# A study on the nutritional status of obese women and associated risk factors

SHALINI SEN AND ARTI SANKHLA

The present study was undertaken to assess the anthropometric, biochemical parameters and dietary intake of the obese females in the age groups of 30-40 years. Forty females with body mass index (BMI) of 25-30 kg/m² were selected from Udaipur city. The results of this study showed that study subjects had higher waist-hip ratio (WHR), body fat per cent, fat mass, low density lipoprotein (LDL-C) level while total body water, fat free mass and high density lipoprotein (HDL-C) level were lower than normal range. The mean cholesterol, triglyceride (TG) and glucose levels of the females were reported to be in the normal range. The majority of the subjects were found to suffer from mild anemia. The study concludes that the major causes of the obesity among females were unhealthy dietary habits (high intake of energy, fat and, sugar whereas intake of fiber and protein was low) and sedentary life style.

**Key Words :** Obesity, Biochemical parameters, Fat free mass, Fiber

## INTRODUCTION

Health is a dynamic life process, which begins at birth and is governed by genetic and environmental factors throughout life. Now a days, due to sedentary lifestyles and industrialization several health problems have crept into people's life among which obesity is predominates (Vijayalakshmi *et al.*, 2003).

Obesity is a multifactorial disease, which is defined as increased fat tissue of the body to above normal level. The prevalence of obesity is increasing in most parts of the world, not sparing any age and sex group. Moreover, obesity is no longer just a concern for developed countries, but it is becoming an increasing problem in many developing countries. Globally, there are more than 1 billion overweight adults, at least 300 million of them obese (WHO, 2010).

Economic growth, modernization, urbanization and globalization of food markets are just some of the forces that are thought to underlie the epidemic. As income rises and population become more urban, diets high in complex carbohydrates give way to more varied diets with a higher proportion of fats and sugars. At the same time, major shift towards less physical activity is also found in the increasing use of automated transport, technology in the home and more passive leisure pursuits. The major health consequences associated with obesity are non – insulin dependent diabetes mellitus, cardiovascular diseases, gout, gall stones, renal diseases, osteoarthritis, psychological problems, mechanical disabilities and certain types of cancer.

Considering all these points, the present piece of research was undertaken to assess anthropometric and biochemical parameters of obese women.

## METHODOLOGY

The methodology followed during the course of conduction of work has been explained under the following heads:

### Locale of the study:

The study was conducted within the municipal limits of Udaipur city to ensure maximum contact with the

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subjects.

**Subject selection:**

A total of forty obese females in the age range of 30-40 years were selected purposively.

**Data collection:**

*Anthropometric measurement:*

Height, weight, waist, hip measurements of the subjects were taken for calculating body mass index (BMI) and waist-hip ratio (WHR). Body composition was also assessed by using body composition analyzer.

*Biochemical analysis:*

Estimation of lipid profile, blood glucose and hemoglobin level were carried out using standard diagnostic kits and procedures.

*Dietary intake and energy expenditure:*

Information on energy intake of subjects was collected using "24 hours recall method". The different items of food cooked and consumed were asked and then converted in terms of their raw ingredients. Average energy of the diet consumed was calculated for each food items by using food composition tables. Energy expenditure was assessed by using BMR and physical activities based method.

**Data analysis:**

Results are expressed as percentage and in mean ± SE.

## OBSERVATIONS AND ASSESSMENT

The result of the present study have been discussed in detail as under:

**Anthropometric measurements:**

Table 1 shows that the mean weight of the subjects was 68.0±0.8 kg, which was more than the weight of a reference Indian woman (50 kg). The average BMI of subjects was found to be 27.9±0.3 kg/m². Results revealed that all the subjects had BMI = 25 (obese) as per the classification given by WHO (2000) for Asia pacific region.

**Table 1.** Anthropometric measurements of the subjects

| Sr. No. | Body measurement | Mean ± SE |
|---------|------------------|-----------|
| 1. | Weight (kg) | 68.0±0.8 |
| 2. | Height (cm) | 155.9±0.7 |
| 3. | BMI (kg/m²) | 27.9±0.3 |
| 4. | WHR | 0.8 ± 0.0 |

It is evident from Table 2 that majority of the subjects (72.5 per cent) had WHR between 0.8 to 0.9 and hence they were classified under high risk category followed by those

**Table 2.** Distribution of subjects with respect to waist hip ratio

| Waist hip ratio (WHR) | Classification* | Percentage (number) |
|-----------------------|-----------------|---------------------|
| < 0.8 | Normal | 27.5 (11) |
| ≥0.8 | High risk | 72.5 (29) |

*Classified advised by WHO Expert Committee, 1997.

falling under the normal category (27.5 per cent). Data in Table 3 point out that the mean body fat per cent (39.4±0.6) and fat mass (27.9±0.9 kg) were higher while total body water (30.6±0.3 kg) and fat free mass (40.6±0.6 kg) were lower than the normal range. Smilowitz *et al.*, (2009) also observed higher levels of body fat per cent (39.7±6.1 per cent), body fat mass (32.1±6.0 kg), and low levels of lean mass (46.0±10.7 kg) in obese subjects in assessing the body composition during energy restriction in obese humans.

**Table 3.** Body composition of the subjects

| Sr. No. | Body composition | Percentage (number) |
|---------|------------------|---------------------|
| 1. | Fat (%) | 39.4±0.6 |
| 2. | Body fat mass (kg) | 27.9±0.9 |
| 3. | Total body water (kg) | 30.6±0.3 |
| 4. | Fat free mass (kg) | 40.6±0.6 |

**Biochemical status:**

Table 4 shows the distribution of the subjects on the basis of lipid profile fractions and it was observed that majority of the subjects (82.5 per cent) had cholesterol and TG levels

**Table 4.** Distribution of subjects on the basis of lipid profile fractions

| Lipid profile fractions (mg/dl) | Classification* | Percentage (number) |
|--------------------------------|-----------------|---------------------|
| **Total cholesterol** | | |
| < 200 | Desirable | 82.5 (33) |
| 200-239 | Borderline high | 15.0 (6) |
| ≥ 240 | High | 2.5 (1) |
| **Triglyceride** | | |
| < 150 | Normal | 82.5 (33) |
| 150-199 | Borderline high | 15.0 (6) |
| 200-499 | High | 2.5 (1) |
| ≥ 500 | Very high | 0.0 (0) |
| **LDL-C** | | |
| < 100 | Optimal | 27.5 (11) |
| 100-129 | Near/above optimal | 55.0 (22) |
| 130-159 | Borderline high | 10.0 (4) |
| 160-189 | High | 7.5 (3) |
| ≥ 190 | Very high | 0.0 (0) |
| **HDL-C** | | |
| < 40 | Low | 25.0 (10) |
| 40-59 | Intermediate | 70.0 (28) |
| ≥ 60 | High | 5.0 (2) |

*Classification devised by NCEP ATPIII (2001)

within the normal value (< 200 and <150 mg/dl) while remaining 15 and 2.5 per cent subjects were at a borderline and high risk group, respectively. Only 5 per cent of the females were in the low risk range on having HDL-C level 60 mg/dl or more and 70 per cent had HDL-C levels between 40-59 mg/dl. LDL-C was found in desirable measures (< 100mg/dl) in only few subjects (27.5 per cent) whereas, in majority of subjects (55 per cent), values ranged between 100mg/dl to 129mg/dl. It was observed that the mean total cholesterol (173.7±4.9mg/dl) and triglyceride (107.1±6.7mg/dl) level were normal. The mean HDL-C (46.8±1.4mg/dl) was low while LDL-C (110.6±3.6mg/dl) was higher than normal range (Table 5). In the same milieu Abulnaja (2009) revealed higher LDL level (128±8.3mg/dl) and low HDL level (40±3.3mg/dl) among obese subjects. Brown *et al.* (2000) reported that the HDL level decrease with the increase in BMI.

**Table 5.** Mean ± SE values of lipid profile fractions

| Lipid profile fractions (mg/dl) | Mean ± SE |
|---|---|
| Total cholesterol | 173.7 ± 4.9 |
| Triglyceride | 107.1 ± 6.7 |
| LDL-C | 110.6 ± 3.6 |
| HDL-C | 46.8 ± 1.4 |

Subjects when classified on the basis of the blood glucose level (Table 6) shows that three-fourth of the females were in the normal range (70 to 100 mg/dl) while one-fourth subjects were found to suffer from impaired fasting glucose (a condition in which the fasting glucose level is consistently elevated above normal level). None of them suffer from diabetes. The overall mean value of fasting blood glucose level in the study population was observed to be 93.3±1.2 mg/dl (Table 7). Volpe *et al.* (2001) also found that the mean fasting glucose level was 91.38±12.7mg/dl in obese women. Subjects when distributed on the basis of hemoglobin level (Table 8), it was found that a minor (17.5 per cent) portion of the females were in the normal range while nearly two-third of them were found to suffer from mild anemia followed by those falling under the moderate anemia (20 per cent). Severe anemic condition was not found in any subject. Hence, it is apparent that mild anemia was widely

**Table 6.** Distribution of subjects with respect to blood glucose level

| Blood glucose levels (mg/dl) | Classification* | Percentage (number) |
|---|---|---|
| Fasting | Normal | 75.0 (30) |
| < 100 | | |
| 100-125 | Impaired fasting glucose | 25.0 (10) |
| >125 | Diabetes | 0.0 (0) |
| Post prandial | Normal | 100 (40) |
| < 140 | | |
| 140-200 | Impaired glucose tolerance | 0.0 (0) |
| 200 | Diabetes | 0.0 (0) |

*Classification devised by American Diabetes Association, WHO and NIH (2005)

**Table 7.** Mean ± SE values of blood glucose levels

| Blood glucose levels (mg/dl) | Mean ± SE |
|---|---|
| Fasting | 93.3 ± 1.2 |
| Post prandial | 122.6 ± 2.0 |

**Table 8.** Distribution of subjects according to the hemoglobin level

| Hemoglobin level (g/dl) | Classification* | Percentage (number) |
|---|---|---|
| 12- 15 | Normal | 17.5 (7) |
| 10.0-11.9 | Mild anemia | 62.5 (25) |
| 8-9.9 | Moderate anemia | 20.0 (8) |
| < 8 | Severe anemia | 0.0 (0) |

prevalent in study subjects, a level which undeniably a matter of concern and needed action. The mean value of hemoglobin was 10.8±1.1g/dl. These findings are in alignment with those reported by Sultan (2007) that the prevalence of mild anemia was significantly higher in female subjects.

**Dietary intake:**
The mean food intake of the subjects was calculated and is presented in Table 9. Results revealed that diet of women in comparison to the balanced diet was substantially inadequate

**Table 9.** Mean ± SE values of food intake

| Sr. No. | Food groups | Balanced diet | Mean ± SE | % to BD |
|---|---|---|---|---|
| 1. | Cereals (g) | 300 | 170.2±4.6 | 56.7 |
| 2. | Pulses (g) | 60 | 28.3±1.7 | 47.2 |
| 3. | Leafy vegetables (g) | 100 | 36.2±5.6 | 36.2 |
| 4. | Roots and tubers (g) | 100 | 125±6.9 | 125 |
| 5. | Other vegetables (g) | 100 | 89.7±8.5 | 89.7 |
| 6. | Fruits (g) | 100 | 72.5±9.9 | 72.5 |
| 7. | Milk and its products (ml) | 300 | 151.2±6.8 | 50.4 |
| 8. | Sugars (g) | 25 | 51.2±0.7 | 204.8 |
| 9. | Fat and oils (g) | 20 | 91±1.5 | 455 |

**Table 10.** Mean daily intake of nutrients by female subjects

| Sr. No. | Nutrient intake | RDA | Mean ± SE | % to RDA |
|---|---|---|---|---|
| 1. | Energy (Kcal)* | 1636.8 | 2104.7±0.4 | 128.5 |
| 2. | Protein (g)* | 81.8 | 39.4±0.6 | 48.1 |
| 3. | Fat (g)* | 36.3 | 105.6±2.6 | 291 |
| 4. | Carbohydrates (g)* | 245.5 | 252.1±3.9 | 102.6 |
| 5. | Fiber (g) | 20 | 7.2±0.1 | 36.4 |
| 6. | Calcium (mg) | 400 | 498.2±8.5 | 124.5 |
| 7. | Iron(mg) | 30 | 18.8±0.3 | 62.9 |
| 8. | Thiamin(mg)* | 0.8 | 1.6±0.0 | 200 |
| 9. | Riboflavin(mg)* | 0.9 | 0.8±0.0 | 88.8 |
| 10. | Niacin(mg)* | 10.8 | 8.9±0.2 | 82.4 |
| 11. | Vitamin C(mg) | 40 | 77.1±1.8 | 192.8 |

RDA- Recommended Dietary Allowance suggested by ICMR, 2000          *Khanna *et al.,* 2003          Energy expenditure:

in food groups such as green leafy vegetables and pulses and slightly inadequate in milk and its products, cereals and fruits whereas intake of fat, sugar and roots and tubers was high. Similarly higher consumption of fat and energy dense food was observed by Tiwari and Sankhla (2005) in a research study on prevalence of obesity, weight perception and dietary behavior of urban college going girls. Researchers also observed higher intake of roots and tubers, sugar and jaggary and concluded that there is a gradual increase in the prevalence of obesity among college going girls and this may be due to faulty food habits.

The nutrient intake of the subjects is presented in Table 10. Findings revealed that diet of obese subjects was higher in energy, fat, carbohydrates, calcium, thiamin and vitamin C as compared to respective recommended values, slightly inadequate in riboflavin, niacin whereas extremely low in fiber, protein and iron. Krishnaswamy (2000) also witnessed significantly higher consumption of fat and energy foods by obese subjects. A positive trend in frequent consumption of high energy foods was seen with increasing turtle of waist hip ratio. It was observed that foods containing relatively high fat and energy content were more frequently consumed by obese.

**Energy expenditure:**

The study subjects spent their maximum time in sleeping (8 hours) followed by resting, sitting, watching TV etc. (4 hours 45 minutes). The other activities that consumed most of their time (2 hours 55 minutes) were cooking, preparing tea etc. Heavy recreation activities which are vastly energy taxing were reported to be not at all performed by subjects (Table 11). Thus, it can be concluded that all the subjects irrespective of their weight status had sedentary lifestyle. Alisa (2001) reported that sedentary life style has lead to obesity. The increasing industrialization, modernization and mechanization have led to sedentary habits which have become the part of the life style.  Data in Table 12 shows that the mean energy intake of subjects was 2104.7 ± 0.4 Kcal which was more than energy expenditure (1978.5±0.6 Kcal). The difference in energy intake and expenditure was 126.2±0.8 Kcal. The physical inactivity is the major factor contributing to the prevalence of obesity. The main cause of obesity is a calorie

**Table 11.**  Mean values of time and energy expenditure spent in various physical activities

| Groups | Physical activities | Mean (Time) | Mean (Energy expenditure) (Kcal) |
|---|---|---|---|
| I | Sleeping | 8:00 | 450.8 |
| II | Resting, sitting and doing light work (eating, watching TV, talking, reading, writing etc.) | 4:45 | 321.1 |
| III | Standing and doing light work (talking, watering plant etc.) | 1:40 | 140.8 |
| IV | Peeling and cutting vegetables/fruit, ironing, sewing, knitting, bathing, fresh up, preparing bed | 2:30 | 197.2 |
| V | Cleaning and arranging utensils, arranging clothes, cleaning food grains | 1:10 | 111.7 |
| VI | Cooking, preparing tea etc. | 2:55 | 295.8 |
| VII | Feeding, bathing and dressing child, picking and arranging things | 0:38 | 78.5 |
| VIII | Light cleaning- washing floor, windows and doors | 1:02 | 157.2 |
| IX | Washing, drying, wrinkling clothes, sweeping house, driving | 1:20 | 225.4 |
| X | Heavy recreation activities | - | - |
| Total | | 24 hours | 1978.5 Kcal |

**Table 12.** Mean ± SE values of energy intake and expenditure

| Energy intake (Kcal) | Energy expenditure (Kcal) | Energy balance (Kcal) |
|---|---|---|
| 2104.7±0.4 | 1978.5±0.6 | 126.2±0.8 |

intake which is persistently higher than calorie output (Weinser *et al.*, 2002). These findings are in accordance to the results revealed by Kushwaha *et al.* (2011) who revealed that the higher energy intake and low physical activity is significantly associated with obesity.

**Conclusion:**

The study concluded that obese women had higher body fat per cent, fat mass, low density lipoprotein (LDL-C) level while total body water, fat free mass and high density lipoprotein (HDL-C) level were lower than normal range. Cholesterol and TG level were normal, which was unexpectedly. It is believed that the prevalence of obesity and high body fat percentage reported in this population may be associated with a diet that is high in energy, fat content and also their sedentary life style.

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