Study on Obesity and Influence of Dietary Factors on the Weight Status of an Adult Population in Jamnagar City of Gujarat: A Cross-Sectional Analytical Study

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ABSTRACT

Background: Obesity has reached epidemic proportions globally and is a major contributor to the global burden of chronic diseases. Dietary factors are the major modifiable factors through which many of the external forces promoting weight gain act. Objectives: The objectives were to find the prevalence of overweight and obesity in the urban population of Jamnagar and to explore the effect of dietary factors on the weight status of the people. Materials and Methods: A cross-sectional study was conducted among the adult population of Jamnagar city. Cluster sampling technique was used to select study samples. Data were collected in a prestructured questionnaire by interviewing subjects through house-to-house visits. Data were analyzed in Epi Info and appropriate statistical methods were used. Results: The prevalence of overweight and obesity was found to be 22.04% and 5.20%, respectively. Overweight was more prevalent in females than males. The prevalence rose with an increase in age up to 60 years. Among dietary factors, the total calorie intake and habit of snacking had a positive association with weight gain ($P < 0.05$). The mean intake of oil was more and the mean intake of vegetables was less among overweight subjects than nonoverweight subjects ($P < 0.05$). Conclusion: The prevalence of overweight and obesity in the urban population in Jamnagar was found to be 22.04% and 5.20%, respectively. Total calorie intake as well as composition of diet was the important dietary factor affecting weight gain.

Keywords: Calorie intake, dietary factors, obesity, overweight, weight gain

Introduction

Obesity is a complex condition, with serious social and psychological dimensions, affecting virtually all ages and socioeconomic groups. Obesity has reached epidemic proportions globally and is a major contributor to the global burden of chronic diseases and disability. India and many other countries in South-East Asia are currently going through the so-called nutrition transition which is associated with a change in the structure of the diet and rapid increase in the prevalence of obesity.$^{(1)}$ Dietary factors strongly influence the energy balance equation and they are major modifiable factors through which many of the external forces promoting weight gain act. With this background, the present study was conducted with following objectives.

Objectives

The objectives of the study were to find the prevalence of overweight and obesity in an urban population of Jamnagar and to study the impact of dietary factors on the weight status of the people.

Materials and Methods

The present study was a cross-sectional study. The study...
was carried out in an urban population within Municipal Corporation limits of Jamnagar city of Gujarat state. The study period was between July 2008 and December 2008.

The sample size was decided using the Epi Info 2002 statistical package. At the 95% confidence level, sample size obtained was 852. The sample size was adjusted to allow for nonresponse and other factors that decrease the yield of usable responses. Taking into account these factors, the sample size derived was 980. The response rate in the present study was 97%. So the final sample size in the present study was 903.

Samples were selected using the cluster sampling technique. A sampling frame was prepared by making a list of cumulative populations of all wards of the city based on the total population of each ward as per census 2001. Thirty clusters were selected proportionate to the population size of wards from the list. To accomplish the sample size, it was decided to select 33 subjects from each cluster. The study subjects were interviewed through house-to-house visits. All persons more than 19 years of age who were present in the household at the time of visit were included in the study. Consent of the participants was taken by initially explaining the purpose of the study.

A predesigned and pretested questionnaire was used for data collection. The questionnaire included information regarding sociodemographic characteristics and dietary factors. A 24-h dietary recall method was used to assess the amount of food consumed. The frequency of food consumption was assessed by a food frequency questionnaire. Standing height and weight were measured. Body mass index (BMI) was used to classify the weight status of subjects. It was derived by dividing weight in kilograms divided by the square of the height in meters (kg/m$^2$). The classification of overweight and obesity was done on the basis of recommendations by WHO [Table 1].

The data entry and analysis were done using the Epi Info 2002 package. Statistical tests applied were the $\chi^2$ test and Z-test.

**Results**

The prevalence of overweight was found to be 22.04% in the study population and that of obesity was 5.20% [Table 2]. Mean BMI of the study population was 22.87 kg/m$^2$.

The prevalence of overweight was higher in females than males. This difference was statistically significant ($P < 0.001$). The prevalence was increased with the rise in age. It was highest in the age group of 50–60 years after which it declined. This difference was also statistically significant ($P < 0.001$). In the study population, people with overweight were in a higher percentage in the upper socioeconomic class than the lower socioeconomic class. There was not much difference in the weight status of people living in slum or nonslum area [Table 3]. The difference in the weight status among different socioeconomic classes and residential areas was not statistically significant.

On observing the effect of dietary factors, it was found that the prevalence of overweight was higher among those who consumed more than recommended calories than those who were taking recommended or less calories per day. The difference was found to be statistically significant. Snacking was also associated with the overweight status. There were more overweight people among those who were taking snacks than among those who were only taking two meals and breakfast. The association was found to be statistically significant. Though overweight people were more in the group consuming a mix diet than those who were strictly vegetarian, the difference was not statistically significant [Table 4].

In the present study it was observed that dietary constitutes also affect the weight status. Mean oil consumption was very high (than recommended) in both the nonoverweight and overweight groups but it was significantly higher in overweight people. Similarly, vegetable consumption was quite low (than recommended) in both the groups, and it was significantly lower in overweight subjects than nonoverweights. These observations were statistically significant ($P < 0.05$) [Table 5].

The effect of the frequency of consumption of certain foods concerning the weight status was explored. It was found that as the frequency of taking vegetables and fruits increased, the proportion of overweight subjects decreased. The proportion of overweight increased with the increased intake of fried food although this difference was not statistically significant [Figure 1].

The frequency of taking food at restaurants and the frequency of intake of fast food had an impact on the prevalence of overweight. The prevalence was higher with higher frequency of eating in restaurants and intake of fast food. However, these observations were not statistically significant [Figure 2].

**Discussion**

The prevalence of overweight and obesity in the urban population of Jamnagar city was found to be 22.04% and 5.20%, respectively. The prevalence of overweight in an urban population of India, as found in National
The prevalence of obesity in Jamnagar Family Health Survey during 2005–06, was 11.38%. The prevalence of obesity was 2.24% in the same survey. Though the prevalence found in the present study is higher than the national average, it is lower than that of developed countries. National Health and Nutrition Examination Survey US observed the prevalence of overweight to be 66.3% in 2004. General Household Survey in UK found the prevalence to be 61% in 2003. National Health Survey in Australia found the prevalence to be 49% in 2005.

The higher prevalence of overweight in the present study could be because of imbalance in the diet and faulty food habits prevalent in the region.

Gender is one of the biological factors affecting the weight
status. It was observed in the present study that the prevalence of overweight is generally higher in females than males. Findings of studies conducted in India by Gopinath et al.,(6) Gopalan,(7) Mohan et al.,(8) Mishra et al.,(9) Ramchandran et al.,(10) Reddy et al.,(11) Shukla et al.,(12) and recent National Family Health Survey III (2005–06)(4) also revealed a much higher percentage for obesity/overweight in females than in males. In females, extra energy gets converted into fat. This pattern of energy usage, or “nutrient partitioning,” in females contributes to further positive energy balance and fat deposition.(9) Due efforts should be undertaken to decrease overweight or obesity in females to make an impact on overall prevalence.

Age is another biological nonmodifiable factor which influences individual’s susceptibility to weight gain and the development of obesity. In the present study, it was found that overweight prevalence increased with the rise in age. It was highest in the age group of 50–60 years after which it declined. The decline in the proportion of overweight in the older age group might be due to the decreased body mass with age which might be a consequence of decreased calorie intake as well as decreased absorption from the gut. The age-wise distribution of obese persons observed in NFHS-III (2005–06)(6) among women also revealed an increasing trend of obesity with the age up to 50 years; in men, a similar trend was observed. Other studies carried out in India by Mishra et al. in 2001(9) and Nutrition Foundation of India in 1998(13) found a similar trend in their observations. Though higher prevalence is observed in the later part of life, this is a consequence of the presence of risk factors of obesity in earlier age. So despite the higher prevalence in the older age group, obesity preventive intervention should be directed in the younger age group and therapeutic and complication prevention interventions should be carried out in later age groups to mitigate the impact of obesity.

Studies have repeatedly shown that the high socioeconomic status is negatively correlated with obesity in developed countries, but positively correlated with it in populations of developing countries.(14,15) In the present study, overweight status had a positive association with the socioeconomic level but the association was not statistically significant.

Dietary energy intake is one end of the energy balance equation. The intake of calories more than our body requirement leads to positive energy balance and so obesity. This fact was confirmed in the present study. It was found that the prevalence of overweight was higher among those who consumed more than recommended calories than those who were taking recommended or less calories per day. The difference was found to be statistically significant (P < 0.001). Recent data from Australia, the United States, and Europe further confirm that the increased self-reported energy intake associated with obesity.(16)

Among other factors in dietary consumption, the intake of snacks impacted overweight positively while the type of food either vegetarian or mixed did not affect the weight status of subjects significantly.

The average intake of oil and vegetables by the study subjects was far less than the recommended intake of these food items. Also, there was a difference in the amount of consumption of these foods in overweight and nonoverweight groups. The amount of oil intake was more among overweight than nonoverweight subjects and the mean intake of vegetables was less among the overweight subjects than their nonoverweight counterparts. Thus, there was positive association between oil intake and overweight status and a negative association between vegetable intake and overweight status which was statistically significant. Similar findings were observed in the study of Nutrition Foundation of India (1998) which indicated that the consumption of refined oil and saturated fats (ghee and vanaspati) was significantly higher among the obese individuals (P < 0.05).(13) Lin BH et al. (2002), on examining the relationship between fruits and vegetables and obesity, found the negative correlation between vegetable consumption and BMI to be significant among adults.(17)

In the present study, an attempt was made to explore the relationship between the frequency of various foods and weight status of subjects. It was observed that overweight was more prevalent among those who were consuming fruits and vegetables less frequently and those who were consuming fried food more frequently though the difference found was not statistically significant. Ledikwe et al. (2006) in their study in US adults found that persons with a high fruit and vegetable intake had the lowest obesity prevalence.(18) In exploring the effects of eating habits on body weight, researchers with USDA’s economic research service found difference in servings of fruits eaten by healthy weight people, overweight people, and obese. Fruit consumption was found to have a significant negative relationship with the body weight status in all age groups in men and women.(17) In a cross-sectional study among Spanish persons aged 29–69 years, it was found that “fried food” was positively associated with general and central obesity among subjects in the highest quintile of energy intake from fried food.(19) In a study among middle aged (≥30 years) Bengali Hindu men of Calcutta, it was found that, of the food pattern variables, the frequency of fried snacks consumption was positively and significantly related with central obesity.(20)
The effect of higher intake of restaurant food and fast food on weight status was also observed. It was found that the proportion of overweight was more among those subjects who were consuming restaurant food and fast food more frequently. According to the WHO expert committee, high intake of energy-dense micronutrient-poor foods which is the case in most of fast food is convincingly related with unhealthy weight gain and there is a possible relation between the high proportion of intake of food prepared outside home and unhealthy weight gain.\(^{(21)}\)

### Conclusion

The prevalence of overweight and obesity in the urban population of Jamnagar was found to be 22.04% and 5.20%, respectively. Among dietary factors, not only the total calorie intake but also the pattern of food consumption affects the weight status of people. Both the amount and frequency of consumption of various foods influence the weight pattern.

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### References

1. Popkin BM. The nutrition transition in low-income countries: an emerging crisis. Nutr Rev 1994;52:258-98.
2. Park K. Obesity. In, Park K, editor. Park’s Textbook of Preventive and Social Medicine. 19\textsuperscript{th} ed. Jabalpur: Bhanot Publishers; 2007. p. 332-6.
3. Obesity: Preventing and managing the global epidemic. Report of a WHO consultation. World Health Organ Tech Rep Ser 2000;894:1-12, 1-253.
4. National Family Health Survey (NFHS-3), 2005-06. Vol. 1. India: Mumbai: IIPS; 2007. p. 303-9
5. WHO Global Infobase: Search by Country. World Health Organization. Available from: http://www.who.int/infobase. [Cited on 2008 Sep 25].
6. Gopinath N, Chadha SL, Jain P, Shekhawat S, Tandon R. An epidemiological study of obesity in adults in the urban population of Delhi. J Assoc Physicians India 1994;42:212-5.
7. Gopalan C. Obesity in the Indian urban ‘middle class’. NFI Bull. 1998;19:1-5.
8. Mohan V, Shanthirani S, Deepa R, Premalatha G, Sastry NG, Saroja R. Chennai Urban Population Study (CUPS No. 4). Intra-urban differences in the prevalence of the metabolic syndrome in southern India – the Chennai Urban Population Study (CUPS No.4). Diabet Med 2001;18:280-7.
9. Misra A, Pandey RM, Devi JR, Sharma R, Vikram NK, Khanna N. High prevalence of diabetes, obesity and dyslipidaemia in urban slum population in northern India. Int J Obes Relat Metab Disord 2001:25:1722-9.
10. Ramachandran A, Snehalatha C, Kapur A, Vijay V, Mohan V, Das AK, et al. High prevalence of diabetes and impaired glucose tolerance in India: National Urban Diabetes Survey. Diabetologia 2001:44:1094-101.
11. Reddy KS, Prabhakaran D, Shah P, Shah B. Differences in body mass index and waist: Hip ratios in North Indian rural and urban populations. Obes Rev 2002:3:197-202.
12. Shukla HC, Gupta PC, Mehta HC, Hebert JR. Descriptive epidemiology of body mass index of an urban adult population in western India. J Epidemiol Community Health 2002:56:876-80.
13. Nutrition Foundation of India. Obesity in the urban middle class in Delhi. 1998. Scientific Report 15.
14. Sobal J, Stunkard AJ. Socioeconomic status and obesity: A review of the literature. Psychol Bull 1989;105:260-75.
15. Brown P, Bentley Condit VK. Culture, evolution and obesity. In: Bouchard C, James WP Bray GA, editors. Handbook of obesity. New York: Marcel Dekker; 1998. p. 143-55.
16. Stubbs CO, Lee AJ. The obesity epidemic: Both energy intake and physical activity contribute. Med J Aust 2004;181:489-91.
17. Lin BH, Morrison RM. Higher fruit consumption linked with lower body mass index. Food Review 2002:25.
18. Ledikwe JH, Blanck HM, Kettel KL, Serdula MK, Seymour JD, Tohill BC, et al. Dietary energy density is associated with energy intake and weight status in US adults. Am J Clin Nutr 2006;83:1362-8.
19. Guallar-Castillón P, Rodríguez-Artalejo F, Fornés NS, Banegas JR, Estévez-Pérez PA, Ardanaz E, et al. Intake of fried foods is associated with obesity in the cohort of Spanish adults from the European Prospective Investigation into Cancer and Nutrition. Am J Clin Nutr 2007;86:198-205.
20. Ghosh A, Bose K, Das Chaudhuri AB. Association of food patterns, central obesity measures and metabolic risk factors for coronary heart disease (CHD) in middle aged Bengali Hindu men, Calcutta, India. Asia Pac J Clin Nutr 2003;12:166-71.
21. Diet, nutrition and the prevention of chronic diseases. World Health Organ Tech Rep Ser 2003;916:61-7.

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