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Evaluating Nutrient Composition of Adult Patients' Normal Diet Menus: Experience of Public Hospitals in Türkiye

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ABSTRACT

Background: Hospital menus are profoundly important to meet the nourishment needs of patients. So, this study is conducted to determine the nutrient adequacy of adult patients' normal diet menus. **Methods:** An evaluation of 30-day fixed menus consisting of 4 dishes was conducted in four different public hospitals in Ankara, the capital of Türkiye. Mean adequacy ratio (MAR) and nutrient adequacy ratio (NAR) were used to examine the sufficiency of nutrients and meals. **Results:** For all the hospitals, MAR value was found higher than %85. However, nutrient adequacy ratio of dietary fiber, calcium and magnesium were lower than the other nutrients. It was determined that total fat, saturated fat, salt and cholesterol (except hospital D) contents were high according to the recommended values. Nevertheless, these fixed menus supplied 75% daily fiber on average. Hospital A and D menus met calcium requirements by 73% and 67%, respectively. While hospital D menus met magnesium (76%) and potassium (67%) requirements moderately, other hospitals approached 100% sufficiency for potassium. It is remarkable that in all the hospitals the amount of fruits seemed very low, up to 34%. **Conclusion:** As the hospital meal is an essential part of in-patients' institutional care and nutritional support, the nutrient contents of menus should be monitored for nutritional requirements and, if necessary, there should be initiatives and arrangements in standard recipes to reduce salt and fat contents.

Keywords: *Menu planning; Nutritional requirements; Fats; Sodium.*

Introduction

Healthy nutrition plays a critical role in the prevention of chronic diseases such as heart disease and diabetes, and accessing healthy food is as important as obtaining a quality care service (Neuhouser, 2019). Although hospital food service is generally less appreciated than other clinical services, patient meals are an integral part of hospital treatment, and dietary treatment is of great importance to help recovery (Mentziou *et al.*, 2015, Osman *et al.*, 2021). While optimum

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nutrition contributes significantly to the recovery of patients, it makes a difference in the daily routines of the patients and ensures that they leave the hospital satisfied (Muraal and Davar, 2014, Roberts *et al.*, 2020). The more the patients' expectations are met, the more satisfied they leave (Murphy, 2017). This created the concept of 'hospitality' by triggering more services and patient care to come to the forefront worldwide (Fernando and Wijesinghe, 2017). In parallel with the concept of hospitality, health institutions prepare an appropriate nutrition plan for patient satisfaction by taking into account the time spent in the hospital (Al-Torky *et al.*, 2016, Fernando and Wijesinghe, 2017).

Most inpatients depend on the hospital menu to meet their nutritional needs. So, failure to provide adequate nutrition can delay recovery time, increase complication rates, and prolong hospital stay. Due to the increasing needs and frequent decrease in appetite, hospitalized patients require special attention regarding nutritional intake; however, nutritional deficiencies are common in many hospitals (Department for Health & Wellbeing, 2014, Fernando and Wijesinghe, 2017). Good food and nutrition offered by the hospital not only reduces patient expenses by protecting against malnutrition, but also reduces hospital expenses. In addition, appropriate food provided by the hospital can meet the individual's special nutritional needs and increase patient's satisfaction by making therapeutic effects (Fernando and Wijesinghe, 2017). Proper nutritional intervention ,through the provision of nutritionally adequate meals, could improve the quality of life, build strength, decrease infectious complication risks, relieve pressure ulcers, and eventually, lower patients' death risk (Correia *et al.*, 2016). Hospital food services may be used as educational tools for sustainable good practice or sustainable healthy eating habits. Therefore, patients may gain healthier eating habits by balancing flavor enhancers such as salt, spices and oil instead of more delicious meals. In addition, healthy eating habits may protect against diseases such as cancer, heart disease, and diabetes (Bannerman *et al.*, 2008).

Dieticians should aim to provide a quality diet suitable for the patient, because diet quality, food service, and physical nutrition environment contribute to patient satisfaction (Kim *et al.*, 2010). The provision of menu choices to patients differs between facilities. Different catering systems and sociodemographic backgrounds cause different menus offered in hospitals, and this difference may affect satisfaction levels, plate waste or patient's saturation (Aminuddin *et al.*, 2018). Although the menu is a fundamental component of foodservice system, the extent of research on hospital menus investigating their quality of nutrients content is not clear. The aim of this study is to determine the nutrient adequacy of adult patients' normal diet menus in public hospitals.

Materials and Methods

Data source

This study is a randomized cartographic database study carried on 4 public hospitals for 30 days regarding fixed type menus (encoded as A, B, C, and D) with 3 meals consisting of 4 dishes per meal to evaluate the consumption of inpatients for a whole day. Public hospitals do not provide snack service to inpatients who do not have chronic diseases; that's why the authors excluded snacks from the inclusion criteria. The hospitals that were randomly selected were public hospitals located in Ankara city, the capital of Türkiye. The hospitals' bed capacity was 3704,100, 250 and 1028, respectively.

Collection and Comparison of data

Menus were obtained from the responsible catering dietitian of the selected hospitals. The researchers interviewed the executive chefs and the catering dietitians to obtain detailed information such as standard recipes, contents of meals, cooking methods, type of fats, oils etc. The standard recipes of Turkish Cuisine (Türkan Kutluay Merdol, 2011) and Nutrition Data Base Software Data Base (Bebis Nutrition Software Data Base (BeBis), 2004) were used to determine the macronutrients, micronutrients, and food group distribution of the hospital menus. Data were compared with the National Institutes of Health

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Office of Dietary Supplements Nutrient Recommendations: Dietary Reference Intakes (DRI) and American Heart Association's recommendations (Institute of Medicine (IOM), 2011, Van Horn *et al.*, 2016). Researchers also compared the meal portions of food groups according to the recommendation by Dietary Guidelines for Türkiye 2015 (Sağlık Bakanlığı Yayın, 2015).

Evaluation of Mean adequacy ratio (MAR) and Nutrient adequacy ratio (NAR) and Nutrition

The adequacy of the menus was evaluated by MAR and NAR was considered the ratio of the diurnal subject's intakes to standard recommended amounts (Guthrie and Scheer, 1981, Madden *et al.*, 1976) and the MAR was calculated via dividing the summation of NARs by the number of nutrients (Mirmiran *et al.*, 2004). Protein, dietary fiber, vitamin A, vitamin C, total folate, vitamin B_{12}, calcium, magnesium, iron, zinc and potassium were the nutrients included in calculating the MAR.

The authors calculated the frequency of meals and food groups served in hospitals and determined the correlation with fatty acid profiles, added sugar, and salt content. The meal groups were classified as follows based on Turkish cuisine: large piece meat dishes, small piece meat dishes, fish dishes, chicken dishes, meatball, vegetable dishes, succulent legumes, soups, rice, bulgur, pastas, pastries, vegetables with olive oil, legumes with olive oil, yoghurt, cacık, buttermilk, fruits, milky desserts, dough desserts + ashura + halva, compote and compotes, fruit desserts, salads.

Ethical considerations

By current laws, an ethics vote was not required for the study design, as the study does not work on or with people or their data.

Data analyzes

Researchers used IBM SPSS for descriptive frequency analyzes, and spearman correlation test was conducted to analyze data.

Results

The average daily energy, nutrients contents, and NAR and MAR percentage of the hospital menus are shown in **Table 1**. As seen in **Table 1**, carbohydrate, protein, A, E, C, B_{12}, B_6 vitamins, total folate, iron, and zinc requirements were sufficient to meet the needs of all the hospitals' menus. Not all the requirements for dietary fiber, calcium, magnesium, and potassium were met in all the hospitals. The MAR values of all the hospital menus were above 85%.

Table 1. The average daily energy, nutrients contents and NAR and MAR percentage of the hospital menus.

Variables/Hospital	A	NAR	B	NAR	C	NAR	D	NAR
Energy (kcal)	2728.8±532.1[a]	-	2593±445.3	-	2736.1±610.6	-	2609.3±467.5	-
Carbohydrate (g)	302±43.4	100	262.3±42	100	315.3±76.9	100	278.6±53	100
Protein (g)	96.8±22.3	100	92.4±23.6	100	111.9 ± 30.2	100	88.1±16.5	100
Vegetable protein (g)	46.5±11.6	-	38.3±7.6	-	45.1±12.5	-	36.5±6.8	-
Animal protein (g)	53.3±12.4	-	54.1±16.3	-	66±21.3	-	51.6±17.6	-
Fat (g)	124.1±32.5	-	121.9±42.4	-	110.8±32.3	-	125.6±40.1	-
Dietary fiber (g)	31.3±8.2	82.4	29.3±7.2	79.2	27.1±10.6	71.0	27.6±6.3	72.6
Vitamin A (µg)	2103.5±620	100	1992.3±782	100	2204.1±510	100	1899.3±1281	100
Vitamin E (mg)	36.8±14.2	100	39.6±21.2	100	35.9±13.1	100	46.9±22.4	100
Vitamin C (mg)	135.4±83.6	100	149.6±63.6	100	151.6±152.1	100	143.4±55.8	100
Total folate (µg)	463.9±123	100	432.6±96.2	100	397.7±183.8	99.4	373.1±93.5	93.3
Vitamin B12 (µg)	7.5±4.5	100	8.3±5.6	100	9.5±7.2	100	6.2±2.3	100
Calcium (mg)	730.2±342	73.2	842.8±432	84.2	949.9±385.2	94.9	672±200	67.2
Magnesium (mg)	374.3±93.2	89.1	342.6±31.4	82.3	364.9±115.1	86.9	322.3±83.6	76.7
Iron (mg)	16.3±6.3	100	15.4±6.2	100	18.8±12.3	100	13.5±3.16	100
Zinc (mg)	13.8±3.4	100	14.3±6.9	100	16.3±7.8	100	13.5±2.67	100
Potassium (mg)	3225±843.1	95	3372±432	98	3553.6±1566.8	100	3132.6±504.3	66.7
MAR (%)	-	94.5	-	94.8	-	95.6	-	88.7

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NAR: *Nutrient adequacy ratio;* **MAR**: *Mean adequacy ratio;* [a]: *Mean±SD.*

Table 2 shows the distribution of the percentages of daily energy and macronutrients from the provided energy. According to **Table 2**, in 3 of the hospitals (A, B, C), 20% of daily energy comes from breakfast, 40% from lunch and 40% from dinner. This ratio was only different in hospital D (with a higher percentage of lunch). In all the hospitals, most of the daily energy comes from fats in breakfast, lunch, and dinner.

Table 3 compares the amounts of food groups corresponding to the recommended amount of energy to be taken daily and the amounts given in food services.

Table 2. Distribution of percentages of daily energy and macronutrients from the energy provided by hospitals in catering services based on the meals.

Energy and nutrients	Breakfast	Lunch	Dinner
Hospital A			
Energy (kcal)	585.7	1031.1	1112.1
Carbohydrate (%)	38.8	44.5	46.9
Protein (%)	10.1	15.7	15.2
Fat (%)	51.1	39.8	37.9
Hospital B			
Energy (kcal)	572.6	1042.3	998.4
Carbohydrate (%)	42.3	45.2	49.2
Protein (%)	11.2	14.2	17.3
Fat (%)	46.5	40.6	33.5
Hospital C			
Energy (kcal)	576.1	1091.3	1091.3
Carbohydrate (%)	47.6	46.7	46.8
Protein (%)	12.6	18.4	18.3
Fat (%)	39.8	34.9	34.9
Hospital D			
Energy (kcal)	455.7	1299.6	854.1
Carbohydrate (%)	40.5	41.1	52.2
Protein (%)	10.3	13.4	18.2
Fat (%)	49.2	45.5	29.6

Table 3. Comparison of amounts of food groups corresponding to the recommended amount of energy to be taken daily.

Food groups /Hospital	Hospitals			
	A	B	C	D
Milk, yogurt, cheese group (day)	50.1	65.2	81.1	50.3
Meat, chicken or fish, eggs (day)	115.3	97.3	91.2	88.2
Fish (week)	33.2	-	-	-
Eggs (weeks)	83.4	56.7	66.6	18.7
Legumes (day)	34.2	72.3	80.3	98.2
Legumes (weeks)	42.8	154.3	175.2	116.7
Nuts (days)	23.3	28.6	26.8	20.4
Bread and cereals group (days)	97.6	82.3	74.9	74.5
Fruits group (days)	20.4	25.6	30.5	34.6
Vegetables group (days)	107.3	56.3	42.8	85.7
Green leafy vegetables (week)	86.2	45.8	62.5	30.5
Other green vegetables (week)	86.7	50.3	25.4	73.3
Red, orange, blue, and purple vegetables (week)	129.1	71.2	33.3	84.2
White vegetables (week)	82.8	56.6	62.5	40.6
Starchy vegetables (week)	306.3	250.7	128.5	203.7
Oil (g / day)	120.3	143.8	187.8	155.2

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The amounts of food groups and their correspondence to the daily energy intake calculated based on (Sağlık Bakanlığı Yayın, 2015).

As indicated by **Table 3**, more than half of the daily recommendation for milk, yoghurt, and cheese group was met in all the hospitals. It was determined that the recommendation for meat, chicken, or fish and egg group was not met in almost all the hospitals. It was observed that only 1 hospital included fish in its monthly menu. For the legumes group, hospital A remained below the recommended level, and almost all of the recommended amount in hospital D was provided. The bread and cereal group was close to the recommended standard in hospitals A, B and D, but remained below the standard in hospital C. The fruit group also remained below the recommended level in all hospitals. While the consumption amount of vegetable group in hospitals A and D was close to the standard level, in hospitals B and D, it remained below the recommended level. The fat group in all hospitals was well above the suggested level.

Fatty acid profiles, mean and standard deviation values of added sugar, and salt contents of the menus applied in hospitals are given in **Table 4**.

Table 4. Mean and standard deviation values of fatty acid profiles, added sugar, and salt contents of the menus applied in hospitals.

Variables	Hospitals			
	A	B	C	D
Fat (%)	40.9	39.1	36.4	43.3
Saturated fatty acid (%)	13.7	12.4	10.6	12.1
Monounsaturated fatty acid (%)	13.3	13.6	12.3	13.1
Polyunsaturated fatty acid (%)	11.0	10.9	9.8	15.5
Cholesterol (mg)	391.8±55.2	423±43.1	532.4±44.9	232.6±73.1
Added sugar (%)	0.19	0.10	0.04	0.18
Salt (g)	17±3.4	9.6±4.1	15.2±3.1	10.6±1.35

Table 5 shows the correlation between monthly frequency and fatty acid profiles, added sugar, and salt content in hospitals. There was a negative and significant correlation between fat and added sugar content and frequency of large pieces of meat dishes. The frequency of chicken dishes, rice pilaf and dough desserts was positively correlated with cholesterol. There was also a positive correlation between the frequency of bulgur and the added sugar. Moreover, a significant positive correlation was determined between the frequency of pasta and pastry administration and saturated fatty acid. There was a positive correlation between polyunsaturated fatty acid and the frequency of administration of legumes, buttermilk, fruit desserts and olive oil.

Discussion

Most patient meals in hospitals are considered for a regular diet which does not meet nutrition standards of a healthy diet. The aim of this study was evaluating the adequacy of the hospital patient meals in accordance with the national and international dietary recommendations and to make suggestions for better hospital food.

The collective nutrition service provides foods and drinks ready for consumption, which focuses on the nutrition of a certain group in the center (Ceyhun Sezgin and Durlu Özkaya, 2014). In this context, especially the hospital catering service is important in terms of satisfying energy and nutrient needs of the patients at an adequate level. Although hospital catering services have evolved from past to present, hospital malnutrition is still an important problem. During hospitalization, patients may not receive sufficient energy and hospital malnutrition is estimated to be up to 45-50% (Konturek *et al.*, 2015, Planas *et al.*, 2016)

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Based on the present study, it can be predicted that hospital malnutrition should not be observed when the MAR levels of the menus provided in hospitals are above 85%. However, it has been shown that low food intake or inadequate intake of energy and protein needs, which are consumed less than 50% of the meals (Curtis *et al.*, 2018, Simzari *et al.*, 2017). In one study, the average energy and macronutrient intake level taken by patients at breakfast, lunch and dinner were found to be significantly lower than the contents of the hospital menus when compare with this study (Konturek *et al.*, 2015). Although the consumption of patients was not examined, considering the energy and macronutrient levels, it is assumed that consuming more than 50% of the meals may meet the standard better than the levels given in the studies (Budiningsari *et al.*, 2016, Curtis *et al.*, 2018, Planas *et al.*, 2016, Schiavone *et al.*, 2019, Simzari *et al.*, 2017).

Table 5. Monthly frequency of meals in hospitals and fatty acid profiles, added sugar, and salt content correlation.

Variables	Fat(g)	SFA(g)	MUFA(g)	PUFA(g)	Cholesterol(mg)	Added sugar(g)	Salt(g)
Large piece meat dishes	-0.962*	-0.745	-0.562	-0.742	0.621	-734	-0.342
Small piece meat dishes	-0.027	-0.801	-0.877	0.562	-0.315	-0.263	-0.471
Fish	0.506	0.927	0.803	-0.146	-0.017	0.610	0.729
Chicken foods	-0.798	-0.354	-0.332	-0.861	0.973*	-0.816	0.519
Meatball	-0.826	-0.944	-0.863	-0.351	0.565	-0.942	-0.223
Meat and egg vegetable	0.202	-0.619	-0.676	0.766	-0.588	0.007	-0.634
Succulent legumes	-0.691	0.085	0.348	-0.849	0.682	-0.455	-0.025
Soups	-0.417	-0.759	-0.569	0.198	-0.126	-0.444	-0.904
Rice	-0.798	-0.354	-0.332	-0.861	0.973*	-0.816	0.519
Bulgur	0.912	0.818	0.735	0.583	-0.770	0.991**	0.005
Pastas	0.457	0.979*	0.947	-0.177	-0.060	0.636	0.516
Pastries (Cheese, potatoes and spinach)	0.622	0.990*	0.899	0.003	-0.210	0.755	0.538
Vegetables with olive oil	0.578	0.523	0.944	-0.034	-0.199	0.740	0.469
Legumes with olive oil	0.637	-0.187	-0.319	0.977*	-0.874	0.466	-0.468
Yoghurt	-0.854	-0.681	-0.412	-0.441	0.462	-0.783	-0.591
Cacık	-0.368	-0.932	-0.938	0.273	-0.035	-0.558	-0.542
Buttermilk	-0.637	0.187	0.319	-0.977*	0.874	-0.466	0.468
Fruits	0.908	0.862	0.676	0.444	-0.570	0.930	0.413
Milky desserts	-0.805	-0.675	-0.401	-0.368	0.382	-0.732	-0.660
Dough desserts + ashura + halva	-0.793	-0.219	-0.166	-0.937	0.994**	-0.759	0.531
Compotes	0.337	0.786	0.931	-0.029	-0.279	0.595	-0.146
Fruit desserts	0.637	-0.187	-0.319	0.977*	-0.874	0.466	-0.468
Salads	0.668	0.657	0.727	0.498	-0.740	0.825	-0.393

*Spearman correlation was applied; *: P<0,05; **: P<0,01.*

Budiningsari *et al* found that the energy and macronutrients consumed by patients at breakfast, lunch, and dinner were similar (Budiningsari *et al.*, 2016). Compared to this study, the energy of lunch and dinner separately met 40% of daily energy and 20% of breakfast. In Moran *et al* study, in line with this study, most of the regular-diet menus exceeded the daily limits for percentage of calories from fat, percentage of calories from saturated fat, and milligrams of sodium. However, unlike this study, the amount of dietary fiber was found to be insufficient (Moran *et al.*, 2015). In the current study, in all the hospitals, more than 40% energy of breakfast came from fat, and approximately 50% from hospitals A and D.

Several studies reported about nutrient adequacy ratios (Eldridge *et al.*, 2019, Ha K. *et al.*, 2021, Sánchez-Villegas *et al.*, 2018, Tavakoli *et al.*,

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2016). Accordingly, vitamin D, E and iron were given the lowest attention in children. In addition, dietary diversity method was consistent with MAR values and may predict iron, zinc and calcium intake (Campbell *et al.*, 2018). In two studies, the MAR values of the participants were between 75-80% which was sufficient. However, there were also studies showing that MAR values may be generally inadequate (Bhattacherjee (Bhattacherjee *et al.*, 2016, Tavakoli *et al.*, 2016). Insufficiency could cause some undesirable situations, for instance, deficiency of more than 4 nutrients is a high risk indicator for depression (Eldridge *et al.*, 2019). In this, MAR values of the menus were above 85% in all the hospitals. Dietary fiber, calcium, magnesium, and in one hospital potassium, had a lower NAR value compared to other nutrients. It seemed that vegetables and legumes were sufficient, yet dietary fiber was low. This may have been caused by the fact that vegetable amounts were low except the starchy ones. When hospital D was examined, the dietary fiber, K, and Mg amounts were lower than all the other hospitals. This situation could be the result of very low amounts of green leafy vegetables, but it could not be recognized at first because it was covered by excessively high amount of starchy vegetables. In fact, in all the hospitals, fruits amounts were consumed too slightly whereas starchy vegetables were as high as 300%. The calcium content of hospitals A and D were as low as 73% and 67%, respectively. Although in hospital B Ca content on the menu was adequate, the amount of milk, yogurt, and cheese was not sufficient. Besides, many reasons such as the region of residence, age, and gender may cause the difference in nutrient adequacy ratios. The sufficient amount of these nutrients is important since the higher intakes of generally lower-consumed nutrients were associated with lower risk of morbidity and mortality (Ha K. *et al.*, 2021).

In this study, total fat, saturated, fat and salt values were found to be high in the hospital menus. Compared with the, Total fat was approximately 2-3 times, and salt values were 1.5-3 times more than AHA recommendations. Daily fruits served in hospital menus were also lower than the AHA recommendations. Vegetables group was more than 85% in hospitals A and D, while it remained low in hospitals B and C. According to AHA and DRI recommendations, it could be presumed that high total fat and saturated fat intake will also increase trans-fat intake that can lead to an increase in non-communicable chronic diseases such as diabetes, coronary artery disease and metabolic syndrome (Currenti *et al.*, 2022, DiNicolantonio *et al.*, 2016, Julibert *et al.*, 2019).

After summarizing the results, two main concerns remain. On the one hand, total fat, saturated fat, cholesterol (except hospital D) and salt amounts were too much. This amount of consumption could have adverse health consequences. On the other hand, nutrient adequacy ratios seemed sufficient; however, the knowledge about consumption of patients was not enough. For this regard, plate waste should be observed effectively.

High fat and high saturated fat consumption adversely affected intra-abdominal adiposity and decreased insulin sensitivity, and consequently, it may result in metabolic syndrome (von Frankenberg *et al.*, 2017). Long-term high-fat consumption could impair mitochondrial function and cause oxidative stress in tissues, especially brain. This can cause neurodegenerative disorders (Langley *et al.*, 2020). In addition, a maternal diet rich in saturated fat would impair offspring hippocampus function (Robb *et al.*, 2017). It is well known that high-fat and high -sugar consumption give rise to weight gain and higher body fat (Stinson *et al.*, 2018). Excessive consumption of salt also increased the development of cardiovascular diseases, diabetes, and chronic kidney disease. Moreover, reduction in salt intake can effectively decrease coronary heart diseases (Kompanowska-Jezierska and Olszyński, 2018).

According to SALTURK I (Erdem *et al.*, 2010), salt consumption of Turkish population was 18 g/day, which was 3 times the AHA recommendation. In SALTURK II's study (Erdem *et al.*, 2017), it was shown that the salt intake was equal to 14.8 g/day (24-h urinary sodium excretion).

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The main sources of salt were reported to be bread (34%), added salt during cooking and preparing (30%), processed foods (21%) and table salt (11%), respectively. In this study, the biggest source of salt came from added salt during cooking. For the purpose of salt reduction, the Ministry of Health announced a national salt reduction program (2011). In this regard, the salt content of some foods such as bread, tomato paste, olive, cheese, pastrami and red pepper spice were reduced. On the package of salt, the statement of "Reduce the salt, care about your health" was added and some criteria were developed for school canteens.

Plate waste is a critical concern among all the stakeholders in hospital food service. In the study by Simzari et al, 25% of the patients were satisfied, and 75% were unsatisfied with hospital foods. This may increase plate waste of the patients. Thereby, while they needed 2030.3 kcal/day by average, their mean intakes were 1326 kcal/day (Simzari *et al.*, 2017). The overproduction in kitchen and meal service could also contribute to the plate waste. It was shown that the bigger the meal portion size, the higher the plate waste ratio would be (Goonan *et al.*, 2014, Ofei *et al.*, 2015). In the same line, the preventions and precautions should be taken because a great amount of food is wasted in hospitals, and more than half of the patients cannot meet recommended levels of energy and protein (van Bokhorst-de van der Schueren *et al.*, 2012). The room service model, a patient-centered food service, was able to reduce plate waste by 13-17%, and also improved patient satisfaction, and increased nutritional intake and meal costs. Therefore, patient-centered food service could decrease food waste and meal cost while enhanced and improved nutritional intake and patient satisfaction (McCray *et al.*, 2018a, McCray *et al.*, 2018b). Compared to thaw-retherm model, the energy and protein requirements were met and the reductions in plate waste and food costs were monitored in room service (Neaves *et al.*, 2022). Thanks to room service, national budget may be rescued from being thrown away, and can be used to improve all hospitals' food service systems. The novel ideas such as Food for Care and Bed Side Menu Ordering systems also improved energy and protein intake and decreased waste and cost (Dijxhoorn *et al.*, 2018, McCray *et al.*, 2018a).

There was not much research about hospital menus, its adequacy ratios of nutrients, as well as the plate and production waste as the authors searched the papers for the last five years up to 2022. In this study, the researchers investigated how the generally lower- and higher-consumed nutrients served in hospital catering services. The dietary quality in accordance with nutrient and mean adequacy ratios could be grasped. Nonetheless, it would be more beneficial to observe the plate waste, since food and nutrient amounts were calculated and then interpreted according to the nutrient and mean adequacy ratio calculations. In addition, more accurate results could be obtained by examining whole year menus instead of one-month menu.

Conclusion

One-month menus of four different hospitals were monitored in line with the national and international dietary recommendations. Most of the nutrients of these menus were considered adequate, yet some of the substantial nutrients were not. Furthermore, salt and fat contents were at undesirable levels. In view of the critical nutrients, dietary fiber, calcium, magnesium and potassium were little, but the risky nutrients such as salt, total amount of fat, saturated fatty acid were a lot; thus, renewing the standard recipes and arranging the patient-centered food management services would be useful strategy. Patient-centered food and catering services may be useful to enhance patient satisfaction and recovery, and diminish meal cost. Therefore, the hospitals and healthcare institutions need an accurate, responsible, and established system for improving the quality of hospital food services to ensure healthy and delicious foods with high consumption.

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Conflict of interests

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Authors' contributions

All the authors designed and conducted the research. Karagöz MF, Dener B, Altıntaş HB, and Çağıran İH performed statistical analysis and wrote the draft and final paper. Bilici S and Köksal E edited and supervised the paper and had primary responsibility for final content. All authors read and approved the final manuscript.

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