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Nutrition and Weight Management Knowledge, Dietary Intake and Body Weight Status in Iranian Postgraduate Students in Universiti Putra Malaysia

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Abstract: Good nutrition, a balanced diet and dietary intake are foundations of good health. Research has found that dietary patterns change dramatically following the arrival of students in a foreign country. However, nutritional status of Iranian students studying overseas have never been investigated. The objective of this study was to assess the associations between socio-demographic factors, nutritional knowledge, weight management knowledge, lifestyle factors, dietary intake and anthropometric factors with body weight status (BMI) among Iranian postgraduate students in UPM. A cross-sectional study was conducted to determine the body weight status of 210 Iranian postgraduate students aged between 22 and 55 years in University of Putra Malaysia. The associations between body weight status and socio demographics factors nutritional knowledge, weight management knowledge were assessed. Anthropometric factors (height, weight, BMI, waist and hip circumferences and body fat composition) were measured. Chi-square, Spearman Rho and Pearson tests were used for data analysis. From a total of 210 postgraduate students 110 were females and 100 males. No significant correlation was observed between smoking and BMI ($p = 0.4$). However, statistically significant correlations were observed between gender ($p = 0.007$), using protein ($p = 0.005$), carbohydrate ($p = 0.002$), fat ($p = 0.001$), fiber ($p = 0.003$), vitamin C ($p = 0.04$), calcium ($p = 0.005$), waist circumference ($p = 0.02$), hip circumference ($p = 0.001$), Waist to Hip Ratio ($p = 0.002$), body fat composition ($p = 0.001$) and BMI. In a nut shell, the primary findings in the present study showed that physical activity influences were the main factors that predicted the BMI among Iranian postgraduate in UPM. This reflects that increase in physical activity influences would result in decreased BMI among Iranian postgraduate students. In general, the findings of the present study have important public health implications. Hence, the present results prove that the nutritional behavior of university students is poor, although their evidently higher level of education.

Key words: Obesity, life style, nutritional knowledge, dietary intake, Malaysia

INTRODUCTION

Nutrition is an input to and base for health and development. Good nutrition, a balanced diet and regular physical activity are foundations of good health. Good nutrition is the cornerstone for strong immune system, disease prevention and a better health (World Health Organization, 2008). The prevalence of obesity has been increased dramatically worldwide. Recent estimates suggest that a Body Mass Index (BMI) over 25 kg/m^2 is responsible for 64% of male and 77% of female cases of type 2 diabetes mellitus worldwide (World Health Organization, 2000). Whilst students leave home to attend college, their nutrition and physical activity become their exclusive responsibility. Dietary habits are established in early life and can have a considerable effect on the health of individuals in the long-term (Johansen et al., 2006). Dietary habits of the majority of adults particularly university students are affected by the

fast-food market. As a result, overweight and obesity are observed more and more among this population (Yahia et al., 2008). Overweight and obesity among university students are documented as a "rising epidemic" in both developed and developing countries (Reeves et al., 2000).

A student's lifestyle may also change notably in a foreign country. Research has found that dietary patterns change dramatically following the arrival of students in a foreign country and students are at risk of developing unhealthy eating habits, especially during their first year of inhabitancy (Reeves et al., 2000). Poor dietary habits and health behaviors among university students have been reported in different countries such as Armenia and the United States (Huang et al., 2003; Hovhannisyan, 2007). With academia as the primary focus, the consumption of nutritional meals and the need to exercise regularly do not appear very high on

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their priority list. Study and social demands leave many university students making food choices primarily on taste, convenience, or peer influence. With the increase in academic demands, less time is spent for physical activities and exercise (Brien and Davies, 2007). Individual assessment of nutritional status of population groups has a vital significance for public health. In this respect, the nutritional status of adults is demonstrated by BMI which is the result of dividing weight (in kilograms) by the square of the height in meters (kg/m^2). Knowledge about food and nutrition is believed to be highly significant and determinative. Some studies implemented nutritional education as a strategy to intervene with the process of obesity and have presented an improvement in nutritional knowledge; in addition to this strategy, attitudes and eating habits have also influenced the families eating habits (Schuit *et al.*, 2002). Attempts to lose weight are often started by acquiring knowledge about the fatal results of obesity, including social stigma and adverse effects on health (Turnbull *et al.*, 2000). According to the World Health Organization, there are four major categories for adults BMI including: underweight (<18.5 kg/m^2), healthy weight (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2) and obese (>30 kg/m^2) (WHO Expert Consultation, 2004). The purpose of the present study was to determine lifestyle and dietary intake in Iranian postgraduate students in Universiti Putra Malaysia. Many studies have reported that body weight status is associated with socio-demographic factors such as sex, age, marital status and living arrangements (Edmonds *et al.*, 2008; Koochek *et al.*, 2008). Unfavorable nutritional outcomes, such as obesity and chronic diseases, resulting from migration or the mobility of population groups have been reported recently by several authors' eighty post-graduate Greek students (Gilbert and Khokhar, 2008; Papadaki and Scott, 2002). Eating behaviors, low quality diet and physical inactivity may result in a greater risk of obesity in adulthood (Demory-Luce *et al.*, 2004). An unpublished study in Malaysia has reported that the prevalence of overweight and obesity among university students was typically due to their low level physical activity (Quah, 2005). The number of foreign students studying in Malaysia is increasing dramatically since 2003. Currently, approximately 4000 foreign students study in University of Putra Malaysia (UPM). Nutritional status of foreign students and especially Iranian students studying at higher educational institutions such as UPM has never been investigated. Therefore, it is crucial to study factors affecting body weight of Iranian postgraduate students in UPM.

MATERIALS AND METHODS

A cross-sectional study was conducted at UPM, in Malaysia. UPM is a destination for a large number of international students, including Iranian students. To achieve the needed sampling size for the study, the researcher obtained a list of Iranian postgraduate students from SGS. The list shows the distribution of the students in the 15 faculties and seven institutes in UPM. Subsequently, contact was made with the person in charge of the Iranian students from each of the faculties and institutes and the Iranian students were identified. Also, the UPM Iranian website and notice boards were used to advertise the study and to invite the students to participate in this study. Those who were interested to participate in the study were requested to come to an assigned postgraduate student room in each of the faculties. The minimum sample size was calculated based on a previous study, showing prevalence of 0.124 for obesity among university students (Nojomi and Najamabadi, 2006). Then 168 samples were estimated to be needed based on the following parameters (α = 0.05, β = 0.80, p = 0.124 and sampling error of 0.05). However, the sample size was increased by 30% and finally 210 samples were selected (from a total of 1458 Iranian postgraduate students in 2009) to compensate possible attritions. To achieve the needed sample size, the researcher obtained a list of Iranian postgraduate students from the center of Student Graduate Studies. The list included the students in 15 faculties and seven institutes of UPM. The instrument used in this study was a self-administered questionnaire divided into three major sections. The first section was consisted of seven questions about socio-demographic factors including the student's gender, age, academic semester in college, program of study, marital status, living arrangement and residency. In the second section, Nutritional knowledge assessed subjects knowledge on nutrition. This section, which consists of fifteen items was adapted and modified (Thombs *et al.*, 1998). Six questions were about food choices (which ask the respondent to choose between different options, to pick the food which is low or high in fat, protein, carbohydrate, saturated fat, salt and alternative red meat). Three items were about knowledge about the nutrient content of different foods and six items were about food group choices.

One point was given for each correct answer and a zero point was given for an incorrect answer. A composite nutrition knowledge score was calculated. The possible maximum total score was 45 points and the possible minimum score was 0. Subjects with a total score in the range of 0 to 64% were categorized as having a low level of nutritional knowledge, 65 to 79% were categorized as having a "moderate level of nutritional knowledge and 80 to 100% were categorized as having a high level of nutritional knowledge. The reliability of nutritional knowledge was measured by Cronbach's alpha which was 0.77. This section consisted of two parts: First, subjects were asked whether they have ever received any information on weight management of which the

answer is in dichotomous form, either "Yes "or "No". If the answer was "Yes", the subjects were required to proceed to the next question on the main sources of their weight management information. Weight management knowledge was used to assess subjects knowledge on weight management. This inventory, which consists of 12 objective questions, was adapted and modified (Wardle and Johnson, 2002). Each question had four choices of answers. Only one choice was the correct answer while the other three were incorrect. Subjects were required to choose the most appropriate answer for each question.

One point was given for each correct answer and a zero point was given for an incorrect answer. The possible maximum total score was 12 points and the possible minimum score was 0. Based on a study (Koay, 1998) subjects with a total score in the range of 0 to 6 points were categorized as having a "low" level of weight management knowledge, 7 to 9 points were categorized as having a "moderate" level of weight management knowledge and subjects with a score of between 10 to 12 points were categorized as having a "high" level of weight management knowledge.

This section included about meal frequency questionnaire. For meal frequency the questions was focused on breakfast, lunch, dinner and fast foods. Dietary intake of each respondent was assessed trough a 24 h dietary recall interview. A 24 h dietary recall for two days (one weekday and one weekend) was used to assess all foods and beverages an individual consumed in the two recent days (midnight to midnight) to calculate respondents' intake of macro and micronutrients. Foods consumed were converted into weights in grams based on a list of food weights according to the Food Composition Table (Koay, 1998). Food quantities and the weight of the foods consumed were converted and entered into Nutritionist Pro^{TM} for analysis. Obtained data was analyzed based on the Malaysian food database using Nutritionist Pro^{TM} software (First Data Bank). If cooked dishes like certain Iranian food were not included in the database of Nutritionist Pro™ Software, the investigator made a recipe for each dish (per 100 g) and then the quantitative information was entered to Nutritionist Pro software. A 24 h dietary recall was used for statistical analysis. Mean intakes of nutrients were compared to the Dietary Reference Intake (DRI). The system is used by both the United States and Canada and is intended for the general public and health professionals. For energy, protein, carbohydrate, vitamins C and minerals (calcium) adequacy was considered achieved if the individuals' mean intake exceeded 100% of the DRI. Dietary Reference Intake has all macronutrients except fat which is not determined (ND). Anthropometric measurement of height and weight was performed by the researcher. BMI was calculated by dividing body weight in kilograms by the square of their height in meters. Waist circumference was obtained by positioning a measuring tape around the abdomen at the highest lateral border of the right iliac crest. The hip circumference was measured at the point where the buttocks extended the maximum, when viewed from the side. Two consecutive recordings were made for each site to the nearest 0.5 cm on a horizontal plane without compression of skin. Waist and hip circumferences were used to calculate the Waist to Hip Ratio (WHR), in which the waist circumference (cm) is divided by the hip circumference (cm). According to Edmonds *et al.* (2008), waist circumference and WHR were classified into at risk and normal. Body fat percentage a scale was used the BIA (Bioelectrical Impedance Analysis) technique (Omron body fat monitor HBF-302, Japan). The Omron body fat monitor HBF-302 was used to obtain subjects? body fat percentage and total body fat mass with accuracy up to 0.1% and 0.1 kg respectively. The cut-off points for percentage of body fat were those recommended by Omron HBF-302. Pretesting for the questionnaire was performed among 20 Iranian students who were not included in data collection on the first of June 2009 in UPM. The pretest was conducted to ensure that the items and questions in the questionnaire can be understood. The researcher took about 15 min to explain the purpose of the study to each participant and measured all students' body weight; height, hip and waist circumferences and body fat composition. Then the respondents took between 40-50 min to answer the questionnaire. The pretest confirmed that the respondents could understand most of the questions. Therefore, some modifications were performed in the questionnaire. The research was taken between May to August 2009. The reliability of pretested questionnaire was measured by Cronbach's Alpha; 0.71.

Ethical considerations: This study was approved by the Medical Research Ethics Committee of Faculty of Medicine and Health Sciences of UPM. Aims of the study were explained to the subjects and they were assured of the confidentiality of personal information before starting the study and all signed a written informed consent. The researchers observed all ethical issues in accordance with the Helsinki Convention.

Data analysis: Descriptive statistics such as frequencies, mean, standard deviation and percentage were calculated for all demographic variables. Chi-square test was used to determine the associations between categorical variables. For parametric variable Pearson product-moment coloration was used to determine the association between two continuous variables. $p < 0.05$ was considered as statistically significant.

RESULTS

A total of 210 postgraduate Iranian students 110 (53.4%) females and 100 (47.6%) males with a mean age of 30.6±5.57 years participated in this study. Table 1 shows the distribution of the respondents according to their demographic factors. More than half of the respondents were single 140 (66.7%) and only 70 (33.3%) of the respondents had got married. About 109 (51.9%) of the respondents were pursing their Masters degree while 101 (48.1%) pursing their PhD degree. There was a significant relationship between gender and body weight status (X^2 = 12.200, p<0.01). Almost two third of the male and female respondents always consumed breakfast. More males appeared to be skipping breakfast (10.0% males vs. 7.4% females) and dinner (11.0% males vs. 7.2% females) compared to females. About 85.0% of the male and 81.8% of the female respondents consumed lunch always. More than two third of the male and female respondents consumed fast food sometimes. This study showed significant associations between intakes of protein, carbohydrate, fat, fiber, vitamin C, calcium with BMI. The average percentage of daily intake of carbohydrate contributed 49.4% of total calories; whereas, fat and protein contributed 37.3 and 13.3% of total calories, respectively. DRI achievement showed that carbohydrate and protein intakes were high in both sexes which exceeded 100% of DRI. Energy, fiber, vitamin C, calcium and iron intakes were less than the recommended intake in DRI in both genders.

The mean weight, height, waist circumference, hip circumference, body fat composition, BMI and WHR for the respondents were 67.1±13.04 kg, 169.2±9.62 cm, 79.7±12.17 cm, 99.4±10.51 cm, 23.3±3.60 kg/m^2 and 0.82±0.41, respectively. The total mean BMI was 23.3±3.6 kg/m^2; however BMI value had a high range (26.15 kg/m^2) where the minimum and maximum value was 16.02 kg/m^2 and 42.17 kg/m^2 respectively. Male respondents (23.9±3.2 kg/m^2) had higher mean value for BMI than female respondents (22.8±3.8 kg/m^2). According to the classification based on BMI, 7.1% of the respondents were under weight, 64.8% normal weight, 24.3% overweight and 3.8% obese. About 6.0% male and 8.2% of female were underweight, 55.0% of male and 73.6% of female were normal weight, 35.0% of male and 14.6% of female respondents were overweight, 4.0% of male and 3.6% of female were obese.

Mean waist circumference for male and female respondents was 86.1±9.51 and 74.02±11.51 cm respectively. About 99.0% of male and 94.5% of female had a normal waist circumference, but about 1.0% of male and 5.5% of female were at high risk for abdominal obesity. Mean waist hip ratios for male and female respondents were 0.86±0.05 and 0.80±0.6 cm, respectively. About 100.0% of male and 93.6% of female had normal waist and waist hip ratio but 6.4% of female

Table 1: Distribution of respondents according to socio-demographic background (n = 210)

Characteristics	Male (100) n (%)	Female (110) n (%)	Total (210) n (%)
Gender	100 (47.6)	110 (53.4)	210 (210)
Marital status			
Single	60 (60)	80 (72.7)	140 (66.7)
Married	40 (40)	30 (27.3)	70 (33.3)
Program			
M.S	58 (58)	51 (46.4)	109 (51.9)
PhD	42 (42)	59 (53.6)	101 (48.1)
Location			
On-campus	12 (12)	36 (32.7)	48 (22.9)
Out-campus	88 (88)	74 (67.3)	162 (71.1)
Living arrangement			
Alone	28 (28)	41 (37.3)	69 (32.9)
Family	43 (43)	34 (30.9)	77 (36.6)
Friends	29 (29)	35 (31.8)	64 (30.5)
Duration stay (month)			
<12	33 (33)	45 (40.9)	78 (37.1)
12-18	20 (20)	23 (20.9)	43 (20.5)
<18	47 (47)	42 (38.2)	89 (42.4)
Transportation			
Yes	44 (44)	35 (31.8)	79 (37.6)
No	56 (56)	75 (68.2)	131 (62.4)

were at risk. Moreover, about 45% of male and 30.9% of female respondents had normal body fat, 47.0% of male and 52.7% of female respondents had low body fat and 8.0% of male and 16.4% of female respondents had high body fat.

DISCUSSION

Many studies have shown that socio-demographic factors such as socio-economic factors, education and income, living arrangement and marital status were related to BMI (Edmonds *et al.*, 2008; Kaplan *et al.*, 2004). Contrary to expectations, this study did not find any significant association between socio-demographic factors and BMI, except for gender, which was significantly correlated to BMI (X^2 = 3.78, p = 0.02). Among male respondents, the proportion of overweight and obese was higher than female respondents. Prevalence of overweight and obesity were 35.0 and 4.0% in male respondents as compared to 14.5 and 3.6% of female respondents respectively. One of the reasons that most of the male respondents were overweight and obese in 110 comparison to the female respondents, might be the fact that the female respondents mainly live alone (37.3%) or with their friends (31.8%), while the (43.0%) male respondents lived off campus with their wives and children. Also, most of the male respondents have their own transportation which may be a critical reason for being overweight. This study also found that there was no correlation between employment status and BMI (r = -0.017, p>0.05). In contrast, research showed that length of residence was associated with obesity. Increasing the relationship between risk of obesity and length of residency could be due to adaptation procedure of the subjects, for instance the acceptance of

Table 2: Association between factors with body weight status (BMI) (n = 210)

Variable		Under	Normal	Overweight	Obese	χ^2	p
Gender	Weight	4 (3.6)	16 (14.5)	81 (73.6)	9 (8.2)	12.2	0.02[a]
	Male (100)	4 (4.0)	35 (35.0)	55 (55.0)	6 (6.0)	-	-
Marital status	Single (140)	14 (9.9)	90 (63.8)	30 (21.3)	6 (5)	5.292	0.1[b]
	Married (70)	4 (5.8)	38 (55.1)	22 (31.9)	6 (7.2)	-	-
Location of residence	On campus (48)	5 (9.8)	34 (66.7)	8 (15.7)	4 (7.8)	4.029	0.3[b]
	Off campus (182)	13 (8.2)	94 (59.1)	44 (27.7)	8 (5)	-	-
Living arrangement	Alone (69)	7 (9.7)	41 (56.9)	17 (23.6)	4 (9.7)	3.98	0.06[b]
	Friend (77)	5 (6.6)	47 (61.8)	21 (27.6)	4 (3.9)	-	-
	Family (64)	6 (9.7)	40 (64.5)	14 (22.6)	4 (3.2)	-	-
Waist to hip ratio (WHR)	Normal	11 (10.1)	80 (73.4)	14 (12.8)	4 (3.7)	3.512	0.02[a]
	At Risk	6 (6.5)	48 (51.6)	36 (38.7)	3 (3.2)	-	-
	Normal	45 (45.0)	34 (30.9)	-	-	-	-
	High	8 (8.0)	18 (16.4)	-	-	-	-

[a]*Significant p-value <0.05   [b]*Significant p-value >0.05

Table 3: Frequency of eating meals (n = 210)

Meal	Male (100)			Female (110)		
	Always (%)	Sometimes (%)	Seldom (%)	Always (%)	Sometimes (%)	Seldom (%)
Breakfast	67.0	23.0	10.0	67.3	25.5	7.4
Lunch	85.0	6.0	9.0	81.8	9.1	9.1
Dinner	69.0	20.0	11.0	47.3	45.5	7.2

Table 4: Relationship between sex and body weight status (BMI) (n = 210)

Variable	Gender		χ^2	p
	Male (100) n (%)	Female (110) n (%)		
Underweight	6 (6.0)	9 (8.2)	12.200	0.007**
Normal	55 (55.0)	81 (73.6)	-	-
Overweight	35 (35.0)	16 (14.5)	-	-
Obese	4 (4.0)	4 (3.6)	-	-

**Significant (p<0.01)

Table 5: Percentage achievement of DRI and percentage of daily intake of the respondents based on 2-day dietary recall (n = 210)

Energy/nutrient	Male (n = 100)	Female (n = 110)		
	DRI%	DRI%	Daily intake (%)	p-value
Energy (Kcal)	62.14	88.11	-	-
Protein (g)	135.90	111.22	13.3	[a]0.000**
Carbohydrate (g)	182.52	176.83	49.4	0.000**
Fat (g)	ND	[b]ND*	37.3	0.000**
Fiber (g)	50.55	78.90	-	0.000**
Vitamin C (mg)	89.48	97.90	-	0.04*
Calcium (mg)	45.70	47.92	-	0.000**

[a]**Significant p-value <0.01, *Significant p-value <0.05
[b]Non-Significant

the unhealthy dietary intake (i.e., a diet high in fat and low in fruits and vegetables) and sedentary lifestyles (Kaplan *et al.*, 2004). The present study showed that carbohydrate and protein intakes of the participants were higher than DRI in both genders. Results also showed that Iranian students in general have increased their fat derived energy intake to 37.3%; while, energy intake from carbohydrate and protein decreased to 49.4 and 13.3%. These findings are to some extent comparable to a Malaysian study in which the intakes of carbohydrate, protein and fat were 59, 14 and 27%, respectively (Mammas *et al.*, 2003). The Iranian studies have also reported that food intake of each Iranian citizen is about 40% more than required amounts. The average Iranians consume 40% more carbohydrates and 30% more fats, than what is needed (Brunt *et al.*, 2008). The

percentage intake of fiber for both sexes was lower than DRI. Similarly, in a study it was found that students consumed less than 15 g of fiber every day (Mirnalini *et al.*, 2008). Also, in this study, the percentage intake of vitamin C and calcium of the male and female students were lower than the DRI. This finding was consistent with the results of another study which found that students consumed less vitamin C and calcium according to the DRI recommendation (Malekzadeh *et al.*, 2005). Many studies have shown that the prevalence of overweight and obesity among youths and adults have increased to epidemic proportions and health care costs related with these conditions have been raised considerably (Tarighat *et al.*, 1999; Poehlman and Horton, 1999; Kimm and Obarzanek, 2002). Moreover, it has been reported that prevalence of abnormal weight

and obesity are increasing (Ogden *et al.*, 2002). In sum, the present study revealed that about 45% of male students and more than 26% of Iranian female students at UPM were underweight or overweight. There were significant associations between BMI and gender, physical activity, dietary intake, body fat, waist and hip circumference and WHR. The findings of this study can provide baseline data for designing nutritional programs to prevent nutritional disorders among Iranian postgraduate students in UPM. The researcher suggests focusing on the factors identified by this study for such programs. The cultural values and attitudes of foreign students might play an important role in the development of students' dietary behaviors and eating disorders. The university authorities, especially the international office, should make a policy intended to ensure involvement of the UPM students in general in physical activities such as moderate and high-intensity walking. The university restaurants would be the next most likely targets of nutritional intervention plans.

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of female respondents had high body fat. The number of steps per day had an opposite relationship with BMI and percentage of body fat. The mean percentage of body fat composition for male and female respondents was (20.9±5.3%) and (30.1±5.5%), respectively based on the classification cutoff point value (Tudor-Lococke *et al.*, 2001). In sum, the present study revealed that about 45% of male students and more than 26% of Iranian female students at UPM were underweight or overweight. There were significant associations between BMI and gender, dietary intake, body fat, waist and hip circumference and WHR. The findings of this study can provide baseline data for designing nutritional programs to prevent nutritional disorders among Iranian postgraduate students in UPM. The researcher suggests focusing on the factors identified by this study for such programs. The cultural values and attitudes of foreign students might play an important role in the development of students' dietary behaviors and eating disorders. The university authorities, especially the international office, should make a policy intended to ensure involvement of the UPM students in general in physical activities such as moderate and high-intensity walking. The university restaurants would be the next most likely targets of nutritional intervention plans.

Conclusions: In sum, the present study revealed that there were significant associations between the BMI and sex, physical activity, dietary intake, body fat, waist and hip circumference and WHR. However, physical activity was the factor most significant for predicting the body weight status of the sample Iranian postgraduate students in UPM. Based on the findings, an increase in physical activity will decrease the body weight status (BMI) among the respondents. The findings of this study can provide baseline data for designing nutritional programs for the prevention and control of obesity among the Iranian postgraduate students in UPM. The researcher suggests for these programs to focus on the factors identified by this study as being significantly associated with obesity among the Iranian postgraduate students in UPM during their postgraduate study time. The cultural values and attitudes of foreign students might also play an important role in the development of their dietary behaviors and eating disorders. The university authorities, especially the international office, should make a policy intended to ensure involvement of the UPM students in general in physical activities like moderate and high-intensity walking, for example. The university restaurants will be the next most likely targets of nutrition intervention plans.

Conflict of interests: The author (s) declare (s) that there is no conflict of interests regarding the publication of this article.

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