

Dietary intake of micronutrient and Basal Metabolic Index of women in rural Pakistan

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Abstract. *Setyawan. 2017. Dietary intake of micronutrient and Basal Metabolic Index (BMI) of women in rural Pakistan. Nusantara Bioscience 9: 396-402.* Population's consumption of essential nutrients and defense against diseases is best indicated by the nutritional status of the individual. Asian women as the central player of the family and, therefore, they propagate the ill effects of malnutrition to generation. In this study, nutritional status and micronutrients (dietary minerals and vitamins) intake of rural women in Pakistan were investigated. One district of Khyber Pakhtunkhwa was selected, out of which, three villages were selected. From each village, 50 rural women were selected for the study. Information about food intake was obtained by a questionnaire. Nutrients intake was obtained from details of food intake in questionnaire, namely, 523 mg/day of calcium; 773 mg/day of phosphorus; 28 mg/day of Iron; 11 mg/day of zinc; 6.61 mg/day of Iodine; 172 R.E./day of Vitamin-A; 21 mg/day of Vitamin-C; 2.79 mg/day of Niacin; 0.31 mg/day of Thiamine; 0.32 mg/day of Riboflavin. The Basal Metabolic Index (BMI) was observed between 19.6 and 52.2 with a mean of 28.54. The study concluded that women's proportion on consuming mineral and vitamins according to RDA was very small, similarly, the proportion of women in a normal range of BMI was also very small and the curve for BMI suddenly changes direction to the right which confirms that the overweight and obese rural women population was quite common.

Keywords: Micronutrient status, rural women, Basal Metabolic Index, Pakistan

INTRODUCTION

Undernutrition is a failure of a person to consume sufficient essential nutrient for prolonged period depriving him of basic requirements which makes his body vulnerable to diseases and retards his growth and development. There are many factors which have been identified as contributors to malnutrition. One of them is the inability of food utilization containing protein, fruit, vegetables, and liquids. Similarly, there are different drugs which have been found associated with loss of hunger (Ruiz-Lopez et al. 2003). Malnutrition is linked to the prevalence of diseases, and weak stature affecting physical and mental labor capability, and repeated times hospitalization (Arellano et al. 2004)

It is poverty that is linked to malnutrition making it the world's major nutritional problem. Malnutrition has been observed in many groups including social groups, age groups, ethnic groups and gender groups (Rouse 2003) and has been found as the greatest problem. It has been identified as a major determinant of health causing a very damaging yet important outcome in the form of illness. Higher female mortality has been caused by various social factors including differential treatment among the girls and boys towards food accessibility. Similar is the case with the healthcare. Malnutrition with its manifestations is accelerated when the society discriminate in the resources of house-hold for allocation for them. A balanced diet has been mentioned as a basic challenge faced by the women of

third world countries, especially the rural women (Martorell et al. 1998; Tabak et al. 2000). Good health can easily be maintained by intake of proper and sufficient diet and it is the improper and insufficient food intake that is the leading cause of development of many nutritional problems like weight gain, heart problems and diabetes, which as a result spoils individual's life quality (Pirlich and Lochs 2001; Peel et al. 2005).

It is women that propagate the effects of malnutrition by giving birth to low birth weight baby (LBW) with increased susceptibility to early mortality and diseased conditions. The rural women face multiple challenges while playing their role in economic, biological, and social fields. They are placed in the secondary position throughout their life and especially when it comes to nutrition and food accessibility leading to the compromise on their childcare efficiency and processing plus preparation of food. The case is worsened when the women are designated to preschooler and infants feeding. In many rural families, the women play a role in economic and it makes them to stay away from household and incompatible with the care of the child.

The modern economic activity has allowed enhanced involvement of women for family support (Pirlich and Lochs 2001; Peel et al. 2005). Rural women's economic role has been negatively affecting her own as well as her children's health. A significant role of women informal-sector employment has been found playing very significant role rural areas and the salutation is worsening in countries

like Pakistan. The outcome of pregnancy is adversely influenced by extensity of physical activity and workload leading to harming of the fetus as manifested in several ways. Similar is the effect of stress alongside fatigue and disturbed nutrition over the pregnancy outcomes.

All over the world, a 2.5kg weight at the time of birth prevails in infants for up to almost 20 million infants which constitutes a 17.6% of worldwide births in third world countries. In developing countries, mother's malnutrition results in growth retardation of intrauterine leading to almost 80% of birth low weights LBW and resultantly these infants have to suffer the fatal consequences of mother's malnutrition as the rate of growth reduction, development and survival.

The above-detailed discussion has made it clear that mother's good nutrition is a lifelines towards the healthy growth of children and infants where the good nutrition of infants warrants delicate attention regarding the achievement of global health standards. Knowledge of the nutrient intake leads to the nutrition information of the subject and that is the reason we planned this study to know the micronutrient intake of rural mothers belonging to District of Nowshera of the province of Khyber Pakhtunkhwa, Pakistan using dietary recall questionnaire.

MATERIALS AND METHODS

The method of 24 hours memory recall questionnaire was used to record the micronutrient and food intake of rural women. Women from three villages namely Kheski, Pir sabaq and Akora Khattak of the District of Nowshera, the Province of Khyber Pakhtunkhwa, Pakistan were selected, moreover the villages were located at the angles of a triangle making it possible as the sample for the whole district. The variations in food habits and culture inside a district were equally considered.

Memory recall questionnaire method

Dietary intake and personal history information from fifty (50) rural women of the three villages which were selected in Nowshera (Kheski, Akora Khattak and Pir Sabak). Using 24-hour recall questionnaire method, three alternate days were selected for data recording during a single week. Variations in cultural, geographical and social considerations were covered by the study. On a volunteer basis, selection of fifty rural women was made from every village. Questionnaire was filled through educated women of each village. She was also designated for data taking, contacts and interface. Training about methodology and objectives of the study was conducted to the women who were responsible for data taking etc. Datasheets were prepared by recording responses to questions of rural women regarding food intake during 24 hours. Calculation of micronutrient intake, dietary mineral and vitamin, was done using excel spreadsheet which was earlier developed by the Department of Nutrition, Food Science Division, Nuclear Institute for Food and Agriculture (NIFA), Peshawar, Pakistan.

Data presentation and statistical analysis

Appendices are representing an intake of micronutrients and food data of rural women of the three villages and the results chapter comprises of the statistics and tables of the three villages along with combined results. Frequency distribution of the obtained results was prepared and RDA table, for comparison reason, was also given in Appendix.

RESULTS AND DISCUSSION

Nutrients intake of women

Akora Khattak

Recommended Dietary Allowances (RDA) for women was used as a reference in calculating group level of the mean daily intake of vitamin and dietary mineral. 24-hour memory recall questionnaire method was used to investigate daily intake of micronutrient of 150 rural women leading to the calculation of daily intake of micronutrient (vitamin and dietary mineral), food and energy. Table 1 show results of micronutrient (vitamin and dietary mineral), food and energy intakes.

The mean value for food intake of rural women was 799 g/day and an adequate intake of mean energy i.e. 2191 k.cal/day was observed which was as per recommendations daily allowance (RDA). An inadequate intake of dietary mineral and a lower utilization of calcium in comparison to recommended daily allowance (RDA) was observed in rural women. A mean intake of 507 mg/day of calcium by the rural women showed that it was 50% below the recommended daily allowance (RDA). An adequate intake of phosphorus, which was 809 mg/day on average, was noted among the rural women as compared to the age-specific suggestion with the assumption of 800 mg/day diet.

A similar intake of iron consumption amounting up to 27.6 mg/day was somewhat higher than RDA, whereas the intake of zinc which was 11.5 mg/day on the average was found inadequate in rural women in comparison to recommended daily allowance (RDA). A similar trend in intake of iodine was observed.

Table 1 shows that vitamins intake of rural women and it is evident that the intake of the vitamin was not adequate. Among most of the rural women, a lower utilization of vitamin-C and vitamin-A was noted in comparison to recommended daily allowance (RDA). A 50% below the recommended daily allowance (RDA) of vitamin-C and vitamin-A intakes were observed amounting up to 21.1 mg/day and 126 R.E/day. The intake of Niacin was not adequate in comparison to recommended daily allowance (RDA) amounting up to 2.79 mg/day. The same trend was noted in the intakes of riboflavin and thiamine which were very low in the rural women. The mean values of riboflavin and thiamine intakes were 0.28 and 0.30 mg/day respectively.

Pir Sabaq

Daily intake of nutrients of fifty (50) rural women was calculated and the 24-hour memory recall questionnaire method was used for the investigation. The calculation of daily micronutrient, energy, and the food was done, and the

results are shown in Table 2. The mean of food intakes of rural women was found to be 831 g/women/day while the mean intake of energy was 2178 K. Calories/women/day which was adequate as per the recommendations.

As a whole, inadequate intake of micronutrients in the rural women was observed and a lower utilization of calcium, in comparison to recommended daily allowance

(RDA), was noted in the majority of rural women. A 50% below the recommended daily allowance (RDA) amounting up to 543 mg/woman/day intake of calcium was observed in rural women. Similarly, the mean intake of phosphorus, which was 766 mg/woman/day, was also not adequate in accordance with the age-specific suggestions namely 800 mg/day.

Table 1. Daily food, energy, dietary mineral intake and daily vitamin intake of women in Village Akora Khattak, District of Nowshera, Khyber Pakhtunkhwa, Pakistan

	Food intake (g)	Food energy (k.cal)	Ash (g)	Calcium (mg)	Phosphorus (mg)	Iron (mg)	Zinc (mg)	Iodine (ppm)	Thiamine (B1)(mg)	Riboflavin (B2)(mg)	Niacin (B3)(mg)	Vitamin-C (mg)	β -Carotene (mcg)	Vitamin-A (R.E)
Mean*	799	2191	10.18	507	809	27.60	11.52	7.69	0.28	0.30	2.79	21.17	138	126
Median	827	2225	11.00	503	810	28	12	3	0.25	0.31	3	18	117	73
Min.	543	1485	5.65	258	410	14.00	6.54	0.13	0.09	0.08	0.85	0.93	22	28
Max.	998	2866	12.96	714	1266	36.33	15.26	47.97	0.69	0.58	6.20	56.43	482	879
SD	115.0	306	1.60	102.5	199.6	4.9	1.8	11.4	0.1	0.1	1.2	14.7	91.5	156.2
CV%	14.40	13.96	15.83	20.23	24.67	17.78	15.94	148.67	46.98	37.14	44.11	69.45	66.34	123.71

Note: *= Values are means of 50 rural women randomly selected in a village

Table 2. Daily food, energy, dietary mineral intake and daily vitamin intake of women in Village Pir Sabaq, District of Nowshera, Khyber Pakhtunkhwa, Pakistan

	Food intake (g)	Food energy (k.cal)	Ash (g)	Calcium (mg)	Phosphorus (mg)	Iron (mg)	Zinc (mg)	Iodine (ppm)	Thiamine (B1)(mg)	Riboflavin (B2)(mg)	Niacin (B3)(mg)	Vitamin-C (mg)	β -Carotene (mcg)	Vitamin-A (R.E)
Mean*	831	2178	10.32	543	766	28.43	11.51	5.28	0.33	0.35	2.74	24.12	622	297
Median	808	2179	10	529	781	28	12	4	0	0	3	22	296	280
Min.	690	1594	6.51	343	419	15.22	7.54	0.40	0.15	0.13	0.78	5.07	55	24
Max.	1048	2644	13.06	910	1083	37.47	14.90	43.53	1.11	0.70	5.80	75.30	4684	859
SD	81.1	196.0	1.1	115.0	199.1	4.2	1.5	7.2	0.2	0.2	1.2	15.2	946.9	195.3
CV%	10	9	11	21	26	15	13	136	53	44	46	63	152	66

Note: *= Values are means of 50 rural women randomly selected in a village

Table 3. Daily food, energy, dietary mineral intake and daily vitamin intake of women in Village Kheskhi, District of Nowshera, Khyber Pakhtunkhwa, Pakistan

	Food intake (g)	Food energy (k.cal)	Ash (g)	Calcium (mg)	Phosphorus (mg)	Iron (mg)	Zinc (mg)	Iodine (ppm)	Thiamine (B1)(mg)	Riboflavin (B2)(mg)	Niacin (B3)(mg)	Vitamin-C (mg)	β -Carotene (mcg)	Vitamin-A (R.E)
Mean*	811	2122	10.04	519	742	27.82	11.11	5.82	0.33	0.32	2.84	18.19	164	93
Median	798	2110	10	500	725	27	11	3	0	0	3	16	135	51
Min.	652	1705	7.77	349	396	20.52	8.22	0.40	0.12	0.08	0.64	2.67	36	5
Max.	1047	2681	13.15	858	1188	36.82	14.65	41.50	0.56	0.65	6.47	53.87	486	364
SD	74.5	219.4	1.2	104.2	183.6	3.6	1.7	8.2	0.1	0.1	1.3	10.8	118.2	83.1
CV%	9	10	12	20	25	13	15	141	35	41	47	59	72	89

Note: *= Values are means of 50 rural women randomly selected in a village

Table 4. Daily food, energy, dietary mineral intake and daily vitamin intake of women in District of Nowshera, Khyber Pakhtunkhwa, Pakistan

	Food intake (g)	Food energy (k.cal)	Ash (g)	Calcium (mg)	Phosphorus (mg)	Iron (mg)	Zinc (mg)	Iodine (ppm)	Thiamine (B1)(mg)	Riboflavin (B2)(mg)	Niacin (B3)(mg)	Vitamin-C (mg)	β -Carotene (mcg)	Vitamin-A (R.E)
Mean*	814	2164	10.18	523	773	28	11	6.61	0.31	0.32	2.79	21	201	172
Median	808	2174	10.29	511	777	28	11	2.85	0.30	0.31	2.72	18	167	103
Min.	543	1485	5.65	258	396	14	6.5	0.13	0.09	0.08	0.64	0.93	22	5
Max.	1048	2866	13.15	910	1266	37	15	48	1.11	0.70	6.5	75	867	879
SD	92.3	245.2	1.33	107.7	194.9	4.3	1.68	9.1	0.14	0.13	1.3	13.8	149.9	175.7
CV%	0.113	0.113	0.131	0.206	0.252	0.153	0.147	1.383	0.456	0.413	0.451	0.654	0.747	1.021

Note: *= Values are means of 50 rural women randomly selected in a village

A similar intake of iron consumption amounting up to 28.4 mg/day was somewhat higher whereas the intake of zinc which was 11.5 mg/day on the average, was found inadequate in rural women in accordance to recommended daily allowance (RDA). A similar trend in intake of Iodine, which amounted up to 5.2 mg/woman/day, was observed.

Table 3 shows vitamins intake of rural women and it shows that the intake of the vitamin was not adequate. Among most of the rural women, a lower utilization of vitamin-C and vitamin-A was noted in comparison to recommended daily allowance (RDA). A 50% below the recommended daily allowance (RDA) of vitamin-C and vitamin-A intakes were observed amounting up to 24.1 mg/day and 297 R.E/day.

The intake of Niacin was not adequate in comparison to recommended daily allowance (RDA) amounting up to 2.74 mg/day. The same trend was noted in the intakes of riboflavin and thiamine which were very low in the rural women. The mean values of riboflavin and thiamine intakes were 0.35 and 0.33 mg/day respectively.

Kheshki

Daily intake of nutrients of fifty (50) rural women was calculated and the 24-hour memory recall questionnaire method was used for the investigation. The calculation of daily micronutrient, energy, and food was done, and the results were shown in Table 3. The mean of food intakes of rural women was found to be 811g/women/day while the mean intake of energy was 2122 k.calories/women/day which was adequate as per the recommendations

As a whole, inadequate intake of micronutrients in the rural women was observed and a lower utilization of calcium, in comparison to recommended daily allowance (RDA), was noted in the majority of rural women. A 50% below the recommended daily allowance (RDA) amounting up to 519 mg/woman/day intake of calcium was observed in rural women. Similarly, the mean intake of phosphorus, which was 742 mg/woman/day, was also not adequate in contrast to the age-specific suggestions namely 800 mg/day.

A similar intake of iron consumption amounting up to 28.8 mg/day was somewhat higher whereas the intake of zinc which was 11.1 mg/day on the average was found inadequate in rural women in comparison to recommended daily allowance (RDA). A similar trend in intake of Iodine, which amounted up to 5.82 mg/woman/day, was observed.

Table 3 shows vitamins intake of rural women and it is evident that the intake of the vitamin was not adequate. Among most of the rural women, a lower utilization of vitamin-C and vitamin-A was noted in comparison to recommended daily allowance (RDA). A 50% below the recommended daily allowance (RDA) vitamin-C and vitamin-A intakes were observed amounting up to 18 mg/day and 93 R.E/day respectively.

The intake of Niacin was not adequate in comparison to recommended daily allowance (RDA) amounting up to 2.84 mg/day. The same trend was noted in the intakes of riboflavin and thiamine which were very low in the rural women. The mean values of riboflavin and thiamine intakes were 0.32 and 0.33 mg/day respectively.

District of Nowshera (Average of all 3 localities)

Daily intake of nutrients of one hundred and fifty (150) rural women was calculated and the 24-hour memory recall questionnaire method was used for the investigation. After the calculation of daily micronutrient, energy, and the food was done, the results are shown in Table 4. The mean of food intakes of rural women was found to be 814 g/women/day while the mean intake of energy was 2164 k.calories/women/day which was adequate as per the recommendations

As a whole, inadequate intake of micronutrients in the rural women was observed and a lower utilization of calcium, in comparison to recommended daily allowance (RDA), was noted in the majority of rural women. A 50% below the recommended daily allowance (RDA) amounting up to 523 mg/woman/day intake of calcium was observed in rural women. Similarly, the mean intake of phosphorus, which was 773 mg/woman/day, was also not adequate in contrast to the age-specific suggestions namely 800 mg/day. A similar intake of iron consumption amounting up to 28 mg/day was observed, which was somewhat higher than RDA, whereas the intake of zinc which was 11 mg/day on the average, was found inadequate in rural women in comparison to recommended daily allowance (RDA). A similar trend in intake of Iodine, which amounted up to 6.61 mg/woman/day, was observed.

Table 4 shows vitamins intake of rural women and it is evident that the intake of the vitamin was not adequate. Among most of the rural women, a lower utilization of vitamin-C and vitamin-A was noted in comparison to recommended daily allowance (RDA). A 50% below the recommended daily allowance (RDA) vitamin-C and vitamin-A intakes were observed amounting up to 21 mg/day and 172R.E/day respectively. The intake of Niacin was not adequate in comparison to recommended daily allowance (RDA) amounting up to 2.79 mg/day. The same trend was noted in the intakes of riboflavin and thiamine which were very low in the rural women. The mean values of riboflavin and thiamine intakes were 0.32 and 0.31 mg/day respectively.

Anthropometry of women

Akora Khattak

This study was aimed to relate the data obtained through 24-hour memory recall questionnaire to the requirement of energy through basal metabolic rates (BMR) calculations. The rural women's weight and height were inquired and calculation of Basal Metabolic Rate (BMR) was done. Estimation of nutritional status of rural women was done and Basal Metabolic Rate (BMR) was calculated using the standard formula $BMI = \text{weight (kg)} / \text{height (m)}^2$. The Basal Metabolic Rate (BMR) was calculated as per World Health Organization (WHO) (FAO/WHO/UNU 1985) guidelines which lead us to the nutritional status of the rural women. The references for different basal metabolic rate (BMI) class which were as: $BMI < 18.5$ were underweight for chronic energy deficiency; 18.5-24.9 for normal; 25.0-29.9 for overweight; 30 for obese.

The weight of rural women in Akora Khattak ranged from 41-81kg where the mean weight was 65.5 kg and the height ranged from 1.14-1.71m where the mean was 1.52m. Similarly, their basal metabolic rate (BMI) ranged from 20.0 to 52.0 bringing the mean of 29.06. It is evident from the results that the BMI of almost all the rural women in Akora Khattak is greater than 18.5. Table 5 shows result of the study which shows that out of the 50 rural women in Akora Khattak, not even a single women was found as underweight whereas the woman in normal category was 28 %, in the overweight category was 36% and in the obesity category was 36 %.

Pir Sabaq

The weight of rural women in Pir sabaq ranged from 43-79kg and the mean of weight was 65.27 kg while the height ranged from 1.26-1.72m and the mean of height was 1.54m. Similarly, their basal metabolic rate (BMI) ranged from 20.0 to 42.0 bringing the mean to 28.07. It is evident from the results that the BMI of almost all the rural women in Pir sabaq is greater than 18.5. Table 5 shows result of the study informing that out of the 50 rural women in Pir sabaq, not even a single women was found as underweight whereas the woman in normal category was 30 %, in the overweight category was 40% and in the obesity category was 30 %.

Table 5. Anthropometry of women in villages of Akora Khattak, Pir Sabaq and Kheskhi, as well as District of Nowshera, Khyber Pakhtunkhwa, Pakistan

	Height(m ²)	Weight (Kg)	BMI (Kg/m ²)
Village Akora Khattak			
Mean*	2.32	65.51	29.06
Median	2.42	65	28
Min.	1.31	41	20
Max.	2.94	81	52
SD	0.437	9.2	6.1
CV%	0.189	0.140	0.208
Village Pir Sabaq			
Mean*	2.37	65.27	28.07
Median	2.43	65	28
Min	1.59	43	20
Max	2.96	79	42
Sd	0.366	8.6	4.7
CV%	0.155	0.132	0.168
Village Kheskhi			
Mean*	2.34	65.18	28
Median	2.42	65	28.1
Min	1.42	41	19.62
Max	2.89	79	46.62
Sd	0.390	8.8	5.0
CV%	0.167	0.134	0.177
District of Nowshera (sum of above three villages)			
Mean	2.34	65.32	28.54
Median	2.42	65	28.07
Min	1.31	41	19.62
Max	2.96	81	52.27
Sd	0.40	8.79	5.28
CV%	0.17	0.13	0.19

Note: *= Values are means of 50 respondents randomly selected in a locality.

Kheskhi

The weight of rural women in Kheskhi ranged from 41-79kg and the mean weight was 65.18 kg and the height ranged from 1.19-1.70m and the mean was 1.52m. Similarly, their basal metabolic rate (BMI) ranged from 19.6 to 46.6 with the mean of 28.00. It is evident from the results that the BMI of almost all the rural women in Kheskhi is greater than 18.5. Table 5 shows result of the study informing that out of the 50 rural women in Kheskhi, not even a single women was found as underweight whereas the woman in normal category was 32%, in the overweight category was 30% and in the obesity category was 38%.

District of Nowshera (Average of all 3 localities)

The basal metabolic rate (BMR) of rural women in District of Nowshera ranged from 19.6 to 52.2 bringing the mean to 28.54. It is evident from the results that the BMI of almost all the rural women in District of Nowshera is greater than 18.5. Table 5 shows result of the study informing that out of one hundred and fifty (150) rural women in District of Nowshera, not even a single women was found in underweight condition, whereas 30% of them was in the normal category, 35.3% of them was in the overweight category and 34.7 % of them was in the obesity category. The weight of rural women in District of Nowshera ranged from 41-81 kg and the mean weight was 65.32 kg and the height ranged from 1.14-1.72 m and the mean was 1.52 m.

Discussion

This study aimed for determination of the nutritional status of the rural women and estimation of intake of micronutrient, food and energy of Pakistani rural women. Considerations in relation to the selection of target group of population, selection of volunteer, food selection awareness along with its relation to nutritional status are very imperative. The intake levels of micronutrient on rural women in target area were estimated with the help of the 24-hour memory recall questionnaire method.

Nutritional status

Weight and height were used to determine the nutritional status through BMI where the results showed the nearly same mean of heights and weights of the rural women from the three villages of Nowshera leading to correspondingly same mean values of BMI in all the villages. The average BMI was higher than normal and a significantly high BMI in women was observed in studies conducted by Chowdhury (1985) and Torres et al. (1990). Approximately similar status of nutrition of women was reported in similar studies.

It was also evident in another study reported by Ahmed (1999), which gave values of anthropometry for women groups. The study targeted women with more land ownership while the second group was women owing less land. The study revealed that women from the households with the land of more than half an acre were found to be significantly weightier than the women having less land. Their heights were, however, reported as the same. The

values for weight and height of rural women were exactly similar to those reported by Ahmed (1999). Nearly same, values of BMI of the rural women in District of Nowshera, in general, were found in line with their socio-economic conditions, which are clearly suggesting that the average value of the basal metabolic index (BMI) is the attribute of their high intake of food.

When the basal metabolic index (BMI) reference values regarding underweight, normal, overweight and obese category were compared with these results, it was evident that obesity prevailed in most of the rural women of Nowshera which further lead to the increased risk of obesity-related disorders and mortality chances. As reported, very little chances the above problems occur in people having a basal metabolic index (BMI) in the normal range. As per World Health Organization (WHO 2005) reports, diabetes, heart disease, osteoarthritis, breast, endometrial and colon cancers are all the dangers which can be associated with increased weight and obese people. It can, therefore, be summarized that women with normal weight are much safer from these nutritional problems than those having higher weight or overweight. Tajik women have been found to be having more load of nutritional problems due to WHO (2000) high basal metabolic index (BMI) plus high blood pressure clearly indicating the relation of overweight/obese with heart diseases.

Energy intake

Energy intake on the average for the three localities of the selected district was 2191 kcal/woman/day in Akora Khattak, 2178 kcal/women/day in Pir Sabaq, and 2122 kcal/women/day in Kheski (data analysis is not shown). The values show only marginal adequacy on the basis of BMR relative to height, acceptable median weight for height. Although it has been suggested that BMR for women in the indo-Pak subcontinent might be lower than the normal reported values (Piers and Shetty 1993), these, however, have not been substantiated with objective evidence and hence FAO/WHO/UNU (1985) suggestions were adopted for calculating BMR values.

One of the primary problems of malnutrition is obesity. Its prevention requires a balance of energy intake and energy output. When the energy intake is less than 1800 to 2000 Kcal, it is difficult to include all nutrients at recommended levels, especially for some of the trace elements. Thus it is more appropriate to increase exercise than to decrease energy intake into below 2000 kcal if the goal is weight maintenance.

For those who are obese, low calories diets ranging from 1000 to 1800 kcal are used. Between 70 and 80% of the women's energy intake was supplied by bread from the food group of "cereals and grain products".

Dietary mineral intake

Calcium intake. The average of calcium intake of the women in the volunteer groups belonging to the three selected locations in District of Nowshera was on significantly lower than the RDA. The mean calcium intake was 523 mg/woman/day (Table 4) which was 36% lesser than the recommended intake level. The recommended

allowance for calcium is 800 mg/day. Although intake of various food groups by the target population group was not recorded, the low calcium intake by the volunteers indicated a low intake of milk and its products in the daily diet. Worsening the situation with respect to intake of calcium and other minerals was the fact that wheat and pulses, as major parts of the diet, contain very high concentrations of phytates. It is well documented (Allen and Wood 1994) that phytates bind most of the mineral matter present in the diet, making it physiologically unavailable to the consuming individual, leading to a deficiency of the mineral in question.

Phosphorus intake. The average daily intake of phosphorus (mg/d) among the volunteer women was much lower than the RDA as calculated by 24 hr memory recall questionnaire method. The women had a mean phosphorus intake of 773 mg/woman/day (Table 4) which was less than the recommended level. The recommended allowance for phosphorus is 800 mg/day (data analysis is not shown). The results showed that mean phosphorus intake of women in Akora Khattak was significantly higher than RDA which was 809 mg (Table 1) while in Pir Sabaq and Kheski, the mean phosphorus intake of women was 766 mg (Table 2), 742 mg/day (Table 3) respectively which were not significantly higher than RDA. Phosphorus along with calcium is essential for the formation of bones and teeth. It is also involved in the storage of energy and its release in the body. Diets that provide adequate energy and protein also supply adequate phosphorus. So the foods that are rich in protein are good sources of phosphorus.

Iron intake. The mean iron intakes were 28 mg/day/women with a range of intake of 14 to 37 mg (data analysis is not shown). The values showed a satisfactory dietary intake level of that mineral as seen in comparison with the RDA (FAO/WHO 1988). However since a predominant part of the diet in the rural population was cereals and pulses, the bioavailability of minerals, including iron, was very low. It has been reported that iron bioavailability from such diet sources might not be higher than 5% (Siegenberg et al. 1991). Iron intake level is critical particularly in child-bearing women due to their unique function of reproduction. It is therefore important to keep the iron nutritional status of these women within safe limits (Abuova 1996).

Zinc intake. Daily zinc consumption (mg/d) was not significantly higher than the RDA in all women as calculated by 24 hr memory recall questionnaire method. The women had a mean zinc intake 11 mg/woman/day (Table 9) which were above the recommended level. The recommended allowance for zinc is 15 mg/day (data analysis is not shown). The results showed that calculated mean zinc intake of women of Akor Khattak, Pir Sabaq and Kheski were significantly lower than RDA which was 11.52 mg/day (Table 1), 11.51 mg/day (Table 2), and 11.11 mg/day (Table 3) respectively. As it was clearly portrayed from the diet consumed by the women, that more than enough calories were furnished by whole-grains bread. Although whole-grains are good sources of zinc, practically all of the minerals are tied up by the high concentration of phytates in the unleavened bread. Due to its involvement in

the immune system, zinc is considered as a very important nutrient. A deficiency of it may lead to vulnerability to several pathogens and their adverse effects (Fraker et al. 1986; Kruse-Jarres 1989). Zinc deficiency is considered to be emerging in Pakistan. This is attributed to a great extent to the exhaustion of the soils due to intensive cultivation systems. Food fortification with zinc compounds is considered to be one of the most promising options to overcome the ill effects of zinc deficiency among the population (World Bank 1994).

The discussions in the preceding sections of this manuscript provide the basis for the conclusion of this study. (i) Nutritional status of women was done by using data on height and weight measurements. BMI value of 18.5 to 24.9 indicated the healthy weight of 18.5 as underweight, of above 25 as overweight and of above 30 as obese. When BMI of women was compared with these categories; it showed that quite large proportion of the women were overweight and obese. (ii) The women's energy intakes were marginally adequate as they were almost equal to the recommendations. (iii) Among the minerals, calcium, phosphorus, and zinc were much less than the recommended daily intakes

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