

Impact of Nutrition Counseling on Dietary Intake of Obese Women from Low, Middle and High Income Group of Hoshiarpur City of Punjab

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Abstract

A study was conducted to assess the impact of nutrition counseling on food consumption pattern of obese women from low, middle and high income group. To study the prevalence of obesity, 150 women in the age group of 40-50 years, belonging to low (LIG), middle (MIG) and high (HIG) income group (50 from each income group) were randomly selected from sub-mountainous region of Hoshiarpur city. Twenty five normal (BMI 20-22.9 kg/m²) and 25 obese (BMI \geq 27.5 kg/m²) women from each income group were selected. Nutrition counseling was imparted to the subjects for 3 months. Its impact was assessed in terms of their dietary intake and gain in knowledge. Prevalence of overweight and obesity was higher in women belonging to HIG (70.7%) followed by MIG (67.3%) and LIG (56.6%). Percent adequacy of food groups like fats & oils, cereals, milk & milk products, roots and tubers and fruits was significantly ($p < 0.01$) higher in obese subjects as compared to normal subjects. Nutrition counseling of the obese subjects resulted in a gain in their knowledge and quantum of improvement, which further led to a decrease in the intake of fats & oils, cereals, milk & milk products, and roots & tubers by the obese subjects, compared to their consumption before the intervention and compared to women who only received routine counseling.

Keywords: Obesity; BMI; Income groups; Nutrition counseling.

Introduction

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have a negative effect on health, leading to reduced life expectancy and/or increased health problems. It can be seen as the first wave of a defined cluster

of non-communicable diseases called "New World Syndrome," creating an enormous socio-economic and public health burden in poorer countries. It has become serious epidemic health problem, estimated to be the fifth leading cause of mortality at global level [1]. The World Health Organization has described obesity as one of the most neglected public health problem, affecting every region of the globe.

Increasing evidence of overweight/obesity indicates that India is experiencing a double burden of communicable and non-communicable diseases. In 2005, nearly 14% of women aged 18 to 49 were overweight or obese, with higher rates among urban women (25%) than rural women (8%) [2]. The rate of overweight and obesity in women, overall increased by 3.5% a year from 1998 to 2005. Comparison of two major studies conducted by National Family Health Survey (NFHS- 2 in 1998-1999 and NFHS-

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3 in 2005-2006 showed that prevalence of obesity among Indian women has elevated from 10.6 to 12.6 per cent (increased by 24.52%). The prevalence is found more in women of age between 40-49 yrs (23.7%), residing in cities (23.5%) and households in the highest wealth quantile (30.5%). Highest percentage of obese women (29.9%) was found in Punjab followed by Kerala (28%) and Delhi (26%), all of which are relatively richer states [3]. Therefore, the increasing trend of obesity among Indians is becoming a matter of concern.

Worldwide debates are continuing about using ethnic-specific or standard methods of assessment of obesity. The most common measure of overweight and obesity is the Body Mass Index (BMI), which is determined by the individual's weight and height. When a BMI value is over 25 kg/m², the value indicates an overweight. People are considered obese when their Body Mass Index (BMI) exceeds 30 kg/m² [4].

One of the major causes of obesity is the changes in the diet in terms of quantity and quality which has become more "westernized" and sedentary life styles [5]. To effectively cure obesity with diet management, controlling the excessive nutrient intake but also concretely instructing the know how of choosing right foods and desirable eating pattern are necessary [6]. Nutrition education/counseling is therefore needed to motivate and create public awareness to preserve healthy life styles and adopt healthy dietary habits to reduce risk factors of obesity.

Nutrition counseling is one of the most effective tools of changing the food habits of the people without affecting their sentiments. It is a process by which the beliefs, attitude, environmental influents and knowledge about food and health are canalized into actual practices [7]. To maintain the reduced body weight after weight control, it is necessary to correct the way or pattern of eating, exercise and overall lifestyle [8]. Also it is important to acquire the ability to control one's own dietary habit by continuous nutrition education and counseling. Keeping these facts in view, the present community based study was carried out in Hoshiarpur city, Punjab to assess the impact of nutrition counseling on food and nutrient intake of obese women of low, middle and high income groups.

Materials and Methods

Selection of subjects

A total of 150 women in the age group

40-50 years (50 belonging to each income group *i.e.* low income group, middle income group and high income group were selected randomly among the localities of Hoshiarpur city to study the prevalence of obesity. The Body Mass Index (BMI) was used as a criterion for the assessment of prevalence of obesity. According to the WHO classification for Asian population the women having BMI more than 27.5 are considered as obese [4]. Based on the BMI, further 50 subjects from each income group were selected into two categories: normal and obese (25 subjects in each category), thus making a total sample size of 150 subjects.

An interview schedule was drafted to obtain the desired information on various aspects such as general information, family history, dietary intake, etc. of the subjects. Pretesting was carried out on 15 subjects to test the reliability and validity of questionnaire and the necessary modifications were made. Pretested subjects were not included in the study.

Background Information

Information about the subjects pertaining to age, educational qualification, monthly income, marital status, family type, family size, nature of work, lifestyle related information, medical history and usage of drugs was recorded through a pre-structured tested questionnaire was collected.

Dietary assessment

Information regarding the intake of food for three consecutive days was collected from the subjects using 24-hour recall method. Mean daily intake of different food groups including cereals, pulses, fruits, green leafy vegetables, roots and tubers, other vegetables, milk and milk products, sugar and jaggery and fats and oils was calculated by taking mean intake of three consecutive days. Cooked food consumed was converted into their raw equivalents. Different food items were converted into their raw equivalents and the average daily intake of energy, proximate principles, important vitamins and minerals were calculated by Dietcal a computer software [9].

Assessment of knowledge

A multiple choice questionnaire was also designed to test the nutrition knowledge of the subjects. After pre-testing the knowledge of the respondent's nutrition education in the form of lectures, trainings, talks, group discussions etc. was imparted to 150 subjects for a period of three months. Full package of knowledge through pamphlet and

booklet on Obesity were also given to the subjects. For evaluating questionnaire 1 score was awarded for each correct and zero for wrong answer. Post nutrition knowledge test was conducted after three months to note the gain in score and quantum of improvements in the diet. Gain in knowledge was calculated using the following equation.

$$\text{Gain in knowledge} = \text{Score of post test} - \text{Score of pre test}$$

$$\text{Quantum of Improvement} = \frac{\text{Post test scores}}{\text{Pre test scores}}$$

Statistical analysis

The data on all the parameters viz. food intake, nutrient intake and gain in knowledge were analyzed statistically with the help of mean, standard error, percentage and paired-'t' test.

Results and Discussion

Dietary Intake

It was observed (Table 1) that majority of the obese subjects i.e. 24, 68 and 52 percent were vegetarians whereas 48, 20 and 16 percent were non-vegetarians in LIG, MIG and HIG, respectively. However, corresponding values for ovatarians in all the three income groups were 28, 12 and 32 percent, respectively.

The daily consumption pattern of fruits and salads in the normal category showed that among the LIG (60%) and MIG (40%) consumed twice a week whereas HIG (40%) consumed daily. In the obese category LIG (72%), MIG (52%) and HIG (68%) consumed thrice a week. As evident from the Table 1 majority of the obese subjects i.e. 92, 100 and 88 percent in LIG, MIG and HIG, respectively preferred to have food from outside. The data clearly indicated that the frequency of

Table 1: Dietary Habits of the selected subjects.

| Parameters | LIG (n=50) | | MIG (n=50) | | HIG (n=50) | |
|---|---------------|--------------|---------------|--------------|---------------|--------------|
| | Normal (n=25) | Obese (n=25) | Normal (n=25) | Obese (n=25) | Normal (n=25) | Obese (n=25) |
| Dietary Pattern | | | | | | |
| Vegetarian | 15 (60) | 6 (24) | 11 (44) | 17 (68) | 8 (32) | 13 (52) |
| Non-vegetarian | 7 (28) | 12 (48) | 9 (36) | 5 (20) | 8 (32) | 4 (16) |
| Ovatarian | 3 (12) | 7 (28) | 5 (20) | 3 (12) | 9 (36) | 8 (32) |
| No. of meals per day | | | | | | |
| Twice | 1 (4) | - | - | - | - | - |
| Thrice | 24 (96) | 22 (88) | 16 (64) | 1 (4) | 7 (28) | 1 (4) |
| Four times | - | 3 (12) | 9 (36) | 9 (36) | 17 (68) | 9 (36) |
| More than four times | - | - | - | 15 (60) | 1 (4) | 15 (60) |
| Fruits and salad consumption | | | | | | |
| Daily | 7 (28) | 4 (16) | 7 (28) | 12 (48) | 10 (40) | 3 (12) |
| Twice a week | 15 (60) | 3 (12) | 10 (40) | - | 9 (36) | 5 (20) |
| Thrice a week | 3 (12) | 18 (72) | 8 (32) | 13 (52) | 6 (24) | 17 (68) |
| Outside food consumption | | | | | | |
| Yes | 9 (36) | 23 (92) | 17 (68) | 25 (100) | 20 (80) | 22 (88) |
| No | 16 (64) | 2 (8) | 8 (32) | - | 5 (20) | 3 (12) |
| Outside food consumption pattern | | | | | | |
| Once a week | 4 (16) | 8 (32) | 4 (16) | 7 (28) | 5 (20) | 3 (12) |
| Twice a week | - | 4 (16) | 2 (8) | 13 (52) | 3 (12) | 14 (56) |
| Thrice a week | 1 (4) | - | 2 (8) | 4 (16) | - | 3 (12) |
| Fortnightly | 4 (16) | 9 (36) | 9 (36) | 1 (4) | 12 (48) | 2 (8) |
| Daily | - | 3 (12) | - | - | - | - |
| Rarely | 16 (64) | 1 (4) | 8 (32) | - | 5 (20) | 3 (12) |

LIG-Low income group, MIG- Middle income group and HIG- High income group

Figures in parenthesis indicate percentage.

food consumption from outside was more in obese subjects belonging to all the three income groups, which might be a major contributor to obesity.

Consumption pattern of various food items

The data regarding food frequency (Table 2) indicated that consumption of fried foods and snacks was significantly higher in obese subjects of all the three income groups, whereas a non-significant difference was observed in the frequency score of carbonated beverages, sweet dishes and bakery products.

Food intake

Mean daily food intake by normal and obese subjects of all the income groups and their comparison with suggested dietary intake [10] are given in Table 3. Mean daily intakes of energy yielding foods such as cereals, roots and tubers, fats and oils and milk and milk products were significantly higher by obese subjects of all the three income groups as compared to normal subjects. The percent adequacy of all the food groups by LIG group was below the suggested intakes. Among MIG, the intake of fruits (115.8 and 115.0%), milk and milk products (130.1 and 137.8%) and fats and oils (100.6 and 212.9%) was found to be adequate by normal and obese subjects respectively. The percent adequacy of pulses was 144.2% and 166.0% by normal and obese subjects of HIG. The consumption of pulses increased with increase in income level. It was also reported that obese women consumed significantly higher ($p \leq 0.05$) quantities of pulses than normal women [11]. Consumption of roots and tubers was higher in the obese subjects in all the three income groups i.e. 199.8 \pm 58.0, 185.4 \pm 66.6 and 156.2 \pm 30.8g as compared to the normal subjects i.e. 145.9 \pm 53.8, 146.2 \pm 41.1 and 120.4 \pm 40.1g in

MIG, HIG and LIG, respectively.

It was observed that fruit intake was significantly higher in normal as well as obese subjects belonging to MIG and HIG as compared to that in the LIG. The consumption of milk and milk products was significantly different among the normal and the obese subjects in all the income groups. The LIG usually consume milk in the form of tea and very few were habitual of drinking milk. However, MIG and HIG subjects consumed milk in the form of paneer, cheese, flavoured milk, tea, sweets etc. Kaur (1995) [12] also reported less milk consumption among LIG (325g) as compared to MIG (658g) and HIG (863g). High intake of milk and its products in obese were also reported in literature [13]. The results (Table 3) showed that average daily intake of fats and oils was significantly ($p \leq 0.05$) higher among the obese subjects as compared to the normal subjects with high intake of 64.4 \pm 13.1 g by HIG obese subjects in comparison to 49.4 \pm 16.2 g by the normal subjects. The percent adequacy for fats and oils in normal subjects belonging to LIG, MIG and HIG was 28.8, 100.6 and 247 percent whereas in the obese subjects it was 41.2, 212.9 and 322 percent, respectively. The higher intake of fats and oils was mainly because of the more consumption of fried food among the three groups. It was also reported in the literature that more than 100 percent adequacy of fats and oil among LIG, MIG and HIG and consumption of higher amount of fat among the HIG (67g) as compared to MIG (58g) and LIG (56g) [14].

Nutrient intake

The mean daily intake of nutrients by the selected subjects is shown in Table 4. The percent adequacy among normal subjects was found out to be 42.5%, 73.6% and 103.3% whereas in obese subjects it

Table 2: Frequency food scores of various food items.

| Parameters | LIG (n=50) | | | MIG (n=50) | | | HIG (n=50) | | |
|----------------------|---------------|---------------|---------------------|---------------|---------------|--------------------|---------------|---------------|---------------------|
| | Normal (n=25) | Obese (n=25) | t value | Normal (n=25) | Obese (n=25) | t value | Normal (n=25) | Obese (n=25) | t value |
| Fried foods | 2.3 \pm 1.4 | 3.8 \pm 0.7 | 4.63* | 3.4 \pm 1.4 | 3.2 \pm 0.8 | 2.63** | 3.5 \pm 0.8 | 3.9 \pm 1.2 | 2.80** |
| Snacks | 2.8 \pm 1.5 | 3.6 \pm 0.8 | 2.24** | 3.6 \pm 1.1 | 4.6 \pm 0.5 | 3.9* | 3.5 \pm 0.7 | 4.7 \pm 0.5 | 6.65* |
| Carbonated beverages | 1.2 \pm 0.8 | 1.4 \pm 1.0 | 0.428 ^{ns} | 1.9 \pm 1.1 | 2.2 \pm 1.0 | 0.76 ^{ns} | 2.3 \pm 1.3 | 2.7 \pm 1.4 | 0.92 ^{ns} |
| Sweet dishes | 2.6 \pm 1.3 | 3.1 \pm 1.6 | 1.12 ^{ns} | 3.2 \pm 1.6 | 3.6 \pm 1.8 | 0.82 ^{ns} | 3.7 \pm 1.0 | 3.9 \pm 1.5 | 0.426 ^{ns} |
| Bakery products | 0.2 \pm 0.4 | 0.7 \pm 0.7 | 2.65** | 1.3 \pm 1.1 | 1.5 \pm 1.1 | 0.73 ^{ns} | 2.2 \pm 0.9 | 2.4 \pm 1.1 | 0.66 ^{ns} |

LIG-Low income group, MIG- Middle income group, HIG- High income group

Values are Mean \pm SD Mean scores (0, 1,2,3,4,5,6)

* Significant at 1%.

** Significant at 5% ^{ns}. Non significant

was 58.5%, 106.3% and 120.7% belonging to LIG, MIG and HIG respectively when compared with RDA [10]. A higher intake of energy in MIG and HIG subjects might be due to higher consumption of fats and oils and also sugar among them. A similar view has also been reported that a higher intake of energy by the obese respondents than their respective RDA [15,16]. Low intake of energy

by LIG as compared to MIG and HIG was also reported in the literature [12].

Except fats, Dietary fiber, calcium and vitamin A the consumption of all other nutrients was significantly different among the normal and the obese subjects in all the income groups. In LIG, the percent adequacy for fat was 100.5 and 114.6 percent

Table 3: Daily food intake of the selected subjects

| Food groups (g/day) | # Suggested Dietary Intake | LIG (n=50) | | | MIG (n=50) | | | HIG (n=50) | | |
|------------------------|----------------------------|--------------|--------------|---------|---------------|---------------|---------|---------------|---------------|---------|
| | | Normal (25) | Obese (25) | t value | Normal (25) | Obese (25) | t value | Normal (25) | Obese (25) | t value |
| Cereals | 270 | 122.0 ± 30.6 | 207.2 ± 48.4 | 7.43* | 172.0 ± 32.8 | 230.8 ± 53.8 | 4.65* | 185.4 ± 39.6 | 241.1 ± 66.2 | 3.60* |
| Pulses and Legumes | 55 | 19.8 ± 8.4 | 19.6 ± 8.6 | 0.08** | 46.6 ± 17.5 | 48.6 ± 33.9 | 0.48** | 79.3 ± 24.0 | 82.2 ± 31.3 | 0.36** |
| Green leafy Vegetable | 100 | 2.4 ± 6.2 | 3.3 ± 6.7 | 0.50* | 4.0 ± 7.0 | 6.9 ± 19.9 | 0.69** | 8.6 ± 13.6 | 8.4 ± 20.7 | 0.053** |
| Roots and Tubers | 200 | 120.4 ± 40.1 | 156.2 ± 30.8 | 3.53* | 145.9 ± 53.8 | 199.8 ± 58.0 | 3.40* | 146.2 ± 41.1 | 185.4 ± 66.6 | 2.50* |
| Other vegetable | 200 | 24.5 ± 14.0 | 28.0 ± 11.6 | 0.96** | 38.4 ± 26.0 | 39.7 ± 47.8 | 1.34** | 41.8 ± 18.5 | 43.3 ± 38.4 | 1.75** |
| Fruits | 100 | 18.5 ± 21.9 | 17.2 ± 18.2 | 0.23** | 115.6 ± 98.4 | 115.0 ± 94.6 | 1.53** | 192.2 ± 87.2 | 193.6 ± 109.8 | 0.049** |
| Milk and milk Products | 300 | 149.6 ± 50.0 | 175.4 ± 65.0 | 3.56* | 390.2 ± 136.2 | 413.4 ± 128.4 | 3.62* | 490.9 ± 133.8 | 542.5 ± 154.7 | 4.26* |
| Sugar | 20 | 9.5 ± 6.1 | 10.0 ± 7.0 | 0.22** | 14.3 ± 7.9 | 12.5 ± 12.1 | 0.63** | 24.1 ± 11.2 | 18.2 ± 20.2 | 1.28** |
| Fats and Oils | 20 | 5.7 ± 2.5 | 8.2 ± 3.8 | 2.68** | 20.1 ± 10.0 | 42.5 ± 15.2 | 6.12* | 49.4 ± 16.2 | 64.4 ± 13.1 | 2.29** |
| Meat and Poultry | | 19.0 ± 36.2 | 23.4 ± 28.9 | 0.47** | 15.0 ± 31.5 | 21.7 ± 46.5 | 0.59** | 34.0 ± 72.7 | 37.6 ± 61.6 | 0.188** |

LIG-Low income group, MIG-Middle income group, HIG- High income group

* Significant at 1%

** Significant at 5% -Non significant

ICMR (2010)

Table 4: Daily nutrient intakes of selected subjects

| Nutrients | #RDA | LIG (n=50) | | | MIG (n=50) | | | HIG (n=50) | | |
|-------------------------|------|---------------|---------------|---------|---------------|---------------|---------|----------------|----------------|---------|
| | | Normal (n=25) | Obese (n=25) | t-value | Normal (n=25) | Obese (n=25) | t-value | Normal (n=25) | Obese (n=25) | t-value |
| Energy (Kcal) | 1900 | 807 ± 94.4 | 1111 ± 210.0 | 6.61* | 1399 ± 235.6 | 2020 ± 267.2 | 8.71* | 1963 ± 405.3 | 2295 ± 323.8 | 3.19* |
| Protein (g) | 55 | 28.9 ± 4.8 | 39.7 ± 7.7 | 5.93* | 45.5 ± 9.0 | 64.4 ± 10.9 | 6.67* | 58.9 ± 13.4 | 71.9 ± 11.4 | 3.69** |
| Fat (g) | 20 | 20.1 ± 7.6 | 22.9 ± 5.2 | 1.52** | 46.1 ± 4.6 | 56.1 ± 19.6 | 1.05** | 85.5 ± 21.3 | 95.0 ± 20.8 | 1.60** |
| Carbohydrates (g) | - | 120.8 ± 23.7 | 185.4 ± 41.3 | 6.76* | 184.3 ± 33.4 | 250.2 ± 36.8 | 6.82* | 217.9 ± 46.2 | 264.5 ± 53.6 | 3.72** |
| Total dietary fiber (g) | - | 7.4 ± 2.5 | 7.4 ± 2.7 | 0.06** | 10.3 ± 3.7 | 13.4 ± 4.6 | 1.94** | 15.5 ± 3.3 | 16.6 ± 6.3 | 0.29** |
| Calcium (mg) | 600 | 437.4 ± 112.7 | 441.4 ± 94.3 | 0.136** | 892.6 ± 263.6 | 982.1 ± 292.7 | 1.67** | 1198.9 ± 344.3 | 1344.2 ± 310.4 | 1.56** |
| Iron (mg) | 21 | 7.9 ± 1.4 | 12.0 ± 2.8 | 6.46* | 11.7 ± 2.4 | 17.8 ± 4.2 | 6.14* | 14.4 ± 2.4 | 18.8 ± 4.9 | 4.03* |
| Vitamin A (µg) | 600 | 182.0 ± 164.6 | 171.6 ± 126.4 | 0.24** | 299.2 ± 172.7 | 351.7 ± 229.5 | 1.60** | 470.6 ± 330.1 | 587.9 ± 580.7 | 0.87** |
| Thiamin (mg) | 1.0 | 0.8 ± 0.1 | 1.2 ± 0.2 | 7.32* | 1.1 ± 0.2 | 1.6 ± 0.3 | 6.36* | 1.4 ± 0.2 | 1.7 ± 0.4 | 3.72* |
| Riboflavin (mg) | 1.1 | 0.4 ± 0.1 | 0.7 ± 0.2 | 5.96* | 0.7 ± 0.1 | 1.0 ± 0.3 | 4.17* | 1.0 ± 0.3 | 1.2 ± 0.3 | 2.19** |
| Niacin (µg) | 12 | 6.1 ± 1.3 | 10.2 ± 2.5 | 6.99* | 8.0 ± 2.2 | 11.6 ± 2.8 | 4.94* | 8.8 ± 2.0 | 12.0 ± 3.5 | 3.91* |
| Folic acid (µg) | 200 | 102.2 ± 26.6 | 140.4 ± 32.3 | 4.56* | 142.0 ± 40.3 | 204.0 ± 63.7 | 4.11* | 198.7 ± 56.4 | 235.2 ± 66.2 | 3.04* |
| Vitamin C (mg) | 40 | 30.2 ± 9.8 | 36.4 ± 9.7 | 2.22** | 69.8 ± 35.6 | 98.0 ± 38.0 | 2.70** | 103.6 ± 34.5 | 119.6 ± 90.3 | 2.42** |

LIG-Low income group, MIG-Middle income group, HIG- High income group.

ICMR (2010)

* Significant at 1%

** Significant at 5% -Non significant

for normal and obese subjects, all other nutrients were inadequately consumed except thiamin in obese subjects. The obese subjects of MIG and normal subjects of HIG were consuming all the nutrients adequately except iron, riboflavin, niacin and folic acid whereas the obese subjects of HIG were having all the nutrients in adequate amounts as compared to RDA. The percent adequacy was found out to be 100.5%, 230.9% and 427.5% by the normal subjects of LIG, MIG and HIG whereas for the obese subjects it was reported as 114.6, 280.85 and 475.45 percent, respectively. This excessive consumption of fat among Punjabi women has also been reported in the literature [17,18]. The high intake of fat in all the three groups might be due to strong liking and a higher consumption of fried and fast foods. In a previous study, it was that dietary fat promotes more obesity than carbohydrate or protein of same energy value [19]. Similar results have been reported in the literature [20,21,16].

The consumption of vitamins namely thiamine, riboflavin, niacin, folic acid and vitamin C differ significantly among the normal and the obese subjects while vitamin A did not differ significantly among the normal and the obese subjects of the three income groups. The results clearly indicated that

the obese subjects consumed large meals resulting in high intakes of energy, protein, carbohydrates and fat but on the other hand, the large meals also provided them with more vitamins which have positive effect on their overall health.

Nutrition Counseling

Nutrition counseling regarding obesity, its causes, consequences, control and prevention, balanced diet, dietary recommendations, cooking practices and ill effects of junk foods was imparted to the subjects for a period of three months. The evaluation of scores was done before (pre-test) and after (post-test) nutrition counseling to assess the difference in nutrition knowledge among normal and obese subjects. The average gain in knowledge during nutrition counseling is presented in Table 5. Quantum of improvement in normal and obese subjects of HIG was (1.2 ± 2.1 and 1.1 ± 1.3 respectively), whereas in MIG it was (1.2 ± 1.2 and 1.4 ± 2.0 respectively) followed by LIG normal and obese subjects (1.3 ± 2.1 and 1.5 ± 2.0 respectively) depicting a significant difference among the quantum of improvement of the subjects in all the three income groups.

Table 5: Gain in scores before and after nutrition counseling

| Groups | LIG (n=50) | | | MIG (n=50) | | | HIG (n=50) | | |
|------------------------|---------------|--------------|--------------------|---------------|--------------|--------------------|---------------|--------------|--------------------|
| | Normal (n=25) | Obese (n=25) | t value | Normal (n=25) | Obese (n=25) | t value | Normal (n=25) | Obese (n=25) | t value |
| Pre Test | 19.1 ± 2.4 | 17.8 ± 2.7 | 1.99 ^{ns} | 21.3 ± 2.3 | 22.1 ± 2.6 | 1.14 ^{ns} | 21.9 ± 2.4 | 23.4 ± 2.1 | 2.28 ^{**} |
| Post Test | 25.2 ± 1.9 | 25.6 ± 1.1 | 0.98 ^{ns} | 26.1 ± 2.1 | 26.8 ± 1.3 | 1.34 ^{ns} | 25.7 ± 2.0 | 26.1 ± 1.4 | 0.78 ^{ns} |
| t-Value | 9.80* | 13.22* | | 7.67* | 8.01* | | 5.96* | 5.21* | |
| Gain | 6.0 ± 2.0 | 8.0 ± 2.0 | 3.21* | 4.8 ± 2.2 | 4.9 ± 2.0 | 2.19** | 3.8 ± 2.1 | 2.7 ± 1.3 | 2.12** |
| Quantum of improvement | 1.3 ± 0.1 | 1.4 ± 0.2 | 2.95* | 1.2 ± 0.1 | 1.4 ± 0.1 | 2.19** | 1.1 ± 0.1 | 1.1 ± 0.0 | 2.15** |

LIG-Low income group, MIG-Middle income group, HIG-High income group ^{ns}-Non significant * Significant at 1% ** Significant at 5%

Table 6: Food intake of the subjects before and after nutrition counseling.

| Food groups (g/d) | LIG (n=25) | | | MIG (n=25) | | | HIG (n=25) | | |
|------------------------|--------------|--------------|--------------------|---------------|---------------|--------------------|---------------|---------------|--------------------|
| | Before | After | t value | Before | After | t value | Before | After | t value |
| Cereals | 207.2 ± 48.4 | 200.8 ± 44.4 | 2.24* | 230.8 ± 53.8 | 227.2 ± 51.8 | 2.45** | 241.1 ± 66.2 | 236.4 ± 65.2 | 2.41** |
| Pulses and Legumes | 19.6 ± 8.6 | 17.2 ± 6.6 | 1.56 ^{ns} | 48.6 ± 33.9 | 42.9 ± 30.9 | 1.89 ^{ns} | 82.2 ± 31.3 | 78.2 ± 30.3 | 1.78 ^{ns} |
| Green leafy vegetable | 3.3 ± 6.7 | 3.8 ± 6.7 | 1.67 ^{ns} | 6.0 ± 19.9 | 6.9 ± 18.5 | 1.76 ^{ns} | 8.4 ± 20.7 | 7.9 ± 19.7 | 1.43 ^{ns} |
| Roots and Tubers | 156.2 ± 30.8 | 152.5 ± 28.8 | 1.2 ^{ns} | 199.8 ± 58.0 | 194.8 ± 54.0 | 1.87 ^{ns} | 105.4 ± 66.6 | 100.4 ± 66.6 | 1.14 ^{ns} |
| Other vegetable | 28.0 ± 11.6 | 26.0 ± 10.3 | 1.48 ^{ns} | 39.7 ± 47.8 | 36.7 ± 47.6 | 1.64 ^{ns} | 43.3 ± 38.4 | 40.5 ± 36.2 | 1.52 ^{ns} |
| Fruits | 17.2 ± 18.2 | 19.6 ± 15.4 | 1.89 ^{ns} | 115.0 ± 94.6 | 118.0 ± 93.6 | 1.56 ^{ns} | 193.6 ± 109.8 | 195.9 ± 108.8 | 1.84 ^{ns} |
| Milk and Milk Products | 175.4 ± 65.0 | 170.3 ± 62.0 | 2.33** | 413.4 ± 128.4 | 409.6 ± 125.4 | 2.76** | 542.5 ± 154.7 | 539.5 ± 153.7 | 2.84** |
| Sugar | 10.0 ± 7.0 | 9.0 ± 6.5 | 1.91 ^{ns} | 12.5 ± 12.1 | 11.5 ± 10.1 | 1.76 ^{ns} | 18.2 ± 20.0 | 16.2 ± 18.0 | 1.54 ^{ns} |
| Fats and Oils | 8.2 ± 3.8 | 7.0 ± 2.5 | 2.87** | 42.5 ± 15.2 | 40.5 ± 12.2 | 2.75** | 64.4 ± 13.1 | 62.3 ± 13.1 | 2.69** |
| Meat and Poultry | 23.4 ± 28.9 | 21.2 ± 26.9 | 2.22** | 21.7 ± 46.5 | 19.6 ± 44.5 | 2.40** | 37.6 ± 61.6 | 36.8 ± 61.6 | 2.37** |

LIG-Low income group, MIG-Middle income group, HIG-High income group ^{ns}-Non significant * Significant at 1% ** Significant at 5%

Table 7: Nutrient intake of the subjects before and after nutrition counseling.

| Nutrients | LIG (n=25) | | | MIG (n=25) | | | HIG (n=25) | | |
|-------------------------|---------------|---------------|---------|---------------|---------------|---------|----------------|----------------|---------|
| | Before | After | t value | Before | After | t value | Before | After | t value |
| Energy (Kcal) | 1111 ± 210.0 | 1100 ± 208.0 | 2.87** | 2020 ± 267.2 | 2017 ± 267.2 | 2.76** | 2295 ± 323.8 | 2289 ± 323.8 | 2.54** |
| Protein (g) | 39.7 ± 7.7 | 38.7 ± 7.7 | 1.43** | 64.4 ± 10.9 | 63.7 ± 10.9 | 1.11** | 71.9 ± 11.4 | 70.9 ± 11.4 | 0.68** |
| Fat (g) | 22.9 ± 5.2 | 20.3 ± 5.2 | 2.88** | 56.1 ± 19.6 | 54.6 ± 19.6 | 2.75** | 95.0 ± 20.8 | 89.0 ± 20.8 | 2.45** |
| Carbohydrates (g) | 185.4 ± 41.3 | 180.2 ± 41.3 | 2.44** | 250.2 ± 36.8 | 248.5 ± 36.8 | 2.31** | 264.5 ± 53.6 | 260.5 ± 53.6 | 2.45** |
| Total dietary fibre (g) | 7.4 ± 2.7 | 7.4 ± 2.7 | 1.10** | 13.4 ± 4.6 | 13.4 ± 4.6 | 1.45** | 16.6 ± 6.3 | 16.6 ± 6.3 | 1.87** |
| Calcium (mg) | 441.4 ± 94.3 | 436.4 ± 94.3 | 2.30** | 982.1 ± 292.7 | 980.4 ± 292.7 | 2.67** | 1344.2 ± 310.4 | 1342.5 ± 310.4 | 2.73** |
| Iron (mg) | 12.0 ± 2.8 | 11.7 ± 2.8 | 1.89** | 17.8 ± 4.2 | 16.4 ± 4.2 | 1.54** | 18.8 ± 4.9 | 16.8 ± 4.9 | 1.73** |
| Vitamin A (µg) | 171.6 ± 126.4 | 167.8 ± 126.4 | 1.93** | 351.7 ± 229.5 | 348.5 ± 229.5 | 1.59** | 587.9 ± 580.7 | 580.3 ± 580.7 | 1.54** |
| Thiamine (mg) | 1.2 ± 0.2 | 1.1 ± 0.2 | 0.98** | 1.6 ± 0.3 | 1.5 ± 0.3 | 0.69** | 1.7 ± 0.4 | 1.6 ± 0.4 | 0.56** |
| Niacin (mg) | 10.2 ± 2.5 | 9.8 ± 2.5 | 1.12** | 11.6 ± 2.8 | 11.0 ± 2.8 | 1.43** | 12.0 ± 3.5 | 11.0 ± 3.5 | 1.76** |
| Folic acid (µg) | 140.4 ± 32.3 | 139.1 ± 32.3 | 0.46** | 204.0 ± 63.7 | 203.0 ± 63.7 | 0.51** | 235.2 ± 66.2 | 233.4 ± 66.2 | 0.64** |
| Vitamin C (mg) | 36.4 ± 9.7 | 34.4 ± 9.7 | 2.10** | 98.0 ± 38.0 | 96.0 ± 38.0 | 2.44** | 119.6 ± 90.3 | 117.6 ± 90.3 | 2.28** |

LIG-Low income group, MIG-Middle income group, HIG- High income group

** Non-significant * Significant at 1% ** Significant at 5%

A significant ($p \leq 0.01$) difference was found between the pre and post test scores of the subjects in all the income groups. Hence it can be concluded that there was gain in knowledge of the subjects after the nutrition counseling.

The data revealed that there was a significant ($p \leq 0.05$) decrease in the intake of cereals, milk and milk products, fats and oils and meat and poultry in the subjects after nutrition counseling whereas the intake of pulses and legumes, green leafy vegetables, other vegetables, roots and tubers, fruits and sugar showed a non-significant change (Table 6).

The data revealed that after counseling there was a significant ($p \leq 0.05$) decrease in the intake of various nutrients viz. energy, fat, carbohydrate, calcium and vitamin C in the obese subjects whereas a non significant change was found in the intake of protein, total dietary fibre, iron, vitamin A, thiamine, riboflavin, niacin and folic acid by the subjects. Significant decrease was observed in carbohydrate intake after nutrition counseling in all the income groups and it was mainly due to avoidance of refined foods, sugar and jaggery and fast foods and also inclusion of high fiber fruits and vegetables, whole wheat flour, dalia etc. in their daily diets as explained during nutrition counseling. Similarly, a decrease in the percent adequacy of the nutrients was observed after nutrition counseling (Table 7). A significant decrease was found in the intake of milk and milk products and fats and oils which might be another contributory factor in lowering the energy, calcium and fat intake after nutrition counseling but total fat and milk intake was found still higher than the suggested intake in MIG and LIG groups. Others workers also reported significant reduction

in fat intakes after nutrition counseling [7].

Conclusion

It may be concluded that the overall prevalence of overweight and obesity in the women of Hoshiarpur was found to be 56.6, 67.3 and 70.6 percent in low, middle and high income group respectively. Percent adequacy of food groups including roots and tubers, fruits, milk & milk products and fats & oils was higher in obese subjects as compared to their normal counterparts in all the three income groups. Nutrition counseling of the subjects resulted in a gain in their knowledge and quantum of improvement, which further led to a decrease in the intake of cereals, milk & milk products, fats & oils and roots and tubers which resulted in significant decrease in energy, fat, carbohydrates, calcium, and vitamin C values by the obese subjects as compared to normal subjects in all the three income groups. Among various nutrients fat and energy intake were found to be associated with the risk factors of obesity so there is a need to create awareness regarding the intake of low fat, low carbohydrate and high fiber diet among the masses. Imparting knowledge about the benefits of physical activity will further help in reducing the risk factors of obesity. Therefore, it is recommended that physical activity is a prerequisite for controlling weight; hence activities like jogging, walking, exercise etc should become a part of daily routine.

References

1. James WPT, Jackson-Leach R, Mhurchu CN,

- Kalamara E, Shayeghi M, Rigby NJ, Nishida C and Rodgers A. Overweight and obesity (high Body Mass Index). In Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors: Ezzati M, Lopez AD, Rodgers A, Murray C J L (ed) Geneva, (World Health Organization). 2004.pp.497-596.
2. Popkin BM, Adair SL and Ng WS. Global nutrition transition and the pandemic of obesity in developing countries. *Nutr Rev.* 2012;70:3-21.
 3. Garg C, Khan SA, Ansari SH and Garg M. Prevalence of obesity in Indian women. *Obes Rev.* 2010;11:105-08.
 4. WHO expert consultant. Appropriate Body Mass Index for Asian populations and its implications for policy and intervention strategies. *Lancet.* 2004;363:157-63.
 5. Antonio G and Chiara A.A natural diet versus modern western diets? A new approach to prevent Well-Being Syndromes. *Digestive Dis Sci.* 2005; 50:1-6.
 6. Nam JH. Effect of weight control program on obesity degree and blood lipid levels among middle-aged obese women. *Korean J Food Nutr.* 2006;19:70-78. [Google Scholar].
 7. Borbora, M, Bhattacharyya, R, Borthakur, S. Impact of nutrition counseling on subjects suffering from cardiovascular disease. *Asian J. Home Sci.* 2009;3:164-66.
 8. Wadden TA, Webb VL, Moran CH, Bailer BA. Lifestyle modification for obesity: new developments in diet, physical activity, and behavior therapy. *Circulation.* 2012;125:1157-70. [PMC free article][PubMed] [Google Scholar].
 9. Kaur G. DietCal-A tool for dietary assessment and planning. 2014. Department of Dietetics, AIIMS, New Delhi.
 10. ICMR. Nutrient requirement and safe dietary intake for Indians. 2010. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India.
 11. Kalsi G. Nutritional status, energy expenditure pattern and risk factors in obese Punjabiwomen. 1989. Ph.D. Dissertation, Punjab Agricultural University, Ludhiana.
 12. Kaur A. Consumption of fat and essential fatty acids by adult population of various socio-economic groups. 1995. M.Sc. thesis, Punjab Agricultural University, Ludhiana.
 13. Gupta N, Shah P, Coel K, Misra A, Rastogi K, Vikram NK, Kumari V, Pandey RM, Kondal D, Wasir JS, Bhardwaj S and Gulati S. Imbalanced dietary profile, anthropometry and lipids in urban Asian Indian adolescents and young adults. *J Am Coll Nutr.* 2010;2:81-91.
 14. Vijayalaxmi PM, Kasturiba B, Naik KR and Malagi U. Influence of fats and oils intake on the lipid profile of adults belonging to different income groups. *JAMA.* 2007;274:131-36.
 15. Geraz T. Study on nature and etiology of obesity and related degenerative disease among urban adults. 1996. M.Sc. Thesis, CCS Haryana Agricultural University, Hisar.
 16. Sangha JK, Pandher AK and Kochhar A. Anthropometric profile and adiposity in the obese Punjabi children and their parents. *J Human Ecol.* 2006;19:159-62.
 17. Kaur G, Singh SP and Singh A. Prevalence of overweight and obesity in urban and rural women of Punjab. *Human Biol Rev.* 2013.pp.306-13.
 18. Dhir R. Effect of dietary protein and exercise on body composition during weight loss regimen in adult women. 2012. M.Sc. thesis, Punjab Agricultural University, Ludhiana, India.
 19. Bennett C, Reed GW, Peters JC, Abumrad N, Sun M and Hill JO. Short term effects of dietary fat ingestion on energy expenditure and nutrient balance. *Am J Clin Nutr.* 1992;55:1071-77.
 20. Bala P. Anthropometry and nutrient adequacy of well-to-do school girls of 13-15 years from Punjab. 2000 M.Sc. Thesis, Punjab Agricultural University, Ludhiana.
 21. Gargiula J. Adolescents and obesity. *Family Practice.* 2002;19:304-09.