Acıbadem Univ. Sağlık Bilim. Derg. 2024; 15 (3)
https://doi.org/10.31067/acusaglik.1410300

ORIGINAL ARTICLE / ARAŞTIRMA YAZISI

Healthcare and Systems / Sağlık Hizmetleri ve Sistemler

Determination of Nutrient Density in Dormitory Menus: Samples of State, Private, and Semi-Private Dormitories

Hatice Merve Bayram[1], **Arda Öztürkcan**[1]

[1] Istanbul Gelişim University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Istanbul, Turkey

Arda ÖZTÜRKCAN
0000-0001-7982-6988

Hatice Merve BAYRAM
0000-0002-7073-2907

Correspondence: Arda Öztürkcan
Istanbul Gelisim University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Istanbul, Turkey
Phone: +90212 422 70 00
E-mail: sozturkcan@gelisim.edu.tr

Received: 27.12.2023
Accepted: 17.02.2024

ABSTRACT

Purpose: This study aimed to evaluate the menus of university dormitories in Istanbul according to nutrient profiling and to determine whether energy and other nutrients meet the needs of students.

Methods: The lunch menus served in winter in three different dormitories (state, private, and semi- private) in Istanbul were examined according to the nutrient profiling (Nutrient Rich Foods NRF9.3 and 15.3 indexes). The energy and nutrient contents of the menus were compared with national and international references values according to the Turkey Nutrition Guide-2022.

Results: The highest NRF9.3 ve 15.3 score was found in private dormitory menus (70.99 ± 47.80, 75.50 ± 52.40), followed by state dormitory menus (63.80 ± 23.71, 67.09 ± 23.73) and semi-private dormitory menus (58.79 ± 38.32, 62.51 ± 41.62). There were no statistically significant differences for NRF9.3 and 15.3 scores between the dormitory menus. Additionally, total fat, saturated fat, and sodium contents were higher in the menus of dormitories, especially state dormitories menus. A significant difference was found between the menus of state and semi-private dormitories for total fat, and saturated fat (p:0.003, p: 0.015), whereas a statistical difference was found between state and private dormitories for sodium (p: 0.007).

Conclusion: Considering the high sodium, total and saturated fat contents of dormitory menus, the standard recipes applied should be improved in terms of salt and fat contents. Therefore, it is of great importance that menus are prepared by dietitians who have been trained in this field and have sufficient knowledge, skills, and equipment.

Keywords: Nutrient profiling; Food service; Menu; University students; Student dormitories.

ÖZET

Amaç: Bu çalışmanın amacı, İstanbul'daki üniversite yurtlarının menülerini besin ögesi profiline göre değerlendirmek ve enerji ve diğer besin öğelerinin öğrencilerin ihtiyaçlarını karşılayıp karşılamadığını belirlemektir.

Yöntemler: İstanbul'daki üç farklı yurtta (devlet, özel ve yarı özel) kış aylarında sunulan öğle yemeği menüleri besin profili (Nutrient Rich Foods Index NRF9.3 ve 15.3) açısından incelenmiştir. Menülerin enerji ve besin öğesi içerikleri, Türkiye Beslenme Rehberi-2022'ye göre ulusal ve uluslararası referans değerlerle karşılaştırılmıştır.

Bulgular: En yüksek NRF9.3 ve 15.3 puanı özel yurt menülerinde (70.99 ± 47.80, 75.50 ± 52.40) bulunurken, bunu devlet yurdu menüleri (63.80 ± 23.71, 67.09 ± 23.73) ve yarı özel yurt menüleri (58.79 ± 38.32, 62.51 ± 41.62) izlemiştir. NRF9.3 ve 15.3 puanları açısından yurt menüleri arasında istatistiksel olarak anlamlı bir fark bulunmamıştır. Ayrıca, toplam yağ, doymuş yağ ve sodyum içerikleri yurt menülerinde, özellikle de devlet yurdu menülerinde daha yüksektir. Toplam yağ ve doymuş yağ açısından devlet ve yarı özel yurt menüleri arasında anlamlı bir fark bulunurken (p: 0.003, p: 0.015), sodyum açısından devlet ve özel yurtlar arasında istatistiksel bir fark bulunmuştur (p: 0.007).

Sonuç: Yurt menülerinin yüksek sodyum, toplam ve doymuş yağ içerikleri göz önünde bulundurulduğunda, uygulanan standart reçetelerin tuz ve yağ içerikleri açısından iyileştirilmesi gerekmektedir. Bu nedenle menülerin bu alanda eğitim almış, yeterli bilgi, beceri ve donanıma sahip diyetisyenler tarafından hazırlanması büyük önem taşımaktadır.

Anahtar Kelimeler: Besin profili; Yemek servisi; Menü; Üniversite öğrencileri; Öğrenci yurtları.

Nutrition is the behaviour of using sufficient nutrients and bioactive compounds needed by the body to maintain and improve health and quality of life. One of the protective factors that play a role in minimising diet-related health problems is an adequate and balanced diet (1).

Youth is a stage of transition from childhood to adulthood, with rapid changes in physical growth, psychosocial development and behavioural changes. Habits, including eating habits, adopted at this age can last a lifetime (2). The need for energy and nutrients increases during these periods when growth and development accelerates, the individual develops mentally and gains gender characteristics (3). In terms of nutrition, as in many other areas, university life, the transition from adolescence to adulthood, marks the beginning of a new phase in young people's lives (4). Therefore, university students are among the risk groups in terms of adequate and balanced nutrition problems. In this period, newly established friendships, economic problems, and accommodation conditions bring unhealthy and irregular eating habits. Inadequate and unbalanced nutritional habits increase the risk of many diseases in adulthood (4,5).

Studies conducted on university students have shown that students frequently skip meals (4,6-8), are malnourished due to economic difficulties (4,7,9), and take inadequate fluids (10). Additionally, it has been reported that students living in dormitories cannot have adequate and balanced nutrition due to dormitory conditions (8,11).

Poor dietary patterns and inadequate intake of nutrients may lead to problems later on in life such as non-communicable diseases (NCDs), as well as osteoporosis, sexual maturation delays, etc. (12,13). Nutrient profiling methods are systems for rating the healthfulness of a food, menu, or diet quality (14). A nutrient-dense food is defined as a food that contains more nutrients than the energy it provides. The method of calculating the nutrient density of each food is known as nutrient density measures (15). Nutrient Rich Foods (NRF) index is a validated international measure that reflects diet quality by measuring nutrient density through a nutrient density measure (16). NRF index scores positively correlate with the 2005 Healthy Eating Index (HEI), a diet quality scale developed by the United States Department of Agriculture (USDA). Five different versions of the NRF index have been published, namely NRF6.3, 9.3, 10.3, 11.3, and 15.3 (17,18). The main difference between these versions is the number of "nutrients to be promoted" that are considered. The number of 'nutrients to promote' is indicated by the first number in the index names (i.e. 6, 9, 10, 11, and 15) (18). It has been shown that the NFR9.3 index scores gives consistent results in the evaluation of menus and is a suitable model for menu evaluations according to a Turkey study (14). The NRF9.3 index score has the highest correlation with the HEI score (17), and the NRF15.3 index score includes all the nutrients of public health concern, such as calcium, potassium, fiber, and vitamin D (19).

The energy and nutrient contents of the menus served in student dormitories are among the important factors affecting the cognitive performance and health status. To the best of our knowledge, there is no study in the literature evaluating the nutrient profiling of menus served in different student dormitories. Therefore, this study aimed to evaluate the menus of university dormitories in Istanbul according to the nutrient profiling and to determine whether energy and other nutrients meet the needs of students.

Methods

This study evaluated the lunch menus of three different dormitories, namely private, semi-private and state dormitories serving university students in Avcılar, Istanbul, which produce traditional cuisine in December 2023.

Determination of Energy and Nutrient Content of Menus

The energy and nutrient contents (protein, carbohydrate, fat, saturated fatty acids, cholesterol, omega-3, omega-6, polyunsaturated fatty acids, fiber, added sugar, vitamins A, D, E, K, B_1, B_2, B_5, B_6, B_{12} and C, niacin, biotin, folic acid, sodium, potassium, calcium, magnesium, iron, zinc, selenium, copper, phosphorus, iron, zinc, selenium, magnesium, iron, zinc, selenium, selenium, copper, phosphorus) were determined using standardized recipes used in public nutrition services (20). According to these recipes, the contents of the nutrients in the meals included in the menus were calculated with the Nutrition Information System (BEBIS) 9 program. Energy and nutrient calculations included 1 roll white bread (50 grams) and the amount of salt used in the meals.

Determination of Menus in terms of Meeting Requirements

In the evaluation of the adequacy of the menus to meet the daily energy and nutrient requirements of students, daily mean energy, protein, carbohydrate, saturated fat, cholesterol, fiber, vitamins A, D, E, K, B_1, B_2, B_5, B_6, B_{12}, C, niacin, biotin, folic acid, sodium, potassium, calcium, magnesium, iron, zinc, selenium and copper for requirement quantities (1), The amounts of saturated fatty acids and added sugars were obtained from the European Food Safety Authority (EFSA), and the amounts of soluble and

insoluble fiber were obtained from the U.S. Food and Drug Administration (FDA) (21,22). As the dormitories provide a single meal service, it was considered sufficient for the contents of the menus to meet 2/5 of the reference values determined for men and women aged 19-24, moderate active group (14).

Determination of Menus According to Nutrient Profiling Models

NRF9.3 and 15.3 indexes were used to determine the nutrient density of menus since NRF9.3 index scores have the highest correlation with the HEI-2005, a diet quality scale developed by the USDA (17), and NRF15.3 includes all nutrients of public health concern (calcium, potassium, fiber, and vitamin D) (19).

NRF9.3 index was developed by Drewnowski et al. (23). NRF9.3 is based on a scoring system. It ranks foods according to their nutrient content. The NRF9.3 index includes protein, fiber, calcium, iron, magnesium, potassium and vitamins A, C, and E as positive nutrients, whereas saturated fat, added sugar, and sodium are considered negative nutrients, per 100 kcal or serving size of food (23).

NRF15.3 index has a similar list of nutrients, but includes some additional nutrients (monounsaturated fat, vitamin D, thiamin, riboflavin, B_{12} and folate) and excludes magnesium (17). Saturated fat, added sugar and sodium are the same for all NRF indices and are nutrients that should be limited (15).

NRF index scores were calculated per 100 kcal of food (15). High scores indicate high nutrient density and low scores indicate poor nutrient density. The requirements determined for Turkey for males and females aged 19-24 years in the moderately active group were used as the reference for the mean daily requirements of the nutrients used to calculate the NRF scores (1). The EFSA values were used as the reference for saturated fat, and added sugar (21), and FDA values were used as the reference for soluble, and insoluble fiber (22).

Statistical Analysis

Data were analyzed using SPSS 24.0. The normality of the data was evaluated with the Kolmogorov-Smirnov test. ANOVA test was used in the statistical evaluation of the difference between the dormitories in the energy, nutrients, and NRF scores of the menus, and the difference between the groups was determined by the Tukey test. A value of $p<0.05$ was considered statistically significant.

Results

The mean percentage of energy from macronutrients in the lunch menus of the dormitories is given in Figure 1. The percentage of energy from carbohydrates was 50% in semi-private dormitory, 46% in private dormitory and 42% in state dormitory. Proteins accounted for 16%, 16% and 15% of energy, respectively. The percentages of fats were 34%, 38%, and 43%, respectively.

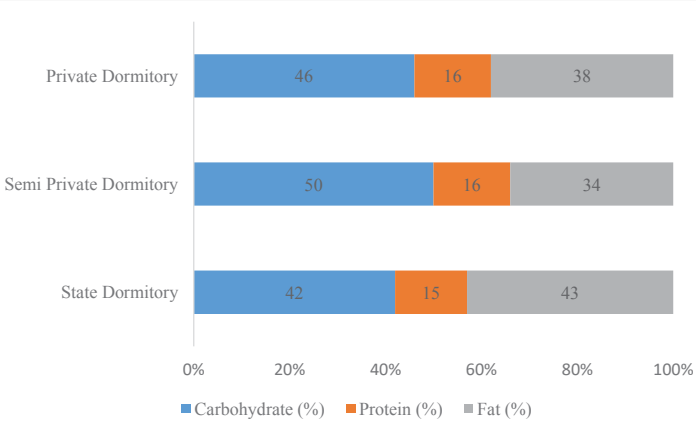

Figure 1: Percentage of mean energy from macronutrients in the lunch menus of different dormitories

Table 1 shows the NRF9.3, NRF15.3 scores, and mean energy and nutrient values of menus. The highest NRF9.3 score was found in private dormitory menus (70.99 ± 47.80), followed by state dormitory menus (63.80 ± 23.71) and semi-private dormitory menus (58.79 ± 38.32). There was no statistically significant difference between the NRF9.3 scores of the dormitory menus (p: 0.461). Similarly, NRF15.3 scores were highest in private dormitory menus (75.50 ± 52.40), followed by state dormitory menus (67.09 ± 23.73) and semi-private dormitory menus (62.51 ± 41.62); and there were no statistical differences (p: 0.468). According to the energy and macronutrient values, the carbohydrate percentages, fat amounts and percentages, and saturated fat amounts were statistically different between semi-private and state dormitory menus (p: 0.003, p: 0.004, p< 0.001, and p: 0.015, respectively). Additionally, the saturated fat percentages and monounsaturated fatty acids amounts were significantly different between the menus of state dormitories and private and semi-private dormitories (p: 0.004, and p< 0.001, respectively). Furthermore, vitamin B_1 and magnesium were significantly different between state and semi-private dormitory menus (p: 0.015, and p: 0.031), whereas sodium and copper were significantly different between state and private dormitory menus (p: 0.007, and p: 0.041).

Table 1: NRF9.3, NRF15.3, and mean energy and nutrient values of menus

	State Dormitory	Private Dormitory	Semi Private Dormitory	p-value†
NFR9.3	63.80 ± 23.71	70.99± 47.80	58.79 ± 38.32	0.461
NRF15.3	67.09 ± 23.73	75.50 ± 52.40	62.51 ± 41.62	0.468
Energy and Macronutrients				
Energy (kcal)	1075.78 ± 217.89	1074.72 ± 169.12	1062.18 ± 121.12	0.945
Protein (g)	38.30 ± 10.27	42.24 ± 10.81	41.24 ± 10.62	0.342
Protein (%)	14.75 ± 3.75	16.22 ± 3.75	15.86 ± 3.72	0.299
Carbohydrate (g)	111.42 ± 36.50	121.90 ± 33.88	128.61 ± 27.14	0.138
Carbohydrate (%)	41.96 ± 7.96[a]	46.16 ± 7.87	49.63 ± 8.68[a]	**0.003***
Fat (g)	52.19 ± 13.27[a]	45.33 ± 11.70	41.34 ± 11.50[a]	**0.004***
Fat (%)	43.39 ± 8.53[a]	37.61 ± 7.88	34.53 ± 7.89[a]	**<0.001****
Saturated fatty acids (g)	15.97 ± 5.80[a]	12.79 ± 4.15	12.12 ± 5.74[a]	**0.015***
Saturated fatty acids (%)†††	13.28 ± 3.98[a,b]	10.77 ± 3.22[b]	10.10 ± 3.85[a]	**0.004***
Omega-3 (g)	0.84 ± 0.98	0.61 ± 0.30	0.69 ± 0.54	0.397
Omega-3 (%)†††	0.64 ± 0.82	0.45 ± 0.50	0.40 ± 0.62	0.343
Omega-6 (g)	13.36 ± 5.57	13.50 ± 5.42	11.69 ± 5.00	0.348
Omega-6 (%)†††	11.10 ± 4.18	11.22 ± 4.11	9.93 ± 4.00	0.406
Polyunsaturated fatty acids (g)	14.37 ± 5.57	14.28 ± 5.41	12.56 ± 5.32	0.355
Monounsaturated fatty acids (g)	16.63 ± 5.02[a,b]	13.34 ± 3.04[b]	12.51 ± 3.49[a]	**<0.001****
Cholesterol (g)	129.01 ± 55.33	121.19 ± 64.23	98.67 ± 78.83	0.204
Fiber (g)	11.13 ± 4.01	14.09 ± 7.21	14.66 ± 6.53	0.069
Soluble fiber (g)	4.11 ± 1.47	5.10 ± 3.05	5.16 ± 3.03	0.248
Insoluble fiber (g)	7.18 ± 2.81	8.68 ± 4.69	9.00 ± 3.76	0.170
Added sugar (g)	14.58 ± 26.14	11.49 ± 18.16	10.88 ± 14.56	0.755
Added sugar (%)††††	4.59 ± 7.09	3.70 ± 5.03	3.95 ± 4.98	0.833
Vitamins				
Vitamin A (mcg)	593.77 ± 426.29	1612.83 ± 4449.27	1039.76 ± 3252.36	0.483
Vitamin D (mcg)	1.09 ± 1.84	1.20 ± 4.12	0.54 ± 0.87	0.600
Vitamin E (mg)	17.17 ± 7.19	16.67 ± 6.53	14.35 ± 5.55	0.206
Vitamin K (mcg)	89.85 ± 155.47	65.07 ± 108.54	57.62 ± 78.49	0.554
Vitamin B_1 (mg)	0.48 ± 0.11[a]	0.57 ± 0.21	0.61 ± 0.18[a]	**0.015***
Vitamin B_2 (mg)	0.61 ± 0.28	0.79 ± 0.90	0.68 ± 0.59	0.567
Niasin (mg)	16.28 ± 7.43	19.13 ± 11.25	17.33 ± 6.48	0.445
Vitamin B_5 (mg)	2.68 ± 1.15	3.58 ± 3.84	3.22 ± 1.59	0.398
Vitamin B_6 (mg)	0.85 ± 0.34	0.92 ± 0.31	0.92 ± 0.21	0.594
Biotin (mcg)	19.52 ± 9.15	30.64 ± 36.89	23.64 ± 19.77	0.232
Folic acid (mcg)	152.17 ± 61.29	199.44 ± 151.59	200.98 ± 125.95	0.224
Vitamin B_{12} (mcg)	3.05 ± 2.14	7.08 ± 15.58	4.81 ± 11.66	0.404
Vitamin C (mg)	68.11 ± 44.47	62.88 ± 48.34	70.86 ± 58.33	0.824
Minerals				
Sodium (mg)††	1892.82 ± 594.41[b]	1511.93 ± 228.68[b]	1651.61 ± 483.06	**0.007***
Potassium (mg)	1426.13 ± 455.96	1544.34 ± 748.81	1490.42 ± 369.95	0.716
Calcium (mg)	256.19 ± 132.75	195.94 ± 82.17	245.90 ± 113.75	0.084
Magnesium (mg)	135.36 ± 42.85[a]	158.80 ± 54.47	168.14 ± 44.28[a]	**0.031***
Iron (mg)	5.63 ± 2.24	7.12 ± 2.91	6.88 ± 2.22	0.056
Zinc (mg)	5.59 ± 2.44	6.90 ± 1.82	6.88 ± 3.13	0.084
Selenium (mg)	2.40 ± 3.18	4.06 ± 3.66	3.06 ± 4.20	0.232
Copper (mg)	0.67 ± 0.23[b]	1.11 ± 0.97[b]	0.99 ± 0.56	**0.041***
Phosphorus (mg)	539.19 ± 142.45	616.90 ± 256.95	615.38 ± 148.59	0.220

*†One-way ANOVA, and posthoc TUKEY were used. ††Including sodium from salt added to food. *p<0.05, **p<0.01. Different letters (a-c) in the same row are statistically different from each other (p<0.05). †††1 g fat = 9 kcal, †††† Calculated as 1 g sugar = 4 kcal.*

The percentages of the mean energy and nutrient contents of the menus meeting the mean daily requirements for men and women are given in Table 2. All dormitory menus meet more than 2/5 of the energy and macronutrient requirements for both genders. Vitamin D, potassium, calcium and selenium were below 2/5 of the requirements for both genders in all dormitory menus. Insoluble fiber were below the requirement for both genders in the state dormitory menus (94.53 ± 37.08%). Zinc was below the requirement in state dormitory menus only in men (85.85 ± 37.44%).

Table 2: Percentage of men and women meeting the mean daily energy and nutrient requirements of menus

Energy and nutrients	Gender	Daily mean requirement	Amount to be covered at the dormitory	State Dormitory	Private Dormitory	Semi Private Dormitory
Energy (kcal)	**Male**	2600	1040	103.44 ± 20.95	103.34 ± 16.26	102.13 ± 11.65
	Female	1800	720	149.41 ± 30.26	149.27 ± 23.49	147.53 ± 16.82
Protein (g)	**Male**	63.1	25.2	151.39 ± 40.60	166.97 ± 42.75	163.66 ± 42.16
	Female	55.2	22.1	173.31 ± 46.48	191.14 ± 48.94	186.62 ± 48.07
Carbohydrate (g)	**Male**	130	52	214.28 ± 70.20	234.43 ± 65.16	247.34 ± 52.19
	Female	130	52	218.28 ± 70.20	234.43 ± 65.16	247.34 ± 52.19
Fat (g)	**Male**	82.7	33.1	157.70 ± 40.10	136.97 ± 35.37	124.91 ± 34.77
	Female	66.1	26.4	197.72 ± 50.27	171.73 ± 44.35	156.61 ± 43.60
Saturated fatty acids (g)	**Male**	20	8	199.71 ± 72.50	159.97 ± 51.92	151.60 ± 71.85
	Female	20	8	199.71 ± 72.50	159.97 ± 51.92	151.60 ± 71.85
Cholesterol (g)	**Male**	300	120	107.51 ± 46.11	100.99 ± 53.53	82.23 ± 65.60
	Female	300	120	107.51 ± 46.11	100.99 ± 53.53	82.23 ± 65.70
Fiber (g)	**Male**	25	10	111.30 ± 40.10	140.92 ± 72.10	146.65 ± 65.38
	Female	25	10	111.30 ± 40.10	140.92 ± 72.10	146.65 ± 65.38
Soluble fiber (g)	**Male**	6	2.4	171.56 ± 61.40	212.69 ± 127.20	215.31 ± 126.50
	Female	6	2.4	171.56 ± 61.40	212.69 ± 127.20	215.31 ± 126.50
Insoluble fiber (g)	**Male**	19	7.6	94.53 ± 37.08	114.30 ± 61.83	118.46 ± 49.59
	Female	19	7.6	94.53 ± 37.08	114.30 ± 61.83	118.46 ± 49.59
Added sugar (g)	**Male**	50	20	72.91 ± 130.73	57.47 ± 90.81	54.43 ± 72.82
	Female	50	20	72.91 ± 130.73	57.47 ± 90.81	54.43 ± 72.82
Vitamin A (mcg)	**Male**	750	300	197.93 ± 142.10	537.61 ± 1483.09	346.59 ± 1084.12
	Female	650	260	228.38 ± 162.96	537.61 ± 1483.09	346.59 ± 1084.12
Vitamin D (mcg)	**Male**	15	6	18.26 ± 30.83	20.10 ± 68.73	9.13 ± 14.59
	Female	15	6	18.26 ± 30.83	20.10 ± 68.73	9.13 ± 14.59
Vitamin E (mg)	**Male**	13	5.2	330.23 ± 128.30	320.63 ± 125.60	275.98 ± 106.89
	Female	11	4.4	390.27 ± 163.45	378.92 ± 148.44	326.16 ± 126.32
Vitamin K (mcg)	**Male**	120	48	187.20 ± 323.91	135.57 ± 226.14	120.05 ± 163.53
	Female	90	36	249.60 ± 431.88	180.75 ± 301.51	160.07 ± 218.03
Vitamin B_1 (mg)	**Male**	1.2	0.48	100.00 ± 24.33	118.95 ± 44.02	128.47 ± 39.25
	Female	1.1	0.44	109.09 ± 26.54	129.77 ± 48.02	140.15 ± 42.85
Vitamin B_2 (mg)	**Male**	1.3	0.52	118.27 ± 54.81	152.98 ± 173.98	131.41 ± 115.08
	Female	1.1	0.44	139.77 ± 64.77	180.79 ± 205.59	155.30 ± 136.00
Niacin (mg)	**Male**	6.7	2.68	607.62 ± 277.40	714.09 ± 419.93	646.94 ± 94
	Female	6.7	2.68	607.62 ± 277.40	714.09 ± 419.93	646.94 ± 94
Vitamin B_5 (mg)	**Male**	5	2	134.23 ± 57.75	179.19 ± 192.45	161.25 ± 79.63
	Female	5	2	134.23 ± 57.75	179.19 ± 192.45	161.25 ± 79.63
Vitamin B_6 (mg)	**Male**	1.3	0.52	164.63 ± 65.73	177.61 ± 61.09	178.14 ± 40.62
	Female	1.3	0.52	164.63 ± 65.73	177.61 ± 61.09	178.14 ± 40.62
Biotin (mcg)	**Male**	40	16	122.03 ± 57.24	191.56 ± 230.58	147.77 ± 123.57
	Female	40	16	122.03 ± 57.24	191.56 ± 230.58	147.77 ± 123.57
Folic acids (mcg)	**Male**	330	132	115.29 ± 50.27	151.09 ± 114.85	152.26 ± 95.42
	Female	330	132	115.29 ± 50.27	151.09 ± 114.85	152.26 ± 95.42
Vitamin B_{12} (mcg)	**Male**	4	1.6	190.83 ± 133.99	443.00 ± 974.15	300.77 ± 728.97

	Female	4	1.6	190.83 ± 133.99	443.00 ± 974.15	300.77 ± 728.97
Vitamin C (mg)	**Male**	110	44	154.80 ± 101.08	142.91 ± 109.87	161.05 ± 132.58
	Female	95	38	176.24 ± 117.04	165.48 ± 127.21	186.47 ± 153.51
Sodium (mg)	**Male**	2300	920	205.05 ± 64.61	195.65 ± 24.86	180.83 ± 51.52
	Female	2300	920	205.05 ± 64.61	195.65 ± 24.86	180.83 ± 52.51
Potassium (mg)	**Male**	4700	1880	79.23 ± 25.33	85.80 ± 41.60	82.80 ± 20.55
	Female	4700	1880	79.23 ± 25.33	85.80 ± 41.60	82.80 ± 20.55
Calcium (mg)	**Male**	1000	400	64.05 ± 33.19	48.99 ± 20.54	61.48 ± 28.44
	Female	1000	400	64.05 ± 33.19	48.99 ± 20.54	61.48 ± 28.44
Magnesium (mg)	**Male**	350	140	96.69 ± 30.61	113.43 ± 38.91	120.10 ± 31.63
	Female	300	120	112.80 ± 35.71	113.43 ± 38.91	140.12 ± 36.90
Iron (mg)	**Male**	11	4.4	128.00 ± 51.13	161.95 ± 66.31	156.48 ± 50.50
	Female	16	4.4	128.00 ± 51.13	161.95 ± 66.31	156.48 ± 50.50
Zinc (mg)*	**Male**	16.3	6.52	85.85 ± 37.44	105.95 ± 27.99	105.62 ± 48.15
	Female	12.7	5.08	110.19 ± 48.06	135.99 ± 35.92	135.56 ± 61.80
Selenium (mcg)	**Male**	70	28	8.61 ± 11.39	14.51 ± 13.10	10.95 ± 15.00
	Female	70	28	8.61 ± 11.39	14.51 ± 13.10	10.95 ± 15.00
Copper (mg)	**Male**	1.6	0.64	105.47 ± 36.15	174.70 ± 152.20	154.74 ± 88.34
	Female	1.3	0.52	129.81 ± 44.50	215.01 ± 187.23	190.45 ± 108.72
Phosphorus (mg)	**Male**	550	220	245.09 ± 64.75	280.41 ± 116.80	279.72 ± 67.54
	Female	550	220	245.09 ± 64.75	280.41 ± 116.80	279.72 ± 67.54

The values given in the table are the Mean±Standard deviation values of the percentages of meeting the mean daily requirements. The mean daily energy, protein, carbohydrate, fat, cholesterol, fiber, vitamins A, D, E, K, B_1, B_2, B_5, B_6, B_{12}, niacin, biotin, folic acid, sodium, potassium, calcium, magnesium, iron, zinc, Selenium, copper and phosphorus requirements were taken from TUBER-2022 (19-24 years old, moderately active group requirements) (1), saturated fatty acids and added sugars from EFSA (21), soluble and insoluble fiber from FDA (22).
** Based on a mixed diet containing 600 mg phytate (1)*

Discussion

At all ages, especially during adolescence, nutrition is crucial (13,24). Nutrient profiling methods have been shown to be an objective, science-based tool for the evaluation and labelling of menus (14,25). In this study we determined the NRF9.3 and 15.3 scores, and energy, macro and micronutrient contents of state, private and semi-private dormitories. According to our results, the highest NRF9.3 and NRF15.3 scores were found in private dormitory menus, followed by state dormitory menus, and semi-private dormitory menus. There was no statistically significant difference for NRF9.3 and NRF15.3 scores for dormitory menus. Furthermore, the energy, macronurients, and most micronutrients amounts of the lunch menus of state, private, and semi-private dormitories met the needs of both genders. Additionally, total fat, saturated fat, and sodium contents were higher in all dormitory menus, especially state dormitories.

The nutrient profiling methods should fully reflect the nutrient pattern of foods, meals and a total diet (25). NRF score can be a helpful tool for consumers to make healthier food choices and improve diet quality. Vegetables, fruits, milk, and dairy products contribute to a high NRF score, while ultra-processed foods, cakes, cookies, pastries, and desserts contribute to a low NRF score (26,27). In a study conducted in Turkey, the highest NRF9.3 index score was found in public institution menus (85.7 ± 18.9), followed by semi-private institution menus (73.8 ± 8.8) and the lowest in private institution menus (38.6 ± 16.6) and a statistical difference was found (28). In another study in which one-month menus served in the cafeterias of 3 private and 2 public universities providing mass catering services in Ankara, NRF9.3 index scores were higher in public universities, with a mean of 16.50 ± 7.17 and 19.79 ± 7.54, respectively, while 16.30 ± 4.03, 16.26 ± 5.79 and 12.28 ± 9.00 were found in private universities (14). In this study, NRF9.3 and 15.3 index scores were highest in private dormitory menus (70.99 ± 47.80 and 75.50 ± 52.40), followed by state dormitory menus (63.80 ± 23.71 and 67.09 ± 23.73) and semi-private dormitory menus (58.79 ± 38.32 and 62.51 ± 41.62). The results emphasize that menus in mass nutrition systems should improve nutrition and health and the importance of dieticians.

Adequate nutrition, particularly in adolescent years, is critical for rapid physiological growth and development as well as for laying the foundation for good health in later years (13). Poor diet is one of the largest contributors to the global burden of NCDs and is recognized as a major modifiable risk factor for chronic disease (24). In a study evaluating the lunch menus of 5 university cafeterias over

one month, it was observed that all menus met the energy needs of female students, while only two menus met the energy needs of male students. It was also reported that the mean total fat content and percentages were high, the mean fiber content was low, and the menus were inadequate in terms of composition (14). In another study, no difference was observed between the energy contents of the menus of state, private, and semi-private institutions, and it was found that the daily requirement was met in both genders. While the menus served in these institutions generally met the energy and nutrient requirements, total fat, saturated fatty acids, and sodium contents of the menus were found to be above the recommendations (28). Similarly, we found that the energy, macronutrients, and most micronutrients of the lunch menus of state, private, and semi-private dormitories met the needs of both genders. Additionally, total fat, saturated fat, and sodium contents were higher in all dormitory menus, especially state dormitories, and a significant difference was found between the menus. This may be due to the high fat and salt content of the standard recipes used in mass nutrition systems (28).

High sugar consumption is associated with NCDs as well as dental caries. The World Health Organization (WHO) strongly recommends that free sugars should be consumed sparingly throughout life and that dietary consumption of free sugars should be less than 10% of total energy intake in children and adults. WHO further recommends that sugar consumption should be reduced to less than 5% of energy if possible (29). In our country, a guideline was published in 2021 to reduce sugar consumption. These guideline recommendations are similar to WHO, and it is recommended that the energy from sugar should not exceed 10% of daily energy and should be below 5% (30). It was reported that the sugar content in the menus of state, private, and semi-private institutions was above 5%. The reason for this was attributed to the frequent use of carbonated drinks, ready-made fruit juices, and desserts in institutions (28). In this study, the ratio of sugar to energy in the menus of all dormitories was below 5%. When the menus were analyzed, it was found that the frequency of desserts was quite low, no ready-to-drink beverage other than ayran was provided, and the menus were prepared under the supervision of a dietician.

Conclusion

University life is the beginning of a new period in the lives of young people in terms of nutrition, as in many areas. Since it plays an important role in contributing to the adequate and balanced nutrition of adolescents in this period, the menus offered in public nutrition systems should be of high dietary quality to meet the energy and nutrient requirements of this age group. Considering the high sodium and total and saturated fat contents of dormitory menus, the standard tariffs applied should be improved in terms of salt and fat contents. Therefore, it is of great importance that menus are prepared by dieticians who have been trained in this field and have sufficient knowledge, skills, and equipment.

Declarations

Ethical Statement

The ethics committee of Istanbul Gelisim University Non-Interventional Clinical Research Ethics Committee [Number:2023-09, date: 20.11.2023] approved the study, which followed the principles of the Declaration of Helsinki.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Disclosures of Financial or Other Potential Conflicts of Interest

None.

Acknowledgements

None.

Authors Contribution

HMB: Study design, data collection, analysis of data, literature search, wring of the manuscript.

AÖ: Study design, literature search, editing of the manuscript.

References

1. Republic of Turkiye Ministry of Health General Directorate of Public Health. Türkiye Beslenme Rehberi. Publication No: 1031, Ankara; 2022.
2. Peltzer K, Pengpid S, Samuels TA, et al. Prevalence of overweight/obesity and its associated factors among university students from 22 countries. Int J Environ Res Public Health. 2014;11:7425–7441. DOI: 10.3390/ijerph110707425.
3. Kalkan I. The impact of nutrition literacy on the food habits among young adults in Turkey. Nut Res Pract. 2019;13(4):352-357. DOI: 10.4162/nrp.2019.13.4.352.
4. Ermiş E, Doğan E, Erilli NA, et al. An examination of nutritional habits of university students: the model of Ondokuz Mayis University. Spor ve Performans Araştırmaları Dergisi. 2015;6(1):30-40. DOI: 10.17155/spd.67561.

5. Kürklü NS, Aloğlu B, Ünal E, et al. The relationship of housing status, nutritional habits and food consumption with constipation in university students. Karya Journal of Health Science. 2023;4(2):121-126. DOI: 10.52831/kjhs.1294058.
6. Arslan SA, Daşkapan A and Çakır B. Üniversite öğrencilerinin beslenme ve fiziksel aktivite alışkanlıklarının belirlenmesi. TAF Prev Med Bull. 2016;15(3):171-180
7. Kabir A, Miah S and Islam A. Factors influencing eating behavior and dietary intake among resident students in a public university in Bangladesh: A qualitative study. PLoS One. 2018;13(6):e0198801. DOI: 10.1371/journal.pone.0198801.
8. Köybaşı GB. Bir yurtta kalan üniversiteli kız öğrencilerin uyku kalitesi, depresyon ve beslenme durumunun incelenmesi. Yüksek Lisans Tezi. Hasan Kalyoncu Üniversitesi Sağlık Bilimleri Enstitüsü, Beslenme ve Diyetetik Anabilim Dalı, Gaziantep; 2020.
9. Doğan H and Akçalı G. An analysis on socio-economic problems of University Students. Üniversite Araştırmaları Dergisi. 2021;4(3):309-316. DOI: 10.26701/uad.903559.
10. Kalkan İ, Pehlivan M, Andaç Öztürk S, et al. Evaluation of nutritional habits and physical activity level of first year nutrition and dietetics students at Istanbul Aydin University. Aydın Sağlık Dergisi. 2018;4(1):45-60
11. Yaman ZA and Ünal E. Evaluation of the nutritional knowledge level and the frequency of obesity/overweight of university students living in dormitories afiliated to The Ministry of Youth and Sports in Bolu city center. Estüdam Halk Sağlığı Dergisi. 2021;6(3):296-309. DOI: 10.35232/estudamhsd.929986.
12. Cena H, Porri D, De Giuseppe R, et al. How healthy are health-related behaviors in university students: The HOLISTic Study. Nutrients. 2021;13(2):675. DOI: 10.3390/nu13020675.
13. Heslin AM and McNulty B. Adolescent nutrition and health: Characteristics, risk factors and opportunities of an overlooked life stage. Proc Nutr Soc. 2023;82(2):142-156. DOI: 10.1017/S0029665123002689.
14. Dikmen D and Pekcan G. Nutrient Profiling: Evaluation of Menus Served in Institutional Food Service Systems. Bes Diy Derg. 2013;41(3):234-241.
15. Drewnowski A. Defining Nutrient Density: Development and Validation of the Nutrient Rich Foods Index. J Am Coll Nutr. 2009;28(4):421S-426S. DOI: 10.1080/07315724.2009.10718106.
16. Katz DL, Njike VY, Faridi Z, et al. The stratification of foods on the basis of overall nutritional quality: the overall nutritional quality index. Am J Health Promot. 2009;24: 133-143. DOI: 10.4278/ajhp.080930-QUAN-224.
17. Fulgoni VL, Keast DR and Drewnowski A. Development and validation of the nutrient-rich foods index: a tool to measure nutritional quality of foods. J Nutr. 2009;139:1549–1554. DOI: 10.3945/jn.108.101360.
18. Hess J, Rao G and Slavin J. The Nutrient Density of Snacks. Glob Pediatr Heal. 2017;4: 2333794X17698525. DOI: 10.1177/2333794X17698525.
19. U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015–20 Dietary guidelines for Americans. Washington, DC: U.S. Government Printing Office; 2015.
20. Merdol T. Standart Yemek Tarifeleri. Hatipoğlu Yayınları: Ankara; 2020.
21. EFSA. European Food Safety Authority. Review of labelling reference intake values-Scientific Opinion of the Panel on Dietetic Products, Nutrition and Allergies on a request from the Commission related to the review of labelling reference intake values for selected nutritional elements. EFSA J. 2009;1008:1-14. DOI: 10.2903/j.efsa.2009.1008.
22. U.S. Food and Drug Administration (2023). Food Labeling. [Cited: December 23, 2023]. https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/cfrsearch.cfm?fr=101.
23. Drewnowski A. Concept of a nutritious food: toward a nutrient density score. Am J Clin Nutr. 2005;82(4):721-732. DOI: 10.1093/ajcn/82.4.721.
24. Green R, Sutherland J, Dangour AD, et al. Global dietary quality, undernutrition and non-communicable disease: a longitudinal modelling study. BMJ Open. 2016;6(1):e009331. DOI: 10.1136/bmjopen-2015-009331.
25. Roodenburg AJ, Schlatmann A, Dötsch-Klerk M, et al. Potential effects of nutrient profiles on nutrient intakes in the Netherlands, Greece, Spain, USA, Israel, China and South-Africa. PLoS One. 2011;6(2):e14721. DOI: 10.1371/journal.pone.0014721.
26. Hess JM and Slavin JL. Healthy snacks: using nutrient profiling to evaluate the nutrient-density of common snacks in the United States. J Food Sci. 2017;82(9):2213-2220. DOI: 10.1111/1750-3841.13819.
27. Gupta S, Hawk T, Aggarwal A, et al. Characterizing ultra-processed foods by energy density, nutrient density, and cost. Front Nutr. 2019;6:70. DOI: 10.3389/fnut.2019.00070.
28. Sevim S, Gümüş D, Topal GG, et al. Evaluation of the Menus of Food Service Systems of Different Institutions During COVID-19 Pandemic. Bes Diy Derg. 2021;49(3):7-18. DOI: 10.33076/2021.BDD.1484.
29. World Health Organization. Guideline: sugars intake for adults and children, 2015.
30. Republic of Turkiye Ministry of Health General Directorate of Public Health. Sağlıklı Beslenme ve Hareketli Hayat İşbirliği Platformu Türkiye Şeker Tüketimini/Kullanımını Azaltma Rehberi. Publication no: 1201, Ankara; 2021.