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Deficient Intakes of Energy and Macronutrients in Pakistani Female Students Assessed by Composite Samples Method

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Abstract: The main purpose of the study was to compare the energy and macronutrients intakes by composite sample method. Duplicate food samples for seven days i.e., breakfast, lunch and dinner and whatever else ate during the week were analyzed for macronutrients consumption. Twenty female students were registered from the female hostel of the NWFP, Agricultural University Peshawar Pakistan. Age, weight, height and skin folds of the students were recorded on the day of the registration. From the anthropometry Basal Metabolic Index (BMI) was determined. The composite food samples were analyzed for protein, carbohydrates and fats. The energy values were determined by multiplying the daily eaten protein, carbohydrates and fats with 4, 4 and 9, respectively. The mean values of energy and macronutrients intakes were compared with the norms as appropriate. The energy and protein intakes were lower by -29.34% and protein intake was higher by 42.65% compared with American Dietetic Association (ADA). Similarly, compared to the WHO/FAO values the energy was lower -30.57 and protein was higher by 43.29, respectively. The energy contribution was higher from protein by 151% and lower from carbohydrates and fats by -28.35 and 23.43%, respectively. This study suggests that students are having deficient or imbalance energy intakes from macronutrients and are at the risk of malnutrition.

Key words: Anthropometry, composite sample, energy, macronutrients, intakes

INTRODUCTION

Nutritional status rather improved nutritional status plays an important role in the well being of an individual or a community (ies). Nutritional status is assessed in different ways but the most frequent used methods are anthropometric, bio-chemical, 24 h dietary-recall intakes and others as well. All these methods can be applied to individuals assessment, community (ies) assessment, or surveys conducted for the nutritional status (Jelliffe, 1996; McMahan and Bistrain, 1991). It has been observed that the university students are at the

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risk of specific nutrients deficiencies, the energy requirements are mainly met through dietary fat intakes. Furthermore, students in hostel develop faulty food habits (Khattak *et al*., 2002; Chiplonkar *et al*., 1993; Wyka and Zechałko-Czajkowska, 2007; Skibniewska *et al*., 2007). These faulty foods habits have been explained to be associated with low nutrients densities of foods consumption (Skibniewska *et al*., 2007). This may result in higher or lower intakes of nutrients and it has been shown that the university students' in particular male have higher energy and protein intake (Šatalić *et al*., 2007). A similar trend was observed in the students both in male and female in the NWFP, Agricultural University, Peshawar, Pakistan when assessed for energy and macronutrients intakes through food frequency questionnaires (Khattak *et al*., 2002). Therefore, this study was designed with an effort to confirm whether or not it is lower among the female students of the NWFP, Agricultural University, Peshawar, Pakistan by composite food sample method.

MATERIALS AND METHODS

Twenty female students were registered from the female hostel of the NWFP, Agricultural University, Peshawar, Pakistan for the assessment of energy and macronutrients (protein, carbohydrate and fats) intakes by composite food samples method. The age, weight and height of the students were recorded on the day of the registration. Also, the skin fold thicknesses of the students were recorded on the day of the registration. The students were asked to collect duplicate foods samples for a week i.e., breakfast, lunch and dinner and whatever else ate during the day. The seven days foods samples were bulked and composite samples were prepared. From the body weight and heights of the students the BMI was determined according to the formula; weight (kg)/height $(m)^2$. The skin-folds were assessed by using the adipometer and the percent body fats of the students were assessed from the body fat measurement chart for women provided in the manual of the adipometer (ACCU-Measure Fitness 2000.LLC P.O. Box 441 Englewood, Co 80155-4411). The collected duplicate food samples were blended with the help of common kitchen food blender on the next day of the last collection. The samples were analyzed for the macronutrients namely protein, carbohydrates and fats by the method of AOAC (1980) and consequently the energy was calculated. The energy values of the composites samples were determined by multiplying the daily eaten protein, carbohydrates and fats with 4, 4 and 9, respectively (Williams, 1999; Goplan *et al*., 1981). The anthropometric and dietary intakes were compared with the international norms namely American Dietetic Association (ADA), World Health Organization and Food and Agriculture Organization (WHO, 1985, 1990, 1995; FAO/WHO, 1985, 2001). Based on ADA, the reference energy of the students was determined by multiplying the mean body weights (kg) by 40 kcal day^{-1} which was $56.5 \times 40 = 2260$ kcal day^{-1}. The reference protein of the students was determined by multiplying the mean body weights (kg) by 0.8 g kg^{-1} body weight day^{-1} which was $56.5 \times 0.8 = 45.0$ g day^{-1} (ADA). According to the WHO/FAO, the reference energy and protein requirements of the students were determined from the reference values for Asian population for the given weight 56.5 kg. The protein energy requirement was 2300 kcal day^{-1} and 45.0 g day^{-1}, respectively (WHO, 1990, 1995; FAO/WHO, 1985, 2001). Similarly, based on the HWCNR, the energy contribution of macronutrients was determined and the reference values of protein, carbohydrates and fats were taken as 15, 55 and 30 g day^{-1}, respectively. The means were compared for the various parameters with the aforementioned norms as appropriate. Descriptive statistics was performed for various comparisons using a statistical package MINITAB (release 8.2) Inc. State. Drive. USA.

Table 1: Anthropometry measurements of the students

Variables	Observed	Reference	Percent increase/decrease over reference
Age (years)	20.80±1.51	-	-
Height (fts)	5.23±0.43	5.5	-4.91
Body weight (kg)	56.50±9.33	58.0	-2.59
Skin fold (mm)	16.57±9.36	20.5	-19.17
Body fat (%)	23.80±7.03	28.4	-16.20
Basal Metabolic Index (BMI)	21.42±4.43	22.4	-4.38

Table 2: Comparison of energy and macronutrients intakes of the students with the norms

Variables	Observed	Reference	Percent increase/decrease over reference
Energy and protein intakes based on ADA reference			
Energy intake (kcal day^{-1})	1597.00±537	2260	-29.34
Protein intake (g day^{-1})	64.48±28.71	45.2	43.28
Carbohydrate intake (g/100 g)	67.55±4.92	-	-
Fat intake (g/100 g)	17.50±3.82	-	-
Energy and protein intakes based on WHO/FAO reference			
Energy intake (kcal day^{-1})	1597.00±537	2300	-30.57
Protein intake (g day^{-1})	64.48±28.71	45	43.28
Energy and protein intakes based on health and welfare Canada nutrition recommendations contributing macronutrients			
Protein intake (%)	37.65	15	151.00
Carbohydrate intake (%)	39.41	55	-28.35
Fat intake (%)	22.97	30	-23.43

RESULTS

The anthropometry measurements of the students indicated that the height, body weight, skin fold thickness, body fat and Basal Metabolic Index (BMI) were lower than the WHO reference values by -4.91, -2.59, -19.17, -16.20 and -4.38%, respectively (Table 1). Similarly, when the energy intake was compared with the norms i.e., American Dietetic Association and World Health Organization the energy consumption was lower by -29 and 30, respectively (Table 2). Protein intake was higher than the recommended reference of ADA and WHO by 43.28 and 42.28%, respectively. Based on the Health Welfare Canada Nutrition Recommendation, when the percent contribution to the total energy was determined from protein, carbohydrate and fats it was found to be 37.65, 39.41 and 22.97% (g/100 g), respectively. The percent increase/decrease over the references intake for protein, carbohydrate and fats was +151.02, -28.35 and -23.43%, respectively (Table 2).

DISCUSSION

Students in the universities have been assessed for energy and nutrients intakes in various universities in different countries around the world. The studies conducted so far report imbalance intake of energy, macronutrients and micronutrients. The present study and the earlier study conducted on the students in this campus who were assessed for the adequacy of energy and macronutrients are comparable in term of trends of higher or lower intakes. The indices for height, body weight, skin fold, body fat, BMI, energy intake were all lower in this study whereas the only food matrix among the macronutrient was protein which was higher than the norms in either case compared to the norms. The same have been reported in other studies where lower anthropometry was observed in particular lower BMI in the female students as indicated in the Table 1 (Sanlier and Unusan, 2007; Peterson *et al*., 2007; Oliveras Lo´pez *et al*., 2006). The present study provide useful information and of

course confirm the earlier study results performed on the energy and macronutrients intakes through Food Frequency Questionnaires (FFQ) and it was found that the female students had lower energy intake compared to the ADA reference intake (ADA). The energy intakes among the Pakistani female students both assessed by FFQS previously by Khattak *et al.* (2002) and through composite food sample method presently were lower than the references intakes. The important point here is the comparison of the intakes of energy assed by both the methods showed reduced consumption of energy. Similar, reduced consumption for energy was observed in the Brazilian study conducted on the university students (Martins Bion *et al*., 2008). In the Brazilian study the decrease in the energy consumption was 21%. In Pakistani students (present study) the consumption of energy was lower by 29.34%. The reduction in energy consumption in the Brazilian student was not at the expense of lower macronutrients (protein, carbohydrates and fats) since the students consumed within the reference amount but the only thing they say is about the dietary fiber; perhaps the author took into account the fermentation energy. In the Pakistani female students, the reduction in the energy consumption was mainly at the expense of lower intake of dietary carbohydrates and fat which were lower than the recommended/permissible limits. In a study conducted by Šatalić *et al*. (2007) on the Croatian students has shown that the average energy intake was increased by 130% of the dietary reference intake which is much higher in comparison to our study. In the Croatian students 64.3% of the students had protein intakes more than double of the dietary reference intake. Similarly, the Pakistani female students had higher consumption of protein and the increase over the reference was 150% which is more than double of the recommended level (Table 2). The observed increase in protein takes and reduced energy consumption compared to the norms both in this study and the earlier one (Khattak *et al*., 2002) is due to lower intake of carbohydrate and fat. Therefore, there has been an imbalance of macronutrients intakes among the students and similar imbalance of macronutrient is exhibited in the form of increased protein and reduced energy. Furthermore, when macronutrients are imbalance then presumably the micronutrients are imbalanced too. This has been shown in particular in female students (Šatalić *et al*., 2007). The imbalance of macronutrients is evident well when the percent contribution of the macronutrients to the total energy was determined. The decrease over the references contribution to the energy intake for carbohydrate and fats per se need to be explored among these students.

In conclusion, this study suggests that students are having deficient or imbalance energy intakes from macronutrients and are at the risk of malnutrition.

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