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# Trend of obesity, socio-economic status and nutrient intake of overweight and obese working women

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## ABSTRACT

Obesity is an important public health problem in today's era. Obesity occurs as a result of positive energy balance in the body. One of the reason for the obesity is the nutrition transition which is based on socio – economic conditions (such as education, occupation and per capita income) and sometimes in individual social background. The objective of the present study is to assess the trend of obesity in among different socio – economic status (SES) of overweight and obese working women and their nutrient intake. For this, cross – sectional study was conducted on 200 working women (respondents) and the respondents were selected by purposive sampling technique. Pretested and predesigned questionnaire – cum – interview schedule was used for data collection. Anthropometric measurements were taken by standard technique (Jelliffe, 1966). The values of percent body fat (PBF) and visceral fat (VF) were taken by Omron Body Composition Monitor; HBF 212. The result revealed that 85.7 percent of the overweight respondents belong to upper lower SES category and among obese grade I respondents 28 percent of the respondents come in upper middle SES category. Significant association was observed between health risk parameters like height ($F= 16.55$, $P < 0.01$), weight ($F= 17.33$, $P < 0.01$), BMI ($F= 3.97$, $P < 0.01$) and PBF ($F= 4.32$, $P < 0.01$) with different categories of SES. In context of dietary intake significant association of SES found with fat ($F= 5.67$, $P < 0.001$), calcium ($F= 10.43$, $P < 0.001$) and total fibre ($F = 3.14$, $P < 0.05$). Correlation between SES, health related risk parameters and nutrient intake was observed from the value of Pearson Correlation coefficient (r). In context of health risk parameters the SES shows positive correlation with height, weight, body mass index (BMI) and VF. In the arena of nutrient intake, SES shows positive correlation with protein, fat, calcium and negative correlation with total fibre. Therefore, it may be concluded that not only SES play role in adiposity but it may be due to sedentary lifestyle, changing eating pattern, lack of physical activity, hormonal imbalance, genetics factors etc be the reason for their overweight and obesity.

**Keywords:** Socioeconomic status, Overweight, Obesity, BMI, Percent body fat, Visceral fat.

## INTRODUCTION

Obesity has reached threatened level all over the world, both in developed and developing countries. It is one of the biggest problems of today's era which affects the individual not only physically but physiologically and psychologically as well. According to recent report of WHO, more than 1.9 billion adults, 18 years and older, were overweight as well as 600 million were reported to be obese in year 2014 [1]. As India is passing through the transitional phase of both nutrition and socio - economic development, which has the potential for changing the nutritional status of the population, groups [2]. The SES is a complex parameter conceptualized by broad spectrum of variables by combining occupation, education and family income. Although these variables measure the same concept, it has been suggested that they cover different aspects of the socio – economic structure contributing individually to the relationship between socio – economic status and diet [3].

Occupation may affect the diet by creating environment or social networks that can influence behavioural health habits [4]. Inspite of this, it also measures prestige, responsibility, physical activity and work exposures in developed societies [5]. Education is considered as an important tool related to health outcomes as it influences the lifestyle behaviours (e.g. exercise and diet), problem solving capacity and values (e.g. importance of preventive health behaviours) [6]. Income is considered as a mirror of availability of economic and material resources and therefore influences the dietary quality by making healthy food more or less affordable and accessible [7].

The analysis of dietary intake (nutrient intake) is an approach to investigate a link between diet and socio – economic status in relation to health risks. It has received a lot of attention from researchers and is indeed important, since it recognizes that foods are consumed in many combinations that are likely to be complex and that nutrient intakes are often highly correlated with certain nutrients having interactive and synergistic effects [8]. Therefore, the aim of this research paper is to investigate the trend of obesity in different socio – economic status category as well as to find the association of SES with health risk parameters and nutrient intake among respondents.

## MATERIALS AND METHODS

### Selection of respondents

The present study has been carried out on total 200 respondents between the ages of 23 – 64 years which were selected by purposive sampling technique from Banaras Hindu University, Varanasi, and Uttar Pradesh, India. The data were collected from all respondents with the help of well-designed questionnaire – cum – interview schedule.

### Ethical considerations

The studies were conducted under the rules and regulation of Institute Ethical Committee, IMS, BHU (Ethical committee letter number - Dean /2012-13/183).

### Socio – demographic characteristics

This section deals with the general characteristics of the respondent i.e. about their age, marital status, type of family, religion, education, occupation, family income per month, socio – economic status and body mass index (BMI).

### Socio – economic information

For socio – economic status, information regarding occupation, education and family income was collected. For the measurement of socio – economic status of the respondents Kuppuswamy's scale was used [9]. The suggested critical limits of Kuppuswamy's scale are as follows:

| Total Score | Socio – economic status |
|---|---|
| 26 – 29 | Upper (I) |
| 16 – 25 | Upper middle (II) |
| 11 – 15 | Lower Middle (III) |
| 5 – 10 | Upper lower (IV) |
| <5 | Lower (V) |

## Anthropometrical parameters

The anthropometrical measurements of the respondents i.e. height and weight were measured by using standard technique [10]. BMI was calculated by dividing weight in kilograms by height in meters square [11]. BMI was then categorized based on standards i.e. NHLBI Obesity Education Initiative 2000 and Report of WHO Expert Consultation 2008 were utilized for the assessment of obesity as given below [12, 13].

| World Body Mass Index (BMI) kg/m$^2$ | Classification |
|---|---|
| >18.50 | Underweight |
| 18.50- 24.99 | Normal |
| 25.00-29.99 | Overweight |
| 30.00 – 34.99 | Grade I obese |
| 35.00 – 39.99 | Grade II obese |
| > 40.00 | Grade III obese |

After that, waist and hip circumference were measured to assess the abdominal obesity. Waist hip ratio (WHR) was calculated by dividing the waist circumference and hip circumference. As per classification of WHO Expert Consultation 2008, the following cut off values used for WC and WHR for the assessment of central or abdominal obesity as given below [13].

| Indicator | Cut off points | Risk of metabolic complications |
|---|---|---|
| Waist circumference | <80cm for women | Normal |
| | >80 cm for women | Increased risk |
| Waist- hip ratio | ≥0.85 for women | Substantially increased |
| | < 0.85 for women | Normal |

Visceral fat (VF) and percent body fat (PBF) were also measured by using Omron Body Composition Monitor (HBF 212). As per Omron Body Composition guidelines, the following cut off values used for VF and PBF for the assessment of abdominal obesity and percentage of fat in the body as given below [14]

| Visceral fat level | Classification |
|---|---|
| 1 – 9 | Normal |
| 10 – 14 | High |
| 15 – 30 | Very high |

| Percent body fat | Classification |
|---|---|
| 20.00 – 29.99 | Normal |
| 30.00 – 34.99 | High |
| 35.00 – 50.00 | Very high |

## Dietary assessment

Nutrient intake of the respondents was recorded by 24 hour recall method with the help of nutritive value of Indian foods [15]. The respondents reported the type and quantity of meal (i.e. food and beverages) consumed over the past 24 hours. The quantities of food consumed were converted into raw equivalents by using household measurements to estimate the portion size of consumed food. The intake was then compared with recommended dietary allowances [16].

## Statistical analysis of the data

Statistical analysis was performed by using trial version of Statistical Package of Social Sciences (SPSS) Version 20.0. The data was analyzed by using descriptive statistics such as frequency and percentage. For determining the significance between the variables chi square test and F- test were used. For calculating the $X^2$ test, the number of respondents comes in obese grade II category is combined together with obese grade I category. To find correlation between the parameters Pearson

correlation coefficient was used. Turkey HSD (post hoc) test was used to assess the significant pairs.

## RESULTS AND DISCUSSION

Obesity results from a positive calorie balance i.e. the intake of calories are greater than its expenditures. Inspite of this, lack of physical activity, faulty dietary pattern, genetic, hormonal imbalance and sedentary lifestyle may also be important factor for etiology of obesity. Nutrition plays a direct role in determining the caloric balance by being the sole variable accounting for the caloric intake [17].

Obesity increases the risk for a variety of chronic diseases including coronary artery diseases, strokes [18], glucose intolerance [19] and some forms of cancer. Obesity is not a direct cause of most of diseases, but unfavourably alters the risk factor profile. For example, obesity may lead to increase in blood pressure and blood cholesterol, which in turn lead to cardiovascular diseases and strokes [17].

From the present study, it was interpreted that about 45 percent of the respondents belongs to 36 – 50 years of age group and 32.5 percent of them lies in ≤ 35 years of age group. The mean age of the respondents was 42 years. It was found that 82.5 percent of the respondents were married and 7 percent of them were single. In context of type of family, 60 percent of the respondents live in nuclear type of family. In arena of educational qualification 62 percent of the respondents were graduate and above and 2.5 percent of among them have primary school of education. It was found that nearly half of the respondents were in education profession i.e. either they were assistant professor, associate professor, professor or teachers in BHU campus. It was found that 57 percent of the respondents have family income per month greater than Rs. 18,498. In context of socio – economic status, it was found that 35.5 percent of the respondents belong to upper socio – economic status category, 37 percent of them belong to middle and 28 percent of them belong to lower socio – economic status category. In the area of BMI, it was found that 80 percent of the respondents were overweight, 18 percent of them belong to obese grade I category and 2 percent of them in obese grade II category as shown in table 1.

Table 1: Distribution of respondents according to socio- demographic characteristics

| Characteristics | Number (200) | Percentage (%) |
|---|---|---|
| **Age Group** | | |
| ≤35 | 65 | 32.5 |
| 36-50 | 90 | 45.0 |
| >50 | 45 | 22.5 |
| Average ± S.D = 42.01 ± 9.86 | | |
| Range = 23 - 64 | | |
| **Marital Status** | | |
| Single | 14 | 7.0 |
| Married | 165 | 82.5 |
| Widow | 21 | 10.5 |
| **Type of family** | | |
| Nuclear | 120 | 60.0 |
| Joint family | 80 | 40.0 |
| **Religion** | | |
| Hindu | 174 | 87.0 |
| Muslim | 16 | 8.0 |
| Christian | 10 | 5.0 |

| **Education** | | |
|---|---|---|
| Profession or Honors | 34 | 17.0 |
| Graduate or Post – Graduate | 90 | 45.0 |
| Intermediate | 12 | 6.0 |
| High School | 7 | 3.5 |
| Middle School | 20 | 10.0 |
| Primary School | 5 | 2.5 |
| Illiterate | 32 | 16.0 |

| **Occupation** | | |
|---|---|---|
| Profession | 72 | 36.0 |
| Semi- Profession | 24 | 12.0 |
| Clerical | 26 | 13.0 |
| Skilled Worker | 4 | 2.0 |
| Semi-skilled Worker | 12 | 6.0 |
| Unskilled Worker | 62 | 31.0 |

| **Income per month** | | |
|---|---|---|
| ≥ 36,997 | 56 | 28.0 |
| 18,498 – 36,996 | 58 | 29.0 |
| 13,874 – 18,497 | 13 | 6.5 |
| 9,249 – 13,873 | 22 | 11.0 |
| 5,547 – 9,248 | 51 | 25.5 |

| **Socio-economic status** | | |
|---|---|---|
| Upper | 70 | 35.5 |
| Upper – middle | 50 | 25.0 |
| Lower middle | 24 | 12.0 |
| Upper lower | 56 | 28.0 |

| **Worldwide Body mass index (BMI)** | | |
|---|---|---|
| Overweight | 160 | 80.0 |
| Obese Grade I | 36 | 18.0 |
| Obese Grade II | 4 | 2.0 |

Socio – economic status is the one of the important parameter to assess the adiposity among women. In this connection, for measurement of obesity in different socio – economic classes BMI was used. BMI is considered as an important tool for measurement of overweight and obesity. It does not measure the body fat directly, but research has shown that BMI correlates to direct measures of body fat such as under water weighing and dual energy x – ray absorptiometry (DXA) [20]. It can be considered as an alternative for direct measures of body fat. Additionally, it is an inexpensive method and easy to perform for the screening of weight categories that may leads to health problems. Therefore, BMI is one of the best methods for population assessment of overweight and obesity [21]. Generally in developing countries, the level of obesity is greater in the higher socio – economic status segments of the society [22]. Evidences exist in Brazil, [23], Cameroon, [24] India, [25], Jordan, [23], and Madagascar [23]. However converse result is found in this cross sectional study that, 85.7 percent of the respondents were overweight come in upper lower category of socio – economic status and 72 percent of them come in upper – middle socio – economic status category. This may be due to lack of knowledge about food, nutrition and health (i.e. recommended dietary guidelines). In context of obese grade I category, it was found that 28 percent of the respondents lie in upper middle category and 20 percent of them come in upper socio – economic category. Through $X^2$ analysis, there is no significant association found between SES and

worldwide BMI (P > 0.05). From these data, it may be concluded that overweight and obesity are not totally dependent on socio – economic status but it may be due to faulty eating habits, sedentary lifestyle, genetic factor, lack of physical activity, hormonal problem or may be due to any other reason as shown in Table 2.

Table 2: Socio- economic status of the respondents according to worldwide BMI

| **Socio– economic status** | **Overweight** | | **Obese Grade I** | | **Total** | |
|---|---|---|---|---|---|---|
| | **No.** | **%** | **No.** | **%** | **No.** | **%** |
| Upper (I) | 56 | 80.0 | 14 | 20.0 | 70 | 100.0 |
| Upper middle (II) | 36 | 72.0 | 14 | 28.0 | 50 | 100.0 |
| Lower middle (III) | 20 | 83.3 | 4 | 16.7 | 24 | 100.0 |
| Upper lower (IV) | 48 | 85.7 | 8 | 14.3 | 56 | 100.0 |
| **Total** | 160 | 80.0 | 40 | 20.0 | 200 | 100.0 |

X2 =3.31, df =3, P > 0.05

In the present finding significant difference were found in height (F= 1.655, P < 0.01), weight (F= 17.33, P < 0.01), BMI (F= 3.97, P < 0.01) and PBF (F= 4.32, P < 0.01) with the different categories SES through F test. Turkey HSD (Post – hoc) test is used to see the significant pairs of health parameters and SES.

Table 3: Mean and standard deviation of health parameters of different socio – economic status of respondents

| | **Socio – economic status** | | | | | |
|---|---|---|---|---|---|---|
| **Health Parameters** | **I (70)** | **II (50)** | **III (24)** | **IV (56)** | **Total** (200) | **Statistical significance** |
| Height (cm) | 154.77±5.93 | 154.18±5.92 | 149.08±8.36 | 147.91±5.73 | 152.02±6.90 | F=16.55, P<0.01 |
| Weight (kg) | 67.10±8.59 | 68.18±8.56 | 60.54±8.83 | 59.20±4.68 | 64.37±8.62 | F=17.33, P<0.01 |
| BMI (kg/m$^2$) | 27.99±2.63 | 28.66±3.30 | 26.96±2.53 | 27.09±2.06 | 27.78±2.72 | F=3.97, P<0.01 |
| WC (cm) | 87.20±8.47 | 87.98±7.63 | 86.54±6.53 | 88.70±8.97 | 87.74±8.18 | F=0.54, P>0.05 |
| WHR | 0.89±0.06 | 0.88±0.06 | 0.89±0.06 | 0.87±0.05 | 0.88±0.06 | F=1.23, P>0.05 |
| VF | 10.27±5.10 | 10.24±3.32 | 9.67±3.73 | 10.93±4.42 | 10.38±4.34 | F=0.54, P>0.05 |
| PBF | 37.11±3.36 | 37.52±3.21 | 36.00±2.84 | 35.57±2.91 | 36.65±3.22 | F=4.32, P<0.01 |

Here, BMI= body mass index, WC= waist circumference, WHR= waist hip ratio, VF= visceral fat and PBF= percent body fat. All values are in mean ± S.D and Turkey HSD (Post- hoc) test is used to assess the significant pairs. Height: I vs. III & IV, II vs. III & IV; Weight: I vs. III & IV, II vs. III & IV; BMI: II vs. IV; PBF: I vs. IV, II vs. IV.

Diet also plays a dramatic role in maintaining the nutritional status of the individual. It is well documented that SES can affect the food choices by structural, material, and economic factors, attitudes and beliefs towards health and food and knowledge about food, nutrition, and health [26]. The relationship between SES and dietary intakes has been investigated in recent years [27]. Some studies shows that high SES is associated with decreased risk of dietary inequalities and lower SES individual are more prone to diet and health disparities [28]. The lower SES seems to be the least likely to purchase or consume foods that are known as healthy foods i.e., consistent with dietary guideline recommendations [29]. As a long-term outcome of this situation, diet related diseases such as obesity has higher mortality and morbidity rates in low SES groups [30]. In this connection, the study states that protein, carbohydrate, calcium, phosphorus and total fibre intake of the respondents were higher in all the categories of SES as compared to RDA 2010. It was reported that lower socioeconomic status might limit adequate consumption of calcium intake and subsequently contribute to poor bone health [31]. But converse result is found in this study, the fat intake was slightly higher in upper SES category and the iron intake was lower in all the categories of SES. Through F – test, it was concluded that the fat (F= 5.67, P < 0.001), calcium (F= 10.43, P < 0.001) and total fibre (F= 3.14, P < 0.005) intake has significant association with different categories of SES. This may be considered as one of the reason

of obesity because excess intake of nutrient leads to storage of energy in form of glycogen in our body via metabolic pathway.

Table 4: Mean and standard deviation of nutrient intake of different socio – economic status of the respondents

| | Socio– economic status | | | | | |
|---|---|---|---|---|---|---|
| **Health Parameters** | **I (70)** | **II (50)** | **III (24)** | **IV (56)** | **Total (200)** | **Statistical significance** |
| Protein (g) | 62.64±14.56 | 61.10±11.74 | 58.63±11.31 | 60.54±12.68 | 60.54 ± 12.68 | F=1.49,P> 0.05 |
| Fat (g) | 43.10±14.41 | 38.72±10.85 | 34.21±9.00 | 34.86±12.60 | 38.63±12.95 | F=5.67,P< 0.001 |
| Carbohydrate (g) | 308.64±60.88 | 313.08±66.43 | 313.38±61.08 | 327.04±68.83 | 315.47±64.56 | F= 0.89,P > 0.05 |
| Energy (kcal) | 1903.76±345.43 | 1879.00±358.19 | 1840.50±304.85 | 1871.95±353.78 | 1881.07±344.53 | F=0.22,P> 0.05 |
| Calcium (mg) | 856.77±294.86 | 894.60±264.74 | 727.79±224.82 | 650.30±200.18 | 792.92±273.11 | F=10.43,P <0.001 |
| Phosphorus (mg) | 1472.49±389.37 | 1535.02±329.67 | 1516.50±356.14 | 1447.32±283.00 | 1486.36±342.53 | F=0.68,P > 0.05 |
| Iron (mg) | 18.2 ±5.46 | 18.54±4.85 | 19.50±6.08 | 17.82±4.58 | 18.34±5.14 | F=0.63,P > 0.05 |
| Total fibre (g) | 43.30 ± 12.45 | 48.38 ± 13.09 | 48.50 ± 9.64 | 49.50 ± 12.88 | 46.93 ± 12.64 | F= 3.14,P < 0.05 |

All values are in mean ± S.D and Turkey HSD (Post- hoc) test is used to assess the significant pairs: Fat: I vs. III & IV; Calcium: I vs. IV, II vs. III & IV; Total fibre: I & IV.

Table 5 depicts the Pearson Correlation coefficient (r) between health parameters with SES. The value of 'r' in this table reveals the significant association of height (r = 0.433, P < 0.001), weight (r = 0.433, P < 0.01), BMI (r = 0.198, P < 0.01) and VF (r= 0.251, P < 0.001) with SES.

Table 5: Correlation between socio-economic status and health parameters

| | Socio – economic status | |
|---|---|---|
| **Health parameters** | **'r' value** | **P - value** |
| Height | $0.433^{S}$ | < 0.001 |
| Weight | $0.433^{S}$ | < 0.001 |
| BMI | $0.198^{S}$ | < 0.01 |
| WC | $- 0.041^{NS}$ | > 0.05 |
| WHR | $0.086^{NS}$ | > 0.05 |
| VF | $0.251^{S}$ | <0.001 |
| PBF | $- 0.036^{NS}$ | > 0.05 |

Here, BMI = body mass index, WC= waist circumference, WHR= waist hip ratio, VF= visceral fat and PBF= percent body fat. S = significant and NS = non-significant. The Pearson Correlation coefficient 'r' value calculated between nutrient and socio – economic status. In table 6 reveals that there is significant positive association found between protein (r = 0.171, P = < 0.05), fat (r= 0.263, P < 0.001), calcium (r= 0.351, P < 0.001) and negative association was found between total fibre (r = - 1.63, P < 0.05) with SES.

Table 6: Correlation between socio – economic status and nutrient intake

| Socio – economic status | | |
|---|---|---|
| **Nutrient intake** | **'r' value** | **P - value** |
| Protein (g) | $0.171^{S}$ | < 0.05 |
| Fat (g) | $0.263^{S}$ | < 0.001 |
| Carbohydrate (g) | $- 0.094^{NS}$ | > 0.05 |
| Energy (kcal) | $0.052^{NS}$ | > 0.05 |
| Calcium (mg) | $0.351^{S}$ | < 0.001 |
| Phosphorus (mg) | $0.064^{NS}$ | > 0.05 |
| Iron (mg) | $0.035^{NS}$ | > 0.05 |
| Total fibre (g) | $-1.63^{S}$ | < 0.05 |

Here, S = significant and NS = non-significant

## CONCLUSION

Socio – economic status is a complex, multifaceted construct based on three parameters i.e. education, occupation and family income. The present study demonstrates that overweight respondents are more in lower SES category than in middle and high SES category. In spite of this it was also observed that the fat intake among the respondents decreases in SES from upper to lower. This may be due to nutrition transition .i.e. shift to high energy, high fat and low fibre diet. The respondents need to develop regular pattern of physical activity along with manipulation in their diet and lifestyle for leading a healthy life. Therefore, there is a need to evolve community based approach to develop strategies for combating the problem of weight gain of the nation.

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## CONFLICT OF INTEREST

The authors of the manuscript have no conflict of interest to declare.

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