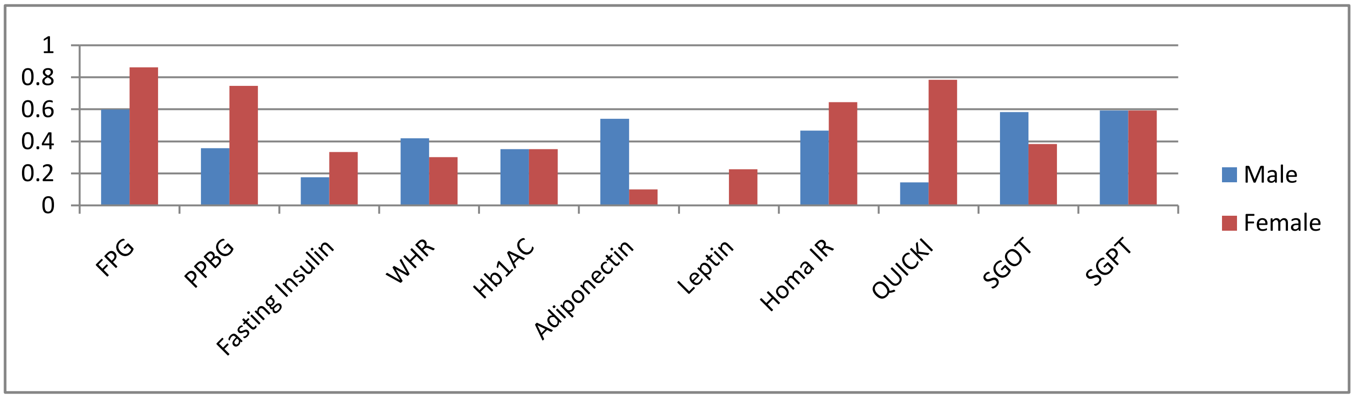
Table 2 presents the BMI and anthropometric related to insulin resistance for both male and female subjects of the BMI distribution compared with the study reference standard. For instance BMI the highest relations between for FPG and lowest relations between for Leptin for male subject. Similarly the BMI highest and lowest relations between for FPG and PPBG respectively.Product moment correlation (Karl Pearson's) as show in appendix.

VI. APPENDIX

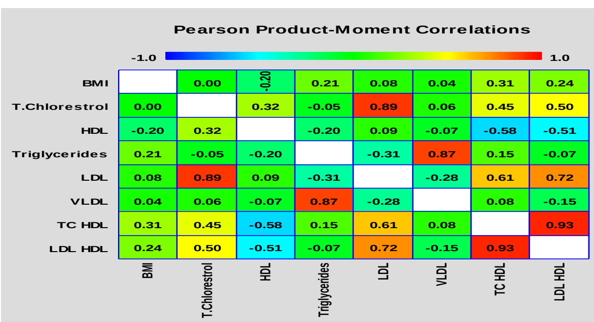
Table 2: Relations between BMI and Anthropometric related to biochemical and insulin resistance parameters in male and Female

Parameter		FPG	PPBG	Fasting Insulin	WHR	Hb1AC	Adiponectin	Leptin	HOMA IR	QUICKI	SGOT	SGPT
Gender (BMI)	Male	0.5991	0.3575	0.1756	0.4178	0.3518	0.5398	0.0013	0.4672	0.1423	0.5827	0.5918
	Female	0.8613	0.7469	0.3337	0.3013	0.3519	0.0993	0.2247	0.6453	0.785	0.3842	0.5918

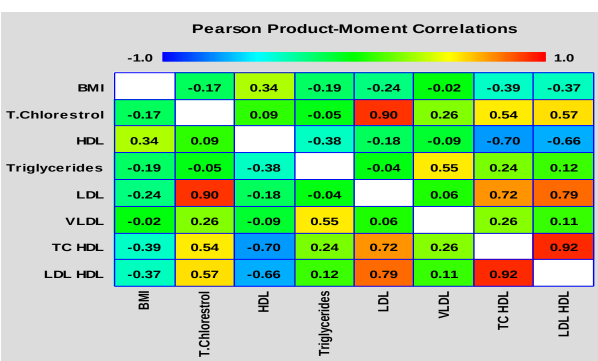
Fig 2: **BMI and insulin resistance parameters**



Product moment correlation-Male



Product moment correlation-Female



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