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Obesity In The Indian Urban 'Middle Class'

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By the turn of the century nearly 35 per cent of India's population will be living in urban areas. The corresponding figure for 1950 was no more than 16 per cent. Steady urban migration has been an important feature of the ongoing developmental transition not just in India, but in all developing countries as well. Thus, Asia's urban population is expected to exceed 1,242 million by 2000 AD, more than a five-fold increase from 226 million in 1950. This process of urbanisation is expected to continue in the decades to follow.

Urbanisation involves changes in occupation patterns, life-styles, family structures and value systems. These changes are reflected in changes in dietary practices and in the levels of physical activity. In the urban population of India, refined wheat and rice have virtually displaced coarse grains and millets as the staple cereal, resulting in a substantial reduction in fibre content in the diet and, possibly, also the content of micronutrients such as vitamin B-complex, zinc and chromium, etc. As the population ascends the socio-economic scale, cereal intake declines and intakes of sugar and fats generally increase. Convenience foods and fast foods find increasing acceptance, especially in the context of globalisation.

While the rural population is mainly engaged in agricultural occupations involving manual labour and a fairly high level of physical activity, urban occupations (except those of some of the urban slum dwellers) are generally of the 'skilled' and 'semi-skilled' categories that tend to favour sedentary life-styles. Bicycles, generally used in earlier years by the staff for commuting from their homes to offices, are now being rapidly displaced by motorbikes and cars – not only in India but in China and other Asian cities as well. Thus, it has been reported that nearly 10,000 automobiles are being added to the automobile fleet in Delhi every month! Apart from cutting down on physical exercise, this change is contributing to significant aggravation of the problem of air pollution in the cities.

While a third of India's population still falls below the poverty line, there has been a steady growth of the relatively affluent urban middle class, now estimated to number over 200 million. A good proportion of this middle class is constituted by those who have achieved affluence within a lifetime. This number is expected to increase in the coming decades.

The changes in dietary practices, physical activity levels and life-styles associated with rising affluence induced by developmental transition mentioned above contribute to the increasing prevalence of overweight/obesity. Earlier issues of this *Bulletin* had drawn attention to the disturbing escalations in the prevalence of chronic degenerative diseases[1] – especially coronory heart disease, diabetes (NIDDM) and the changing profile of cancers in the urban populations. The underlying feature common to these disturbing developments is the rising prevalence of overweight and obesity in the middle class. Our efforts must now be directed to control this basic problem which has far-reaching public health implications.

THE NFI STUDY

The Nutrition Foundation of India has just completed a study of the prevalence of obesity in urban Delhi. The study was supported by the Indian Council of Medical Research (ICMR) and was carried out with the active cooperation and participation of Dr S. Padmavati from the National Heart Institute of Delhi. Detailed statistical analysis of the data was carried out by Dr Visweswara Rao of the National Institute of Nutrition (NIN). The results of the study are being published separately in a Scientific Report of the Foundation. In this paper, some salient observations emerging from the study are briefly discussed.

In view of wide disparities with respect to diet, physical activity and life-styles in general, as between the 'middle class' and the poor in India, 'average' figures of prevalence of obesity have no meaning and do not provide any leads for corrective action. The study, therefore, made an attempt to capture fairly representative segments of the middle class

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TABLE 1
Percentage prevalence of overweight (BMI 25+) in urban adults by socio-economic status

Economic status	Prevalence %	
	Males	Females
Middle Class		
1. High	32.2[a] (118)	50.0[a] (142)
2. Middle	16.2[b] (142)	30.3[b] (33)
3. Low	7.0[c] (86)	27.8[b] (18)
Slum (poor)	1.0[d] (218)	4.0[c] (250)

[a,b,c,d] $p<0.05$ ( ) sample size
Sex differences are significant in all ($p<0.05$)
Source: NFI studies, 1997

and of the poor in urban Delhi. It was carried out in two locations: 1. A large office establishment employing several hundred people, drawn largely from what may be termed the 'middle class' consisting of officers (high-income), clerks (middle income) and peons/attendants (low-income); and 2. A slum in Delhi inhabited mostly by poor, unorganised labour, the slum being typical of numerous others in Delhi and its environs.

The investigations included anthropometery, blood pressure recordings, assessment of diets and levels of physical activity. In a subsample of (1) above, ECGs and estimations of serum lipid profile, serum insulin and sugar levels were also carried out. Internationally accepted yardsticks for the assessment of the prevalence of overweight, obesity and abdominal obesity were employed as follows: Body Mass Index (BMI): Weight (kgs)/Height^2 (metres); Overweight: BMI between 25 and 30; Obesity: BMI>30; Abdominal Obesity: Waist/Hip Circumference (WHR) >1.0 in males and >0.85 in females.

PREVALENCE OF OVERWEIGHT

The striking difference in the prevalence of overweight between the middle class and the slum dwellers is obvious from the data in Table 1 which clearly show how, with the ascent in the socio-economic scale, the overweight problem worsens. Thus, as against the prevalence rate of overweight of 1 per cent for males and 4 per cent for females in the slums, the corresponding figures for the high-income group among the middle class were 32.2 per cent and 50 per cent. More females than males have been found to be overweight in all age groups in both locations.

Table 2 presents the distribution of all subjects of the middle class according to the BMI in two age groups. It will be seen that the prevalence of overweight/obesity is higher in the age group >40 years. The prevalence of obesity (BMI>30) is about 3 per cent in males and about 14 per cent in females above 40 years.

The prevalence rates of obesity observed in the NFI study in urban Delhi are generally in line with observations reported by Visweswara Rao *et al*[2], except that the rates among the high-income group in the NFI study are somewhat higher. Thus, Visweswara Rao *et al* had reported a prevalence rate of 23.9 per cent in urban males and 36.3 per cent in urban females of the high socio-economic group as compared to 0.8 per cent in rural males and 2.2 per cent in rural females. The NNMB report of 1996[3], covering nine Indian states, reported a prevalence rate of overweight of 3.6 per cent in rural males and 6.6 per cent in rural females. These figures are somewhat higher than those figures reported by Visweswara Rao, but they are still far less than those observed for any section of the urban middle class.

The prevalence of overweight/obesity in the urban middle class as revealed from the data of the NFI study is less than what has been reported for Europe[4] or the USA[5]. Thus, in the UK, 50 per cent men have been reported to be overweight as against 32 per cent in the high Indian socio-economic group investigated here; 15 per cent of men and 16.5 per cent of women in Europe have been reported to be obese (BMI>30) as against 3 per cent of males and 14 per cent of females above 40 years in India. The

TABLE 2
BMI and WHR levels in two age groups

Age Group (Yrs)	Number		BMI								WHR			
			Less than 18		18.0 – 24.99		25.0 – 29.99		30 and above		Less than 1/0.85		1/0.85 and above	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
<40 yrs	95	88	21	08	65	57	09	19	–	04	79	59	16	29
% Distribution	27.45	45.6	22.10	9.09	68.84	64.49	9.47	21.60	–	4.54	83.15	67.04	16.85	32.96
40-60 yrs	251	105	25	02	167	40	51	48	08	15	146	38	105	67
% Distribution	72.55	54.4	9.96	1.90	66.53	38.09	20.31	45.71	3.19	14.28	58.16	36.19	41.84	63.81
Total	346	193	46	10	232	97	60 (17.3%)	67 (34.8%)	08 (2.31%)	19 (9.84%)	225	97	121 (49.7%)	96 (34.9%)

TABLE 3
Percentage prevalence of abdominal adiposity in adults by socio-economic status and sex

Economic status	Prevalence %	
	Males	Females
Middle Class		
1. High	39.0[a] (118)	50.0[a] (142)
2. Middle	28.9[b] (142)	48.5[a] (33)
3. Low	16.3[c] (86)	50.0[a] (18)
Slum (poor)	3.7[d] (218)	6.4[b] (250)

[a,b,c,d] p<0.05 ( ) Sample size
Sex differences are significant in all (p<0.05)
Source: NFI studies, 1997

TABLE 5
Prevalence rates (percentage) of high BP by grades of BMI and WHR

BMI	WHR*	% with high BP	
		Males	Females
<18.5	Low	1.9	0.0
	High	0.0	0.0
18.5-25.0	Low	9.8	1.7
	High	12.5	10.8
>25	Low	15.0	5.4
	High	31.1	15.6

** Note: Those having systolic and diastolic blood pressure of more than 140 and 85 respectively are taken as having high blood pressure*
High: >1.0 in males and >0.85 in females
Low: <1.0 males and <0.85 in females

corresponding figures for obesity in the USA are 19.7 per cent and 24.7 per cent.

The relatively low figures for overweight/obesity in the Indian urban middle class, however, should *not* lead to complacence. The special features pertaining to the Indian population have to be taken into account in drawing conclusions based on international comparisons of overall prevalence rates of obesity. The distribution of excessive fat in the body may be an important factor which may determine the implication of a given order of obesity. Abdominal adipocytes are metabolically different from those in other locations and abdominal adiposity may carry a more sinister significance than general obesity. Indeed, the possibility that Indians may be genetically more prone to develop abdominal adiposity needs to be considered. Furthermore, the possibility of some sections of the Indian population being more susceptible to the deleterious effects of overweight because of genetic predisposition or because of undernutrition (including intra-uterine) in early life needs to be kept in mind. If this is the case, the yardsticks for identification of overweight (BMI>25) and obesity (BMI>30) may need revision in the case of Indian (and Asian) subjects.

TABLE 4
% of subjects with high WHR (abdominal obesity) by grades of BMI

Details	Grades of BMI	% (with high WHR)	
		Males	Females
		(>1.0)	(>0.85)
Under-nourished	<18.5	1.8	1.75
Normal	18.5-25	17.8	20.0
Overweight /obese	>25	68.1	58.0

ABDOMINAL OBESITY

The prevalence of abdominal adiposity in the subjects of the NFI study (Tables 2 and 3) was higher than the prevalence of overweight/obesity (BMI>25).

When all subjects of the middle class were considered together (see Table 2), abdominal adiposity was found in 34.9 per cent of males and 49.7 per cent of females; the figures for general overweight (BMI>25) were 19.6 per cent in males and 44.5 per cent in females. Abdominal obesity, thus, did not always go hand in hand with overweight/obesity. Abdominal obesity was found in 68.1 per cent of males with overweight (BMI>25) and 58 per cent of females (Table 4). In these subjects, greater the grade of BMI, the greater was the abdominal adiposity. It was noteworthy that nearly

TABLE 6
Mean values of parameters by tertile values of BMI and WHR

Parameter	BMI				WHR			
	Males		Females		Males		Females	
	I	III	I	III	I	III	I	III
Systolic BP (mmHg)	123.1	133.9***	119.4	130.1**	122.7	134.2***	120.0	132.6***
Diastolic BP (mmHg)	78.1	84.9***	77.9	82.3*	77.7	85.5***	79.0	81.8
Triglycerides (mg/dl)	118.2	166.3**	99.0	146.9	106.6	173.2**	103.8	146.6
Cholesterol (mg/dl)	181.7	209.7*	191.9	218.9	186.2	217.6*	180.9	213.9
LDL Chol. (mg/dl)	-	-	148.2	157.0	-	-	132.3	152.3
VLDL (mg/dl)	-	-	21.1	32.4	-	-	28.7	29.8
HDL Chol. (mg/dl)	35.0	34.7	42.3	40.3	35.5	33.6	43.3	37.7
Chol. Ratio	5.3	6.2	4.8	5.7	7.6	6.4	4.4	5.7
Blood Sugar (mg/dl)	95.4	105.6	98.9	105.3	94.6	104.7	113.6	100.6
Insulin	22.3	24.0	21.2	23.0	24.0	24.5	29.1	22.1

** Note: Those marked with stars are only significant.*
** P<0.05; ** P<0.01; *** P<0.001*
I and III refer to the respective tertiles

a third of overweight males and more than 40 per cent of the overweight females did not show abdominal obesity. On the other hand, nearly 19 per cent of non-overweight male subjects with BMI<25 and 22 per cent females showed abdominal obesity (Table 4).

These data will show that in Indian subjects, abdominal obesity frequently, but not always, coexists with general overweight/obesity. Abdominal obesity could be present in the absence of general overweight/obesity also. Abdominal obesity would thus appear to be different with respect to its pathogenesis and possible implications. The presence of abdominal obesity aggravates the deleterious effects arising from general overweight/obesity alone. It will be seen from the data in Table 5 that the superimposition of abdominal obesity had brought about a two-fold increase in the prevalence rate of high blood pressure in males and a three-fold increase in females.

Careful analysis of bio-chemical findings of the study (Table 6) showed that higher the tertile values of BMI, higher were the mean values for cholesterol, triglycerides, blood sugar, LDL, VLDL and blood pressure. Similarly, with an increase in the tertile values of WHR, there was a significant increase in the mean values of blood pressure, cholesterol and triglycerides. In subjects suffering the additive effects of high BMI and distorted WHR, the values were significantly worse. These observations serve to underline the central role of overweight/obesity and the additive deleterious effects of abdominal obesity in the pathogenesis of disordered lipid and carbohydrate metabolism, leading to coronary heart disease and diabetes mellitus (NIDDM).

DISCUSSION

It would appear from the data presented above that nearly a third of males, and more than half of females, belonging to what may be termed the 'upper middle class' in India are currently overweight (BMI>25). The prevalence of abdominal obesity in this group is even higher. Assuming that the 'upper middle class' in India numbers around 100 million (half the number of middle class), it may be computed that there are roughly 40 to 50 million overweight subjects belonging to the upper middle class in the country today. If present trends continue, the situation can get worse even within a decade, and overweight could emerge as the single most important public health problem in adults. Overweight/obesity may not be considered a specific 'disease' but it is certainly the 'mother' of important degenerative diseases in adult life. Prevention and control of this problem must, therefore, claim priority attention.

A possible genetic basis behind Asians being prone to abdominal obesity was suggested by observations of McKeigue *et al*[6], who had reported that Asian migrants exhibited greater proneness to syndrome X, characterised by higher levels of BMI, prevalence of abdominal obesity, blood pressure, serum cholesterol and triglycerides. Bhatnagar *et al*[7] had shown in the Asian migrants the presence of increased Lp (a) levels which may imply diminished tolerance to trans-fatty acids and greater proneness to disordered lipid metabolism. On the other hand, Barker *et al*[8] had suggested a possible etiologic role of foetal undernutrition in the proneness to syndrome X in adult life. If Barker's hypothesis is right, it may be argued that escalation in the prevalence of abdominal obesity is a transient phenomenon confined to a generation of those born in poverty, with low birth-weights but who had acquired affluence with all its attendent deleterious effects in adult life. With the control of low birth-weights, future generations may be spared; but at this stage, this can only be a speculation.

Genetic predisposition can find expression only if potentiating factors such as dietary errors and lack of regular physical excercise are operative. This should be obvious from the near-absence of overweight/obesity/abdominal obesity in the slums and rural populations. Diets in India, and indeed in South Asia, are predominantly based on cereals – wheat or rice – unlike Europe or North America. Much of the excessive dietary energy in overweight/obese South Asian subjects is, therefore, derived from carbohydrates unlike in Europe. It has been computed that as much as 20 per cent of the ingested carbohydrate (including starch and non-starch polysaccarides) may be malabsorbed in the small bowel and may pass beyond the caecum to the colon to be acted upon by microbial flora and converted into short chain fatty acids – acetic, propionic and butyric acids – which are wholly absorbed[9-12]. Therefore, the possible role of excessive carbohydrates in Indian diets, in the elevation of serum triglycerides (and abdominal obesity) would also require consideration.

It is, however, reasonable to expect that irrespective of the nature of basic predisposing factor(s) dietary discipline and regular physical excercise should be able to contain the problem of overweight/obesity.

The need for according high priority to control the rising prevalence of overweight/obesity/abdominal obesity, especially, in the urban middle class, must be appreciated. The problem could get worse in the decades to follow. The most prudent and cost effective way of controlling the disturbing escalation of CHD and NIDDM in Indian urban population would obviously consist in combating the problem of overweight in them.

Apart from dietary errors and excesses, lack of regular physical excercise in the urban middle class with sedentary occupations, is a major underlying factor. In an earlier issue of the *Bulletin*, Shetty[13] had discussed the importance of physical activity in the control of CHD and NIDDM. The beneficial harmonal effects of physical excercise and especially its role in combating insulin resistance, a feature associated with abdominal obesity, are now better understood.

The answer to the problem of obesity is not to be found in the numerous 'instant slimming' centres that are springing up in the mega cities of India. The undesirable effects of drastic weight reduction or of weight cycling are now being recognised.

Among the positive strategies that can be adopted to retard the escalation of obesity in urban Indians could be the following:

- An intensive programme of health education through the media, on the problem of overweight/obesity, designed to promote healthy dietary practices and regular physical excercise.
- The provision of facilities for dietary counselling and short periods of daily physical excercise/training in large establishments (public/private sector) employing large number of