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Antropometric measurement and it's correlation with life style and Noncommunicable Diseases among selected high school students – A cross sectional study in Gujarat, India

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Abstract

Background: In recent years, non-communicable diseases (NCDs) have become an emerging pandemic globally with disproportionately higher rates in developing countries even at early ages. WHO identifies the six leading risk factors that are associated with non-communicable diseases among which physical inactivity and overweight/ obesity are mutually independent risk factors.

Materials and methods: 200 students, 100 each from class 8 and class 9, were selected for the study and were given the format to fill up the required personal information (like religion, diet, and routine activities) and biological measures (like height, weight, BMI, BP, abdominal girth, waist hip ratio) were taken. Further details were taken from parents.

Results: Overweight (> 23) as well as obesity (>27) was more common in boys. Religion or diet was not significantly correlated to BMI. BP could not be correlated to BMI. Still, 12% incidence rate of BP at this tender schooling age is alarming. High abdominal girth was not correlated significantly with BMI. Hip to waist ratio was more prevalent than BMI and could be the earliest indicator of the obesity even before BMI increases.

Conclusion: Obesity and its manifestation like hypertension are commoner than expected at this tender high school age. Waist to hip ratio can serve as the earliest indicator with due confirmation and causal-web analysis, urgent action is needed.

Introduction

In recent years, non-communicable diseases (NCDs), such as cardiovascular diseases (CVD), diabetes, chronic obstructive pulmonary diseases (COPD) and cancers have become an emerging pandemic globally with disproportionately higher rates in developing countries [1]. The financial costs of these diseases are of great concern. Ten times as many people suffer from NCDs as from HIV AIDS, and the likely economic impact of NCDs eclipses global warming, according to the World Economic Forum. [2, 3] The socioeconomic impacts of NCDs are also affecting progress towards the Millennium Development Goals (MDGs) [4] with serious implications for poverty reduction and economic development.

Several studies, mainly from high-income countries, have shown that NCD rates are higher in disadvantaged and marginalized people and communities than in groups with higher socioeconomic status.[5-10] Furthermore, within-country NCD in equalities have not received explicit attention in global NCD discussions. Although the Millennium Development Goals (MDGs) do not specifically address within-country equity, social inequalities in MDGs and their interventions are large, and reduction of these inequalities will help to achieve the MDGs.[11]

The scarcity of similar worldwide evidence for NCDs creates difficulties in formulation and implementation of actions that reduce NCD inequalities, and in assessment of how these actions might help to decrease the total NCD burden.

As NCDs are preventable, although such prevention was missing from the Millennium Development Goals. So, new initiatives are needed. This was addressed by the UN high level meeting on Prevention and Treatment of NCDs held in September 2011 (www.un.org/en/ga/ncdmeeting2011/). [12]

In India, there is no regular system for collecting data on non-communicable diseases (NCDs)-which can be said to be of adequate coverage or quality. Thus, most of these estimates at best may be taken as approximation only.

It is becoming increasingly recognized that the current programs aimed at obesity reduction in adults are not working.[3] that's why repeated and demographically different studies are required to formulate area-wise policy. With this aim the current study is planned with objectives: to screen the high school students for routine lifestyle and general health parameters, to ascertain any anomaly (prevalence or incidence) as per internationally recognized criteria and to find out non-communicable disease pattern, mostly in correlation to BMI.

Materials and Methods

We conducted the study in July 2017 on 200 students, 100 each from class 8 and class 9, from LP Savani School, Adajan, Surat. As per decided protocol, student were given the format to fill up the required personal information (like religion, diet, and routine activities) and biological measures (like height, weight, BMI, BP, abdominal girth, waist hip ratio) were taken.

For some parameters (birth weight, familial health background), parents were contacted to confirm. As the students were from the same class, age was nearly same and it could not be considered a significant variable for calculation. Birth weight was noted down to nearest grams and height was measured in centimeters. According to the Center for Disease Control, to obtain an accurate height measurement, we began by removing bulky clothing, including thick-soled shoes and hair ornaments.

Students stood against a wall facing outwards and look straight ahead – head, shoulders, rear end and heels touched the wall. Body mass index (BMI) is a statistic developed by Adolphe Quetelet in the 1900's and we used it as such (body weight in kg divided by square of "height in centimeters"). As per Indian Academy of Pediatrics (IAP criteria, at *www.iapindia.org*) > 23 was considered overweight and > 27 was considered obese.

BP was measured using standard Diamond sphygmomanometer and 120 mmHg systolic blood pressure was taken as upper cut off. Abdominal girth was measured at the level of umbilicus as suggested by the image page of the medline plus (https://medlineplus.gov/ency/imagepages/8709.html).

Normal abdominal girth is different for males and females. For males < 100 cm is normal but for female it must be < 90 cm. (as explained in BMIexpress. blogspot.com). In case of waist to hip ratio, male and female cut-off is <1.00 and <0.90 respectively, as per DGSP criteria of sports fitness.

Waist to hip ratio was taken normal <0.80 for girls and <0.90 for boys (though a relaxed criteria of < 0.85 for girls is also permitted at some websites like http://www.healthline.com/health/waist-to-hip-ratio#overview1). The study was approved by local ethics committee and assent was obtained from all study participants. As per decided protocol, student were given the format to fill up the required personal information (like religion, diet, and routine activities) and biological measures (like height, weight, BMI, BP, abdominal girth, waist hip ratio) were taken. For some parameters (birth weight, familial health background), parents were contacted to confirm. As the students were from the same class, age was nearly same and it could not be considered a significant variable for calculation.

Results

We conducted the study in July 2017 on 200 students, 100 each from class 8 and class 9, from LP Savani School, Adajan, Surat. Out of 117 boys and 83 girls screened, as per IAP criteria, 21 boys (17.95%) were overweight (BMI ε 23) and 8 boys (6.84% ε 27) were frankly obese. Out of 83 girls, 12 (14.46%) were overweight and 4 (4.82%) were frankly obese indicating a significant difference of sex preponderance of overweight/ obese students (more in males) as shown in table 1.Out of 45 overweight/ obese students, 1 (0.5%) was Muslim and frankly obese and remaining 199 (99.5%) were Hindus.

Out of 200 students screened, 53 were non-vegetarians and 147 were vegetarians. Out of 53, 12 (22.64%) non-vegetarians were overweight/ obese, while out of 147, 33 (22.44%) vegetarians were overweight/ obese as shown in table.3. Thus diet didn't make any significant difference in prevalence of overweight/ obesity. (Table 1)

Out of 200, 176 students had systolic BP δ 120 mmHg, out of those 24 with higher BP, high BP with high BMI was seen in 10 students, while others were within normal limits. But high BP in 12% population at this tender age was itself a cause of concern. Thus in total 4 categories could be drawn – normal BMI as well as BP (141) normal BMI but high BP (14), high BMI but normal BP (35), high BMI as well as BP (10). Out of 117 boys, 99 were having normal BP – remaining 18 (15.38%) were hypertensive. Among 83 girls, 76 were having normal BP but 7 (8.43%) were hypertensive. Of course, satistically significant preponderance of BP is seen more in boys. (Table 2)

Only 43 boys (1.69%) were having normal (<1.0) waist to hip ratio. Out of 117, remaining 74 have it increased – thus there were 23 with increased waist to hip ratio as well as BMI while 37 had both parameters normal. (Table 2)

Among 83 girls, only 3 have high abdominal girth (>90 cms) and all were high in BMI too. The rest 80 have the abdominal girth normal. Concerning waist to hip ratio, only 1 girl was normal even if criteria is relaxed up to 0.85, and remaining 82 have it increased (>0.80). Out of 16 having increased BMI, waist to hip ratio was increased in all. Again like boys, increase in waist to hip ratio manifests the earliest (100%), then increase in BMI follows (19.28%), but increase in abdominal girth is still a rare phenomenon (3.61%). (Table 3)

Discussion

There is a paradigm shift in the quality of life in urban population resulting in substantial increase in childhood as well as adult obesity in the urban population. It is observed that 30% of obesity begins in childhood and out of that 50% to 80% become obese adults. [13] In our study overall prevalence was found to be 22%. Similar findings were observed in many Indian studies. [14-20]

Obesity and religion was not found to have any association in our study. This may be due to small size of sample (esp non-Hindu students), no statistically significant difference of religion in occurrence of overweight/ obesity should be concluded.

While BMI and BP also showed no significant association, it might be due to the fact that age was too tender to manifest as chronic systemic problems like blood pressure which was overt only in extreme cases. Similar findings were observed in other studies from different countries. [21-24]

In our study population, one of the boys was having high abdominal girth (despite 42 overweight/ obese). Here higher abdominal girth might be a late manifestation not appearing as early as high BMI. Secondly, the cut off value is means for adults, which an 8-9 standard student can reach only if morbidly obese. If verified in large sample studies, it could be said that in boys, increase in waist to hip ratio manifests earlier than increase in abdominal girth, even before an increase in BMI. Thus even in girls, higher abdominal girth might be a late manifestation not appearing as early as high BMI, which was observed by many studies. [25-27]

With the increase in obesity prevalence, there is a parallel increase in obesity associated chronic diseases and their clinical onset at a very younger age. The obesity has reached an epidemic proportion in urban Indian population.

There are some limitations in this study. Seeing the limited time and resources available, the study used convenience sampling – neither sample size was guided by parameters' probability of prevalence, nor elaborate sampling techniques (like randomization, stratification etc) were used. Sample size was quite small and the study can be taken as a pilot project doing feasibility and trend analysis for future large scale study. As it was a cross sectional study limited to two consequential classes of students (8th & 9th), it couldn't asses the effect of age on these parameters. For better understanding of some parameters defined by adult criteria of cut off (esp abdominal girth), the same population should be followed by a repeat analysis after a gap of 10 years.

Conclusion

Increased BMI was less common in girls (19.28%) compared to boys (24.79%). Overall 22.5% (45 students out of 200) occurrence is ominous. Religion was not significantly correlated to BMI – showing no cultural influence at this sample size. Diet didn't make any difference in prevalence of increased BMI – 22.44% of vegans and 2.64% non-vegans were having increased BMI. 12% incidence rate of BP at this tender schooling age is alarming – that's why hypertension is a classical example of "tip of the iceberg phenomena" in epidemiology. Though BP could not be correlated to BMI statistically significantly, but temporally incongruous occurrence (BMI manifesting earlier in the life than BMI anomalies) might be explanatory. High abdominal girth was not correlated significantly with BMI – might be because abdominal girth is mostly a late manifestation. Thus BMI could provide earliest indicator in boys. High waist to hip ratio manifested the earliest and could be the earliest indicator, manifesting even earlier than increased BMI.

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Tables

Table 1. Gender wise and diet wise distribution of study participants as per BMI (N=200)

	Boys	Girls
Obese	8	4
Overweight	21	12
Normal	88	67
Total	117	83
	Vegan	Non-vegan
Normal	114	41
Overweight/ Obese	33	12
Total	147	53

Table 2. Frequency of study participants with their BMI Vs BP and BMI Vs Waist hip ratio (N=200)

normal BMI as well as BP	141 (70%)
normal BMI but high BP	14 (7%)
high BMI but normal BP	35 (18%)
high BMI as well as BP	10 (5%)
Normal BMI as well as waist to hip ratio	37 (32%)
Normal BMI but high waist to hip ratio	51 (43%)
High BMI nut normal waist to hip ratio	06 (5%)
High BMI as well as high waist to hip ratio	23 (20%)

Table 3. Gender wise distribution of increased waist hip ratio in study participants

Increased waist to hip ratio (boys) in overweight/ obese	63.24%
Increased waist to hip ratio (girls) in overweight/ obese	100%