

# Application of Dietary Reference Intakes in dietary intake assessment of female university healthcare students in Botucatu, State of São Paulo, Brazil

## *Aplicação das Dietary Reference Intakes na avaliação do consumo alimentar de estudantes universitárias da área de saúde em Botucatu, Estado de São Paulo, Brasil*

### ABSTRACT

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*University students are usually in their late adolescence and early adult life and this is a moment in life when social changes occur and new eating patterns and habits tend to become established. Then, the energy and micronutrient intake of 112 healthcare students from a public university in the state of São Paulo, Brazil, was evaluated by applying a non-consecutive 3-day dietary record. The energy intake was compared to the Estimated Energy Requirement (EER), and the mean micronutrient intake was compared to the (Estimated Average Requirement) EAR value. To evaluate the prevalence of inadequacy, the ISU (Iowa State University) method was used, and prevalence was calculated by the PC-Side software. It was possible to observe that energy intake was adequate and statistically similar to the recommendation for the population, according to age and gender. High intake inadequacy percentages were found for vitamin E (97.74%), zinc (38%) and thiamine (30%). For vitamins B6, B12 and A, lower inadequacy values were found (27%, 18%, 14.79%, respectively). The results showed an unbalanced dietary quality of most healthcare students, which raises concerns, since they should value a healthy diet and act as real multipliers of such information in society.*

**Keywords: Nutrition Requirements. Micronutrients. Eating. Students. Female.**

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## RESUMEN

*Estudiantes universitarios se encuentran generalmente entre el fin de la adolescencia y el inicio de la vida adulta, momento de cambios sociales, de hábitos alimentares con adquisición de nuevos modelos. Debido a esto, fue evaluada la energía y la ingestión de micronutrientes de 112 estudiantes de salud de una universidad pública en São Paulo, Brasil, utilizando un registro de la dieta de 3 días. La ingesta de energía se comparó con las Estimated Energy Requirement (EER), y la ingesta promedio de micronutrientes en comparación con las Estimated Average Requirement (EAR). Para evaluar la prevalencia de insuficiencia, fue utilizado el método ISU (Iowa State University) y la prevalencia fue calculada por el software PC-Side. Fue posible observar que el consumo de energía es adecuada y estadísticamente similar a la recomendación para la población. Altas porcentajes de insuficiencia de consumo se encontraron para vitamina E (97,74%), zinc (38%) y tiamina (30%). Para las vitaminas B6, B12 y A, se encontraron valores más bajos (27%, 18%, 14,79%, respectivamente). Los resultados mostraron un desequilibrio en la dieta de la mayoría de los estudiantes de salud, lo cual es preocupante, puesto que deben conocer el valor de una dieta saludable y actuar como verdaderos multiplicadores de dicha información*

**Palabras clave:** Necesidades nutricionales. Micronutrientes. Ingestión de alimentos. Estudiantes. Femenino.

## RESUMO

*Estudantes universitários encontram-se geralmente no final da adolescência e início da vida adulta, momento na vida em que ocorrem mudanças sociais e novos padrões e hábitos alimentares tendem a se estabelecer. Assim, o consumo de energia e de micronutrientes de 112 estudantes de saúde de uma universidade pública no Estado de São Paulo, Brasil, foi avaliado através de um registro alimentar de 3 dias não-consecutivos. O consumo de energia foi comparado ao Estimated Energy Requirement (EER) e a ingestão média de micronutrientes foi comparada ao valor de Estimated Average Requirement (EAR). Para avaliar a prevalência de inadequação, o método ISU (Iowa State University) foi utilizado, e a prevalência de inadequação de consumo foi calculada pelo software PC-Side. Foi possível observar que o consumo de energia foi adequado e estatisticamente semelhante à recomendação para a população, de acordo com idade e sexo. Altas porcentagens de consumo inadequado foram encontradas para vitamina E (97,74%), zinco (38%) e tiamina (30%). Para as vitaminas B6, B12 e A, menores valores foram encontrados (27%, 18%, 14,79%, respectivamente). Os resultados mostraram um desequilíbrio na qualidade da alimentação da maioria dos estudantes de saúde, o que é preocupante, uma vez que estes deveriam valorizar a alimentação saudável e atuar como verdadeiros multiplicadores dessas informações na sociedade.*

**Palavras-chave:** Necessidades nutricionais. Micronutrientes. Ingestão de alimentos. Estudantes. Feminino.

## **INTRODUCTION**

University students are usually in their late adolescence and early adult life, and this is a good moment to provide opportunities for implementing activities aimed at preventing health problems (WORLD HEALTH ORGANIZATION, 1995). This is a period in life when social changes occur and new eating patterns and habits tend to become established under the influence of psychological, social and socio-economic factors, such as moving over from their parents' home. This distance from the family may be able to promote quitting some habits and adopting new lifestyles (BARROS, 1991).

According to Jacobson, 1998, this is a privileged moment to put preventive measures into practice, since the eating habits developed when an individual establishes his/her independence persists in the future. Haberman e Luffey (1998), have also pointed out that many eating habits acquired by students during the years spent in college continue in adult life. Therefore, the correct characterization of this population's diet is important, since new eating habits will influence these young people's health conditions in the future, their adult life and aging, particularly in a scenario of nutritional transition and high risk for obesity and chronic diseases (DIETZ, 1998).

Additionally, the knowledge of how many individuals have higher or lower intakes than a given criteria is relevant for planning healthcare actions. Furthermore, studies on nutrient intake prevalence may lead to hypotheses for establishing theories on diet and health inter-relationships (MORIMOTO; MARCHIONI; FISBERG, 2006).

To assess the prevalence of inadequate nutrient intakes, information about the usual nutrient intake distribution is required. The distribution should reflect the person-to-person nutrient intake variation within the group, that is, it should be adjusted to remove the intra-personal intake variability of nutrients that spreads the distribution and leads to overestimation or underestimation of the inadequacy prevalence (BARR; MURPHY; POOS, 2002; CARRIQUIRY, 1999; MORIMOTO; MARCHIONI; FISBERG, 2006; SLATER; MARCHIONI; FISBERG, 2004). Dietary Reference Intakes can be used as reference values. They were originally developed for Americans and Canadians and established for planning and assessing the diets of individuals or groups of healthy individuals according to their stage of life and gender (USES OF DIETARY REFERENCE INTAKES, 1997).

Hence, the aim of this study was to evaluate energy intake and to estimate the prevalence of inadequate nutrient intake among female college healthcare students at a public university in São Paulo, Brazil.

## **METHODS AND MATERIAL**

### **SUBJECTS AND DESIGN**

This is a cross-sectional study, and data were collected during the 2006-2007 school year in order to evaluate female healthcare students from a public university in Botucatu,

state of São Paulo, Brazil. Second-year students from the following programs were invited to participate: Biology, Biology Applied to Medical Sciences, Medicine and Nutrition. They summed up 360 individuals, of whom only 112 students who were interested in participating and fully met the protocol established were considered. The male students were excluded due to lack of their interest to participate in the research, besides the low number of men enrolled in most of these courses. Hence, the participants represented approximately 31% of the total number of registered students.

All participants were asked about the practice of physical activity. They were asked if they did any kind of physical activity or not, and, if they did, they were asked about the kind of it and its frequency. Their level of activity was classified according to Institute of Medicine (2002).

The study protocol was approved by the ethics committee of the School of Medicine, São Paulo State University.

## **BODY MASS INDEX**

An anthropometric evaluation of the participants in the study was performed by measuring their weight and height. The body mass index (BMI) was calculated and the individuals were then classified according to categories defined by the World Health Organization (2000).

## **DIETARY ASSESSMENT**

Food intake was evaluated from a non-consecutive 3-day food record, including one weekend day. All the students received detailed instructions about how to complete the food record. Nutwin 2002 software was used to analyze nutrient intake. The food items with nutritional figures not belonging to the program were included by using the "Food Composition Table: support for nutritional decision" (PHILIPPI, 2002), "Table for dietary intake evaluation of home measures" (BENZECRY et al., 2004) as well as food composition analyses supplied by manufacturers as reference. For fortified food (some types of milk, yogurt, bread, breakfast cereal), data were obtained from manufacturers and also entered in the software database. Individuals whose energy intake was less than 500kcal or more than 4000kcal on any of the days evaluated were excluded (WILLET, 1998). The energy intake data (in calories) and those for vitamins A, E, B6, B12, thiamine, pantothenic acid, zinc and calcium were obtained.

The results will be shown as a comparison between the present student and a student done by Morimoto, Marchioni and Fisberg, 2006, who analyze the micronutrient intake and the prevalence of inadequacy intake among female nutrition college students. This cited author used a different method to assess the prevalence of inadequacy, but both studies adjusted the data to remove the intra-personal variability and were done with female college students.

## PREVALENCE OF INADEQUATE MICRONUTRIENT INTAKE

The prevalence of inadequate intake was obtained using the EAR cut-off point method, proposed by Beaton, 1994, after adjustment for intrapersonal variability by using the Iowa State University (ISU) method (GUENTHER; KOTT; CARRIQUIRY, 1997; NUSSER et al., 1996). The Dietary Reference Intakes were used as reference values. For those nutrients with no EAR established, the distribution of intakes was estimated and compared to the AI, which occurred for pantothenic acid and calcium.

## STATISTICAL ANALYSIS

The statistical analyses were performed in PC-Side (Software for Intake Distribution Estimation) software, version 1.0 (2003). For those micronutrients which were not possible to obtain the results from the PC-Side, the software SAS for Windows, v.9.1.3 was used in order to obtain the prevalence of inadequacy, using the same methodology.

## RESULTS

This study analyzed 112 female college healthcare students aged 18 to 28 years, with a mean of 20.9 years (SD=0.57). The means for weight, height and BMI were 56.54kg (SD=8.31), 1.62m (SD=0.07) and 21.54kg/m<sup>2</sup> (SD=2.6), respectively.

Regarding BMI classification, it was observed that 3.57% were underweight, 11.61% were overweight and 84.82% presented normal weight. There was no obese student among the participants.

Regarding physical activity, there was a high level of sedentary participants (68.75%). Among the students who reported being physically active, 71.43% were considered low active.

The mean calorie and micronutrient intakes among the students, the mean intake obtained by a similar study for students in the Nutrition Program at a University in the city of São Paulo (MORIMOTO; MARCHIONI; FISBERG, 2006), the micronutrient intake reference values (EAR or AI) and the estimated inadequacy prevalence for nutrient intake are presented in table 1.

The mean energy intake was statistically similar ( $p=0.184$ ) to the mean EER.

Among the students, 99.7% and 92.1% of the students consumed less than the AI value for calcium and pantothenic acid respectively.

The mean intake of micronutrients observed in the present study are similar to the ones described by Morimoto, Marchioni and Fisberg, 2006.

**Table 1 – Estimated Average Requirement (EAR) or Adequate Intake (AI), mean and standard deviation of intakes and prevalence of students with inadequate intake in comparison to EARs, based on data from healthcare college students (present study) and nutrition college students (MORIMOTO; MARCHIONI; FISBERG, 2006). Botucatu, 2007**

Nutrient	EAR/AI	Present study		Morimoto et al., 2006	
		Mean±SD intake	Inadequacy prevalence #	Mean±SD intake	Inadequacy prevalence #
Calorie	2013.26**	1933.13±771.38	-	-	-
Vit A (mcg)	500	748.66±683.87	14.79	-	-
Vit E (mg)	12	7.28±5.71	97.74	-	-
Thiamine (mg)	0.9	1.19±0.71	30	1.55±0.57	12.53
Vit B6 (mg)	1.2	1.43±0.95	27	1.37±0.42	25.72
Pantothenic (mg)	5*	3.21±1.92	-	3.26±0.86	-
Vit B12 (mcg)	2	3.34±2.97	18	3.02±1.24	20.6
Zinc (mg)	6.8	7.99±4.62	38	7.0±2.36	46.71
Calcium (mg)	1000*	695.3±402.76	-	714.85±191.05	-

\* AI value.

\*\* EER value.

\* values adjusted for the intra-personal variability.

High intake inadequacy percentages were found for vitamin E (97.74%), zinc (38%) and thiamine (30%). For vitamins B6, B12 and A, lower inadequacy values were found by using the ISU method (27%, 18% and 14.79% respectively).

Thiamine, zinc, pantothenic acid and vitamins B6 and B12 did not show intake normal distribution, and also the PC-Side software could not find a transformation that made the intake distribution more symmetrical, so the PC-Side software did not give any result for these nutrients. In these cases, a square-root-type transformation made the intake distribution more symmetrical and, in order to obtain the inadequacy prevalence, the NRC method was used (FISBERG, et al., 2005). For these micronutrients, the transformations and the inadequacy prevalence were obtained by using SAS for Windows, v.9.1.3.

## DISCUSSION

It was observed that the number of overweight students was small and there was no obese student in this sample. A high prevalence of normal weight was observed, which shows that this group of students is adequate, regarding the nutritional status. BMI results obtained in the present study were very similar to the ones described by Fisberg et al., 2006, who found a small number of overweight and obese students.

It was observed that the mean energy intake was statistically similar ( $p=0.184$ ) to the mean EER, which is a different result from that obtained by Fisberg et al., 2006 for nutrition college students. In the cited study, the mean energy intake was smaller than the estimated energy requirement. The nutrition students may have omitted or underestimated their intake in an attempt to not reveal very caloric or unhealthy food items. It can also be supposed that nutrition students tend to truly reduce their intake of unhealthy items, which would eventually result in an intake below the requirement.

High intake inadequacy percentages were found for vitamin E, zinc and thiamine. For vitamins B6, B12 and A, lower inadequacy values were found.

Morimoto, Marchioni and Fisberg (2006) obtained similar results for vitamin B6, B12, zinc, calcium and pantothenic acid. However, higher values were observed for thiamine. These results differ from the ones obtained by Silva et al. (2010), who found a higher inadequacy of vitamin A among children, but found a similar inadequacy of zinc. This author has also used the EAR cut-off point method and adjusted data considering the intra-personal variability.

A high inadequacy prevalence for vitamin E was found. A similar result was observed in pregnant women attended by public healthcare services in the same city (MALTA; CARVALHAIS; CORRENTE, 2008). Lopes et al. (2005), assessing adults and elderly, found that the vitamin E intake of 100% of the participants was lower than the adequate level, however this cited author used another method to classify the adequate intake, which does not consider the intra-personal variability.

Silva et al., 2010, observed a frequency of inadequacy for vitamin E intake between 25% and 100% among children in Maceió.

These data show us that the high prevalence of inadequate intake of vitamin E occurs in all age groups.

No EAR values are available for calcium or pantothenic acid, which makes the evaluation of intake inadequacy prevalence impossible. However, for both nutrients, the mean intake was lower than the AI. It is noteworthy that in the group of college students studied, none showed the intake of such micronutrients in higher amounts than the AI.

When the average consumption of a nutrient exceeds the AI value, a low prevalence of inadequate intake can be expected. When the average consumption is lower than the AI, there is no conclusion about the prevalence of consumption. This is the case of calcium and pantothenic acid in this study.

However, low calcium intake needs attention, especially among women, since this mineral is closely related to osteoporosis, a highly prevalent disease in this group (KASS-WOLFF, 2004).

Morimoto, Marchioni and Fisberg (2006) used the method proposed by the National Research Council, which often overestimates the prevalence of inadequacy, but, despite this fact, the results found by this cited author were similar to the ones found in the present study.

These results raise concerns since they show an unbalance in the diet quality of a large number of individuals in this population, especially because the subjects were college healthcare students, who should supposedly value a healthy diet. Further investigation is recommended in order to identify the reasons or factors which could explain this situation. Such studies are necessary to design strategies aiming at promoting good health and preventing and controlling non-transmittable chronic diseases. With this regard, universities play an important role in promoting a healthy environment as this enables the training of individuals to be aware of the importance of a healthy diet for their own welfare, thus effectively educating multipliers of such information in society.

Adequate energy intake was observed in college students in the second year of healthcare graduate programs from a public university in the state of São Paulo, Brazil. Despite this fact, the prevalence of insufficient intake of vitamin E, zinc and thiamine was high. Slightly lower rates were observed for vitamin B6, B12 and A.

## CONCLUSIONS

Research like this is needed to direct strategies for health promotion, prevention and control of chronic noncommunicable diseases. In this sense, universities have an important role to play in promoting a healthy environment which is conducive to the formation of individuals aware of the importance of healthy eating for your well-being, forming, in effect, multiplying this information in society.

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