Assessing the Nutrient Intake, Energy Expenditure and Physical Activity Level of Obese and Non-Obese Women in Hisar district, India: A cross sectional study

ABSTRACT

The present study was conducted on thirty obese and thirty non-obese women (30-45 years) of Hisar district, Haryana to assess their mean nutrient intake, adequacy of intake of different nutrients, energy expenditure and physical activity level. The subjects did not exhibit any health complications and, overall, were in a state of good health. It was found that the mean intake of energy, protein, fat, folic acid and magnesium by respondents was comparable to Recommended Dietary Allowances (RDA) i.e 98 to 129 per cent of RDA. But when assessed on parameter of adequacy it was found that only 50 to 53.3 percent of respondents consumed adequate protein. Intake of most of the nutrients (iron, β-carotene, folic acid) under study, by them, was marginally adequate to inadequate when compared to the recommended values (with few exceptions). Calcium intake of 50 per cent of non-obese women was adequate while iron intake of 66.7 per cent of them was 50 to 74.9 per cent of RDA. All the obese and non-obese women were sedentary workers and consumed more energy than their requirement. This low intake in their nutrient intake may be due to inadequate intake of protective foods and it was felt that they need awareness regarding balanced diet and endorse adoption of a healthy life style by including minimum of 30 minutes of physical activity in their daily routines.

Keywords: Adequate, Inadequate, Nutrient intake, Obese, Recommended intake

1. INTRODUCTION

It has been extensively debated that balanced food intake, adequate intake of fruits, vegetables and functional foods and healthy lifestyle are important determinant of a person's health profile and associated lifestyle disorders[1]. It has been reported in several studies that obesity is a metabolic disorder which many of the respondents do not even perceive as a threat and many of them even do not know that they are obese. It has been suggested in studies that during the past several years'that obesity is becoming pandemic and affects mostly young population due to their improper eating habits that engrosses consumption of calorie loaded sugary juices, drinks, fast food, junk food; and involvement in less physical activities and outdoor game[2]. It has also been correlated that income also has a significant impact on food intake and this impact can be both ways affirmative as well as negative. Some people cannot afford nutritious food due to their higher cost and thus depend on cheap high calorie food for satisfying their hunger, thereby, adversely affecting their body mass index. At the same time some people lack knowledge about importance of intake of fruits, vegetables, green leafy vegetables, nuts, dietary fibre, water, choice of right type of poultry, right type of proteins and fats and need to curtail intake of excessive processed foods, they end up having a disturbed metabolism and hidden hunger[3]. So obesity and overweight cannot be studied in isolation as a number of social, economic and behavioural aspects are associated with food choices and it is challenge before governments to ensure availability of cost effective balanced diet to people belonging to different types of social fabric. It is well argued that alteration in metabolism due to faulty eating habits and sedentary life style may be a predisposing factor for diabetes, cardiovascular diseases, inflammation, body responses to different types of infections, cancer, constipation, hypertension, respiratory complications etc. and that there are scopes of altering the complications by reversal diets and enhancing the energy expenditure[4,5]. Obesity not only affects the health but also influences the thinking process of obese people and many of them can develop depression, whether they express it or not. They may even develop inferiority complex and it is very important to identify such cases and guide them properly so that they can attain desirable body weight. There is need to give proper counselling and nutrition education to the masses so as to improve their knowledge of health and desirable lifestyle which will positively influence their quality of life. In this time of COVID, intake of proper amount of food, nutrients specially vitamins and minerals, phytochemicals, active lifestyle and good mental health are gaining importance for augmenting the immune response of people. The present study was conducted to assess the nutrient intake of women and to assess their energy expenditure pattern so as to find out how they can be advised to maintain healthy weight and improve the overall health and wellbeing.

2. METHODOLOGY

This survey was conducted on 60 middle age group women (30-45 years) residing in CCS HAU Hisar Campus and those having Body Mass Index (BMI) less than 25 were classified as non obese and BMI more than 27.5 were classified as

obese[6]. All the subjects were healthy and did not have any kind of medical history. The information relating to nutrients' intake was calculated on the basis of their food intake reported earlier[7]using Food Composition Table[8]. The average daily nutrient intake was compared with Recommended Dietary Allowances[9] and nutrient adequacy ratio was calculated. The adequacy of nutrient intake was classified as 100% and above (I), 75-99.9% (II), 50-74.9% (III) and <50% (IV) of recommended intake. The information relating to their 24 -hour activity schedule was used to assess their level of activity. Physical Activity Level (PAL) values (1.53 for sedentary activity) and equations for prediction of Basal Metabolic Rate (BMR) based on body weight (8.3× B.W. (kg) + 788) were used to calculate Total Energy Expenditure (TEE)[9].

3. RESULTS AND DISCUSSION

3.1 Macro and micro nutrient intake and adequacy

The mean daily intake of energy, thiamine, folic acid and magnesium by the respondents was 4 to 29 per cent higher than the recommended values (Table 1). It was observed that the energy intake of all types of subjects whether obese or non obese was higher than the recommended values and the difference in their BMI may be due to differences in their Basal Metabolic Rate (BMR) and overall physical activity pattern[10]. On mean basis (Table 1) the protein intake of subjects was as per RDA adequate but Tables 2 and 5 indicated that the intake of protein was adequate, only, in case of about 50-53.3 percent of subjects while the fat intake of all of them was adequate. It means that they were consuming enough sources of fat and carbohydrates but intake of protein rich food like legumes and animal protein (poultry, eggs) was less[11,7] and that there is need to create awareness among them about importance of consuming a balanced diet containing protein sources like nuts, lean poultry, soybean, legumes etc.

Table 1. Mean daily intake of nutrients by obese and non-obese women (n=60)

Nutrients	RDA	Obese (n=30)	t-value	Non-obese (n=30)	t-value
Energy (Kcal)	1900	2142±34.49 (113)	7.01**	2132±39.94 (112)	41.73**
Protein (g)	55.0	54±0.94 (98)	1.06^{NS}	55±1.23(100)	0.00^{NS}
Calcium (mg)	600	519±18.52 (87)	4.37**	492±22.84 (82)	4.72**
Iron (mg)	21	13±0.39 (62)	20.51**	13±0.44 (62)	18.81**
β-carotene (µg)	4800	276±46.07 (6.0)	98.19**	454 ±90.65 (9.0)	47.94**
Thiamine (mg)	1.0	1.2±0.03 (120)	6.66**	1.2±0.04 (120)	5.0**
Riboflavin (mg)	1.1	0.84±0.0 (76)	26.00**	0.82±0.02 (74)	14.0**
Niacin (mg)	12	8±0.16 (67)	25.00**	8±0.36 (67)	11.11**
Folic acid (µg)	200	207±4.71 (104)	1.48^{NS}	215±6.74 (108)	2.22*
Magnesium(mg)	310	399±10.50 (129)	8.47**	392±11.84 (126)	6.92**
Zinc(mg)	10	9±0.18 (90)	5.55**	9±0.21 (90)	4.76**

Values are mean ±SD *Significant at 5 % level
Values in parentheses indicate percent RDA **Significant at 1% level
RDA- Recommended Dietary Allowances (ICMR 2010) NS = Non-significant

The mean daily intake of calcium, iron and zinc among all the respondents was significantly lower than RDA i.e. 62 to 90 per cent of recommended allowances. Calcium intake of only 13.3 percent of obese and 50 per cent of non-obese respondents was adequate (Tables 3 and 6).

Table 2. Adequacy of macro nutrient intake by obese women (n=30)

Adequacy level	Energy	Protein	Fat
I	25 (83.3)	15 (50)	30 (100)
II	5 (16.7)	15 (50)	-

I 100 per cent and above the RDA (Adequate)

II 75 to 99.9 per cent of RDA (Marginally adequate)
Values in parenthesis indicate per cent.

Table 3. Adequacy of mineral intake by obese women (n=30)

Adequacy level	Calcium	Iron	Magnesium	Zinc
I	4 (13.3)	-	28 (93.3)	6 (20)
II	21 (70)	3 (10)	2 (6.7)	24 (80)
III	5 (16.7)	21 (70)	-	-
IV	-	6 (20)	-	-

I 100 per cent and above the RDA(Adequate)
II 75 to 99.9 per cent of RDA (Marginally adequate)
III 50 to 74.9 per cent of RDA (Marginally inadequate)
IV Less than 50 per cent of RDA (Inadequate)
Values in parenthesis indicate per cent.

Table 4.Adequacy of vitamin intake by obese women (n=30)

Adequacy level	β-carotene	Thiamine	Riboflavin	Niacin	Folic acid
I	-	28 (93.3)	-	-	16 (53.3)
II	-	2 (6.7)	18 (60)	7 (23.3)	14 (46.7)
III	-	-	12 (40)	23 (76.7)	-
IV	30 (100)	-	-	-	-

I 100 per cent and above the RDA (Adequate)
II 75 to 99.9 per cent of RDA (Marginally adequate)
III 50 to 74.9 per cent of RDA (Marginally inadequate)
IV Less than 50 per cent of RDA (Inadequate)
Values in parenthesis indicate per cent.

Table 5.Adequacy of macro nutrient intake by non-obese women (n=30)

Adequacy level	Energy	Protein	Fat
I	26 (86.7)	16 (53.3)	30 (100)
II	4 (13.3)	14 (46.7)	-

I 100 per cent and above the RDA (Adequate)
II 75 to 99.9 per cent of RDA (Marginally adequate)
III 50 to 74.9 per cent of RDA (Marginally inadequate)
IV Less than 50 per cent of RDA (Inadequate)
Values in parenthesis indicate per cent.

Iron intake of 66.7 to 70 per cent of subjects was marginally inadequate while magnesium and zinc intake of maximum number of respondents (80 to 93.3 per cent) ranged from adequate to marginally adequate. This suggested that their intake of sources of minerals was not adequate. The mean daily intake of vitamins i.e. β-carotene, riboflavin and niacin by respondents was significantly lower than RDA i.e 6 to 9, 74 to 76 and 67 per cent of recommended amounts, respectively. β-carotene intake of all the respondents was inadequate i.e. less than 50 per cent of RDA while thiamine intake of 86.7 to 93.3 per cent of women was adequate (Tables 4 and 7).

Table 6.Adequacy of mineral intake by non-obese women (n=30)

Adequacy level	Calcium	Iron	Magnesium	Zinc
I	15 (50)	-	28 (93.3)	6 (20)
II	7 (23.3)	3 (10)	2 (6.7)	22 (73.3)
III	7(23.3)	20 (66.7)	-	1(3.3)
IV	1(3.3)	7 (23.3)	-	1(3.3)

I 100 per cent and above the RDA (Adequate)
II 75 to 99.9 per cent of RDA (Marginally adequate)
III 50 to 74.9 per cent of RDA (Marginally inadequate)
IV Less than 50 per cent of RDA (Inadequate)

Values in parenthesis indicate per cent.

Table 7. Adequacy of vitamin intake by non-obese women (n=30)

Adequacy level	β-carotene	Thiamine	Riboflavin	Niacin	Folic acid
I	-	26 (86.7)	-	1 (3.3)	20 (66.7)
II	-	4 (13.3)	15 (50)	3 (10)	9 (30)
III	-	-	15 (50)	25 (83.3)	1(3.3)
IV	30 (100)	-	-	1 (3.3)	-

I 100 per cent and above the RDA (Adequate)
II 75 to 99.9 per cent of RDA (Marginally adequate)
III 50 to 74.9 per cent of RDA (Marginally inadequate)
IV Less than 50 per cent of RDA (Inadequate)
Values in parenthesis indicate per cent.

The majority of respondents (76.7%) consumed niacin 50 to 74.9 per cent of RDA and folic acid intake of respondents ranged from adequate (53.3%) to marginally adequate (46.7%). This may be explained owing to their tendency of consuming low amounts of fruits and vegetables due to lack of knowledge regarding importance of inclusion of enough amounts of fruits and vegetables in daily diets, and also may be cost involved in purchase of fruits and vegetable, and size of family may be a contributing factor in low intake of fresh foods[12].

3.2 Energy expenditure and physical activity level

From Table 8 it was observed that all the respondents were sedentary workers and their physical activity level was found to be 1.53. The energy expenditure of obese women was found to be less than their energy intake i.e 1949 Vs 2142 while the energy expenditure of non-obese women was more than their energy intake i.e 2050 Vs 2132 Kcal (Tables 1 and 8). This explained that, the non-obese respondents, inspite of consuming energy higher than the recommended amount, were in the normal range of weight, and that their active lifestyle was responsible for more energy expenditure than they consumed. This exerted protective a effect to maintain favourable BMI and, that, they were not obese. In review of earlier studies it was concluded that it is not only energy expenditure and energy intake that matters in studying the etiology of obesity and overweight but a number of metabolic and endocrine disturbances also underline the episode of obesity[13]. It is important to understand that the obese subjects under study were in a positive energy balance, which if continued over a period of time, could lead to more complications in the years to come. Physical activity has direct impact on an individual's health status[14]. The need was felt to create awareness in the respondents that if they did not control their food intake and adopt active lifestyle it could be detrimental for their health.

Table 8. Physical activity pattern and total energy expenditure of obese and non-obese women

Type of Activity	Obese (n=30)	Non obese (n=30)
Sedentary worker (%)	100	100
Mean PAL*	1.53±0.02	1.53±0.03
Mean TEE (Kcal)**	1949±145.25	2050±133.22
Mean Energy intake (Kcal)	2142±34.49	2132±39.94

*PAL; Physical Activity Level **TEE; Total Energy Expenditure

4. CONCLUSION

From the present study it is concluded that intake of energy, fat, thiamine and magnesium by majority of respondents was adequate but the intake of protein, riboflavin, niacin, folic acid, β-carotene, calcium, iron and zinc by majority of them was not adequate. The obese respondents were in positive energy balance while non obese were in negative energy balance and all of them were sedentary workers. An urgent need has been felt to arrange an awareness programme for them so as to make masses understand the importance of adoption of righteous dietary and lifestyle habits. It is also felt that there is need to control foods rich in salt, sugar and oil while emphasis should be given on consumption of coarse cereals, fruits and vegetable.Adequate knowledge regarding food guide pyramid and balanced diet is need of the day.

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