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Assessment of Food and Nutrient Intake in Female Adults Basing on Body Composition

KEYWORDS: Food , Nutrition, Dietary assessment, Green Leafy Vegetables(GLVs), Body composition, Basal Metabolic Rate(BMR), Body Mass Index(BMI), Lean Body Mass(LBM), Haemoglobin (Hb)

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ABSTRACT *The food and nutrition intake population depends up on age, sex, and workloads. One obvious approach to evaluate food and nutrient intake is dietary assessment and it can be influenced by body composition levels. The study was carried out on assessment of food and nutrient intake in female adults basing on body composition on 30 female college going post graduate students. Food and nutrient intake was assessed by standard questionnaire by 3-day recall method and compared with different body composition levels. And results revealed that the food intake of subjects was not adequate except for fruits. The consumption of GLVs and fruits basing on BMR, roots and tubers basing on LBM and cereals, GLVs and fleshy foods basing on Hb correlated highly at 1 per cent level. Whereas nutrient intake i.e. energy, fat, calcium, iron, Vit C, B-complex vitamins basing on BMR and Hb level was significant at 1 per cent level. From this study we concluded that poor food and nutrient intake by subjects.*

INTRODUCTION:

Body composition is an important indicator of the health of individuals and populations. Excess body weight is associated with an increased risk of numerous health problems including type 2 diabetes, hypertension, obstructive sleep apnea, osteoarthritis, many types of cancer (including breast, colorectal and pancreatic), cardiovascular disease (coronary heart disease and stroke), (Health Canada, 2003; Public Health Agency of Canada, 2011) and reduced mental well-being, (Luppino et al., 2012). Excess abdominal fat (fat around the waist and upper body) has a greater association with health risks than fat located in the hip and thigh areas, (Health Canada, 2003). Being underweight is also associated with health problems, including osteoporosis, under-nutrition, infertility and an increased risk of mortality. (Health Canada, 2003; Orpana, 2010).

Body mass index (BMI) is defined as the ratio of person's weight in kilograms by their height squared in meters (kg/m2). BMI represents an estimate of fatty tissue based on weight related to height. (Health Canada, 2003). It is important to note that the BMI does not directly measure body fat and can lead to some misclassification of health risk. For example, a person with greater fat-free mass (e.g.muscle or bone) (Health Canada, 2003), might be categorized as overweight based on their BMI, but the actual health risk for that person would be lower than someone with the same BMI who has more fat mass. Waist circumference is therefore used as an indicator of abdominal fat mass to further refine health risk classification in adults. Excess fat around the waist and upper body is associated with greater health risks than fat located in the hip and thigh areas. (Health Canada, 2003).

Humans require a wide range of essential micronutrients and macronutrients for normal growth and development and to support healthy aging throughout the life cycle. Essential nutrients, including most vitamins, minerals, amino acids and fatty acids, water and fiber, must be obtained through foods and beverages because they cannot for the most part be endogenously synthesized, or are not endogenously synthesized in adequate amounts to need recommended intakes. Understanding the extent to which the U.S. population and various age, sex, and racial/ethnic groups within the population achieve nutrient intake requirements through available food and beverage intake, including foods and beverages that are enriched or fortified, is an important task of the DGAC. Notably, the DGAC considers that the primary source of nutrients should come from foods and beverages. Nutrient-dense forms of foods (those providing substantial amounts of vitamins, minerals and other nutrients and relatively few calories) are recommended to ensure optimal nutrient intake without exceeding calorie intake or reaching excess or potentially toxic levels of certain nutrients.

The purpose of the study is to evaluate the assessment of food and nutrient intake in female adults basing on body composition

REVIEW OF LITERATURE:

Kulkarni *et al.*, (2014) conducted a study on dual-energy X-ray absorptiometry (DXA) and isotope dilution technique have been used as reference methods to validate the estimates of body composition by simple field techniques; however, very few studies have compared these two methods. In this study also compared the estimates of body composition by DXA and isotope dilution (18O) technique in apparently healthy Indian men and women (aged 19-70 years, n 152, 48 % men) with a wide range of BMI (14-40 kg/m2). Isotopic enrichment was assessed by isotope ratio mass spectroscopy. The agreement between the estimates of body composition measured by the two techniques was assessed by the Bland-Altman method. The mean age and BMI were 37 (sd 15) years and 23·3 (sd 5·1) kg/m2, respectively, for men and 37 (sd 14) years and 24·1 (sd 5·8) kg/m2, respectively, for women. The estimates of fat-free mass were higher by about 7 (95 % CI 6, 9) %, those of fat mass were lower by about 21 (95 % CI - 18,

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- 23) %, and those of body fat percentage (BF%) were lower by about 7·4 (95 % CI - 8·2, - 6·6) % as obtained by DXA compared with the isotope dilution technique. The Bland-Altman analysis showed wide limits of agreement that indicated poor agreement between the methods. The bias in the estimates of BF% was higher at the lower values of BF%. Thus, the two commonly used reference methods showed substantial differences in the estimates of body composition with wide limits of agreement. As the estimates of body composition are method-dependent, the two methods cannot be used interchangeably.

A study was analysed by Mitchikpe *et al.,* (2009) on the food pattern and resulting energy and nutrient intakes of rural Beninese school-aged children in relation to season and school attendance. The study was performed in northern Benin in eighty randomly selected children aged 6-8 years. Dietary intake was assessed using observed weighed records. Food, energy and nutrient intakes were measured in post- and pre-harvest seasons. Complete food consumption data sets were available for seventy-five children. Food pattern showed seasonal variations. Cereals, roots and tubers were the main staple foods. Contributions of animal products to the diet were very small. The food pattern was not different for either boys v. girls or for children attending v. not attending school. Median daily energy intakes were 5.0 and 5.3 MJ in the post- and pre-harvest season, respectively. Only fat and vitamin C showed seasonal differences ($P < 0.05$). Energy and nutrient intakes were different for boys and girls but, unexpectedly, not for children attending v. not attending school

Lin *et al.* (2007) determined a prospective observational study conducted in 8 rural villages. Upon enrollment, demographic, anthropometric, and dietary intake data were collected. Children were studied every 2 weeks for 10 weeks to determine whether they developed kwashiorkor. Dietary intake was assessed on enrollment using a food frequency questionnaire, which included all possible foods in the child's diet. Food frequency data were used to estimate energy, protein, vitamins C and A, niacin, thiamin, zinc, and iron intake using food composition and serving size data. Dietary diversity was assessed with a 7-point score. Regression modeling was used to determine whether the consumption of any food or nutrient was associated with the development of kwashiorkor. The results revealed that A total of 43 (2.6%) of the 1651 healthy children ages 1 to 3 years enrolled developed kwashiorkor. Children who developed kwashiorkor were younger and had more nutritional wasting than those who did not. Thirty children (70%) who developed kwashiorkor were breast-fed. In the combined regression model no foods or nutrients were found to be associated with the development of kwashiorkor. There were no differences in the dietary diversity between children who developed kwashiorkor and those who did not.

METHODOLOGY:

The present study conducted on 30 female post graduate and Ph.D students were selected from Acharya N.G. Ranga Agricultural University. The food and nutrient intake was assessed by food frequency questionnaire (Anuradha 1981) and 3 day dietary recall method (Thimmayamma et al., 1987). The nutrient intake and percent adequacy was assessed using per consumption unit and RDA through nutritive value of Indian foods(2000). Body composition of selected subjects were measured using "Bioelectrical Impedance" named as "Body Stat".

Method of measurement of body composition:

The subjects were made in lie down in a relaxed state and out of the four electrodes two were attached at the back of the right palm while two electrodes were attached right leg upper side of the foot. Body stat also contains electrodes that have wires and these were attached with electrodes. The total detailed body composition was measured through Body stat. The gel electrodes were attached at the center of the third and fourth fingers of the palm and another one was attached below the electrode and near the wrist. For right leg, the gel electrodes were attached between third and fourth toes of right foot and another electrode were attached above to first electrode and towards right ankle. The electrodes are having two colors i.e. red and black wires and red wire electrode attached close to fingers and toes while black color electrodes was attached close to wrist and ankle joints. After completing the circuits, the data pertaining to subject number, age, height, weight, sex and activity (Sedentary / Moderate / Heavy) were entered. Body stat measures the total body composition such as total body fat (BF), lean body mass (LBM) and total body water (BW). BMI and Basal metabolic rate (BMR) were obtained according to subject, height, weight, body composition and also recommended range of each parameter that displayed in the monitor was recorded.

RESULTS AND DISCUSSION:

The Food and nutrient intake of subjects were assessed through meal pattern, food consumption frequency and percent adequacy

Meal pattern :

The meal pattern is not similar between any two individuals and meal pattern provides information on culture and food intake.

Table 1: Meal pattern of selected subjects

Meal pattern	Subjects	
	No	Per cent
Early Morning :		
Coffee/Tea	23	77
Milk	5	17
Break fast :		
Idly/Dose / Chapatti/ Upma/ Poori	30	100
Mid Morning :		
Biscuits	7	33
Lunch/Dinner :		
Rice with vegetables & curd	15	50
Chapatti with vegetables & curds	2	7
Chapatti + Rice with vegetables & curd	13	43
Evening Snacks :		
Coffee/ Tea	17	59
Milk	5	17
Fruit juice	3	7
Biscuits	5	17
Before going to Bed :		
Milk	3	10
Butter milk	3	10

From the Table 1 distribution, the meal pattern of the selected subjects was similar with three meals a day except few (33 per cent) were taking mid morning snacks and very few were taking milk (10 per cent) or butter milk (10 per cent) before going to bed. Majority of the subjects staple diet was rice (50 per cent) followed by wheat and rice (43 per cent) and least were taking wheat is staple (7 per cent).

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Food Consumption Frequency

Frequency of food consumption quantity of selected subjects was categorized into daily, alternatively, weekly, fortnight and monthly.

Table 2 : Frequency of Food Consumption Quantity of selected subjects

Food groups & Ranges	Daily	Alternate Day	Weekly			Fortnight			Monthly
			Once	Twice	Thrice	Once	Twice	Thrice	
Cereals									
300 – 400	30 (100)	-	-	-	-	-	-	-	-
Pulses									
25 – 35	6 (20)	-	6 (20)	-	-	4(12)	-	-	-
35 – 45	8 (27)	2 (7)	-	2 (7)	-	2(7)	-	-	2 (7)
Green Leafy vegetables									
50 – 100	4 (13)	2 (7)	7 (23)	2 (7)	-	7(23)	2 (7)	-	6 (20)
Roots & Tubers									
20 – 30	7 (23)	-	4 (14)	-	-	1 (3)	-	-	-
30 -40	6 (20)	-	3 (11)	-	-	1 (3)	-	-	-
40 – 50	7(23)	-	-	-	-	1(3)	-	-	-
Other vegetables									
20 - 30	6 (20)	2 (7)	-	-	-	-	-	-	-
30 - 40	5 (16)	2 (7)	-	2 (7)	-	1 (3)	-	-	-
40 -50	7 (22)	-	2 (7)	-	-	2 (7)	-	-	-
Fruits									
30 – 60	5 (16)	3 (10)	2 (7)	2 (7)	2 (7)	2 (7)	2 (7)	2(7)	-
60 -100	3 (10)	3 (10)	2 (7)	1 (3)	-	-	-	-	-
Milk									
50-100	20 (68)	1 (3)	1 (3)	4 (13)	4 (13)	-	-	-	-
Fleshy Foods									
20 - 30	-	-	7(23)	-	-	2(7)	-	-	2 (7)
30 - 40	-	-	6 (20)	-	-	3 (10)	-	-	2 (7)
40 – 50	-	-	5 (16)	-	-	2 (7)	-	-	1 (3)
Fats & oils									
20 – 30	10 (33)	-	-	-	-	-	-	-	-
30 -40	10 (33)	-	-	-	-	-	-	-	-
40 -50	10 (34)	-	-	-	-	-	-	-	-
Sugar & Jaggery									
20 – 30	3 (10)	3 (10)	-	-	-	-	-	-	-
30 -40	3 (10)	3 (10)	2 (7)	-	-	-	-	-	-
40 -50	2 (7)	2 (7)	-	-	-	-	-	-	-

The cereal consumption of all (100 per cent) subjects was between 300 to 400g subjects while 52 per cent were consuming 25 to 35 g pulses either daily (20 per cent), once a week or once in fort night. All the subjects were consuming 50 to 100 g GLV, while 40 per cent were consuming 30 to 40 g other vegetables and equal number (40 per cent) were consuming 20 to 30g Roots and tubers. Greater proportions of subjects (67 per cent) were consuming 30 to 60 g fruits. All the selected subjects had the habit of consuming animal foods. Selected subjects were also consuming fats and oils and sugar and jaggery in various proportions. The details are presented in Table2.

Mean food intake and per cent adequacy of Subjects

The adequacy of food intake of subjects ranged between 73 per cent (GLV) and 238 per cent (Fruits). The intake of all the foods were not adequate (73 to 87 per cent) and except for fruits (238 per cent) and fleshy foods (118 per cent) and sugar (120 per cent). The details are presented in table 3.

Table 3: Mean food intake and per cent adequacy in subjects

Food Groups (g)	Mean ± SD (g)	RDA (g)	Per cent adequacy
Cereals	363.33 ±25.45	410	87
Pulses	34.8 ± 3.40	40	87
Green leafy vegetables	73.3± 15.28	100	73
Other Vegetables	34.26 ± 5.79	40	86
Roots and Tubers	38 ± 6.36	50	77
Fruits	71.5 ± 23.4	30	238
Fleshy foods	35.3 ± 11.5	130	118
Milk (ml)	75.8 ± 27.5	100	76
Sugar	24 ± 8.30	20	120
Fat	35.6 ± 10.46	20	78

Mean food intake basing on BMR, BMI, LBM and Hb level

The details pertaining to food intake of all subjects basing on BMR, LBM and Hb are furnished in table 4.

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Table 4 : Mean food intake of selected subjects basing on BMR, BMI, LBM and Hb level

Parameters	Foods (g)									
	Cereals	Pulses	GLV	Other Veg	R & T's	Fruits	Milk (ml)	Fleshy Foods	Sugar	Fat
RDA	410	40	100	40	50	30	100	50	20	20
Basal metabolic rate (K.cal) F = 2.57935*										
1501 - 1750 (2)	369 ± 16.5	32	88 ± 8.0	28 ± 6.0	44 ± 6.0	45 ± 5	75 ± 25.0	35 ± 15.0	35 ± 15	38 ± 7.5
1251 - 1500 (21)	371 ± 19.6	35 ± 3.3	76 ± 13.3	34 ± 5.8	39 ± 5.8	71 ± 23.7	82 ± 27.9	38 ± 10.4	24 ± 7.3	36 ± 10.1
1000 - 1250 (7)	340 ± 28.5	35 ± 3.6	60 ± 13.2	36 ± 4.4	36 ± 6.5	81 ± 18.8	57 ± 17.9	28 ± 10.3	22 ±3.6	33 ± 11.6
Correlation	0.4263*	-0.0611	0.551**	-0.205	0.4163*	-0.5557	0.057	0.1716	0.0781	0.1286
Regression	-0.371	-1.337	1.474	0.128	0.575	-2.622*	1.066	0.22	0.524	-0.44
Body mass index F = 1.31284NS										
Obese (1)	385	32	96	34	38	50	100	50	50	45
Over Weight (1)	352	32	80	22	50	40	50	20	20	30
Normal (23)	361 ± 25.1	35 ± 3.3	73 ± 15.0	35 ± 5.1	39 ± 6.2	70 ± 23.3	75 ± 24.4	35 ± 11.0	25 ± 9.1	35 ± 9.9
Mild (5)	364 ± 28.6	34 ± 3.8	72 ± 18.3	31 ± 4.8	39 ± 6.1	90 ± 12.2	90 ± 37.4	33 ± 12.0	23 ± 14	39 ± 11.5
Correlation	0.1788	-0.1197	0.2503	0.2728	-0.0179	-0.4392*	-0.257	0.2103	-0.0232	0.167
Regression	0.084	-0.351	0.548	1.579	-0.05	-1.656	-0.749	0.549	-0.519	0.052
Lean body mass (Per cent) F = 1.94398NS										
>75 (7)	375 ± 18.6	35 ± 3.3	93 ± 15.3	31 ± 6.8	41 ± 5.9	81 ± 24.2	93 ± 31.9	36 ± 13.0	29 ± 13	39 ± 10.5
65 -75 (20)	360 ± 25.8	35 ± 3.5	71 ± 13.9	35 ± 4.2	38 ± 6.0	70 ± 21.7	74 ± 24.3	34.7 ± 10.7	23 ± 5.3	35 ± 9.87
55 - 65 (3)	359 ± 29.0	34 ± 2.0	69 ± 13.4	35 ± 8.5	32 ± 5.2	63.3 ± 26.6	50	36.6 ± 12.4	20	33.3 ± 12.4
Corelation	-0.0497	0.0083	-0.226	0.4539*	-0.5604	-0.0856	-0.1276	0.2139	-0.0429	0.0886
Regression	0.365	1.234	-0.518	0.987	-1.838	-1.234	0.69	0.934	-0.837	0.257
Haemoglobin status (g / dl) F = 6.319085 **										
Normal (8)	384 ± 16.1	36 ± 4.0	93 ± 2.7	34 ± 5.9	42 ± 5.2	77 ± 20.4	97 ± 26.3	42 ± 8.6	32 ± 12	41.8 ± 8.92
MIld (17)	362 ± 22.6	33 ± 3.0	70 ± 9.0	34 ± 6.1	39 ± 6.1	64 ± 23.5	71 ± 24.6	36 ± 10.8	21 ± 2.5	35 ± 9.3
Moderate (5)	334 ± 13.5	33 ± 2.1	52 ± 2.0	36 ± 3.7	31 ± 1.9	90 ± 12.2	60 ± 20	21 ± 2.0	22 ± 4	29 ± 11.3
Corelation	0.5540**	0.3609	0.8314**	-0.2932	.5545**	-0.1406	0.2474	0.4883**	0.254	0.2892
Regression	-1.166	0.111	3.759**	-0.696	0.408	0.292	0.802	1.203	-0.558	-0.073

Values in parethesis indicate number of subjects - Negative correlation & Regression

* Significance level 5% ** Significance level 1%

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When BMR was taken into account for classification of food intake, cereals intake (340 g / day) was lowest in lower range group (1000 – 1250) followed by higher range (1501 – 1750) group (369 g / day) while highest intake (371 g /day) was observed in the middle range group (1251 – 1500). Among all the foods, consumption of green leafy vegetables (88 g / day) was greater in higher range group and the intake of fruits (45 g), fleshy foods (35 g), sugar (35 g) and fat (38 g) was higher than RDA. While in the medium range group the intake of fruits (71 g), fleshy foods (38 g) and fat (36 g) was more than RDA. In the case of lower BMR range, the intake of fruits (81 g) and fat (33 g) was more than RDA.

Subject's falling into obese group basing on BMI was taking excess of fruits (50 g), fleshy foods (50 g), sugar (50 g) and fat (45 g). While subject's in over weight group were taking fruits (40 g) and fat (30 g) in excess to RDA. Subject's belonging to normal and mild under nutrition showed similarities by taking excess of fruits (70, 90 g), fleshy foods (35, 33 g), sugar (25, 23 g) and fat (35, 39 g). Negative correlation and regression were observed for pulses, roots and tubers, fruits, milk and sugar and was significant at 5 per cent level. The correlation was significant at 5 per cent level for cereals, roots and tubers and fruits while significance was observed at 1 per cent level regression were significant for fruits at 5 per cent level.

Basing on LBM, the subjects were taking fruits, fleshy foods and sugar in excess to RDA irrespective of LBM range. The lowest fat (33 g) intake was noticed in lower (55 – 65 per cent) LBM group. Negative correlation was observed for cereals, GLV, Roots and tubers, fruits, milk and sugar and was significant at 1 per cent level for roots and tubers. Negative regression was observed for GLV, Roots & tubers and sugar.

Subjects having different grades of haemoglobin level showed similarities by taking cereals, pulses, GLV, other vegetables, roots and tubers and fleshy foods less than RDA, while fruits, sugar and fat were taken above RDA. Subject's having moderate haemoglobin level were taking fewer amounts of fleshy foods (21g) than normal and mild haemoglobin level groups. Negative correlation was observed for other vegetables and fruits while it was significant at 1 per cent level for cereals, GLV, Roots & tubers and fleshy foods. Regression was significant for GLV at 1 per cent level. The intake of foods such as cereals, pulses, GLV, roots and tubers, other vegetables, milk and fat ranged between 73 to 89 per cent of adequacy, while the intake of fruits, fleshy foods, and sugar was between 118 to 238 per cent of adequacy.Mean nutrient intake and per cent adequacy in subjects

Table5: Mean nutrient intake and per cent adequacy in subjects			
Nutrients	**Mean ± SD**	**RDA**	**Adequacy (%)**
Energy (K.Cal)	1665 ± 120.3	1875	89
Protein (g)	42 ± 3.35	50	84
Fat (g)	40 ± 8.72	20	199
Iron (mg)	26± 1.81	30	86
Calcium (mg)	331 ± 25.52	400	83
β – carotene(μg)	497 ± 35.26	2400	21
Vitamin C (mg)	33.0 ± 2.31	40	83
Thiamin (mg)	0.70 ± 0.26	0.9	78
Riboflavin (mg)	0.90 ± 0.113	1.1	82
Niacin (mg)	8.0 ± 69.08	12	67

The nutrient intake of subjects was poor with regard to all nutrients except fat (199 per cent). The β – carotene intake was much lower (21 per cent) to the RDA. Most of the nutrients consumed were moderately adequate and ranged between 69 per cent (Niacin) and 89 per cent (Energy). Thus all the essential nutrients were consumed below the RDA (Table 5).

Mean nutrient intake basing on BMI, BMR LBM and Hb level

The intake of various nutrients basing on BMR, BMI, LBM and Hb is being presented in (Table 6) and from the table it is clear that the intake of all nutrients except fat was low either basing on BMR, BMI, LBM or Hb. Only fat intake was high among all the food groups, thus resulted in excess intake of (199 per cent) while adequacies of other nutrients were below normal and ranged from 69 per cent (Niacin) to 89 per cent (Energy).

	Table 6 : Mean nutrient intake of selected subjects basing on BMR, BMI, LBM and Hb level									
Parameters	**Nutrients**									
	Energy (K.cal)	**Protein (g)**	**Fat (g)**	**Iron (mg)**	**Calcium (mg)**	**β-Carotene (μg)**	**Vitamin C (mg)**	**Thiamin (mg)**	**Riboflavin (mg)**	**Niacin (mg)**
RDA	1875	50	20	30	400	2400	40	0.9	1.9	12
Basal metabolic rate F = 1.72306										
1501 - 1750 (2)	1708**± 98**	43.5**±2.5**	54±17.2	26.4**±**1.5	340±19.5	511**±29.3**	34±1.9	0.70±0.0	0.90±0.0	8.5±0.4
1251 - 1500 (21)	1698±93.2	42.8**±0.9**	40±7.2	26.1**±**1.3	338±17.9	507**±26.8**	34**±1.7**	0.70±0.0	0.90±0.0	8.4±0.4
1000 - 1250 (7)	1554**±130.8**	39.5**±3.3**	35±2.9	24.1±2.0	310±26.0	465**±39.0**	31±2.6	0.60±0.0	0.80±0.0	7.7±0.6
Correlation	0.5236**	0.4303*	0.505**	0.502**	0.5354**	0.5392**	0.53**	0.570**	0.515**	0.543**
Regression	-0.721	0.271	1.248	-0.864	-	0.487	0.283	-0.087	-0.735	-0.864
Body mass index F = 0.67303										

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Obese (1)	1806	46.0	71	28.0	360	540	36	0.80	1.00	9.0
Over-Weight (1)	1600	41.0	37	25.0	321	481	32	0.70	0.90	8.0
Normal (23)	1660±120.5	41.9±3.4	40±9.8	25.6±1.7	330±23.4	495±35.0	33±2.3	0.70±0.5	0.90±0.7	8.2±0.5
Mild (5)	1664±130.5	42.6±3.3	38±3.0	25.1±1.9	497±25.9	497±43.0	33±2.4	0.70±0.0	0.90±0.0	8.3±0.6
Correla-tion	0.1917	0.1381	0.1837	0.1914	0.2012	0.2057	0.2279	0.216	0.2239	0.2106
Regres-sion	-0.932	0.603	-0.226	-0.919	-	0.868	1.669	-0.619	0.458	0.874
Lean body mass F = 0.30564										
>75 (7)	1719±90.1	43.8±2.3	43±11.4	26.5±1.3	343±17.9	514±2.0	34±1.6	0.70±0.0	0.90±0.5	8.6±0.4
65 -75 (20)	1650±121.9	41.6±3.4	39±7.7	25.4±1.8	328±23.5	49±35.2	33±2.32	0.70±0.0	0.90±0.0	8.2±0.5
55 - 65 (3)	1640±133.1	41.6±3.2	37±3.0	25.4±2.0	327±26.4	490±39.7	33±2.64	0.70±0.0	0.90±0.0	8.2±0.6
Corela-tion	-0.115	-0.0799	-0.1047	-0.0718	-0.1067	-0.1052	-0.0913	-0.0954	-0.133	-0.116
Regres-sion	-0.474	0.322	-0.842	0.59	-	0.32	0.45	-0.423	1.129	0.242
Haemoglobin status F = 3.93570**										
Normal (8)	1770±78.9	44.1±3.9	47±13.6	27.0±1.2	351±15.2	527±22.5	35±1.5	0.70±0.0	0.90±0.0	8.7±0.3
MIld (17)	1657±150.5	42.1±2.5	38±2.3	25.6±1.6	330±20.6	495±30.9	33±2.0	0.70±0.0	0.90±0.5	8.3±0.5
Moder-ate (5)	1528±62.3	38.8±1.5	35±1.4	23.6±0.9	304±12.3	457±18.5	30±1.2	0.60±0.0	0.80±0.0	7.6±0.3
Corela-tion	0.6288**	0.4683**	0.4181*	0.557**	0.6190**	0.6249**	0.620**	0.625**	0.641**	0.6333**
Regres-sion	-0.079	-0.52	0.767	-2.235*	-	-0.016	1.061	0.528	-1.188	0.186
# Values in parethesis indicate number of subjects - Negative correlation & Regression										
* Significance level 5% ** Significance level 1%										

Basing on BMI, significant positive correlation at 1 per cent level was observed for all nutrients except protein which was significant at 5 per cent level only significant correlation or regression was observed for nutrients, basing on LBM. Basing on Hb level, highly significant (1 per cent) positive correlation was observed for all nutrients except for fat which was significant at 5 per cent only. While regression was negative and was significant at 5 per cent level only for iron.

CONCLUSION

In the present study majority of subjects had normal BMI, LBM ranged from 65-75 per cent and BMR ranged from 1251 and 1500k.cal, even though the food and nutrient intake of subjects was not adequate. Hence nutrition education is very essential to motivate and educate the students about importance of balanced diet.

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