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Evaluation and proposal of a new menu for the supper served at a public hospital foodservice in Florianópolis-SC, Brazil

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Abstract

Planning menus for a unit of food and nutrition (UAN) involves several dimensions of quality such as nutritional and sensory, as well as profile and satisfaction of commensals, plus the cost. This study aimed to analyze and propose changes to the supper menu served in the restaurant of a public hospital in Florianopolis-SC, Brazil. The methods adopted for the characterization of commensals were: assessment of nutritional status, satisfaction survey and calculation of the total energy requirement (NET). For the evaluation of supper menus, quantitative (using food composition tables TACO, UNIFESP and USDA), qualitative (by the method AQPC) and cost (using the purchase requisitions and contracts with suppliers) analyzes were performed. The results showed that most commensals were overweight (39%) and pleased with the meal (52%). Qualitative evaluation of menus pointed excess of fried food (53%) and insufficient supply of leafy (58%) and non-starchy vegetables (26%). Quantitative analysis demonstrated inadequacy of energy, lipids, proteins and sodium, all above recommendation. The average daily cost of supper menus, composed of seven preparations, was R$ 3.26 per person. After reformulation of menus, the per capita cost decreased to R$ 2.94 and menus were adapted to the nutritional and sensory quality, aimed at promoting health and greater satisfaction of commensals. It was observed that improving the nutritional and

sensory quality of the meals not necessarily imply increased costs. It was possible to aim higher nutritional and sensory balance, in accordance with the costs of menus in order to future adjustments to the other quality dimensions.

Keywords: Menu Planning. Consumer Satisfaction. Quantitative Analysis. Qualitative Analysis. Costs and Cost Analysis. Hospital Food Service.

Introduction

The responsibility of Food and Nutrition Units (FNUs) is to manage, produce and offer meals under adequate health-hygiene and quality conditions that contribute to promoting, maintaining or restoring the health of consumers, thus assisting in the development of healthier eating habits.[1-3]

Adequate food can qualitatively and quantitatively meet nutritional needs, as well as preserve the sensory characteristics of food, while respecting individuals' eating habits and preventing the development of diseases as a result of poor eating habits.[4]

Menus are the tool that nutritionists can use to offer proper meals.[1-3] Suitable menu planning is beneficial to consumers and institutions, as it conveniently uses the resources and structure available, increases workers' productivity and their degree of motivation and job satisfaction, thus reducing the incidence of certain diseases or improving the health status of employees.[2,5] Consequently, the structure and planning of menus should consider the nutritional needs of consumers, please their taste, remain within the estimated costs and work as a tool for changing and improving eating habits.[6,7]

Meeting the nutritional needs of consumers must be a priority of an FNU, which should offer, in general, enough amounts of energy and nutrients for health promotion and training at work.[2] Inadequate caloric intake, for example, leads to low performance in the workplace, and the resulting malnutrition can lower resistance to diseases and contribute to the occurrence of work-related accidents.[8] The supply of foods that are rich in simple sugars, sodium, saturated fats and trans fats should also be controlled, since excessive intake of these nutrients may lead to the development of chronic diseases.[2] Quantitative assessments of menus are crucial for revealing information about the nutritional composition of menu components to be offered.[9]

To ensure adequate nutrient intake, nutritionists must pay attention to the quality of food and menu components offered, repetitions and color combinations, preparation techniques for available dishes and supply of certain foods, such as fruits and vegetables, types of meat and flatulence-

producing and difficult-to-digest foods.[2,7] The Qualitative Evaluation of Menu Components (QEMC) method assists in such evaluation and facilitates this process.[7]

Measurement of consumer satisfaction has to include consumers' opinion about the menu components offered, so that changes can be made and nutrition education activities can be held in the food and nutrition unit.[2] The regular practice of conducting customer satisfaction surveys is an important tool to evaluate consumer perception, increasing the awareness of unit managers.[2,10]

The cost of meals is a key factor for FNUs, and it must remain within the estimated budget.[7,11] Cost analysis can be performed by calculating per capita costs, considering fixed and variable, direct and indirect costs.[11] Nutritionists, however, must be consistent with social, economic and sustainable issues, i.e., the cost of menus should not be the main or sole criterion for menu planning. This is a way to prevent foods and nutritional and healthy menu components from being excluded or replaced with low-nutrient foods.[2,5,12]

Given the importance of nutritional and sensory quality of menus, cost control and consumer satisfaction, this study is very relevant because it aims to evaluate and redesign the supper menu offered in the cafeteria of a public hospital in Florianópolis, SC. The purpose of the present study was to evaluate and reduce costs, considering the nutritional needs and the satisfaction of consumers, as well as the nutritional and sensory quality of the meals. Menu analysis is also important as a means of health promotion and nutrition education of employees.

Method

Characterization of the food and nutrition unit

The FNU serves approximately 556 consumers a day, namely patients, caregivers and hospital staff. The meals are subsidized by agencies of the federal government such as the Ministry of Health /National Health System (SUS) and the Ministry of Education (MEC), because it is a teaching hospital. The funds are intended for hospital administration, which is in charge of controlling expenses and making purchases for each department, as needed.

The meals offered at the hospital are divided into large meals (lunch, dinner and supper - the latter for employees only); medium meals (breakfast and afternoon snack) and small meals (breakfast and supper).

The supper menu is composed of three fixed components (rice, brown rice and legumes), a hot side order, two or three kinds of salads, a soup and a type of dessert. Supper is served at the cafeteria and to hospital staff only.

The FNU at the hospital is not registered in the Worker Food Program (WFP), hence the program guidelines are not considered while preparing the menu.

Characterization of consumers and evaluation of their satisfaction with the supper

Consumer profile and consumer satisfaction with the supper were evaluated during the period of distribution of this meal, on two different days, with the voluntary participation of consumers.

The characterization of consumers was performed by applying a self-report questionnaire, calculating body mass index and calculating the average total energy requirement (TER). The questionnaire included variables such as age, sex, presence of non-communicable chronic diseases, allergies and food intolerances. Body mass index (BMI) was calculated based on the measurement of weight, with the aid of a Vitallys Plus® portable electronic scale for up to 180kg; height was self-reported by consumers. The BMI of the consumers was analyzed according to the classification of the World Health Organization.[13] TER and macronutrient needs were calculated by the Dietary Reference Intakes (DRIs),[14] considering age and average weight and height of consumers (data collected through the questionnaire).[15]

Consumer satisfaction with the supper served was evaluated by using the same questionnaire. Consumers were asked to rate their overall satisfaction with the supper by using a five-point rating scale: very poor, poor, fair, good or very good. They were also told to use this scale to classify each group of components (rice, soups, salads, hot side orders, meat and eggs, desserts) against criteria such as temperature, flavor, appearance and variety. At the end, they were also asked to indicate their favorite components add suggestions or criticism.

All data were double entered on the software Microsoft Excel®.

Evaluation of supper menus

The evaluation of the 19 menus originally served at supper included quantitative evaluation, qualitative evaluation and cost assessment.

The quantitative evaluation of the menu included the analysis of the nutritional composition of components, energy content, macronutrients and per capita sodium intake provided by the original supper menus. These values were compared with the ideal values provided by Ordinance No. 193/2006, the Worker Food Program (WFP)[16]. Although the hospital was not registered in this

program, it was used as the basis for analysis because supper at the cafeteria was served to hospital staff only. The analysis of nutritional composition was based on the following food composition tables: Brazilian Food Composition Table (TACO),[17] Chemical Food Composition Table by Unifesp[18] and *Food Composition Database of the United States Department of Agriculture* (USDA).[19]

Because there was no technical information available at the FNU, the per capita nutritional value of the components was calculated using the gross weight of foods, as described in the purchase orders, divided by the total number of consumers. This may have caused a difference in the end nutritional value, as net weight was not used for all foods. However, gross weight as informed in the purchase orders was not applied to fruits and vegetables, given the high correction factor presented by these foods. A different calculation was still necessary for the per capita amount of salt, oil and chicken leg quarter.

As oil was used in most components, the per capita amount was quantified according to the literature: 12.5mL per capita oil for fried components and 2ml per capita oil for other components.[20,21] To calculate the amount of salt, 500g salt per menu was considered for preparing all components of the supper (amount referred to by nutritionists at the study FNU).

In addition, due to the large difference between gross and net weight, per capita values reported in the literature were used to calculate the nutritional value of fruits and vegetables, considering medium per capita portions for these foods.[22] Still, for the only meat with bone received by the unit, chicken leg quarter, the amount of 135g per capita was also used as described in the literature for the calculation of nutritional menu components.[22]

To analyze the nutritional adequacy of the menu, its information was compared with the energy and nutrient recommendations of the WFP[16] for dinner, as the supper corresponds to a great meal for the study consumers (hospital staff). Thus, given a corresponding TER of 2,000 kcal, the percentage of 30% was selected for the analysis of dinner. Macronutrient energy distribution was 15% protein (23g), 60% carbohydrate (90g) and 25% lipids (17g). The analysis also considered 10g fibers and 960mg sodium.[16]

Qualitative evaluation of supper menus was performed using the Qualitative Evaluation of Menu Components (QEMC) method[2,7].

The cost of the menus was analyzed using the cost of raw materials recorded in the purchase orders and constant prices in the contracts signed with the suppliers, as bidding was the method of purchase.

Redesign of original supper menus

Data observed in the analyses described above was used to redesign the menus. In addition, physical structure, equipment, utensils and foodstuffs available in the unit were weighted.[11]

After the menus were redesigned, new quantitative, qualitative and cost assessments were performed in accordance with the methods described above, allowing the comparison of the results of both original and redesigned menus.

Results

Characterization of consumers and evaluation of their satisfaction with the supper

The FNU analyzed produces 3,270 daily meals; 109 meals are served at supper. There are 19 daily menus for supper, served cyclically, according to the following pattern: two types of salad, one type of soup, a protein source, white and parboiled rice, a hot side dish and one dessert.

97 out of the 109 consumers served by the FNU at supper, responded to the satisfaction and general information survey (89%). The mean age of consumers was 36 ± 15 years; 68% of them were female (n = 64).

The presence of chronic diseases or food allergies was reported by 10.3% (n = 10) of consumers, corresponding to hypertension (n = 4, 4.1%), diabetes *mellitus* (n = 2, 2.1%), asthma (n = 2, 2.1%), soy allergy (n = 1, 1.0%) and lactose intolerance (n = 1, 1.0%).

As for nutritional status, 59 consumers agreed to participate at the stage of analysis of nutritional status, through self-reported height and weight measurement. The data showed 41% of normal weight (n = 24) and 59% of inadequate nutritional status (n = 35), 3% of Grade I thinness, 39% overweight, 14% Grade I obesity and 3% Grade II obesity.

TER was approximately 2,349 kcal. It was calculated using mean age (36 ± 15 years), mean weight (71.3kg), mean height (1.66m), prevalent nutritional status (overweight) and predominant sex of the sample (female). Whereas supper is a main meal and therefore accounts for 30% of TER (16), this meal is expected to have around 700 kcal distributed in percentages referred by DRIs in 26g of protein (15% of TER), 105g of carbohydrates (60%) and 19g of fat (25% of TER).

Evaluation of supper menu

Overall consumer satisfaction with the supper was 67%, a percentage divided into "good" as rated by 51.6% of the consumers (n = 47), and "very good", by 15.4% (n = 14).

Table 1 shows the degree of consumer satisfaction with the supper by groups of components. The sum of the ratings "good" and "very good" ranged from 60 to 80%; this sum was greater than the sum of the options "very poor", "poor" and "fair".

The ratings "poor" or "very poor", mentioned by 43% of consumers (n = 42), were justified by: small range of salads (n = 10, 10.3%); small range of desserts, meats and soups (n = 5, 5.2%); dissatisfaction with the types of components and preparation techniques (n = 6, 6.2%).

Only 14.7% (n = 15) of consumers, at the time of data collection, reported that they had not eaten all the food served on their plate. They justified their answers with the following information: bad taste (n = 6, 6.2%); visual aspect of component was better than the taste (n = 5, 5.2%).

The three favorite foods or types of menu components as cited by consumers were soups (n = 52, 53.6%), chicken (n = 32, 32.9%) and salads (n = 22, 22.6%).

Consumers suggested the following improvements to the supper: serving the supper eariler (n = 7, 7.2%) and decreasing the frequency of fatty menu components (n = 5, 5.1%). The main criticism against the supper was relative to the sensorial quality of the meal (n = 6, 6.2%).

Table 1. Consumer satisfaction, in percentage terms, with the supper menu of a hospital FNU, by group of components. Florianópolis-SC, 2013.

Aspects under analysis	Very Poor	Poor	Fair	Good	Very Good
Rice					
Temperature	-	3	26	55	16
Taste	-	4	22	56	17
Appearance	-	6	28	51	14
Variety	-	9	25	50	16
Soups					
Temperature	1	2	17	52	28
Taste	1	1	25	46	27
Appearance	3	10	21	41	25
Variety	1	7	22	44	26
Salads					
Temperature	-	5	15	57	23
Taste	-	9	24	56	11
Appearance	-	5	27	47	21
Variety	2	14	24	45	15
Hot side orders					
Temperature	-	5	15	61	19
Taste	-	4	28	53	15
Appearance	-	8	30	46	16
Variety	1	3	34	48	14
Meat					
Temperature	-	3	22	56	19
Taste	-	3	33	47	17
Appearance	1	11	34	38	16
Variety	1	12	30	41	16
Dessert					
Taste	-	4	25	54	17
Appearance	-	10	30	44	15
Variety	-	12	30	44	14

(n=97)

By applying the QEMC method to 19 menus originally served at supper, the following positive aspects were identified: high frequency of fruit for dessert (95%); no supply of fatty meat and fried foods on the same day; and low supply of sweets for dessert and fried foods on the same day (5%). Aspects to be improved include the frequency of 53% of fried foods on ten days of the menu, the presence of two menu components with flatulence-producing or difficult-to-digest food on the same day (32%) and 58% of days with the presence of leafy vegetables (11 days).

Quantitative analysis, in all evaluated menus (n = 19), showed that the quantities supplied exceeded the recommended energy amounts for proteins, lipids and sodium; and there was an adequate supply of fiber, according to the recommendations of the WFP.[16] As for carbohydrates, there was adequate supply in only 63% (n = 12) of the days.

The per capita cost of menus ranged between R$ 2.55 and R$ 4.39, within the amount budgeted by nutritionists at the FNU. The most costly menu components were proteins, especially breaded meats. Among protein components, kung pao chicken had the lowest per capita cost (R$ 1.28), while breaded fish fillet had the highest per capita cost (R$ 3.11); it appeared on three days of the menu.

Redesign of original menus

Based on the results found through quantitative, qualitative and cost evaluations, changes to the original menus were proposed to improve aspects assessed as inadequate.

The proposed changes kept the original structure in 16 out of the 19 menus of the FNU. Changes were made to the menu pattern on those three days because the nutritionists at the FNU had requested a redesign on the menu so that it includes sandwich and soup, and allows the analysis of the feasibility of these changes in the future. Table 2 shows the redesigned menus.

Table 2. Changes made to the supper menus at the hospital FNU. Florianópolis (SC), 2013.

M	Changes made		Final version of proposed menu
	Components excluded from the menu	Components added to the menu	
1	Soup (zucchini, arracacha, chayote, capellini pasta, meat and spices); sautéed potatoes with olive oil	Vegetable Soup II (arracacha, chayote, collard greens, pumpkin); green beans and chayote	Cabbage and pineapple; Vegetable Soup II (arracacha, chayote, collard greens, pumpkin); colorful rice; brown rice; breaded chicken; green beans and chayote; apple
2	Endive and chickpeas with tomato and basil; pea soup with chicken; buttered carrot	Tomato with basil; pea soup with mint Cooked carrots	Tomato with basil; pea soup with mint; parboiled rice; brown rice; steak with onions; cooked carrots; orange or tangerine
3	Tomatoes, green and yellow peppers; spaghetti with garlic, olive oil and parsley	Tomatoes, green and yellow peppers; lettuce; braised eggplant	Tomatoes, green and yellow peppers; lettuce; chicken soup (rice, carrots, parsley, potatoes and chicken); parboiled rice; brown rice; rump roast; braised eggplant; pineapple
4	Watercress and carrots with basil; lentil soup (conchiglie, squash, potatoes, spices, pepperoni); parboiled rice; brown rice; fish fillet breaded; mashed potatoes	Lentil soup (lentil, squash, potatoes, spices); tuna sandwich with ricotta cheese, olive oil, lettuce, tomato, grated carrot	Lentil soup (lentil, squash, potatoes, spices); tuna sandwich with ricotta cheese, olive oil, lettuce, tomato, grated carrot; orange or peach
5	Cucumber; potato cream soup with collard greens and meat; rice balls	Arugula with orange; creamy polenta	Beet; arugula with orange; creamy polenta; parboiled rice; brown rice; meat stew; apple or watermelon

M	Changes made		Final version of proposed menu
	Components excluded from the menu	**Components added to the menu**	
6	Cauliflower; soup (zucchini, chayote, carrots, rice and meat); Spaghetti and garlic, oil and parsley	Watercress and sautéed cauliflower; vegetable soup I (zucchini, chayote, carrots, cassava)	Watercress and sautéed cauliflower; vegetable soup I (zucchini, chayote, carrots, cassava); parboiled rice; brown rice; meatballs with sauce; spaghetti and garlic, oil and parsley; orange
7	Soup (arracacha, chayote, collard greens, meat, squash and capellini pasta); breaded banana	Endive; vegetable Soup II (arracacha, chayote, collard greens, squash); cooked carrots	Tabbouleh salad; endive; vegetable soup II (arracacha, chayote, collard greens, squash); parboiled rice; brown rice; roast pork loin; cooked carrots; pineapple
8	Soft polenta	Boiled green beans	Red cabbage with vinaigrette and orange; chicken soup (rice, carrots, chicken, spices and potatoes); parboiled rice; brown rice; top round roast with peas; boiled green beans; apple or plum
9	Endive and boiled carrots; lentil soup (lentil, vegetables w / conchiglie and meat); parboiled rice; brown rice; chicken fingers; cauliflower with white sauce	Lentil soup (lentil, squash, potatoes, spices)	Lentil soup (lentil, squash, potatoes, spices); shredded cooked chicken sandwich with tomato, arugula and grated carrots; sagu (tapioca pearls in red wine)
10	Chickpeas; soup (carrot, chayote, potatoes, collard greens, rice and chicken); browned potatoes	Tomatoes, onions, endive; vegetable soup III (carrots, chayote, potatoes, collard greens); *quibebe* (type of squash soup);	Tomatoes, onions, endive; vegetable soup III (carrots, chayote, potatoes, collard greens); parboiled rice; brown rice; kung pao chicken; *quibebe*; orange or bitter orange

M	Changes made		Final version of proposed menu
	Components excluded from the menu	Components added to the menu	
11	Lettuce with oregano and vinaigrette; pea soup with chicken; chayote with white sauce; banana	Lettuce with apple; pea soup; baked potato with parsley; melon	Lettuce with apple; pea soup; parboiled rice; brown rice; breaded fish fillet; baked potato with parsley; melon
12	Soup (pea, capellini pasta, squash, chayote, potatoes, spices and meat); shoestring potatoes; melon or ponkan	Vegetable soup IV (peas, capellini pasta, squash, chayote, green beans, spices); baked potato; orange or ponkan	Cooked beet and cabbage; vegetable soup IV (peas, capellini pasta, squash, chayote, green beans, spices); parboiled rice; brown rice; beef stroganoff; baked potato; orange or ponkan
13	Sweet pepper; Soup (zucchini, carrots, cauliflower, potatoes, green beans, conchiglie and meat); macaroni salad;	Vegetable soup V (zucchini, carrots, cauliflower, potatoes, green beans); Squash soup;	Tomato and endive; vegetable soup V (zucchini, carrots, cauliflower, potatoes, green beans); parboiled rice; brown rice; roast chicken; Squash soup; pear
14	Soup (rice, chayote, chicken and squash);	Vegetable soup I (zucchini, chayote, carrots, cassava)	Watercress and cabbage; vegetable soup I (zucchini, chayote, carrots, cassava); parboiled rice; brown rice; ground beef pancake with red sauce; greens beans and carrot; apple or grape
15	Scalded onion; Soup (conchiglie, chayote, carrots, potatoes and meat); breaded chicken skewer; corn soup	Lettuce; Lentil soup (lentil, squash, potatoes, spices); chicken with carrots and tomatoes; cooked cassava;	Beet and lettuce; lentil soup (lentil, squash, potatoes, spices); parboiled rice; brown rice; chicken with carrots and tomatoes; cooked cassava; orange or watermelon

M	Changes made		Final version of proposed menu
	Components excluded from the menu	**Components added to the menu**	
16	Lettuce and boiled carrots; parboiled rice; brown rice; breaded fish fillet; potatoes with gratinated cheese;	Parboiled rice; brown rice; breaded fish fillet; potatoes with gratinated cheese; vegetable soup II (arracacha, chayote, collard greens, squash); braised loin sandwich with pineapple, grated beets and watercress	Vegetable soup II (arracacha, chayote, collard greens, squash); braised loin sandwich with pineapple, grated beets and watercress; papaya or tangerine
17	Tomato and green beans; squash and meat soup; spaghetti with tomatoes, oilive oil, garlic and basil;	Tomato and arugula; squash soup with peas; cooked green beans;	Tomato and arugula; squash soup with peas; parboiled rice; brown rice; breaded steak; cooked green beans; pineapple
18	Soup (squash, conchiglie, chayote, potatoes, meat);	Spinach cream soup (spinach, potatoes, spices)	Endive and boiled carrots; spinach soup (spinach, potatoes, spices) parboiled rice; brown rice; roasted kebab; *quibebe*; apple or khaki
19	Scalded onion; toasted manioc flour with parsley;	Lettuce; braised zucchini	Boiled beet and lettuce sugar; chicken soup (carrot, rice, chicken, potatoes and parsley); parboiled rice; brown rice; top round roast; braised zucchini;

Caption: M = Days of the menu

Quantitative, qualitative and cost analyses were performed for the redesigned menus as well. The qualitative analysis of the original menus highlighted the need to reduce the excessive number of fried foods, increase the supply of leafy vegetables and non-starchy vegetables served as hot side dishes, and reduce the repetition of colors and the supply of flatulence-producing and difficult-to-digest food in the same meal. Table 3 shows the result of the items evaluated by the qualitative method (QEMC) for original and redesigned menus.

Table 3. Comparison of the results of the qualitative evaluation of the original and proposed menus by the QEMC method. Florianópolis (SC), 2013.

Qualitative aspects under analysis	Original menus (%)	Proposed menus (%)
Presence of leafy vegetables	58	100
Presence of fruits for dessert	95	95
Presence of non-starchy vegetables in hot side dishes	26	75
Presence of ≥ 3 menu components with the same colors	42	-
Presence of ≥ 2 components with flatulence-producing foods	32	-
Presence of fatty sauces	26	10
Presence of fruits for dessert	5	5
Presence of fried foods	53	16
Presence of fatty meat	11	11
Presence of fatty meat and fried foods on the same day	-	-
Presence of sweets and fried foods on the same day	5	-

(n= 19 days of the menu)

Quantitative analysis of the original menus showed oversupply of energy, proteins, lipids and sodium. Redesign of these menus led to a reduction in energy content and other excess nutrients (Figure 1).

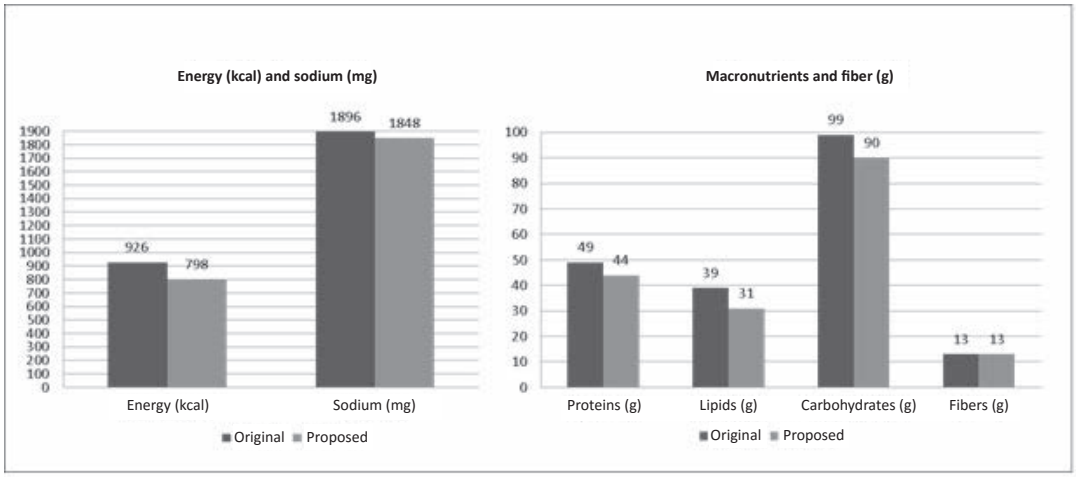
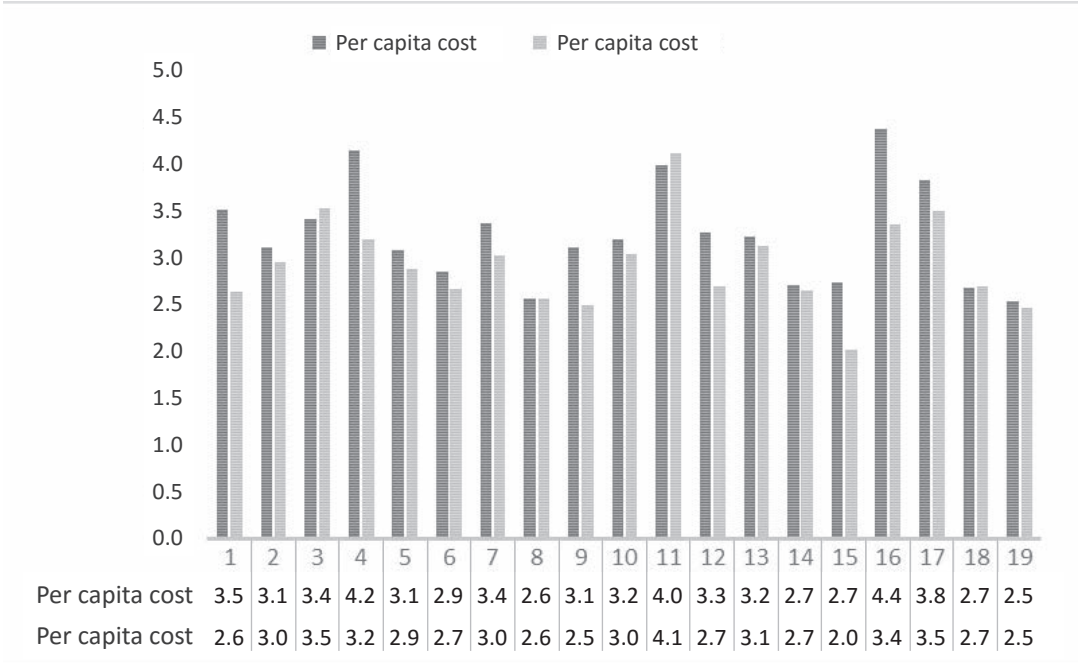


Figure 1. Average composition of the original and redesigned menus as for energy, macronutrients, fiber and sodium. Florianópolis (SC), 2013.

The cost of redesigned menus decreased when compared with the original menus. Figure 2 shows the average per capita cost of the 19 original and redesigned menus.

As for the redesigned menus, the most costly menu was number 16, which consisted of vegetable soup II, braised loin sandwich with pineapple, grated beetroot and watercress. The least expensive redesigned menu was number 19, with the following components: cooked beet and lettuce salad; chicken soup (carrot, rice, chicken, potatoes and parsley); parboiled rice; brown rice; top round roast; cooked zucchini as a hot side dish and orange for dessert.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Per capita cost	3.5	3.1	3.4	4.2	3.1	2.9	3.4	2.6	3.1	3.2	4.0	3.3	3.2	2.7	2.7	4.4	3.8	2.7	2.5
Per capita cost	2.6	3.0	3.5	3.2	2.9	2.7	3.0	2.6	2.5	3.0	4.1	2.7	3.1	2.7	2.0	3.4	3.5	2.7	2.5

Figure 2. Per capita cost in Brazilian reais (R$) of the original menus (O) and redesigned (R) menus. Florianópolis-SC, 2013.

Discussion

NFUs, which are managed by nutritionists, are in charge of supplying and adapting the food they offer so as to meet the nutritional needs and profile of consumers, thus ensuring both health recovery and health promotion as forms of disease prevention. In addition, the meals offered are supposed to satisfy consumers and serve as an example for nutrition education and compliance with quality requirements, in its various dimensions, while considering the financial feasibility for implementation of activities. For this purpose, menus are the main working tool of nutritionists throughout the process.[2,7]

The prevalence of inadequate nutritional status in the study population (59%), characterized by overweight rates of 39% and 15% obesity, is worrying. Magrine et al.[23] also found significant rates of overweight and obesity in their study of 255 consumers. They observed that 28.95% of women and 44.97% of men were overweight, and 3.94% of women and 14.09% of men had some degree of obesity. The authors concluded their study by suggesting the need for nutritional education processes.

In addition, given that this study has regular consumers, i.e., they have supper several times a week at the study FNU and do not have the choice of having this meal elsewhere, there is a clear need for greater care and control of the meals served, including the types of menu components and cooking techniques employed.[24,25] After the redesign of menus, there was decreased offer of fried foods, fatty sauces and starchy vegetables served as hot side dishes.

The percentage of overall satisfaction with the supper was 67%, and the sum of the ratings "good" and "very good" for the evaluation of groups of menu components was greater than the sum of the options "very poor", "poor" and "fair"; therefore, it is considered that consumers were satisfied with the supper. Ramos et al.,[8] when assessing the satisfaction of consumers at a food and nutrition unit, also considered that consumers were satisfied with the meal because they found that consumer satisfaction with the largest meal was more than 70% in all five criteria, except for the number of salads and quality of desserts. Dissatisfaction with the variety of salads was also found in the present study.

In fact, the variety of the menu was pointed out by consumers as a point to be improved. It can be seen that variety is a challenge to nutritionists because striking a balance between healthy menu components, sensory characteristics and costs is a process that requires a great deal of planning.[2] Menu components usually need to be rethought for greater sensory attraction (for example, vegetables and fruits with different colors), and a more attractive visual aspect, as well combinations of preparation techniques and healthy and appetizing sauces and seasonings that can arouse greater interest in consumption.[2,7]

The frequency of leafy vegetables on the original menus (58%) was lower than the one found in other studies, e.g. those by Ramos[10] (100%) and Veiros et al.[7] (82.6%). The daily presence of vegetables is important, because they are sources of vitamins, minerals and fiber, which contribute to the prevention of chronic diseases, and they also have low calories.[4,8] The leafy vegetables were included on all days of the redesigned menus.

Although the range of colors (42%) was narrower than the one observed in the studies of Ramos (69%)[8] and Veiros et al. (69%),[7] this aspect was actually revised in the redesigned menus so as to ensure a diverse nutrient intake and provide colorful and attractive dishes that could arouse consumers' interest in the foods offered.[2,7]

The supply of fatty meats and fried foods in the original menus was similar to the one found in the study of Veiros et al.,[7] while there was lesser simultaneous availability of these two components on the same day. Toral et al.[26] also found excessive supply of oils and fats.

Frying is a commonly used preparation method because it is quick and offers particular sensory characteristics to menu components.[2,8] However, it has negative physical and chemical changes; for example, the food absorbs the frying oil simultaneously, which helps to increase the caloric value of the component; besides, it may also lead to the formation of acrolein and trans fat, if there is no control of temperature, time, type of oil and method for use of oil.[27,28] On the redesigned menus, the frequency of pre-fried products (e.g., breaded fish fillet) was reduced, as these food products contain large amounts of fat as a result of previous industrial frying; the quality and composition of the oils used in this step are unknown,[29,30] but they are commonly rich in trans fat.

Quantitative analysis of the original menus showed high content of energy, protein and lipid in the supper. Inadequate supply of energy and macronutrients as advocated by the WFP was also reported by Pecorati & Maistro.[31] The oversupply of lipids was also found in 42% of menus in five geriatric centers in Spain, although protein supply was adequate in all those menus, unlike the results of the present study.[9] These results reinforce the need for constantly adapting the energy and macronutrient supply to consumers,[9] together with the sensory and symbolic quality of the meal.[32] In redesigned menus, energy supply has been reduced, and consumer satisfaction with supper was also taken into consideration.

Cost and consumer satisfaction are equally important as far as consumer loyalty is concerned, i.e., consumers have meals at the FNU more often. Menus are more cost-effective for the FNU when they are better planned and implemented, and more consumers are served. However, the FNU analyzed in this study is located in a non-profit public agency; for this reason, cost is a factor that should be carefully handled, given the limited budgets of such type of agencies. Proper management can reduce expenses and streamline production costs.[33]

Although the average cost of the original menus was considered to be reasonable by the nutritionists of the FNU, it was believed that an increase in the supply of leafy vegetables could reduce production costs and meet the demand for such vegetables, as identified in the qualitative assessment of the menus. Changes such as this one show the possibility of improving the nutritional and sensory quality of menus without increased cost.

In general, changes to the menus took into consideration the demands of consumers and the need for improvement as suggested by the qualitative and quantitative analysis of the original menus, thus seeking to improve the data in subsequent evaluations of the redesigned menus, although they have not been tested. It is also expected that the planned changes can be implemented and evaluated, with consequent increase in the level of consumer satisfaction and improved nutritional status of the study population.

Conclusions

The initial need for analysis and reduction of costs, as pointed out by the FNU, resulted in the analysis of supper menus in several respects. Given the importance and the role of the menus in promoting health and healthy eating habits, there were qualitative and quantitative analyses, as well as a nutritional assessment and a consumer satisfaction survey with the supper provided.

The satisfaction survey provided greater contact with consumers, insights about their perceptions of the food and the service offered, and information about their food preferences. These data were crucial and were taken into consideration while redesigning the menus. Another factor that qualified the redesign of menus was the nutritional assessment of regular consumers, which highlighted the importance of nutritional quality for the menu components offered.

Moreover, the qualitative and quantitative analyses showed aspects and items that should be improved on the original menus. Costs analysis also identified that certain nutritionally adequate menu components had the lowest cost, compared with other options that were not as healthy, e.g. roasted and fried foods. Thus, the qualitative, quantitative and cost analyses should be performed together to support the changes and possible improvements in the nutritional and sensory quality of menus at FNUs, thus strengthening and qualifying the nutritionist's role in promoting health, regardless of the location and type of FNU.

This study described the challenges faced by nutritionists involved in meal production while performing the complex activity of menu planning. This task requires adequate supply of food covering all dimensions of quality, especially the nutritional and sensory ones.

Finally, the analyses performed in this study should be highlighted as crucial to support the correct assessment and the necessary changes to menus that are planned and implemented.

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