

## ROLE OF DIET IN IMPROVING THE HEALTH OF ADULTS

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### ABSTRACT

A nutritional survey on one hundred women in the age group of 20-40 years belonging to middle income group was conducted. The diets consumed by the subjects were found to be inadequate in respect to cereals, pulses, green leafy vegetables and other vegetables while the consumption of milk and milk products, roots and tubers, sugar and jaggery and fats and oils was higher in comparison to the RDA. The intake of energy, riboflavin, ascorbic acid, iron and zinc was inadequate to meet the daily requirements. The average daily energy consumption was  $2106 \pm 28.9$  kcal and the energy expenditure was  $2048 \pm 37.1$  kcal with an overall energy balance of 56 kcal. The daily iron consumption was  $23.68 \pm 1.32$  mg which was inadequate. Results revealed that poor energy and iron status resulted in poor physical work performance of the subjects.

**Keywords : Iron, Energy status, Farm women, physical fitness.**

### INTRODUCTION

Adequate nutrition is one of the key factors which helps each person to attain his full potential as an adult. The energy required for a physical activity is directly proportional to the amount of work done, and the body size of the individual (Astrand, 1977). The maintenance of energy balance throughout life depends on the relationship between energy intake and energy expenditure. Very limited data are available on the intake and expenditure of energy of the farm women. The present investigation was undertaken to study the energy balance and iron status of adult women belonging to middle income group engaged in different types of routine activities and to study the work performance of the subjects in relation to their energy and iron status.

### MATERIAL AND METHODS

The study was conducted on one hundred adult women in the age group of 20-40 years belonging to middle income group (Rs. 500-1000/-capita/month) selected randomly from district Ambala. A questionnaire was formulated to collect the general information of the respondents. The height, weight, mid-upper arm circumference and skin fold thickness (biceps, triceps, sub-scapular and supriliac) of the subjects were measured by the methods of Jelliffe (1966). Body fat percentage was calculated from the sum of triceps, biceps, sub-scapular and supriliac using the equation given by Durnin and Womersley (1974). The body mass index was calculated using the equation given by Garrow (1981). The dietary survey was carried out on all the subjects by using the '24-hour recall' method. The amount of each food consumed by the subjects throughout the day was recorded. The record the amount of foods and beverages consumed was standardized. Katories and glasses were used. To assess the amount of wheat flour used in the preparation, paranthas and chapatis were weighed. General information on consistency of foods especially dals and vegetables was asked. The foods were cooked in the laboratory under similar conditions as in the households, in order to find out the weight of raw ingredients used in these preparations to facilitate the calculations of foods in the diets. The MSU Nutriguide (Song *et al*, 1992) was used to calculate the different nutrients intake. The results of mean nutrients intake were compared with Recommended Dietary Allowances (ICMR, 1990).

The energy expenditure (EE) was determined during the dietary survey period. Basal metabolic rate (BMR) of all the subjects was determined with prediction equation based on body weight by ICMR (1990) for age group of subjects. Energy expenditure was measured by physical activity diary method recording activities for each 15 min. interval. The energy expenditure of each activity was calculated by using energy values of various activities and time spent for the activity using Table Values of James and Schofield (1990). Energy balance was calculated from the energy intakes and energy expenditure. To assess the physical work performance, "Harvard step test" (Weiner and Lourie, 1969) was used. The test was performed at least three hours after a heavy meal. The rapid fitness index (RFI) was calculated as follows :

$$\text{RFI} = \frac{\text{Duration of Exercise in seconds}}{5.5 \times \text{Pulse count (1 to 1.5 minute after exercise)}} \times 100$$

## RESULTS AND DISCUSSION

The study was conducted on 100 adult (20-40 years) women of middle income group. The majority of subjects (88 per cent) were from Sikh religion. The family size ranged from 2 to 14 members. Majority of the subjects had 6 to 8 members (48 per cent) in their family. Most of the subjects (54 per cent) had land holding one to five acres. A majority of the subjects (50 per cent) were engaged in agriculture, 209 per cent were in service and remaining were involved in labour activities or small-scale business. The per capita income ranged from Rs. 500 to 1000 per month. The average income was Rs. 786/- capita/month.

The data on the anthropometric measurements are given in Table 1. The mean value for height among the subjects was 156.5 cm and was more as compared to the height of the adult Indian women (152.5 to 153.3 cm) given by ICMR (1989). The values obtained in the present study were quite close to the figure reported by Satinderjit (1993). The body weight of the subjects was slightly higher as compared to the value given (50 kg) by ICMR (1989) for healthy adult women.

**Table - 1**  
**Anthropometric measurements of the subjects**  
(n=100)

Parameters	Range	Mean±SD
Height (cm)	148 - 167	156.5±0.46
Weight (kg)	36 - 80	52.5±0.41
* Body Mass Index (Kg/m <sup>2</sup> )	14.8 - 34.2	19.6
** Mid-upper arm circumference (cm)	18.9 - 34.6	25.0±0.31
*** Triceps skinfold thickness (mm)	10.9 - 33.2	16.5±0.47
Sub-scapular (mm)	10.5 - 41.0	20.1±0.79
Suprailiac (mm)	11.2 - 46.0	26.4±0.87
Body fat (%)	24.4 - 43.21	31.3±0.58

Standard Value : \*20-24 kg/m<sup>2</sup> (Garrow, 1981)

\*\*28.5 cm and

\*\*\*16.5 mm (Jelliffe, 1966)

The mid-upper arm circumference (MUAC) of the subjects was in the range between 18.9 to 34.6 cm with a mean value of 25.0 ± 0.31 cm. According to Jelliffe (1966), the standard for MUAC of healthy women is 28.5 cm. The values obtained in 25 per cent of the subjects were more than the standard values. Majority of the subjects (79 per cent) had values about 80 per cent of the standard values. The mean value of triceps skin fold thickness (TSFT) was 16.5±0.47. The value

obtained in the present investigation was in accordance with the standards (Jelliffe, 1966) indicating sufficient energy reserves as subcutaneous fat. The mean values for sub-scapular and suprailiac skin fold thickness were  $20.1 \pm 0.79$  mm and  $26.4 \pm 0.87$  mm respectively (Table 1). The Body Mass Index (BMI) of the subjects was in the range of 14.8 to  $34.2 \text{ kg/m}^2$ . The NIN (1990) reported the mean BMI of  $19.6 \text{ kg/m}^2$  of women of 20-40 years which was quite close to the value obtained in the present study. Distribution of the subjects on the basis of BMI classification given by Garrow (1981) indicated that 36 per cent of the subjects had normal energy status while 20 per cent were low weight normals. Thirteen per cent of the subjects had mild energy deficiency while moderate and severe energy deficiency was seen in eight and four per cent of the subjects, respectively. On the other hand, 16 per cent of the subjects were in the category of obese with grade I obesity and 3 per cent had grade II obesity.

The total body fat (per cent) was calculated from the sum of biceps, triceps, sub-scapular and suprailiac skin fold thickness (Durnin and Womersley, 1974). The percentage of body fat of the adult women ranged from 24.4 to 43.2 per cent (Table 1). The mean body fat was found to be  $31.3 \pm 0.58$  per cent. The average body fat was in accordance with the reported value (19-53 per cent) as given by Durnin and Womersley (1974) indicating good energy status of the adult women.

The mean daily intake of various foodstuffs by the subjects is given in Table 2. The daily consumption of cereals ranged between 200 to 600 g with mean intake of  $334.5 \pm 8.02$  g. The obtained value was 24 per cent less as compared to the required amount 440 g given by ICMR (1987) for adult women. Varmeet (1993) has also reported an inadequate consumption of  $251 \pm 3.6$  g by adult women. The mean intake of pulses (43.35 g) was marginally low as compared to the recommendations of 45 g (ICMR, 1987). The consumption of roots and tubers by adult women ranged between 10 to 275 g with the mean intake of 91.18 g. The intake was much higher as compared to recommended allowance of 50 g (ICMR, 1987). The higher consumption may be due to the low cost and easy availability of roots and tubers during the survey period. The mean intake of green leafy vegetables (27.5 g) was much lower as compared to the RDA of 100 g (ICMR, 1987). Varmeet (1993) also reported a daily intake of  $38 \pm 7.2$  g among adult women. The low consumption of green leafy vegetables in the present study may be attributed to less availability in summer season, when the survey was conducted. The consumption of milk as such or in the form of tea, curd, butter or butter milk was liberal. The mean intake was  $305 \pm 16.68$  g which was nearly 202.6 per cent adequate compared to RDA of 150 g. The high intake of milk and milk products may be attributed to the easy availability of milk at home. The mean daily intake of 27.8 g of sugar and jaggery by the adult women was higher than that proposed (20.0 g) by ICMR for balanced diet. The intake of sugar and jaggery among adult women was primarily along with tea or milk preparation which was consumed frequently by the subjects. The daily intake of fats and oils was in the range of 15 to 55 g with a mean intake value of  $37.6 \pm 3.14$  g. The value obtained was higher in comparison with the RDA of 25 g (ICMR, 1987). Varmeet (1993) also reported a high intake (30.0g) of fats and oils among adult women.

**Table-2 Average intake of various foods (g/day) by the subjects(n=100)**

Food	Range	Mean Value	RDA	Per cent adequacy
Cereals	200-600	334.50±8.02	440	76.02
Pulses	25-225	43.35±3.91	45	96.33
Roots and tubers	10-275	91.18±6.92	50	182.36
Green Leafy vegetables	0-400	27.50±8.72	100	27.50
Other vegetables and fruits	0-270	37.26±5.83	40	93.15
Milk and Milk Products	100-800	305.00±16.78	150	202.66
Sugar and Jaggery	10-60	27.81±0.98	20	139.05
Fats and Oils	15-55	37.61±3.14	25	150.44

\* RDA for moderately active women (ICMR, 1987)

The average daily nutrient intake of all the subjects is given in Table 3. The mean intake of energy was 2106±2.89 kcal/capita and was marginally lower than the ICMR (1990) recommendation of 2318 kcal/capita for moderately working women with a mean body weight of 52.5 kg. The energy intake was 41.97±0.84 kcal/kg body weight which was marginally lower than 44.15 kcal/kg weight for moderately working adult women (ICMR, 1990). The marginal inadequacy in the energy intake by the subjects may be attributed to an inadequate intake of cereals. Majority of the subjects (59 per cent) consumed energy between 75 to 100 per cent of recommended allowances by ICMR (1990). Another 31 per cent of the subjects had energy consumption more than 100 per cent of the RDA. Only 10 per cent of the total subjects consumed energy less than the minimum requirement (75 per cent) given by ICMR (1990).

**Table-3  
Average intake of various foods (g/day) by the subjects  
(n=100)**

Nutrients	Mean Value	RDA*	Per cent adequacy
Energy (Kcal)	2106±2.89	2318	90.85
Carbohydrates (g)	318.5±6.08	\$	-
Protein (g)	64.66±1.389	52.5	123.16
Total fat (g)	58.56±1.48	\$	-
Vit. A (B-carotene) (ug)	2577±176.67	2400	107.37
Thiamine (mg)	2.00±0.0423	1.1	181.81
Riboflavin (mg)	0.98±0.025	1.30	75.76
Niacin (mg)	16.73±0.353	14.0	119.50
Folacin (ug)	215.65±7.87	100.0	215.65
Vit. B <sub>12</sub> (ug)	0.28±0.017	1.0	28.60
Ascorbic acid (mg)	29.99±2.740	40.0	74.75
Iron (mg)	23.68±1.132	30.0	72.93
Calcium (mg)	791.61±28.71	400	197.90
Phosphorus (mg)	1703.30±41.90	400	435.75
Copper (mg)	262±0.07	2.2	119.09
Zinc (mg)	10.06±0.265	15.5	64.90

Values are Mean ± S.E

\$ Data not available

\* Recommended Dietary Allowance (ICMR, 1990)

The mean intake of protein by the subjects was 64.66±1.39 g/day which was more than the ICMR's (1990) recommendation of 52.5 g/day. The high protein intake may be attributed

to a very high intake of milk and milk products. The various workers have reported the mean intake of protein by adult women in the range of 43.5 to 78.0 g/day (Harpreet, 1992 and Varmeet, 1993). Majority of the subjects (83 per cent) were consuming higher amount of protein than the recommended amount. Another 15 per cent of the subjects had a protein consumption between 75 to 100 per cent of the recommendation and 2 per cent of the total subjects consumed less than the minimum requirement (75 per cent) of RDA.

The mean daily intake of carbohydrates by the subjects was  $318.54 \pm 6.08$  g which formed 60 per cent of the total energy consumed. The daily intake of total fat ranged between 33 to 93 g with an average intake of  $58.56 \pm 12.48$  g. Fat contributed to 25 per cent of the total energy consumed by the subjects. The consumption of fat was liberal in the household due to easy availability of butter and ghee prepared from whole milk. A highly significant ( $p < 0.05$ ) correlation was observed between energy and fat and sugar showing that sugar and fat led to an increase total energy intake.

The intake of vitamin A ( $\beta$ -carotene), thiamine, niacin, folacin, calcium, phosphorus and copper were found to be  $2577 \pm 176.62$  ug,  $2.00 \pm 0.04$  mg,  $16.73 \pm 0.35$  mg,  $215.65 \pm 7.87$  ug,  $791.61 \pm 28.71$  mg,  $1703 \pm 41.90$  mg,  $2.62 \pm 0.07$  mg, respectively, which were higher than the RDA prescribed by ICMR (1990). The mean intake of riboflavin was  $0.98 \pm 0.025$  mg/capita which was marginally inadequate as compared to the RDA (1.3 mg/day). The mean intake of vitamin B<sub>12</sub> was  $0.286 \pm 0.017$  ug which was much lower than the recommendation (1 ug/capita/day). Ascorbic acid intake showed a mean value of  $29.99 \pm 2.74$  mg/capita which was lower than the RDA of 40 mg/day. The intake of iron was found to be 23.68 mg which was inadequate as compared to the recommendation of 30 mg by the ICMR (1990). The low iron intake may be attributed to insufficient intake and non-availability of green leafy vegetables in the summer season when the survey was conducted.

The daily energy intake by the subjects was found to be  $2106 \pm 2.89$  kcal while the total daily expenditure or energy was  $2048.0 \pm 37.17$  kcal (Table 4). The mean energy balance among the adult women was 56 kcal. The range of energy balance varied between -720 to 588 kcal/day. Further 59 per cent of the subjects had a positive energy balance while 41 per cent of them had negative energy balance. The daily energy intake showed a positive and significant correlation with body weight ( $r = 0.323$ ), TSFT ( $r = 0.237$ ) and body fat ( $r = 0.272$ ). However, the correlation between energy expenditure and body weight, TSFT, MUAC and body fat was even higher.

**Table-4**

**Overall energy intake, energy expenditure and energy balance of the subjects**

	Range	Mean $\pm$ S.D.
Energy Intake (Kcal/day)	1530-3219	2106.0 $\pm$ 2.89
Energy Expenditure (Kcal/day)	1527-2699	2048.2 $\pm$ 3.71
Energy Balance (Kcal/day)	-720 to 588	+56.0

The mean exercise time for the 'Harvard Step Test' was  $60.06 \pm 3.23$  secs. and the mean pulse rate after the test was  $78.06 \pm 10.26$  beats/min. (Table 5) which was above the normal pulse rate (72 beats/min.). The mean Rapid Fitness Index (RFI) score of all the subjects was  $17.96 \pm 1.38$ . According to the classification proposed by Mathews (1973), all the subjects had poor level of physical fitness as the RFI score was below 50. The subjects also had energy intake below the recommended allowances given by ICMR (1990). Although the inadequacy was marginal, yet when accompanied by iron deficiency anaemia it led to poor physical performance by the subjects. The poor physical work capacity could also be due to lack of training and exercise because the subjects

were not used to this type of physical work. Thus, it is essential that the dietary status of the adult women be improved especially with regard to iron rich foods. There, is also a need to increase awareness among the subjects by imparting nutrition education and health and hygiene which will help them to improve their dietary status and increase their work output.

**Table-5 Physical work capacity of the subjects (n = 25)**

	<b>Range</b>	<b>Mean ± S.D.</b>
Rapid Fitness Index (RFI)	10-26	17.96±1.38
Pulse Rate (beats/min.)	72-90	78.04±10.26
Time (sec.) taken to perform HST*	30-90	60.06±3.23

\*HST - Harvard Step Test

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