Overweight and Obesity Among Adult Bengalee Hindu Women of Kolkata, India

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INTRODUCTION

Obesity has emerged as the most prevalent serious public health problem of our time (Roberts and Mayer, 2000). It is a complex disorder, which is a detrimental to good health and well being. Obesity is the most prevalent nutritional disorder in prosperous communities and is the result of an incorrect energy balance leading to an increased storage of energy, mainly as fat. It is the most common nutritional disorder in Western countries and among the higher income groups in developing countries. The prevalence of obesity is increasing in most of the populations of world, affecting children, adolescents and adults. Kopelman (2000) suggests that obesity is now so common within the world's population that it is beginning to replace undernutrition and infectious diseases as the most significant contributor to ill health. Obesity is increasing at an alarming rate throughout the world. At present, it is estimated that there are more than 250 million people world-wide are affected by obesity, equivalent to 7% of the adult population. Thus, obesity should not be regarded simply as a cosmetic problem affecting certain individuals, but a serious ailment that threatens global well being (WHO, 2000).

Overweight refers to increased body weight in rela-tion to weight, when compared to the same standard of acceptable or desirable weight. Obesity is defined as an excessively high amount of fat or adipose tissue in relation to lean body mass (Stunkard and Wadden, 1993). Kopelman (2000) defines the term obesity as "excess fatness" or fatness leading to pathology. The amount of excess fat, its distribution within the body, and the associated health consequences vary considerably between obese individuals. Obesity may develop at any age in either sex and in as increasing health problem. Obesity develops over time and, once it develops, is difficult to treat. The excess of fat in men tends to accumulate in the upper abdomen. In women the favored sites for the accumulation of fat are the buttocks, hips and thighs (Bose, 1995). The site of fat accumu- lation is considered a predominant factor for metabolic disorders of obesity (Van Gaal et al., 1988). However, the overall incidence of obesity was found to be higher among women than men (Pi - Sunyer, 1994).

Several reasons may contribute to the development of obesity. It is not a single disorder but a heterogeneous group of conditions with multiple causes. Recent epidemiological trends in obesity indicate that the primary cause of the global obesity problem lies in environmental and behavioural changes. Georges et al.(1991) suggest a larger role for socio-cultural factors in the patterning of body fat distribution. Mueller and Reid (1979) suggested that environmental factors such as nutrition, stress and exercise have significant effect on subcutaneous fatness. On the other hand, the role of inherited factors in the origin of obesity is anticipated but the genetic mechanism is not well defined. Whereas clear genetic effects exist, these are modified by environmental and behavioral factors (Pi-Sunyer, 1994). Thus, obesity is multifactorial in origin. In developed countries the occurrence of obesity is higher in the lower socio-economic groups, whereas in developing countries this relationship is reversed (Sobol and Stunkard, 1989). The worldwide obesity problem can be viewed as a consequence of the substantial economic, social and cultural problems now observed in developing and newly industrialized countries. In India the increased levels of obesity is primarily associated with the transition from rural to urban lifestyle. However, it is evident that this phenomenon is more profound among the urban populations in comparison to the rural ones (Venkatramana and Chengal Reddy, 2002). Regardless of its cause, obesity may be associated with a variety of risks. Obesity causes or exacerbates many health problems, both independently and in association with other diseases. It is related to the risk for developing non-insulindependent diabetes mellitus, hypertension, and cardiovascular disease (Smith et al., 2001). It also creates an enormous psychological burden. Thus, obesity is associated with a significant increase in morbidity and mortality.

Anthropometrics plays an important role in the assessment of obesity in conjunction with other sophisticated techniques-viz. bioelectrical impedance analysis (BIA), magnetic resonance imaging (MRI), dual-energy x-ray absorptiometry

(DEXA), isotope dilution, computed tomography (CT), hygrometry and ultrasound. In anthropometry, body mass index (BMI) is the most commonly used measure of overall obesity (generalised obesity) while circumferences and skinfolds are measures of central obesity. BMI can be considered to provide the most useful, albeit crude, population-level measure of obesity (WHO, 1995; WHO, 2000). In cross-sectional comparisons, BMI values may be used to estimate the prevalence of obesity within a population and the risk associated with it. It allows meaningful comparisons of weight status within and between populations and the identification of individuals and groups at risk of morbidity and mortality (Bose, 1995). For meaningful comparison between or within populations WHO (2000) advised the use the single BMI cut-off points. A BMI of ≥ 25 and ≥ 30 are now widely accepted as denoting overweight and obesity, respectively. It allows a firm basis for evaluating interventions. WHO recommended this classification of overweight and obesity for adult population according to BMI values which is age-independent and the same for both sexes. On the other hand, waist circumference (WC) is an indicator of deep adipose tissue and it is related to fat mass. Waist circumference is a convenient and simple measurement that is an approximate index of intra – abdominal fat mass and total body fat (Lean et al., 1996). In addition, waist hip ratio (WHR) is an indicator of the degree of masculine distribution of adipose tissue. It is now well established that a high WHR indicates abdominal fat accumulation (Bose and Mascie-Taylor, 1998). Measurements of impedance (bioelectrical impedance) have recently been introduced and provide accurate measurements of body fat on most adults. Bioelectrical impedance analysis (BIA) is a safe, non-invasive, portable method of estimating body composition (Houtkooper et al., 1996). Several studies (Segal et al., 1988; Guo et al., 1989; Heitmann, 1990) have utilized BIA to assess body composition among different populations.

There are numerous studies worldwide that have dealt with obesity and its consequences (WHO, 2000). However, in the Indian context, very limited information is available. Considering the economic burden and importance of overweight and obesity, documenting the patterns and trends in overweight and obesity in different Indian populations are of paramount importance. However, it is noteworthy to point out that, to date, there is no reliable estimate of the frequency of overweight and obesity among adult Hindu Bengalee women of Kolkata, West Bengal. Hence, the present investigation is an endeavor to understand the obesity situation of adult Bengalee Hindu women. It also compares these rates in respect to Indian and global context.

MATERIALS AND METHODS

Area and Population: The investigation was carried out during the year 2001-2003. The data were collected from adult urban Bengalee women residing within the North Dum Dum Municipal Area under the jurisdiction of Kolkata Metropolitan Development Authority (KMDA) in the district of North 24 Parganas, West Bengal, India. The study population of the present investigation consisted of 854 women aged 20-50 years. They belonged to the Bengalee Hindu Caste Population (BHCP).

Methods of Data Collection: Requisite information on socio-demographic profile was collected by interview and questionnaire method. The present investigation was cross-sectional household survey in nature. The subjects were requested to make an appointment at their house. Separate pre-tested questionnaire was utilized for each participant, which contains a number of specific open and close-ended questions. Socio-demographic and behavioral data for each subject included age, sex, caste, marital status, family composition, income, educational background, occupation, food habits and physical exercise.

Anthropometry: A total of fourteen metric measurements were taken for each subject including anthropometric, bioelectrical and physiological variables. The anthropometric measurements taken for each subjects were-height, weight, three circumferences (mid-upper arm, minimum waist and maximum hip) and four skinfold measurements (biceps, triceps, subscapular and suprailiac). Bioelectrical analysis measured the body fat content. Physiological variables included blood pressure and pulse rate among the studied population. However, in the present communication, two directly measured variables (minimum waist circumference and percent body fat) and two derived variables (body mass index and waist hip ratio) were included. All anthropometric measurements were made by using standard anthropometric techniques as proposed by Lohman et al. (1988). Body mass index (BMI) and waist hip ratio (WHR) were computed using standard equations (WHO, 1995).

Bioelectrical Impedance Analysis: Bioelectrical impedance analysis (BIA) is an important method of assessing body fat. The measurement

is based on the flow of electricity through the body, which is facilitated by the fat-free tissue and extracelluar water because of the electrolyte content. The resistance (or impe-dance) to the flow of current is related directly to the level of body fat. Among all the tissues forming the human body, fat tissue has almost no electrical conductivity. As a result, by measuring the body's electrical resistance value, the percentage of fat tissue to other tissues can be estimated. Moreover, when requisite details are entered, the technique gives a painless and fast readout of fat mass, percentage body fat and is widely used. Bioelectrical impedance data were collected by utilizing body fat monitor (OMRON, HBF-302, Japan). When details about age, sex, height and weight were entered, the technique gives a quick and reliable readout of percent body fat (PBF) and fat mass (FM).

Data Management and Analyses: Data were collected on a pre-designed proforma and finally transferred from data sheets onto a computer database package (WordStar 7.0, 1992). All the entries were double-checked for any probable keyboard mistake. The data file was edited and corrected and then transformed into a statistical software programme. All statistical analyses were computed using the SPSS Package (SPSS 7.5.1, 1996) on a desktop computer. Technical errors of measurements (TEM) were calculated and the results were found to be within reference values cited by Ulijaszek and Kerr (1999). Therefore, TEM was not incorporated in statistical analyses.

RESULTS

The frequency of overweight and obese subjects is presented in Table 1. The overall prevalence of obesity (BMI≥ 30.00) was quite high in the studied sample (17.45%) but the frequency of overweight (BMI 25.00 - 29.99) was even higher (37.24%). It may be noted that this estimation is based on an indirect technique, i.e. anthropometry and International Classification of Adult Overweight and Obesity (WHO, 2000) cut-off points were utilized.This BMI classification is adopted to facilitate meaningful international comparison of adulthood obesity rates, to predict the magnitude of the future obesity problems, and to monitor and evaluate the effectiveness of intervention strategies.

The prevalence of obesity of the studied population based on percent body fat, waist circumference and waist-hip ratio are presented in Table 2. The cut-off points of obesity were adopted as recommended by Dudeja et al. (2001) for PBF (≥ 30.0%); Dasgupta and Hazra (1999) for WC (≥ 72.0 cm) and Abdul Rahim et al. (2001) for WHR (≥0.85). Excess percent body fat (PBF), which is the measure of overall obesity, showed a high prevalence rate of 36.53%. Similar high prevalence (42.39%) was also observed when waist-hip ratio (WHR), a popular and widely accepted measure of central obesity was utilised. Waist circumference has been extensively used as an independent indicator to identify those at risk from either increased body weight or central body fat distribution or both. Considering this parameter, it was found that more than half of the surveyed population were centrally obese (55.15%).

Table 1: Prevalence of overweight and obesity among adult Bengalee women of Kolkata based on BMI

Sample size	*Age (in years)*	*Overweight (BMI 25.00-29.99)*		*Obesity (BMI≥30.00)*	
854	20-50	318	(37.24)	149	(17.45)

Figures in parentheses denote percentages.

Table 2: Frequency of obesity among the adult Bengalee women of Kolkata based on PBF, WC and WHR.

Variable	*Cut-off points of obesity*	*Frequency*	
Percent Body Fat (%)	≥ 30.0	312	(36.53)
Waist Circumference (cm)	≥ 72.0	471	(55.15)
Waist-Hip Ratio	≥ 0.85	362	(42.39)

Figures in parentheses denote percentages.

DISCUSSION

This study indicated that the prevalence of obesity among Bengalee Hindu women varied considerably depending on the criteria used. The highest prevalence (55.15%) was observed when waist circumference was utilized while the lowest prevalence (17.45%) was reported when we considered BMI. In between these rates, were those using PBF (36.53%) and WHR (42.39%). These findings implied that probably the use of WHO BMI cut-off point for obesity (BMI ≥ 30.0) may not be appropriate for use among adult Bengalee Hindu women because its use may underestimate the true prevalence of obesity. Since BMI is the most commonly used measure of obesity universally, we suggest that prospective studies be undertaken on this population to identify the most appropriate cut-off point for BMI. Alternatively, cross-sectional studies utilizing receiver operating characteristic (ROC) curves be undertaken to identified the most

Table 3: Obesity prevalence in different regions of India (BMI ≥ 30.0)

State/ Region	*Location*	*Prevalence of obesity(%)*	*Source*
Andhra Pradesh	Rural and urban	2.00	Griffith and Bentley 2001
Jammu and Kashmir	Six districts of Kashmir	23.69	Zargar et al. 2000
Northern India	Urban slum	15.60	Misra et al. 2001
Tamil Nadu	CMC Hospital, Vellore	2.20	Thomas and Krishnaswami 1995
Uttar Pradesh	Varanasi city	30.24	Asthana et al. 1998
West Bengal	Kolkata city	17.45	Present study

Table 4: Obesity prevalence among different Lworld populations (BMI ≥ 30.0)

Country	*Year of study*	*Prevalence of obesity (%)*	*Source*
Australia	1989	13.20	WHO 2000
Bahrain	1991-92	30.30	WHO 2000
Brazil	1989	13.30	WHO 2000
Canada	1995	25.60	Johnston et al. 2004
China	1991	0.86	WHO 2000
Cyprus	1989-90	24.00	WHO 2000
Czechoslovakia	1988	20.00	WHO 2000
England	1995	16.50	WHO 2000
Finland	1991-93	11.00	WHO 2000
Germany	1992	27.00	WHO 2000
Iran	1993-94	7.70	WHO 2000
Japan	1993	2.60	WHO 2000
Kuwait	1994	41.00	WHO 2000
Malaysia	2002	5.80	Ismail et al. 2002
Melanesia	1991	54.30	WHO 2000
Nauru (Micronesia)	1987	70.30	WHO 2000
Netherlands	1995	8.00	WHO 2000
New Zealand	1989	13.00	WHO 2000
Palestine	2001	49.00	Abdul Rahim et al. 2001
Samoa (Polynesia)	1991	76.80	WHO 2000
Saudi Arabia	1990-93	28.00	WHO 2000
South Korea	1998	3.20	Kim et al. 2004
South Africa	1990	44.00	WHO 2000
Spain	2001	40.80	Gutierrz-Fisac et al. 2004
Tanzania	1986-89	3.60	WHO 2000
UAE	1992	38.00	WHO 2000
USA	1988-94	24.90	WHO 2000
India (Kolkata)	2001-2003	17.45	Present study

specific and sensitive cut-off point for BMI among this ethnic group. Since these curves can be studied based on cross-sectional data, it may be more advantageous compared to undertaking prospective studies which are both time consuming as well as expensive to undertake. A recent study on 5-10 year old Bengalee girls (Ghosh, 2004) has under-taken ROC studies to determine the best cut-off points. Similar studies are needed on adult Bengalees of both sexes.

The results of the present study are compared (based on body mass index) with adult female populations of different regions of India to facilitate a relative evaluation (Table 3). In the Indian context, data on overweight and obesity are very limited. However, studies from different parts of the country show a diverse scenario. Recent studies from North Indian region demonstrated higher incidence of obesity reported by Asthana et al., 1998 (30.24%); Zargar et al., 2000 (23.69%) and Misra et al., 2001 (15.60%) whereas South Indian region showed very low prevalence of obesity as reported by Thomas and Krishnaswami, 1995 (2.20%), and Griffith and Bentley, 2001 (2.00%). However, the present study among adult Bengalee Hindu women reported a moderate prevalence of obesity (17.45%).

In the global context, it is clear that obesity has become the most prevalent public health problem (Table 4). The highest frequency of obesity is found among Samoans (Polynesia, 76.80%) followed by Nauruans (Micronesia, 70.30%) whereas the lowest rates are among the Chinese population (0.86%). Moderately high frequency of obesity is found in Melanesia (54.30%), Palestine (49.00%), South Africa (44.00%), Kuwait (41.00%), UAE (38.00%), Bahrain (30.30%), Saudi Arabia (28.00%), Germany (27.00%), USA (24.90%) and Cyprus (24.00%). On the contrary, low prevalence of obesity is observed in Japan (2.60%), South Korea (3.20%), Tanzania (3.60%), Malaysia (5.80%), Iran (7.70%) and Netherlands (8.00%).

The prevalence of obesity (based on BMI) of the present study (17.45%) was found to be very close (Fig. 1) to the populations of Czechoslovakia (20.0%), England (16.5%) and Brazil (13.3%). Moreover, the results of the present investigation were in concordance with two recent Indian studies, one among North Indians (15.60%) reported by Misra et al. (2001) and another from the Kashmiri population (23.69%) studied by Zargar et al. (2000).

In conclusion, the main findings of the present investigation may be summarized as follows:

(1) The frequency of obesity among the adult

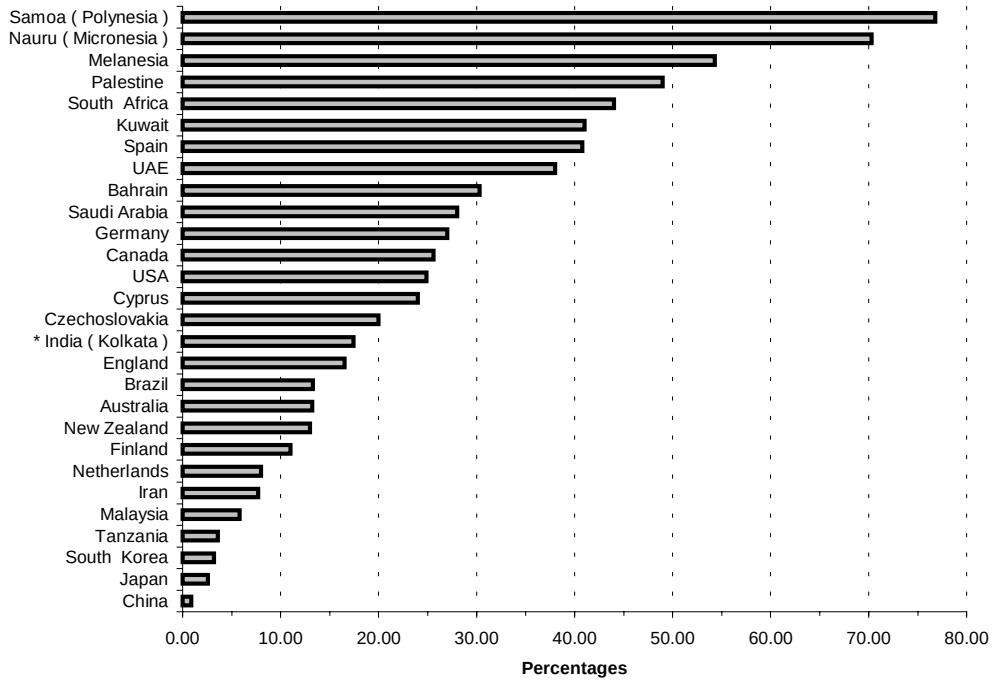

Fig. 1. Obesity Status among different world populations

Bengalee Hindu women is 17.45% on the basis of BMI, whereas the same is very high considering PBF (36.53%). This discrepancy could be due to the fact that the WHO cut-off value of BMI does not accurately predict the prevalence of obesity among Bengalee Hindu population. Thus, there is a need to revise the WHO cut-off levels of BMI for defining overweight and obesity among Bengalee Hindus. The new ethnic-specific BMI cut-off points should be generated, after considering percent body fat (PBF) and total amount of body fat (TBF).

(2) The prevalence of central obesity measured as waist circumference (55.15%) and waist-hip ratio (42.39%) is significantly higher than generalised obesity measured as BMI (17.45%) among adult Bengalee Hindu women. This implied that the existence of central obesity is considerable higher, as compared with generalised obesity, among the adult Bengalee females.

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KEYWORDS Overweight. Obesity. Body Mass Index. Percent Body Fat. Waist Circumference. Waist Hip Ratio. Bengalee. Women.

ABSTRACT Obesity has appeared as the most prevalent serious public health challenge in the new millennium. It is continuously increasing at an alarming rate throughout the world and dispersing as an epidemic that threatens global well being. At present, it is estimated that there are more than 250 million people world-wide who are affected by obesity, equivalent to 7% of the adult population. Obesity is the most common nutritional disorder in the developed as well as developing countries. It is the result of an incorrect energy balance leading to an increased storage of energy

mainly as fat. Certain detrimental effects to health are attributed to obesity and it may develop at any age in either sex. Several factors may contribute to the development of obesity. Regardless of its cause, obesity may be associated with a variety of risks. There are numerous studies worldwide that have dealt with obesity and its economic and health costs. However, information on the prevalence of obesity among different ethnic groups of India is scanty. The present investigation is an endeavor to understand the obesity situation among adult Bengalee Hindu women. It also attempts to compare the levels of overweight and obesity among adult Bengalee Hindu women with those reported in other studies from India and abroad. Result revealed that the overall frequency of obesity (BMI 30.00) is moderately high (17.45%) but the frequency of overweight (BMI 25.00 - 29.99) is alarming (37.24%) among the studied sample.

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