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Do spices and condiments increase food intake of patients with low sodium diet?

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Abstract

Objective: To evaluate whether food intake of hospitalized patients on a prescribed low-sodium diet increased after adding spices and condiments. *Methods*: Non-randomized, controlled and blind clinical test, performed with patients in a public hospital in the city of Florianopolis-SC, Brazil. The sample was chosen by convenience. Patients were their own control. They received on two consecutive days, alternating at lunch and dinner, the standard low-sodium hospital diet and modified low-sodium diet (with spices and condiments added). Food intake was evaluated in grams and percentages, comparing the "standard" with the "modified" diet and both in relation to the patient characteristics, care units and study start day. Analysis was carried out in the Stata 11.0 software. The level of statistical significance was $p<0.05$. *Results*: Ninety patients completed the study (66% men; average aged 60 years; 81% with 0-8 school years; 56% did not control salt intake; 91% used drugs which altered taste; 81% interned for chronic disease; 52% receiving general clinical care). No significant difference was found between the diets in terms of intake levels, in grams ($p=0.794$) or in percentage ($p=0.619$), nor according to gender, age, sodium/salt consumption before admission, care units, drugs involved with chemosensory disturbance and study start day. Statistically significant difference was noted for school level with greater acceptance of the standard diet ($p<0.001$). *Conclusion*: The addition of spices and condiments to low-sodium diets did not increase the food intake of hospitalized patients.

Keywords: Low-Sodium Diet. Hypertension. Spices. Food Intake.

Introduction

Salt is widely used in human diet. It is added to the preparation of meals, to industrialized products, and at the table, due to its capacity to improve sensorial aspects of food such as texture, color, and flavor.[1] This capacity, associated with the behavior described as "human appetite for salt", seeks to please the palate.[2]

Studies have associated the elevated consumption of sodium, mainly from cooking salt, with systemic arterial hypertension, vascular and cardiac illnesses, kidney and liver failure, gastric cancer, osteoporosis, asthma, and obesity.[3-5] Scientific evidence reveals however, that any reduction in salt consumption diminishes the arterial pressure[3-5] and improves the morbimortality profile of these diseases.[6]

The World Health Organization (WHO)[4] recommends an intake of less than 5 g of salt per day (equivalent to 2,000mg/day of sodium) for healthy people. For specific diseases, the restrictions for salt and sodium are sometimes severe. With cardiac failure for example, the consumption of up to 2g of salt/day, equivalent to 800mg of sodium, is recommended.[7]

The restriction of salt consumption, though necessary, is well known for its low patient compliance[8,9] mainly due to eating habits and complaints of lack of flavor in food.[10-13] Low compliance results in insufficient food intake, and energy supply and nutrients lower than the nutritional necessities.[14,15]

Culinary modifications through the use of spices, condiments, and preparation techniques have been recommended to encourage the consumption of certain foods or partially or totally substitute ingredients that should be diminished or absent in restrictive diets, such as salt in the low-sodium diet.[16,17]

Given the aspects pointed out, the objective of the study was to evaluate if the food intake of hospitalized patients with prescribed low-sodium diets increased after the addition of spices and condiments to its preparations.

Method

Participants

Experimental study, of the non-randomized clinical trial type, controlled and blind, developed with admitted patients in medical, surgical, and emergency clinic units in a public hospital in the state of Santa Catarina, Brazil. Adult patients of both sexes between the ages of 25 and 85 years old with a prescribed low-sodium diet of mild or normal consistency, without the restriction of other nutrients, energy and/or foods, were included. The sample was defined by convenience and temporal saturation. To meet the objectives of the research, each patient was his own control - reason for why the sample was not randomized.

The research study consisted of comparing the food intake of patients that received the low-sodium diet modified by culinary techniques and the addition of spices and condiments, referred to as "Modified Low-Sodium Diet - MLD", with the standard low-sodium diet of the hospital, referred to as "Standard Low-Sodium Diet - SLD". The comparison was carried out between the lunch and dinner meals over two consecutive days, with admitted patients between their first and eighth days of admission. The research study occurred during weekdays. The patient was inserted into the study when he filled the inclusion criteria and was apt (without fasting or preparation for exams/surgeries).

Culinary Modifications

The modifications were added to three of the four hot preparations served at lunch: meat, legumes, and side dishes. The choice of seasonings and culinary techniques was based on recommendations in the literature.[16, 17] The quantities were determined via test pilots. The culinary modifications described below were carried out in a distinct sector of the dietary kitchen, so as to not interfere with the preparation of the standard diet:

Meats: marinating technique for 24 hours under refrigeration with the proportions of 1Kg of meat/1 portion of seasoning (3 full teaspoons of equal parts basil, rosemary, and dry oregano, 100ml of water, 50ml of alcohol vinegar, and 5g of pressed fresh garlic). The SLD was seasoned before cooking with the ingredients from the sector.

Legumes: modified after cooking with the proportions of 1 portion of legumes (six ladles)/1 portion of seasoning (sautéed boiling with 9ml of oil composed of soy/olive flavored with garlic and onion, 2g of fresh diced garlic and 1/6 of a standard teaspoon of ground bay leaves).

Side dishes: modified 5 minutes before the cooking finished with the proportion of 1 portion of side dish (24 full soup spoons)/1 portion of seasoning (3 full teaspoons of dried herbs: parsley, chive, tarragon, and chervil).

The ingredient brands were standardized during the experiment.

The mild low-sodium diet lunch menu was repeated at dinner for the two days of intervention. On the first day, the patient would receive MLD lunch and SLD dinner. On the second day this relationship was inverted, so that SLD was lunch and MLD was dinner. The lunch and dinner proportions were carried out at the same time for each patient. The dinner meal was maintained under refrigeration after proportioning and later reheated in a combination oven. The preparations were produced without the addition of salt and ingredients with salt. All participants received 1g of salt and one slice of lime at lunch and dinner. These functions were part of sector protocol.

Collection of data and statistical analysis

The data on sex, age, education level, previous consumption of sodium/salt before admission, reason for admission, and prescribed medicines (for evaluation of those involved with chemosensory disorder) and type of admission clinic, were obtained with the patient or from their medical record. The quantities of the meals offered and rejected (in grams) were weighed on a Filizola® brand digital balance model MF-301 (e=5g), for later calculation of the low-sodium diet food intake (SLD and MLD). The patient's day of insertion into the experiment was registered to relate it to the date of hospital admission.

Data were typed with double entry into the Microsoft Office Excel 2003 program. The description of the sample was expressed with absolute and relative frequency, presenting characteristics of individuals, admission clinic, and day of insertion into the study. Analytical statistics were used to compare the average of food in grams offered, rejected, and taken in, of the SLD and MLD. Additionally, the percentage intake of each individual was estimated (intake in grams / offering in grams x 100). The intake average of the two meals was verified by the sum of ingested food at lunch and at dinner of the corresponding diet (SLD or MLD), and later divided by two. For characteristics of these variables, the average and the standard deviation (SD) or the

median and the interquartile range were used, according to the symmetry of the variables. The possible associations were later tested with the *t* test or the Wilcoxon test for paired data.

To evaluate the association of the average intake difference between the SLD and the MLD, in accordance with the variables related to the characteristics of the individuals and admission clinic, the *t* and the Wilcoxon tests were used for unpaired data in the case of dichotomous variables, and the ANOVA test of heterogeneity for polytomic variables.

The acceptable statistic significance level was established as $p<0.05$. All of the analyses were performed on STATA 11.0 *software* for Windows version 11.0 (StatacorpLakeway Drive College Station, Texas, USA).

Ethical principals

The research study was submitted to the Committee of Ethics in Research on Human Beings (Comitê de Ética em Pesquisa com Seres Humanos) of the Federal University of Santa Catarina (Universidade Federal de Santa Catarina), approved under number 654 on March 29, 2010, and was in accordance with the ethical principals contained in the Declaration of Helsinki. The participants received orientation about the objectives of the study, and after reading signed the Term of Free and Clarified/Informed Consent (Termo de Consentimento Livre e Esclarecido - TCLE).

Results

Of the 130 patients, 90 concluded the study. Sample loss occurred due to prescribed fasting on study insertion days (15); release from hospital (13); change in routine from the meal production sector, interfering with research protocols (05); change in low-sodium diet from mild or normal (03); patient withdrawal (03); and showing symptoms of nausea during a meal (01).

The final sample's median time of admittance was 14 days (11.00 - 20.75 days). The patients were registered in accordance with the clinic at which they began their participation, 52% of which were in medical clinic units.

The main characteristics of the participants are presented in table 1.

Table 1. Characteristics of participants. Florianópolis-SC, 2010.

Categories	Frequency (%)
Gender	
Male	59 (66%)
Female	31 (34%)
Age Range	
< 60 yrs	45 (50%)
≥ 60 yrs	45 (50%)
Education	
0-8 yrs	73 (81%)
> 8 yrs	17 (19%)
Control of salt consumption before admission	
No	51 (57%)
Yes	39 (43%)
Clinic of admission	
Medical	47 (52%)
Surgical	31 (35%)
E.R.	12 (13%)
Use of medication that alter taste and/or smell*	
No	8 (9%)
Yes	82 (91%)

Categories	Frequency (%)
Motives for admission	
Cardiac and/or vascular disease	34 (38%)
Other chronic diseases	27 (30%)
Cancer	12 (13%)
Infectious diseases	9 (10%)
Uncertain diagnosis	8 (9%)
Day of entering the research in relation to admission date	
On the 1st day of admission	7 (8%)
From the 2nd to 4th day of admission	45 (50%)
On the 5th and 6th day of admission	27 (30%)
On the 7th and 8th days of admission	11 (12%)

* According to the table presented by Doty et al.[24]

Two thirds of the sample (66%) was male and 81% had only an elementary school level of education. Among the participants, 57% referred to not restricting salt consumption before admittance, and 91% received some type of pharmaceutical cited in the literature to cause chemosensory disorders.

The most frequently used drugs were the anti-hypertension and medications for cardiac diseases, followed by lipid-lowering agents, the antibacterials, anti-depressives, and anti-virals.

The intake analyses of the two low-sodium diets (SLD and MLD) are found in table 2.

Table 2. Mean differences of quantities offered, rejected and ingested (in grams) in different meals of DHM and DHP. Florianópolis-SC, 2010.

Meals	DHM		DHP		Mean differences		
	M	DP	M	DP	M	IC95%	p
Lunch							
Offered	633.7	119.3	618.7	111.3	15.0	-20.0; 50.0	0.398*
Rejected‡	*157.5*	*(65.0; 300.0)*	*155.0*	*(60.0; 230.0)*	*10.0*	*(-40.0; 95.0)*	*0.188†*
Ingestion	442.6	149.5	444.1	160.1	-1.5	-35.2; 32.2	0.930*
Ingestion percentage§‡	*73.8*	*(54.7; 89.0)*	*76.6*	*(59.6; 88.2)*	*0.0*	*(-11.1; 8.1)*	*0.738†*
Dinner							
Offered	630.4	131.4	635.5	128.9	-5.1	-40.1; 30.0	0.775*
Rejected‡	*185.0*	*(70.0; 320.0)*	*167.5*	*(85.0; 325.0)*	*0.0*	*(-85.0; 80.0)*	*0.867†*
Ingestion	426.7	162.6	430.2	169.2	-3.4	-37.6; 30.7	0.842*
Ingestion Percentage§‡	71.5	(48.3; 88.7)	72.1	(49.1; 86.5)	*-0.3*	*(-12.2; 12.8)*	*0.998†*
Mean: lunch/dinner							
Offered	632.1	94.5	627.1	84.8	5.0	-15.2; 25.1	0.627*
Rejected ‡	*185.0*	*(82.5; 295.0)*	*168.8*	*(92.5; 275.0)*	*7.5*	*(-20.0; 35.0)*	*0.198†*
Ingestion	434.7	133.6	437.1	134.1	-2.5	-21.1; 16.2	0.794*
Ingestion Percentage§ ‡	*69.5*	*(54.9; 86.4)*	*74.6*	*(56.3; 84.6)*	*-0.3*	*(-4.4; 3.9)*	*0.619†*

* T-test for pair data

† Wilcoxon test for pair data

‡ Values presented represent median and interquartile interval (in parentheses)

§ Percentage between ingested and offered quantity

The intake of both diets was similar, independent of the meal evaluated (lunch, dinner, or average of lunch and dinner), in grams and in percentage. The intake of the two diets was between 70 (MLD) and 75% (SLD), corresponding to the median percentage intake of the two meals.

The average differences in intake between SLD and MLD in relation to the characteristics of the participants (table 3) showed that there was no difference between the two diets due to sex, age group, control of salt before admittance, clinic of origin, use of medications that altered the palate and/or olfactory, and day of insertion into the research study. The analysis in relation to education level showed greater intake of SLD among individuals that studied more than eight years ($p < 0.001$).

Table 3. Differences of means of ingestion§ between DHM and DHP, according to the characteristics of the population, admission clinic and start of participation in the study. Florianópolis-SC, 2010.

Variables	Mean of diferences of means (IC95%)	Value p
Gender		
Male	3.6 (-19.0; 26.3)	0.373*
Female	-14.1 (-48.5; 20.3)	
Age range		
< 60 yrs	-4.9 (-27.1; 17.2)	0.358†
≥ 60 yrs	0.0 (-31.0; 31.0)	
Education		
0-8 yrs	13.4 (-4.8; 31.7)	<0.001*
> 8 yrs	-70.7 (-123.6; -17.8)	
Control of consumption of salt before admission		
No	8.7 (-10.6; 28.1)	0.474†
Yes	-17.1 (-52.7; 18.4)	

Admission clinic		
Medical	-20.6 (-45.2; 4.1)	0.084‡
Surgical	25.3 (-4.1; 71.5)	
E.R.	-3.1 (-77.7; 71.5)	
Use of medication that alters taste		
No	17.5 (-45.3; 80.3)	0.510*
Yes	-4.4 (-24.3; 15.5)	
Day of entering the research in relation to admission date		
On the 1st day of admission	57.5 (-3.4; 118.4)	0.09‡
From the 2nd to 4th day of admission	-17.7 (-47.3; 11.9)	
On the 5th and 6th day of admission	-0.5 (-30.7; 29.6)	
On the 7th and 8th days of admission	16.8 (-37.2; 70.8)	

*T-test for non-paired data †Wilcoxon test for non-paired data ‡ANOVA test of heterogeneity §The values presented represent the mean difference in grams between the quantity ingested on DHM (mean of lunch and dinner) and on DHP (mean of lunch and dinner). Positive values represent greater ingestion of DHM and negative values greater ingestion of DHP.

Discussion and conclusion

The sensory stimulation arising from the culinary modifications surrounding aroma, flavor, and presentation of the low-sodium preparations did not show an increase in patient food intake, revealing that there were other determining factors in the result.

Yabuta et al.,[18] analyzing the acceptance of food by patients who received a low-sodium diet in a cardiology hospital, observed a consumption of good to great among 69.2% of patients. The preparations were made without salt and without industrialized products with an elevated level of sodium. As such, the lack of salt was referred to as being responsible for the low food consumption (21.1%) and for the dissatisfaction in terms of the flavor of the meal (11.5%).

Heo et al.,[8] evaluating the compliance with the low-sodium diet dietary treatment, observed a rate of non-compliance of 40%. In this study, some patients related that they were aware of the necessity to restrict salt, but the pleasure of eating was considered to be of greater value, demonstrating that for them the reduction of salt implied a loss of pleasure in eating.

Demário et al.[10] observed that a decrease in appetite, the use of medicines, the environment, the presence of company, and sensory aspects of the food (presentation, appearance, and aroma), in addition to the type of preparation, influenced food intake. The lack of salt and seasoning was a reason for dissatisfaction, even among patients with a normal diet.

The studies citied indicate that the quantity of salt restricted in the low-sodium diet interferes with the perception of the palate, with repercussions in regards to food intake, satisfaction in relation to the meal's flavor, and compliance to the treatment. Highlighting that in the present study, the salt offering was 2g/day (1g/lunch; 1g/dinner), characterizing a severe reduction in relation to the daily consumption of the Brazilian population, estimated at 9.6g/day.[19]

A study about the acceptance of diets with different concentrations of sodium showed a better acceptance for those with medium levels (2,300mg), followed by higher (3,500mg), and finally by the lower concentrations (1,200mg). The results indicated that the diets with low sodium content were as well accepted as the others, in a period of 30 days of analysis. Hence, the preparations utilized were prepared in an experimental kitchen with salt blended into the food, in accordance with the culinary habits of the population.[20]

Salt is known to be a sapida molecule that stimulates the taste bud receptors. In addition, it selectively suppresses unpleasant flavors and intensifies the pleasurable ones.[21] In the present study, the preparations were made without salt, being added to the food at the moment of the meal by the patient himself. This process is common in hospitals. However, it differs from the habit of people and can influence the perception of the palate, for the salt is concentrated on the surface of the food and not mixed in to it's composition.

Education level of the patients studied showed a significant relation to food intake, being greater for the SLD ($p<0.001$). The consulted literature does not discuss this type of relationship. The number of individuals in this category (17=19%) can be a limiting factor in this analysis.

In terms of the medications involved with chemosensory disorders, 91% of the patients studied received one or more of these drugs (table 1), which possibly interfered with the intake of both diets (MLD and SLD). Among the participants, 13% (table 1) were being treated for neoplastic diseases and possibly used chemotherapeutics. Such medications, for being blood circulators, are permeable to saliva and affect the palate receptors, resulting in the phenomenon of intravascular alteration of taste, which affects the food behavior of patients.[22]

The anti-hypertension and cardiac medications were the most prescribed among the patients. Anti-hypertension drugs, when chewed or maintained in the mouth for long periods, produce a long-lasting bitter taste sensation, possibly activated by the intravascular system or directly over the chemoreceptors of the palate and the olfaction.[23] Captopril, for example, can change the sweet flavor of food and leave a salty sensation, in addition to maintaining a persistent bitter or salty flavor in the mouth[24], alternating the perception of food flavors. The use of medications may have decreased the patients' perception of aroma and flavor, in the MLD as well as the SLD.

The susceptibility to the effects of drugs on the palate depends on innumerous factors, including sex and age.[24] The elderly are particularly vulnerable to the effects of these drugs, producing a reduction of palate perception and dry mouth.[25] Highlighting that 50% of the patients were elderly (table 1). As such, the food intake may have suffered an influence of taste alterations due to age, aggravated by the conditions of diseases[26] and use of medications.[24]

The analyses showed a percentage intake of 70% and 75% for MLD and SLD, respectively (table 2). These values coincide with reports in the literature about the food intake of hospitalized elderly patients.[27]

The objective of the present study was not to analyze if the quantity ingested was able to meet the nutritional necessities of the patients involved. At the hospital in the study, the patients received three to four small meals (breakfast; and morning, afternoon, and evening snacks) in addition to the meals analyzed (lunch and dinner). Therefore, the patients' quantity of food intake may be related to satiety,[28] independent of the addition of culinary modifications.

Thibault *et al*.[29] analyzed the evolution of food service at a hospital in Geneva (Switzerland) after ten years of implemented improvements. The analysis was made in 1999 and 2008, utilizing the same procedures. Comparing the two periods, the results showed that 78% of the patients did not ingest all of the food of the main meals (breakfast, lunch, and dinner). In 2008, 25% of the meals provided were not consumed. It was verified that there was an increase of 15% in the prescription of restrictive diets. But soon after the evaluation in 1999, the hospital's low-sodium diet was suppressed.

Another aspect to be considered is related to the low expectation and experience with hospital food, which contrasts unfavorably with food at home.[30] Dallepiane & Bós,[12] introducing the utilization of condiments without salt among outpatients, obtained positive results with compliance to the dietary treatment and food palatability. However, the intervention and the meals were made in the patients' home, which could reveal the influence of the hospital environment over the intake of modified diets.

The necessity for standardization of the experiment's culinary modifications imposed the same flavor for all of the patients. However, the food habits are varied [31] and therefore the condiments preferred by some may not be appreciated by others. The herbs utilized in the preparations of the side dishes and the marinating sauce for the meats are less used in the local culinary. Bay leaves, in this case, are commonly used in leaf and not in powder form, producing a lighter flavor. Possibly with the use of condiments incorporated into the patients' eating habits, the results would be different, for individuals and groups better accept that which they know, including culinary rules and their meanings.[32]

In conclusion, the addition of spices, condiments, and culinary techniques in the preparations of the low-sodium diet did not increase the food intake of the studied patients. However, the results point to a possible influence over intake, related to the reduced level of salt offered in the diet and the addition of salt in the ready-made preparations. These factors may have been determinants, independent of the addition of spices and condiments, of the types of seasonings utilized and the use of medications. The aspects addressed may generate new hypotheses and be the object of new intervention studies.

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