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Evaluation of the dietary quality of selected public, university, and private hospital menus

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ABSTRACT

Objective: The aim of this study is to examine the dietary quality of public, university, and private hospital menus.

Methods: In this study, the meal menus for October 2025 and April 2026 were analyzed for hospitals in the provinces of Ankara and Konya (one public, one university, and one private hospital from each province). The nutrient adequacy ratio (NAR) and mean adequacy ratio (MAR) were used to assess diet quality. Additionally, the nutrient content of the menus was analyzed and compared with the recommendations of the Türkiye Dietary Guidelines-2022 (TDG-2022).

Results: There was no significant difference in MAR values between public hospitals (72.5-79.1%) and university hospitals (71.4-78.1%), while the MAR value for private hospital menus (76.3-82%) was significantly higher than the other two hospitals ($p=0.001$, $\eta^2 \leq 0.05$). The NAR values for calcium, magnesium (for men only), potassium (for men only), and folate in public and university hospital menus were below 66%. The NAR values for calcium (for women aged 51-70) and magnesium (for men aged 31-70) in the private hospital menu were below 66%. The fiber, vitamin B2, vitamin B6, calcium, potassium, magnesium content, and energy percentage from polyunsaturated fatty acids of all hospital menus were found to be below the TDG-2022 recommendations, while the energy ratio from total fat and saturated fat and the sodium content were found to be above the TDG-2022 recommendations. Furthermore, the vitamin C content of public and university hospital menus was below the TDG-2022 recommendations, while the cholesterol content of public and private hospital menus was above the TDG-2022 recommendation.

Conclusion: The fiber, vitamin B2, vitamin B6, calcium, potassium, and magnesium content of all hospital menus examined does not meet the TDG-2022 recommendations. The menus need to be improved in terms of the nutrients found to be lacking, while saturated fat and sodium content should be reduced. Based on MAR scores, the menus of public and university hospitals need to be improved in terms of the examined nutrients, taking into account the nutritional needs of men.

Keywords: nutritional assessment, hospital care, calcium, malnutrition, menu planning

Introduction

Nutrition plays a central role in maintaining and improving health. Inadequate and unbalanced nutrition is associated with an increase in the prevalence of noncommunicable diseases and healthcare expenditures, as well as reduced quality of life.[1] Malnutrition refers to deficiencies or excesses in nutrient intake, imbalances in essential nutrients, or impaired nutrient utilization.[2] Increased

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nutrient requirements associated with acute or chronic illness, and disease-related malnutrition resulting from symptoms affecting nutrition, represent one of the most common conditions in the hospital setting.[3] Since hospital menus are the sole source of nutrition for hospitalized patients, the dietary quality of these menus plays a major role in supporting healthy nutrition and improving the patient's nutritional status and health.[4] Delayed wound healing, increased risk of complications and infection, prolonged hospital stay, higher readmission and mortality rates are some of the poor health outcomes associated with hospital malnutrition.[5] A systematic review reported that malnutrition affects 20-50% of hospitalized patients and that meal dissatisfaction is among the frequently reported causes of malnutrition.[6] A study conducted with 200 patients hospitalized in the internal medicine department of a hospital in Türkiye reported that 75% of patients ate less than half of the hospital meals and that the incompatibility of the meals on the menu in terms of content was an effective factor in this situation.[7]

Although hospital food services are often less appreciated than other clinical care services, they are an integral part of treatment.[8] Patients report that the service they remember most after discharge is nutrition services.[7] Furthermore, since healthcare institutions are expected to be advocates for a health-promoting lifestyle, the menus offered in such settings have the potential to influence the public's perception of what constitutes healthy eating.[1] Research examining the dietary quality of hospital menus is needed to ensure patients receive optimal nutrition.[3] Such studies can identify interventions that could improve the health and well-being of patients receiving nutrition services and potentially lead to policy changes to ensure that healthy foods predominate in hospital menus.[9] The aim of this study is to evaluate the dietary quality of menus for patients on a normal diet in public, university, and private hospitals using the nutrient adequacy ratio (NAR) and mean adequacy ratio (MAR).

Main Points

- The fiber, B2, B6 vitamin, calcium, potassium, magnesium content, and percentage of energy from polyunsaturated fatty acids in all hospital menus were below the recommendations of TDG-2022.
- It was found that the total fat and saturated fat energy percentage of all hospital menus, as well as their sodium content, exceeded the recommendations of TDG-2022.
- Based on mean adequacy ratio scores, public and university hospitals need to improved in terms of the examined nutrients, taking into account the nutritional needs of men.

Methods

Hospital selection and data collection

In this study, the meal menus for October 2025 and April 2026 were analyzed for hospitals in the provinces of Ankara and Konya (one public, one university, and one private hospital from each province). The menus are consist of three meals: breakfast, lunch and dinner. Hospitals were selected using a web-based randomization program (random.org). The public and university hospitals was selected from among hospitals with monthly three-meal menu available on their website. Since the private hospitals menus were not available on their websites, the institution authorities were contacted. All hospital menus were prepared by institutional dietitians. Hospital menus do not consist of menus that repeat on a weekly or biweekly cycle. A menu analysis was conducted for 122 days (31 days in October and 30 days in April, with two hospitals in each group) for hospitals in each category (public, university, and private).

Analysis and evaluation of menus

The information regarding the ingredients and portion sizes of the dishes on the menus is based on the Standard Recipes for Turkish Cuisine[10] and the Bed-based Treatment Institutions Operating Regulations.[11] A total of 150 grams of white bread per day, 50 grams per meal, has been added to the menus for all hospitals. This practice has been implemented to avoid bias. This is because while some hospital menus include bread with meals, others do not specify it on the menu. In hospitals, patients are usually given a roll with their meals, and each roll weighs 50 grams. However, when foods such as cake, simit, pogaca, pastry, lahmacun, and meat bread are included in a meal, 50 grams of white bread has not been added to that meal. The energy and nutrient content of the menus was analyzed using the Nutrition Information System software.[12] The nutrient content of the menus was then compared with the recommendations of the Türkiye Dietary Guideline-2022 (TDG-2022).[13]

Mean adequacy ratio (MAR) and nutrient adequacy ratio (NAR) calculation

NAR and MAR scores were used to assess diet quality. NAR scores were calculated using the following formula, based on Dietary Reference Intake (DRI) levels categorized by age and gender:[14]

NAR = Daily amount of the nutrient analyzed in the menu x 100 / DRI level of the nutrient

NAR values range from 0 to 100. A score closer to 100 indicates diets more consistent with nutrient intake references. To mitigate the effects of high consumption, the calculated NAR values have been truncated at 100.[15] In this study, NAR scores were calculated for ten nutrients (calcium, magnesium, potassium, vitamins A, E, C, B1, B2, B9, and B12). As in previous studies, a NAR score of <66% for a nutrient was considered an inadequate intake.[16,17]

The MAR score was obtained by taking the average of the NAR scores calculated for the ten nutrients. As in previous studies, a MAR score of <75% was considered indicative of overall micronutrient intake inadequacy.[16,18] NAR and MAR scores were calculated separately for women and men aged 19-70 years.

Statistical analysis

The normal distribution of the data was tested using the Shapiro-Wilk test and skewness-kurtosis values. The homogeneity of variances was assessed using the Levene test. Quantitative data with normal distribution are presented as mean ($\bar{x}$) ± standard deviation (SD), while quantitative data without normal distribution are presented as median (interquartile range). In addition %95 confidence intervals (%95 CI) for the means have been calculated. One-way ANOVA and Kruskal-Wallis test, whichever was appropriate, were used for inter-hospital comparisons of the nutritional content of menus. The post-hoc Tukey test or Tamhane's T2 test was used to identify the group causing the difference. To assess the magnitude of differences between groups, the effect size measure eta square (η^2) was calculated. The classifications proposed by Cohen were used to interpret the effect sizes ($\eta^2 \approx 0.01$: small effect; $\eta^2 \approx 0.06$: moderate effect; $\eta^2 \approx 0.14$: large effect).[19] The unit of analysis is the number of days. As previously explained, a 122-day menu analysis was conducted for each hospital group (public, university, private). A two-tailed $p<0.05$ value was considered statistically significant for all statistical analyses. All statistical analyses were performed using the SPSS 26.0 Windows (SPSS Inc.; Chicago, USA) software.

Results

In this study, which analyzed 122 daily menus from each hospital group (public, university, and private), the energy and nutrient contents of the menus are presented in Table 1. There was no significant difference in the average daily energy content of public (1833.12 kcal) and university (1866.08 kcal) hospital menus, while the energy content of private hospital menus (1984.91 kcal) was significantly higher than the other two hospitals ($p<0.001$, $\eta^2=0.09$). The average daily carbohydrate and fat amount in the menus of public and university hospitals was significantly lower than that in the menus of private hospitals ($p<0.001$, $\eta^2=0.09$ and $p=0.003$, $\eta^2=0.03$ respectively), while no significant difference was observed between the three hospitals in terms of the percentage of energy derived from carbohydrates and sucrose in the menus ($p=0.077$ and $p=0.434$ respectively). The fiber content in public and university hospital menus was similar (18.93 and 18.20 grams, respectively) and was found to be significantly lower than that in private hospital menus (21.14 grams) ($p<0.001$, $\eta^2=0.05$). No significant differences were observed among the hospital groups in terms of the cholesterol content of the menus, the percentage of energy derived from fat, or the percentages of energy derived from monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs) ($p>0.05$). The saturated fat content of public and university hospital menus was found to be similar and significantly lower than that of private hospital menus ($p<0.001$, $\eta^2=0.06$). While no significant difference was observed between the groups in terms of the average protein content of the menus ($p=0.171$), the proportion of energy derived from protein in private hospital menus (14.57%) was found to be significantly lower than that in public and university hospital menus (16.22% and 16.40%, respectively) ($p<0.001$, $\eta^2=0.07$).

The levels of certain micronutrients were similar in public and university hospital menus but were found to be significantly lower in private hospital menus (e.g., vitamin E, B9, vitamin C, calcium, potassium, and magnesium). The differences between groups showed a moderate effect size for potassium ($\eta^2=0.07$) and a small effect size for other nutrients (η^2 values ranging from 0.03 to 0.05). The zinc and vitamin B12 content in the menus was similar in the public and private hospital groups but was found to be significantly lower in the university hospital group

Table 1. Energy and nutrient content of hospital menus

Energy and nutrients	Public		University		Private		p value1	Eta Squared (η2)
Number of hospitals	n=2		n=2		n=2			
Total number of menu days	n=122		n=122		n=122			
	x̄ ± SD or M (IQR)	%95 CI	x̄ ± SD or M (IQR)	%95 CI	x̄ ± SD or M (IQR)	%95 CI		
Energy (kcal)	1833.12± 178.37^{a}	1801.1-1865.1	1866.08± 209.12^{a}	1828.6-1903.6	1984.91± 237.12^{b}	1942.4-2027.4	**<0.001**	0.09
Carbohydrate (gr)	204.59± 28.31^{a}	199.5-209.6	205.33± 36.92^{a}	198.7-211.9	226.27± 33.17^{b}	220.3-232.2	**<0.001**	0.09
Carbohydrate (%E)	45.75± 5.21	44.8-46.7	45.31± 5.48	44.3-46.3	46.86± 5.77	45.8-47.9	0.077	0.01
Fat (gr)	78.80± 16.04^{a}	75.9-81.7	80.64± 15.86^{a}	77.8-83.5	86.30± 20.32^{b}	82.7-89.9	0.003	0.03
Fat (%E)	38.01± 5.50	37-39	38.24± 5.15	37.3-39.2	38.55± 6.92	37.3-39.8	0.773	0.001
Protein (gr)	72.18± 12.64	69.9-74.4	74.28± 13.38	71.9-76.7	70.78± 17.43	67.7-73.9	0.171	0.01
Protein (%E)	16.22± 3.09^{a}	15.7-16.8	16.40± 2.89^{a}	15.9-16.9	14.57± 3.22^{b}	14-15.2	**<0.001**	0.07
Fiber (gr)	18.93± 4.68^{a}	18.1-19.8	18.20± 4.56^{a}	17.4-19.0	21.14± 7.03^{b}	19.9-22.4	**<0.001**	0.05
Fiber (gr)/ 1000 kcal	10.34± 2.38^{a,b}	9.9-10.8	9.81± 2.41^{a}	9.4-10.3	10.69± 3.43^{b}	10.1-11.3	**0.049**	0.02
Sucrose (%E)	5.69± 3.64	5-6.4	5.93± 4.74	5.1-6.8	6.35± 3.57	5.7-7	0.434	0.01
SFA (%E)	15.15± 2.91^{a}	14.6-15.7	15.57± 2.88^{a}	15.1-16.1	16.99± 3.93^{b}	16.3-17.7	**<0.001**	0.06
MUFA (%E)	13.51± 2.73	13-14	13.60± 2.40	13.2-14	13.17± 2.76	12.7-13.7	0.398	0.01
PUFA (%E)	6.11± 2.16	5.7-6.5	5.94± 1.86	5.6-6.3	5.82± 2.23	5.4-6.2	0.552	0.003
Cholesterol (mg)	306± 124.33	283.7-328.3	287.27± 114.19	266.8-307.7	315.71± 157.60	287.5-344	0.240	0.01
Vitamin A (µg)	906 (640.85)	992.1-1225.1	810.8 (556.55)	932.3-1356.7	1209.95 (781.03)	1157-1561.5	0.116*	0.01
Vitamin E (mg)	10.66± 4.67^{a}	9.8-11.5	9.56± 4.88^{a}	8.7-10.4	12.50± 7.39^{b}	11.2-13.8	**<0.001**	0.04
Vitamin B_1 (mg)	0.77± 0.15^{a}	0.74-0.80	0.80± 0.21^{a,b}	0.76-0.84	0.84± 0.21^{b}	0.8-0.88	**0.028**	0.02
Vitamini B_2 (mg)	1.17± 0.24	1.13-1.22	1.22± 0.32	1.17-1.28	1.25± 0.36	1.19-1.32	0.141	0.01
Niacin equivalent (mg)	27.06± 7.07^{a,b}	25.8-28.3	28.80± 6.68^{a}	27.6-30	25.48± 8.85^{b}	23.9-27.1	**0.003**	0.03
Vitamin B_6 (mg)	1.19± 0.25^{a,b}	1.14-1.24	1.14± 0.23^{a}	1.1-1.19	1.24± 0.35^{b}	1.18-1.3	**0.035**	0.02
Vitamin B_9 (µg)	250.85± 64.44^{a}	239.3-262.4	253.21± 95.89^{a}	236-270.4	288.94± 93.28^{b}	272.2-305.7	**0.001**	0.04
Vitamin B_{12} (µg)	4 (2.72)^{a}	3.8-4.4	5 (3.4)^{b}	5-6.4	3.75 (3.1)^{a}	3.3-4.7	**<0.001***	0.05

CI: Confidence Interval, E: energy, IQR: Interquartile Range, M: Median, MUFA: monounsaturated fatty acids, PUFA: polyunsaturated fatty acids, SFA: saturated fatty acids 1ANOVA (post hoc Tukey test) or *Kruskal Wallis test (post hoc Tamhane's T2 test), whichever is appropriate, was used.

Different lowercase superscripts on the same row indicate a statistically significant difference between groups

Table 1. Continued

Energy and nutrients	**Public**		**University**		**Private**		**p value1**	**Eta Squared (η2)**
Number of hospitals	**n=2**		**n=2**		**n=2**			
Total number of menu days	**n=122**		**n=122**		**n=122**			
	x̄ ± SD or M (IQR)	**%95 CI**	**x̄ ± SD or M (IQR)**	**%95 CI**	**x̄ ± SD or M (IQR)**	**%95 CI**		
Vitamin C (mg)	78.64± 33.81[a]	72.5-84.7	77.99± 40.37[a]	70.7-85.2	101.73± 60.80[b]	90.8-112.6	**<0.001**	0.05
Calcium (mg)	620.34± 156.56[a]	592.3-648.4	613.97±163.28[a]	584.7-643.2	712.66± 236.61[b]	670.3-755	**<0.001**	0.05
Magnesium (mg)	247.28± 44.15[a]	239.4-255.2	247.96± 42.14[a]	240.4-255.5	267.03± 75.11[b]	253.6-280.5	**0.008**	0.03
Sodium (mg)	3449.49± 551.59[a]	3350.6-3548.4	3972.10± 837.01[b]	3822.1-4122.1	4289.63± 1259.92[c]	4063.8-4515.5	**<0.001**	0.12
Potassium (mg)	2104.29± 341.76[a]	2043-2165.5	2101.53± 352.51[a]	2038.3-2164.7	2359.73± 586.85[b]	2254.5-2464.9	**<0.001**	0.07
Iron (mg)	9.66± 1.94	9.3-10	9.89± 1.98	9.5-10.2	10.42± 3.58	9.8-11.1	0.070	0.02
Zinc (mg)	10.57± 2.53[a]	10.1-11	11.87± 2.54[b]	11.4-12.3	10.44± 3.01[a]	9.9-10.9	**<0.001**	0.05

CI: Confidence Interval, E: energy, IQR: Interquartile Range, M: Median, MUFA: monounsaturated fatty acids, PUFA: polyunsaturated fatty acids, SFA: saturated fatty acids 1ANOVA (post hoc Tukey test) or *Kruskal Wallis test (post hoc Tamhane's T2 test), whichever is appropriate, was used.
Different lowercase superscripts on the same row indicate a statistically significant difference between groups

($p<0.001$, $\eta^2=0.05$). There are no significant differences in vitamin A, vitamin B2, and iron content among the groups ($p>0.05$).

The sodium content of the menus was 3449.49 mg in the public hospital group, 3972.1 mg in the university hospital group, and 4289.63 mg in the private hospital group; there was a statistically significant difference among all groups ($p<0.001$, $\eta^2=0.12$).

When compared with the TDG-2022 recommendations, the proportion of energy derived from carbohydrates and protein in the menus was consistent with the recommendations across all groups, whereas the proportion of energy derived from fat exceeded the recommended range (20–35%). The total fiber content of the menus and the fiber content per 1000 kcal were below the TDG-2022 recommendations (at least 25 grams and 14 g/1000 kcal, respectively) in all groups. It was found that the percentage of energy derived from saturated fat in the menus of all groups exceeded the TDG-2022 recommendations (<10%). While the percentage of energy derived from MUFAs was consistent with the TDG-2022 recommendations across all groups, the percentage of energy derived from PUFAs was below the TDG-2022 recommendations (7–10%). The cholesterol content of public and private hospital menus (306 and 315 mg, respectively) exceeds the TDG-2022 recommendations (<300 mg). In all groups, the vitamin B2, vitamin B6, calcium, magnesium, and potassium content of the menus was below the TDG-2022 recommendations, while the sodium content exceeded the recommended 2000 mg. The vitamin C content of public and university hospital menus falls below the TDG-2022 recommendations. The vitamin A, vitamin B1, vitamin B9, niacin equivalent, and iron content of the menus meet the TDG-2022 recommendations for all groups.

Data on NAR and MAR scores used to evaluate the dietary quality of hospital menus are presented in Table 2. Calcium, magnesium (excluding those calculated for women), potassium and folate NAR scores were similar in public and university hospital menus but significantly lower than in private hospital menus ($p<0.05$). This significant difference corresponds to a small to moderate effect size (η^2 values ranging from 0.02 to 0.07). The NAR score calculated for vitamin B12 was similar in the public and university hospital groups but significantly higher than that of the private hospital group ($p<0.001$, $\eta^2=0.06$). The NAR scores for calcium, magnesium (calculated only for men), potassium (calculated only for men), and folate

Table 2. NAR and MAR scores for hospital menus by age and gender groups

Variables	Public		University		Private		p value[1]	Eta Squared (η^2)
Number of hospitals	n=2		n=2		n=2			
Total number of menu days	n=122		n=122		n=122			
NAR Calcium (%)	**$\bar{x}$ ± SD**	**%95 CI**	**$\bar{x}$ ± SD**	**%95 CI**	**$\bar{x}$ ± SD**	**%95 CI**		
Men aged 19-70, Women aged 19-50	61.9± 15.2[a]	59.1-64.6	61.4± 16.3[a]	58.5-64.3	69.3± 18.7[b]	65.9-72.7	**<0.001**	0.05
Women aged 51-70	51.7± 13.0[a]	49.4-54	51.2± 13.6[a]	48.7-53.6	58.7± 17.5[b]	55.5-61.9	**<0.001**	0.05
NAR Magnesium (%)								
Men aged 19-30	61.8± 11.0[a]	59.8-63.7	61.9± 10.5[a]	60.1-63.8	66.0± 16.8[b]	63-69.1	**0.018**	0.02
Men aged 31-70	58.9± 10.5[a]	56.9-60.7	59.0± 10.0[a]	57.2-60.8	63.1± 16.4[b]	60.1-66	**0.013**	0.02
Women aged 19-30	78.9± 12.5	76.7-81.2	79.4± 12.4	77.2-81.6	81.0± 15.4	78.3-83.8	0.442	0.004
Women aged 31-70	76.8± 12.6	74.5-79	77.1± 12.4	74.9-79	79.2± 15.9	76.4-82.1	0.308	0.01
NAR Potassium (%)								
Men aged 19-70	61.8± 10.0[a]	60.1-63.7	61.8± 10.3[a]	59.9-63.6	68.8± 15.5[b]	66.1-71.6	**<0.001**	0.07
Women aged 19-70	80.5± 12.1[a]	78.3-82.7	80.2± 12.2[a]	77.9-82.3	85.4± 13.9[b]	82.9-87.8	**0.002**	0.03
NAR Vitamin A (%)								
Men aged 19-70	87.9± 16.1[a,b]	85.1-90.8	84.8± 16.9[a]	81.7-87.8	91.7± 14.8[b]	89.1-94.4	**0.003**	0.03
Women aged 19-70	95.4± 10.1	93.6-97.2	94.0± 11.3	91.9-96.1	96.7± 9.2	95.1-98.3	0.125	0.01
NAR Vitamin E (%)								
Men and women aged 19-70	67.0± 23.3[a,b]	62.9-71.2	60.6± 24.5[a]	56.2-65	70.5± 24.5[b]	66.1-74.8	**0.005**	0.03
NAR Vitamin C (%)								
Men aged 19-70	77.4± 23.3[a,b]	73.2-81.6	73.5± 25.3[a]	68.9-78.1	82.5± 22.6[b]	78.4-86.5	**0.014**	0.02
Women aged 19-70	84.8± 21.1[a,b]	81-88.6	80.6± 23.2[a]	76.5-84.7	88.2± 19.6[b]	84.6-91.6	**0.023**	0.02
NAR Vitamin B_1 (%)								
Men aged 19-70	64.5± 12.8[a]	62.2-66.7	66.1± 15.3[a,b]	63.4-68.9	69.4± 16.4[b]	66.5-72.3	0.033	0.02
Women aged 19-70	70.0± 13.2[a]	67.7-72.4	71.6± 15.6[a,b]	68.8-74.4	74.8± 16.4[b]	71.9-77.8	0.041	0.02

MAR: Mean Adequacy Ratio, NAR: Nutrient Adequacy Ratio
[1]ANOVA and the Tukey post hoc test were used.
Different lowercase superscripts on the same row indicate a statistically significant difference between groups.

Table 2. Continued

Variables	**Public**		**University**		**Private**		**p value[1]**	**Eta Squared (η^2)**
Number of hospitals	**n=2**		**n=2**		**n=2**			
Total number of menu days	**n=122**		**n=122**		**n=122**			
NAR Calcium (%)	**x̄ ± SD**	**%95 CI**	**x̄ ± SD**	**%95 CI**	**x̄ ± SD**	**%95 CI**		
NAR Vitamin B_2 (%)								
Men aged 19-70	86.3± 13.5	83.9-88.8	86.8± 14.2	84.3-89.4	88.1± 14.5	85.6-90.7	0.603	0.003
Women aged 19-70	94.1± 9.7	92.4-95.8	93.7± 9.7	91.9-95.4	94.5± 10.6	92.6-96.4	0.814	0.001
NAR Folate (%)								
Men and women aged 19-70	62.5± 15.9[a]	59.7-65.3	61.6± 17.7[a]	58.4-64.7	70.2± 18.7[b]	66.9-73.6	**<0.001**	0.05
NAR Vitamin B_{12} (%)								
Men and women aged 19-70	96.2± 10.7[a]	94.3-98.2	97.9± 8.7[a]	96.4-99.5	89.5± 19.9[b]	85.9-93.1	**<0.001**	0.06
MAR (%)								
Men aged 19-30	72.8± 7.8[a]	71.4-74.1	71.7± 8.6[a]	70.1-73.2	76.6± 10.5[b]	74.7-78.5	**<0.001**	0.05
Men aged 31-70	72.5± 7.8[a]	71.1-73.9	71.4± 8.6[a]	69.8-72.9	76.3± 10.5[b]	74.5-78.2	**<0.001**	0.05
Women aged 19-30	79.1± 7.3[a]	77.8-80.4	78.1± 8.2[a]	76.6-79.5	82.0± 9.5[b]	80.3-83.7	**0.001**	0.04
Women aged 31-50	78.9± 7.3[a]	77.6-80.2	77.9± 8.2[a]	76.4-79.3	81.8± 9.5[b]	80.1-83.5	**0.001**	0.04
Women aged 51-70	77.9± 7.2[a]	76.6-79.2	76.9± 8.0[a]	75.4-78.3	80.8± 9.3[b]	79.1-82.4	**0.001**	0.04

MAR: Mean Adequacy Ratio, NAR: Nutrient Adequacy Ratio
[1]ANOVA and the Tukey post hoc test were used.
Different lowercase superscripts on the same row indicate a statistically significant difference between groups.

in public and university hospital menus were found to be below 66%. In addition, the NAR score for vitamin B1 (calculated for men only) in public hospital menus and the NAR score for vitamin E in university hospital menus were found to be below 66%. The NAR scores for calcium (calculated for women aged 51–70) and magnesium (calculated for men aged 31–70) in private hospital menus were found to be below 66%.

There was no significant difference in the MAR score calculated for all age and gender groups examined between public hospitals (72.5-79.1%) and university hospitals (71.4-78.1%), while the MAR score for private hospitals (76.3-82.0%) was significantly higher than the other two hospitals ($p<0.001$, η^2 values ranging from 0.04 to 0.05). The MAR scores calculated for men based on public and university hospital menus were found to be below 75% (indicating an overall deficiency in micronutrient intake).

Discussion

Hospital menus are a key communication tool between hospitals and inpatients and can also support disease-specific nutrition education.[20] Ensuring that menus meet energy and nutrient requirements is essential for recovery and the prevention of adverse outcomes.[5] In this study, menus from public, university, and private hospitals consistently failed to meet TDG-2022 recommendations for fiber, vitamin B2, vitamin B6, calcium, potassium, magnesium, and PUFAs energy contribution, while exceeding recommended limits for sodium, total fat, and saturated fat. This pattern indicates a systematic imbalance in menu planning, characterized by energy-dense but nutrient-poor food choices. Our findings have important implications for improving healthcare practices and policies in the areas of identifying and managing malnutrition in hospital settings.

The coexistence of high sodium and fat levels with low fiber and micronutrient content suggests a reliance on processed foods and insufficient inclusion of plant-based food groups and dairy. Our findings are similar to the results of studies conducted in hospital settings in Türkiye and other countries.[1,3,21] A study examining five hospital menus from four different regions of Türkiye found that all hospital menus contained higher levels of energy, protein, fat, saturated fat, and sodium than recommended by TDG-2022, while fiber content was below TDG-2022 recommendations.[21] A study conducted in Spain found that menus offered to patients were deficient in vitamin E, magnesium, calcium, potassium, and zinc.[3] High sodium, low dietary fiber, and low potassium intake are well-known risk factors for noncommunicable diseases such as hypertension and cardiovascular disease.[22]

Nutrient adequacy analyses further reinforce these concerns. MAR scores indicated that menus in public and university hospitals require improvement, while NAR results highlighted insufficient intake of key micronutrients such as calcium, magnesium, potassium, vitamin E, vitamin B1, and folate. In a study examining the menus of four public hospitals in Ankara, although overall adequacy scores were reported to be higher, the NAR scores calculated for calcium, magnesium, and dietary fiber were found to be lower than those of other nutrients.[8] The consistent identification of low calcium, magnesium, fiber, and high fat, saturated fat and sodium levels across studies suggests a persistent structural issue in menu composition rather than isolated deviations.[1,8,22]

In a study examining menus at a hospital in Greece during different seasons, it was found that the dairy content of the menus did not meet European guidelines.[23] In a study examining the menus of a hospital in Portugal, it was found that the menus evaluated during the study period did not comply with nutritional recommendations in terms of cooking techniques, vegetable, fruit, and fish content.[4]

In our study, the observed nutrient profile may be explained by menu composition, particularly the higher proportion of red meat and processed foods and the limited inclusion of vegetables, fruits, legumes, and dairy products. Processed foods have low nutrient density and contain higher levels of saturated fat, sugar, and sodium. An analysis of hospital menu in Greece found that the median energy value from ultra-processed foods was 25.2%, and that the energy provided by minimally processed foods was positively associated with the menu's energy, protein, zinc, selenium, iron, and vitamin B12 content.[24] Ultra-processed food consumption has been linked to an increased risk of cardiovascular disease and cancer, making it crucial to limit such foods in hospital menus for the protection and promotion of health.[25]

International experiences demonstrate that implementing nutritional standards in hospital food services can significantly improve menu quality.[22,24,26] However, compliance with such standards remains inconsistent. A systematic review of five observational studies involving thirty hospitals reported that approximately half of the hospitals did not comply with nutritional standards.[9]

This study contributes to the literature by comparing different hospital types and evaluating nutrient adequacy across demographic groups. However, the findings should be interpreted in light of several limitations. The first limitation is that the study only examined the nutritional profiles of menus over a total of two months at hospitals in the provinces of Ankara and Konya. Each hospital group (public, university, and private) is represented by only two hospitals. Although the unit of analysis was defined as the daily menu, the evaluated menus were derived from a limited number of hospitals. Therefore, the observations may not be fully independent, which may introduce a potential risk of pseudoreplication and reduce the generalizability of the findings. In addition, multiple statistical comparisons were conducted across numerous nutrients and dietary quality indicators, which may increase the risk of type I error inflation despite the application of appropriate statistical procedures. Seasonal variations and geographic region are important factors influencing menu planning. In our study, we analyzed the autumn (one-month) and spring (one-month) menus of hospitals in the Central Anatolia Region (with limited representativeness). This does not constitute a sufficient source of information about the nutrient profile of menus in hospitals across Türkiye. The second limitation concerns the fact that the consumption status of the examined menus was not questioned. The analysis of the nutritional values of meals served to hospitalized patients is an indicator of dietary intake when the entire meal is consumed. In this study, only the menus served by the hospital kitchen were evaluated, and the consumption records of these foods by patients were not examined. Since our study lacks patient-level dietary intake data, the use of NAR and MAR to assess dietary quality may overestimate nutrient adequacy. In addition, 50 grams of roll bread was included in the analysis for each meal, but actual consumption could not be verified. Another limitation of the study is its focus on normal diet menus. In reality, hospitals offer a wide variety of diet menus tailored to patients' specific needs, such as low-sodium, diabetic, and low-fat diets. Furthermore, since patients' energy and nutrient requirements may vary depending on their medical conditions, the use of standard DRI values in menu evaluations may lead to inaccurate assessments. Future research should incorporate actual intake data and clinical outcomes, such as length of hospital stay and malnutrition incidence, to better understand the impact of menu quality on patient health.

Conclusion

Hospital meals are an important part of institutional care and nutritional support for inpatients, so their nutrient content should be reviewed at regular intervals. Our study found that none of the hospital menus examined met the fiber, vitamin B2, vitamin B6, calcium, potassium, magnesium, and PUFAs content recommendations of TDG-2022. Menus should be improved to address identified nutrient deficiencies, and the levels of energy from fat, energy from saturated fat, and sodium content that exceed recommended limits should be reduced. In addition, hospital menus need to be developed with due consideration for the micronutrient requirements of specific age and gender groups (particularly men and women aged 51–70). It is thought that reducing the frequency of red meat and increasing the frequency of vegetables, fruits, and dairy products in menus would be a beneficial approach. However, it should be noted that our study has a limited sample size and includes only a two-month analysis of menus; therefore, our findings may not be applicable to all hospital menus.

In conclusion, this study advances the existing body of knowledge by providing a comprehensive comparison of menus in public, university, and private hospitals in Türkiye in terms of their nutrient content. The findings highlight an urgent need to standardize hospital food services nationwide in strict accordance with the TDG-2022 guidelines. From a practical and policy perspective, our results offer valuable evidence for Turkish healthcare policymakers and administrators.

Ethical approval

Ethical approval for this study was obtained from the Non-Interventional Clinical Research Ethics Committee of Alanya Alaaddin Keykubat University (Approval No. E-25767966-050.04-325976).

Author contributions

Conception and design: A.K., A.E.B.; Data acquisition: A.K.; Data analysis: A.K.; Data interpretation: A.K.; Drafting of the manuscript: A.K., A.E.B.; Critical revision of the manuscript: A.K., A.E.B. All authors reviewed the results, approved the final version of the manuscript, and agreed to be accountable for all aspects of this study.

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Ethical approval for this study was obtained from the Non-Interventional Clinical Research Ethics Committee of Alanya Alaaddin Keykubat University (Approval No. E-25767966-050.04-325976). Informed consent was not required for this study.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflict of interest

The authors declare that this study was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Generative AI statement

The authors declare that no generative AI or AI-assisted technologies were used in the writing or preparation of this study.

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