ORIGINAL ARTICLE

Acceptance of Low-Sodium Hospital Diet by Cardiac Patients: A Randomized Controlled Crossover Trial

Bruna Fraga dos Santos,[1] Bruna Eibel,[1] Ana Lúcia Grasel Antunes,[1] Cláudia Monster Martins,[1] Renata Della Giustina,[1] Melina Borba Duarte,[1] Izabele Vian da Silveira Corrêa[1]

Instituto de Cardiologia,[1] Porto Alegre, RS – Brazil

Abstract

Background: Cardiovascular diseases are the major cause of hospitalization. Dietary salt restriction is indicated as part of clinical treatment, however, it is not always well accepted by the patients, resulting in low food intake and malnutrition.

Objective: To compare acceptance of a low-sodium diet cooked with salt with a standard low-sodium diet in cardiac inpatients. Methods: A randomized controlled crossover trial in patients with low-sodium diet prescriptions (Clinical Trials NCT03481322). Patients were given a control standard low sodium diet (cooked without salt; salt [2g per meal] added by the patient at the time of consumption) on one day and on the next day patients were given the intervention diet – a low sodium diet cooked with salt (2 grams of salt, divided between preparations). Dietary acceptance was evaluated by weighing leftover food and calculating intake. A questionnaire was used to verify reasons that influenced acceptance. For data analysis, parametric data are presented as mean and standard deviation, Student's t test was used to compare means, with significance defined as $p<0.05$.

Results: Sixty-four patients were evaluated, with a mean age of 66 ± 11.3 years; 64% were male. There were no differences in percentage acceptance between the standard low-sodium diet and the low-sodium diet cooked with salt at lunch ($p= 0.876$) or at dinner ($p= 0.255$). Around 80% of what was offered at each meal was consumed by the patients, with no significant difference between groups.

Conclusions: The low-sodium diet cooked with salt was well accepted, but there was no difference when compared with the standard low-sodium diet, which also had adequate acceptance.

Keywords: Sodium Chloride; Diet, Sodium-Restricted; Cooking; Heart Diseases.

Introduction

Cardiovascular diseases are the major cause of hospitalization in the public sector, affecting 29% of the elderly population.[1] In 2015, 17.7 million people died from cardiovascular diseases worldwide.[2] One of the risk factors for cardiovascular diseases is systemic arterial hypertension (SAH), the treatment for which includes a low-sodium diet. Hospital diets with nutritional restrictions are 50% less likely to be accepted and this should be of greatest concern with relation to low-sodium diets.[3-4] Severe sodium reduction (by 2 g of salt/day) is associated with a lower food intake,[5] which can result in weight loss during hospitalization. Low food intake is the main independent risk factor for hospital mortality[6] and can lead to malnutrition.

Hospital malnutrition affects almost half (48.1%) of inpatients in Brazilian public hospitals.[7] In Latin America, the prevalence rate has ranged from 40 to 60% over the past 20 years. It is known that malnutrition affects the response to clinical treatment, resulting in longer hospital stays and greater risk of complications, and also has a great impact on health system costs, since expenditure on malnourished patients is on average 61% higher.[8-10]

Mailing Address: Bruna Fraga dos Santos
Instituto de Cardiologia. Avenida Princesa Isabel, 390. Postal code: 90620-000. Porto Alegre, RS – Brazil
E-mail: brunafragasantos@gmail.com

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High rates of nutritional impairment can be prevented if nutritional care is appropriate during hospitalization, with early diagnosis of nutritional risk and malnutrition and adjustment of food intake, thus reducing hospital mortality.[10]

Brazilians consume very large amounts of salt, around 12 g/day, which possibly undermines their acceptance of low-salt diets.[11] The World Health Organization (WHO) recommends a maximum intake of 2,000 mg of sodium/day, which corresponds to 5 g of salt.[12] Many people who consume far more sodium than is recommended are not aware of the risks involved,[11] and changing to a low-salt diet and following it for a long period is quite difficult.[5,13] Moreover, a hospital diet is considered tasteless,[14] as is the case of a salt-free diet, since salt adds flavor to the natural seasonings used in foods. To date, there have been no literature studies that assess food acceptance by hospitalized cardiac patients, comparing low-sodium meals cooked with salt with those to which salt is added after cooking.

Dietary salt restriction is indicated as part of clinical treatment, but it is not always well accepted by patients, resulting in low food intake and, as a likely consequence, in malnutrition, which is highly prevalent in hospital settings. It is therefore necessary to formulate strategies to improve these patients' dietary intake. The goal of this study was to compare acceptance by cardiac inpatients at a tertiary hospital in Porto Alegre, Brazil, of a low sodium diet cooked with salt with acceptance of a standard low-sodium diet to which salt is only added after cooking.

Methods

A randomized controlled crossover trial was conducted between September 2017 and June 2018 with adult male and female patients aged ≥ 18 years prescribed a low-sodium diet, a low-sodium diet for diabetes, or a low-sodium diet for dyslipidemia, within the first four days after hospital admission. The following patients were excluded from the study: those prescribed any other type of diet or with other dietary restrictions and/or changes to food consistency; those who chose to eat soup and/or chicken soup for lunch or dinner; those who did not receive their meal with proper standardization (e.g., without beans); and those unable to answer the questionnaire and unaccompanied by a caregiver.

Study Implementation

The salt-restricted diets offered at the hospital consist of four preparations: one portion of carbohydrate (cereals or type C vegetables), one portion of legumes, one portion of meat, and one portion of garnish (type A or B vegetables in the low-sodium diet for diabetes or dyslipidemia, or a portion of type A or B vegetables or another portion of carbohydrate in the low-sodium diet). The amount and weight of foods is the same for all three diets. The characteristics of macronutrients were maintained, differing only in terms of salt, depending on the randomization group.

All patients received both of the diets tested. Each diet was offered at lunch and at dinner on one day, differing only in the order in which they were offered, depending on the randomization group.

Control diet: standard low sodium. Foods cooked without salt, with addition of salt (2 g per meal) by the patient only at the time of consumption.

Intervention diet: low sodium cooked with salt. In this case, each meal was cooked with 2 g of salt per patient divided between the preparations, following standardized recipes.

Randomization and Blinding

The patients were randomized into two groups using a randomization software program.[15] Following signature of the consent form, the randomization order of each patient was disclosed by a blinded researcher. As a complement to the study, a questionnaire was administered by another researcher, who was blinded to the diet (control or intervention) the patient would receive.

The patients from group 1 received the standard low sodium diet on the first day and the low sodium diet cooked with salt on the second day. The patients from group 2 received the same diets, but in reverse order; thus, on the first day, they received the low sodium diet cooked with salt, and on the second day, the standard low sodium diet.

Acceptance of the Diets

The amount of foods ingested by the patients was evaluated by weighing leftover food and calculating intake. The weight of the leftovers was deducted from the initial weight and the resulting food intake was later converted to percentage acceptance. The foods given to

each patient were weighed previously when divided into portions. After the meals, the leftovers were stored in plastic vessels and properly labeled for weighing. Weight was measured on an electronic scale (Toledo®), with 3 kg capacity and specificity of 1 g, and the leftovers were immediately disposed of appropriately.

Questionnaire

The questionnaire contained questions on the reasons for non-acceptance of the diet and on previous control of salt intake, adapted from a study by Santos et al.[16] The questionnaire was administered to each patient twice, i.e., at the end of each diet (standard low-sodium diet and low-sodium diet cooked with salt). Diagnoses of underlying diseases were obtained from patient records and transcribed according to the International Classification of Diseases (ICD-10).

Ethical Aspects

The study followed the CONSORT statement for randomized controlled studies[17] and was approved by the Research Ethics Committee at the Institute of Cardiology after submission to the Plataforma Brasil (UP 5364/14) and Controlled Trials (NCT03481322). The participants' data were kept confidential. All patients were given a copy of their signed consent form. The data collected were only used for this research and will be stored for five years and destroyed after that, in accordance with Resolution 466/12.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 23.0. Nominal values were presented in absolute and relative frequencies. Parametric data are presented as mean and standard deviation. The Shapiro-Wilk test was used to verify normality of the data. Student's *t* test was used for independent samples. Categorical variables were evaluated with Pearson's chi-square test. Statistical significance was defined as $p<0.05$.

Sample Size Calculation

The sample size was calculated with PEPI version 4.0, taking into account data from a study by Santos et al.,[16] considering that the mean diet acceptance rate in that study was 66%, with a standard deviation of 29%, and also that the level of acceptance of hospital diet considered appropriate is at least 80%, according to Sousa et al.[18] For a power of 80% and a level of significance of 5% (95% confidence interval), adding 20% for possible losses to follow-up and refusals to participate, it would be necessary to include 68 patients in the study.

Results

Sixty-four patients were evaluated and 41 completed the study, receiving two meals from each diet. Figure 1 shows the sample losses according to the CONSORT flowchart. The sample of adult male and female patients is described in Table 1.

Table 2 presents the percentage acceptance of the diets. Around 80% of what was offered in each meal was eaten by the patients, without significant difference between diets (standard low-sodium diet or low-sodium diet cooked with salt) or between meals (lunch or dinner). When analyzed according to the percentage considered adequate, that is, consumption of at least 80% of what was offered, the diet cooked with salt achieved a higher rate of adequacy when compared with the standard low-sodium diet, but the difference was not significant (Table 2).

Men consumed greater amounts at lunch (87.0 ± 19.9% of the standard low sodium diet and 85.1 ± 23.3% of the low sodium diet cooked with salt) when compared with women (63 ± 24.3% of the standard low sodium and 69.5 ± 22.7% of the low sodium diet cooked with salt), ($p=0.000$ standard low sodium diet; $p=0.017$ low sodium diet cooked with salt). Regarding previous control of salt intake at home, checked through simple questions, most patients reported controlling salt intake at home. On the other hand, daily or sporadic use of industrialized seasonings was reported by most patients (65%), contradicting their self-reported salt intake control. It was also observed that most of these patients are used to cooking with salt (Table 3).

After eating their diets (standard low-sodium on one of the days and low-sodium diet cooked with salt on the other day, according to their randomization group), the patients were asked about their acceptance of the diets. Most patients (72%) reported not missing salt in the hospital food, and this percentage was the same for both diets ($p=1.0$). As for the preference among diets, 51% of the patients reported preferring the low-sodium diet cooked with salt. Even among the patients who claimed they controlled salt at home, 23% missed salt in the low sodium diet cooked with salt and 24% missed salt in the standard low sodium diet, with no difference between groups ($p=1.0$).

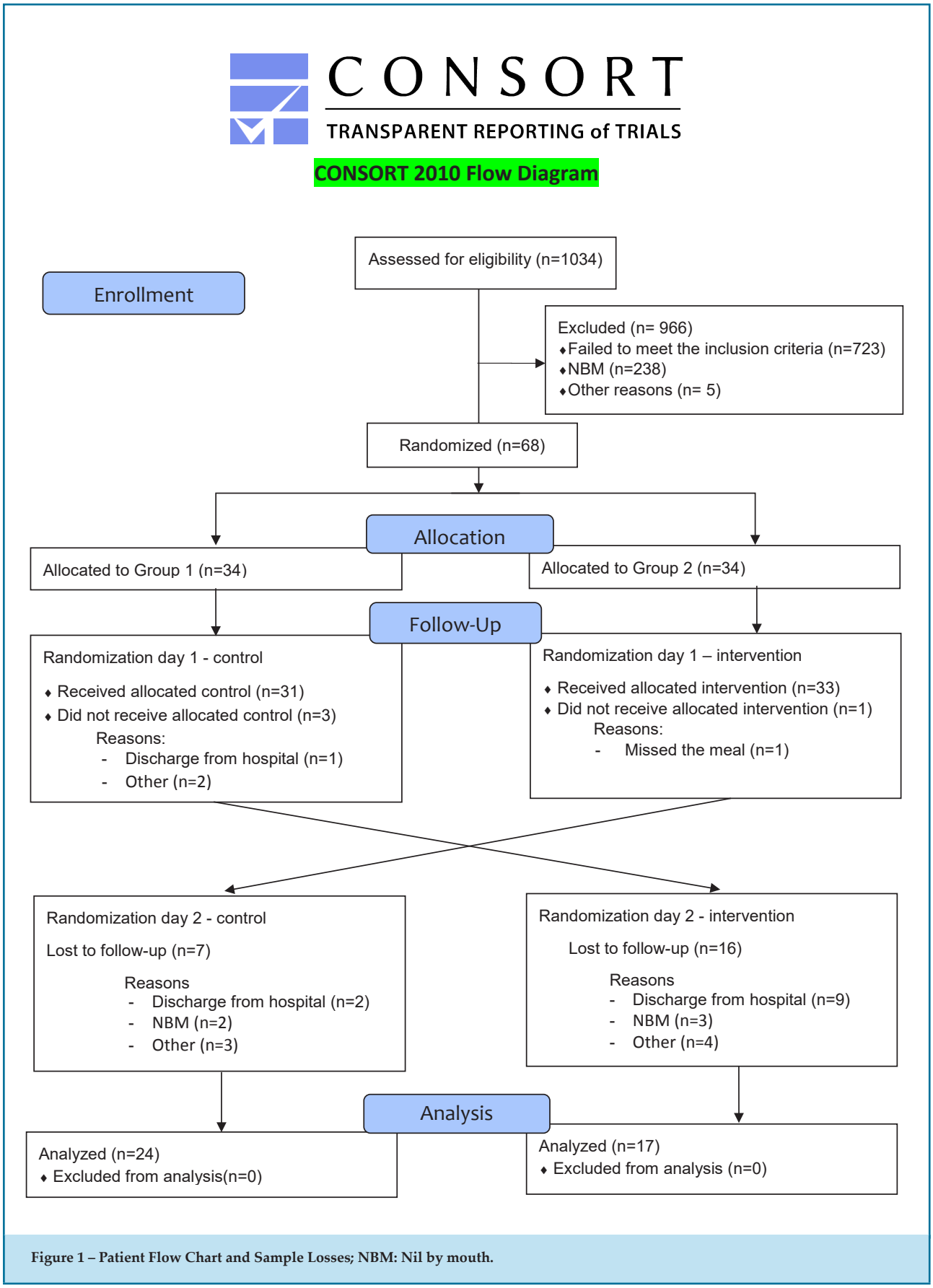

Figure 1 – Patient Flow Chart and Sample Losses; NBM: Nil by mouth.

Table 1 – Sample characteristics

Characteristics	Results n=64 (100%)
Age	66 ± 11.3
> 60 years	41 (64%)
Sex	
Male	41 (64%)
Pathologies	
CHF	17 (26.6%)
Angina	12 (18.8%)
CAD and IC	10 (15.6%)
Flutter and Fibrillation	5 (7.8%)
Diet prescription	
Low sodium	32 (50%)
Low sodium for Diabetes	18 (28.1%)
Low sodium for Dyslipidemia	14 (21.8%)

CHF: Congestive Heart Failure; CAD: Coronary Artery Disease; IC: Ischemic cardiomyopathy.

The findings related to reasons that may have interfered with acceptance of the diets were similar for both diets (Table 4), but lack of salt was the most prevalent reason for both diets, followed by lack of seasonings, inappropriate mealtime, and excessive quantity of food.

Discussion

The present study identified an adequate percentage acceptance of the diets, meaning that patients consumed around 80% of what was offered to them. There was no difference in acceptance between the two diets offered. No studies in the literature have tested a low-sodium diet cooked with a controlled amount of salt in hospitalized cardiac patients. However, accounts of acceptance of salt-restricted diets in the literature are usually below the recommended levels, which is at odds with the findings of the present study, in which the patients consumed 80% of what was offered in each meal, with no significant difference between the diets. It was also observed that men consumed greater amounts at lunch than did women, with acceptance of 85.06 ± 23.3% for the diet cooked with salt.

Table 2 – Percentage acceptance of diets

	Standard low sodium	Low sodium cooked with salt	p
Acceptance per meal			
Lunch (n=51)	79.8 ± 24.1	80.2 ± 22.7	0.876
Dinner (n=42)	75.6 ± 23.9	79.2 ± 22.1	0.255
Appropriate acceptance (>80% of the meal)			
Yes (n=119)	54 (51%)	65 (59%)	0.292
No (n=97)	51 (49%)	46 (41%)	

Table 3 – Previous salt control

	Yes	No	Sometimes
Controls salt at home	37 (61%)	19 (31%)	5 (8%)
Cooks with salt	50 (82%)	9 (15%)	2 (3%)
Adds salt to food already cooked with salt and salad	6 (10%)	46 (75%)	9 (15%)
Uses industrialized seasonings	19 (31%)	21 (34%)	21 (34%)

Table 4 – Reasons that interfered with the acceptance

	Standard low sodium	Low sodium cooked with salt
Lack of salt	15 (29.4%)	15 (27.3%)
Lack of seasonings	14 (27.5%)	13(23.6%)
Inappropriate mealtime	13 (25.5%)	9 (16.4)
Excessive amount	9 (17.6%)	10 (18.2%)
Lack of appetite	3 (6%)	8 (14.5%)
Unpleasant flavor	4 (7.8%)	5 (9.1%)
Inappropriate temperature	3 (5.9%)	1 (2%)
Difficulty chewing/swallowing	1 (2%)	1 (2%)
Gastrointestinal disorders	1 (2%)	3 (5.5%)
Does not like the food	2 (3.9%)	0
Unpleasant odor	2 (3.9%)	0
Unpleasant appearance	1 (2%)	1 (2%)

Souza et al. (2011) evaluated acceptance of hospital diets and found that the salt-restricted diet presented a greater leftover-intake percentage (33.84%).[18] Santos et al.[16] found a leftover-intake percentage of 27% for salt-restricted diets. Casado et al.[19] evaluated acceptance of low-sodium diets, finding good acceptance, as most individuals said the diet offered had adequate flavor and temperature. However, in this study, most patients (51% at lunch and 60.6% at dinner) ate less than half of the meal offered to them. An appropriate leftover-intake percentage for the sick population should not exceed 20%.[18]

In the present study, acceptance of both low-sodium diets was above average, this aspect may not have influenced improved acceptance of the low-sodium diet cooked with salt. In this study, 4 g of salt/day was used for each patient for both diets, unlike the standard diet used in Brazilian hospitals, which is 2 g of salt/day.[16,20] An intake of only 2 g of salt/day is considered severe and impacts on acceptance of the diet and on inpatients' nutritional status. Studies suggest that a strict reduction of sodium to 2 g of salt/day in patients with heart failure (HF) is associated with reduced food intake and can worsen prognosis and influence the progression of cardiac cachexia[5]. In the present study, salt restriction was not so severe, in accordance with what has been advocated in the literature. The Brazilian Guidelines on Heart Failure recommend a less severe salt reduction, not exceeding 7 g of salt/day for patients with chronic HF, and not exceeding 5 g of salt/day for those with seriously symptomatic or advanced HF.[21]

It is known that acceptance of low-sodium diets is historically low and modifications are not always well accepted, nor do they improve acceptance by patients. In a crossover study, Filipini et al. (2014) evaluated acceptance of low-sodium diets using light salt – potassium chloride-based salt, with sodium reduced by 60%. The meals were prepared using 2.5 g of light salt, divided between the preparations. However, the modification was not well accepted by the patients and acceptance was considered unsatisfactory, and the percentage of leftover-intake ranged from 29 to 40% of the meals. Use of spices was the characteristic most widely mentioned by the patients as a factor that negatively impacted on acceptance of this diet and even the potassium salt may have interfered with the patients' perceptions, since it has a characteristic flavor and is not part of this population's eating habits.[22] In the present study, the proposed intervention – a diet cooked with a controlled amount of salt – did not improve the patients' food intake. This may have been influenced by an inappropriate previous control over salt restriction. As shown in this study, although 61% of the patients claimed that they restrict salt at home, lack of salt was the main reason that influenced

acceptance, reported by approximately 30% of the patients for both diets.

According to the patients, lack of salt was the factor that most influenced acceptance of both diets, followed by lack of seasonings, inappropriate mealtimes, and excessive quantities – which can explain the inpatients' lack of appetite. Lack of salt and seasonings is usually reported as the factor that most interferes with acceptance of salt-restricted diets. Yabuta et al. (2003) evaluated the acceptance of a low-sodium diet in hospitalized patients and found that factors negatively affecting acceptance were lack of salt (21.1%) and the flavor of the meal (11.5%).[23] In a similar population, even among those patients who claimed to fully accept the meal offered, 82% missed salt in their meals and 52% missed spices.[16]

The amount of salt offered in these diets is very close to the amount considered by the Brazilian Ministry of Health as normal, i.e., 5g/day.[12] On the other hand, in this study, 82% of the patients said they cook with salt at home. Thus, it can be inferred that this salt control may not be adequate for the reduction needed and that the patients' eating habits are too far from what would be appropriate, which is the biggest challenge for these patients to overcome. Therefore, the low-sodium diet cooked with salt is an option for nutritional education of patients at hospital admission, since most of them are in the habit of cooking with salt. Thus, the proposed modification could adjust their taste perception to cooking with an appropriate amount of salt from hospital admission.

In the present study, temperature did not influence acceptance of the diets, which was not observed in other studies. Ribas et al. (2013) observed that temperature was the factor with the greatest negative impact on acceptance of the diet.[20] Both meal delivery carts without a temperature control system and food vessels may have contributed to inappropriate temperature of the food. In the study by Souza et al. (2011), temperature was also a key factor, mentioned by 43% of the patients.[24] Even though the hospital where the research was carried out did not have heated and chilled meal delivery carts, appropriate routines helped maintain the temperature of the meals until the time of delivery. Maintenance of the temperature may have contributed to adequate levels of acceptance in this study.

One of the limitations of this study is that a considerable number of patients did not complete the study and did not receive both meals from each diet. As the study was conducted in the usual hospital admission setting, interruption of feeding as preparation for medical examinations and hospital discharge earlier than planned is possible and sometimes prevented the patients from completing the study. Another important factor is that the standard low-sodium diet was well accepted by inpatients, which is not usually observed and may have influenced the lack of difference in acceptance between the two diets. Unlike at most Brazilian hospitals, the standard low-sodium diet at this hospital included 4 g/day of additional salt, which may have led to greater acceptance of the diets. The fact that all foods were weighed before and after being given to the patient attests to the reliability of intake measurements, with no variations caused by differences in the division of food into portions or by evaluators' visual perceptions.

Conclusions

In conclusion, the low sodium diet cooked with salt was well accepted; however, there was no difference when compared with the standard low sodium diet, which also had adequate acceptance. Lack of salt and seasonings were the main reasons for poor acceptance of the diets, demonstrating that these factors still have to be addressed to improve acceptance and other strategies need to be tested in future studies. Low sodium diets cooked with salt are suggested as an alternative option for hospital meals. Although the proposal of this study did not show better acceptance than that the standard low-sodium diet, it was able to maintain food intake at an amount considered to be appropriate. Therefore, we consider using it to promote nutritional education on salt control, because this diet stimulates the patient's taste perception of the adequate amount of salt soon after hospital admission, considering that patients are in the habit of cooking with salt at home.

Author contributions

Conception and design of the research: Santos BF, Corrêa IVS, Antunes ALG, Martins CM, Eibel B; Acquisition of data: Santos BF, Martins CM, Giustina RD, Duarte MB; Analysis and interpretation of the data: Santos BF, Corrêa IVS, Antunes ALG, Eibel B; Statistical analysis: Santos BF, Corrêa IVS, Eibel B; Writing of the manuscript: Santos BF, Corrêa IVS, Antunes ALG, Martins CM, Giustina RD, Duarte

MB, Eibel B; Critical revision of the manuscript for intellectual content: Santos BF, Corrêa IVS, Antunes ALG, Eibel B.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

This article is part of the thesis of master submitted by Bruna Fraga dos Santos, from Instituto de Cardiologia de Porto Alegre.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of the CEP do Instituto de Cardiologia under the protocol number 5364/14. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

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