Editorial

Measuring Obesity to Assess Cardiovascular Risk - Inch Tape, Weighing Machine, or Both?

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Asian Indians have an increased predisposition not only to diabetes[1] but also to premature coronary artery disease.[2] This has been attributed to the so called 'Asian Indian Phenotype'[3,4] characterized by less of generalized obesity as measured by body mass index (BMI) but greater central body obesity as shown by greater waist circumference (WC) and waist-to-hip ratios (WHR).[3,4] This leads to unique biochemical and hormonal changes including higher plasma insulin levels, greater insulin resistance, lower HDL cholesterol, higher triglyceride levels, increased small dense LDL cholesterol as well as small dense HDL cholesterol and C-reactive protein and leptin levels but decreased adiponectin levels.[4-7] Thus many Asian Indians fit into the category of metabolically obese, normal weight individuals.

While it is clear that obesity measured by any index almost always correlates with cardiovascular disease risk (CVD) risk factors, there are differences in the relationship of these anthropometric measures and CVD risk factors in different ethnic groups. In this context the paper by Gupta R, *et al*[8] in this issue of JAPI assumes great significance. The authors report on a large series of 1800 urban subjects with an aim of correlating the BMI, WC and WHR with multiple cardio-metabolic risk factors. They show a positive correlation between BMI, WC and WHR with systolic and diastolic blood pressure, fasting glucose and LDL cholesterol and a negative correlation with physical activity and HDL cholesterol in both men and women. All three parameters correlated with diabetes, hypertension and metabolic syndrome while WHR was additionally correlated with dyslipidemia. While the findings are neither unexpected nor novel, there is very little data from India based on well carried out population based studies and the study results add new data from northern India on CVD risk factors and hence the study is a welcome addition to the growing volume of literature on this subject from within the subcontinent.

Since different indices [i.e. body mass index (BMI), waist circumference (WC), waist-to-hip ratio (WHR)] are used to define obesity, the debate as to which is the best to assess CVD risk continues. While direct assessment of fat mass may be a better index of obesity-related to health risk, it is difficult to measure this accurately in large epidemiological studies particularly in the field setting. Thus, anthropometry still remains the most widely used method for clinical and epidemiological purposes. Each obesity index has its own implications in relation to health risk in general and CVD risk in particular. In the study by Gupta R, *et al,*[8] the importance of BMI, WC and WHR are all shown to be important for estimating CVD risk due to their positive association with various CVD risk factors. Survey of the literature also shows that no single obesity index can be recommended for this purpose from a global standpoint. The recent INTERHEART study showed that waist-to-hip ratio was a much better predictor of CVD events than BMI[9] and the accompanying Lancet editorial is provocatively titled "*A farewell to body mass index?".*[10] Indeed, INTERHEART also showed for the first time that not only is waist a 'risk' factor, but that hip is an independent 'protective' factor. Hence the WHR becomes an even stronger marker because the numerator (waist) is a 'risk' factor while the denominator (hip) is a 'protective' factor and therefore the ratio is, at least theoretically, a stronger predictor than either alone. However, while waist itself is difficult to standardize, measuring hip is even more challenging as one needs to undress the subject and, in the case of women, this could pose cultural and logistic problems eg. finding enough privacy, women health workers to perform measurements etc. Moreover, many studies report that WC is as good if not better than using WHR[11] and it is much simpler as it needs standardization of only one measurement.[9,12-14] While proponents of BMI would point out the difficulties in standardization of WC and WHR, we would argue that measuring BMI needs not only a weighing machine, but also a stadiometer to measure height. Standardization of the latter is a major problem particularly in rural areas where even the floor is not uniform, while calibration of weighing machines, particularly the spring balance which is commonly used, would always remain an epidemiologist's nightmare. Moreover, the sheer convenience of carrying a measuring tape in one's pocket or purse for doing

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opportunistic screening e.g. during an event, in an office, etc., as compared to carrying a stadiometer and a weighing machine around, is pretty obvious. In our opinion therefore, even if the waist (± WHR) was only equal to BMI in its usefulness to assess or predict diabetes and/or CVD risk, it would still come out as a clear winner for purposes of opportunistic screening. Indeed, we have shown that a simple Indian Diabetes Risk Score (IDRS) developed by us which includes only WC in addition to four questions, helps to predict not only undiagnosed diabetes in the community[15] but also metabolic syndrome and coronary artery disease.[16]

Defining obesity either by BMI or WC is purely arbitrary, and the risk assessment can vary widely based on the cut points used. Thus, data from different ethnic groups using different obesity index cut points should be interpreted with caution. To illustrate this point, a very recent study from our group on a representative population of 2,350 subjects in Chennai[12] reported that the age standardized prevalence of obesity using the international (western) definition of BMI $\geq$ 30 kg/m^2 was 4.0%, using BMI $\geq$ 27.5 kg/m^2, it was 9.9%, while using the Asia Pacific definition of obesity BMI $\geq$ 25 kg/m^2, it was 26.5%, and finally using the most recent definition of BMI $\geq$ 23 kg/m^2, it was 45.9%.[12] Thus the prevalence of generalized obesity ranged from 4% to 45.9% in the same population studied depending on the cut points used. Similarly, using different cut points for WC or WHR would also lead to varying prevalences of central or abdominal obesity in any population.

Several studies have examined appropriate cut points to define overweight and obesity in Asian populations.[17,18] A study done in urban adult populations from six cities in India[19] reported a BMI<23 kg/m^2 and WC of 85 cm for men and 80 cm for women as the optimal cut point values. We recently derived obesity index cut points for urban Indians; the optimal BMI cut point for identifying any two cardio-metabolic risk factors was 23 kg/m^2 in both sexes while that of WC was 87 cm for men and 82 cm for women.[20] These cut points are marginally lower than those recommended in the WHO Asia Pacific guidelines, with the exception of WC for women. Studies on north Indian populations have also reported a lower cut point for WC[21] and BMI.[22] These studies clearly illustrate the limitations of applying uniform BMI and WC cut points to assess the health risk of individuals globally. The rising prevalence of obesity in developing countries calls for longitudinal studies defining the role of obesity (generalized and abdominal) in Asians (as identified by BMI, WC or WHR), in predicting diabetes and/or CVD events. In addition, there is an urgent need for deriving appropriate cut points for obesity in children as all the current cut points are based on adult data. Population based distribution of BMI, WC and WHR in children need to be derived both for urban and rural populations. One of the challenges in doing this in children is that we will not have any cardiovascular endpoints to determine the appropriate cut points in children. Percentiles of population can be derived, but even these are moving targets, as the population as a whole can be expected to get more obese with time. The need of the hour therefore, is well planned longitudinal, preferably multi-centric, studies in India to address these very important scientific issues.

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