ORIGINAL ARTICLE

Analysis of the dietary habits and nutritional status of patients with spinal cord injury after nutritional intervention

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ABSTRACT

According to the World Health Organization, disability is defined as a restriction of bodily structure or function that is not offset by social measures, with spinal cord injuries (SCI) being a common type of physical disability. Several factors may influence the nutritional status of individuals with SCI, and metabolic complications can lead to a number of acute and chronic changes in the body that are related to the development of chronic diseases and obesity. The evaluation and proper nutritional management of patients with SCI can assist in improving their nutritional status, minimize complications associated with the injury, and facilitate their rehabilitation in the long term. **Objective:** To evaluate the effect of the nutritional intervention measures used in one nutrition clinic on the eating habits and nutritional status of patients with spinal cord injuries. **Method:** This was a cross-sectional retrospective exploratory study in which we analyzed the eating habits of all the SCI outpatients in the period from April 2012 to October 2013. **Results:** 30 patients with mean age of 46 ± 15.29 years were evaluated, 70% of whom were male. After the nutritional intervention there was a reduction in saturated fat intake, a decreased intake of refined grains, and an increased consumption of fruits and vegetables. **Conclusion:** The study showed the importance of a nutritional intervention in the dietary habits of individuals, and that nutrition education should begin early to prevent complications secondary to the injury.

Keywords: Spinal Cord Injuries, Nutritional Status, Food Habits, Food and Nutrition Education

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INTRODUCTION

According to the World Health Organization, physical disability is defined as a restriction in the body structure or function that is not offset by social measures.[1] A common type of disability is the spinal cord injury (SCI), considered a public health problem in Brazil. It afflicts approximately 40 new annual cases per million people, totaling from 6 to 8 thousand cases a year,[2] and of those afflicted, 80% are male and 60% are between 10 and 30 years old.[3]

The spinal cord is a nervous tissue mass that extends throughout the body from the cerebral hemispheres, protected by the spinal vertebrae, and whose main characteristic is flexibility due to the mobility of these vertebrae. The spinal cord can be injured when it suffers excessive, prolonged, or unexpected physical stress. Considering that normally the spine is programmed to withstand the physical stresses which it is subjected to in our daily activities, stresses that are unexpected may be damaging.[4]

Approximately 80% of the SCIs are traumatic, and the main causes are: car accidents or motor vehicle collisions (47.5%), falls from height, diving into shallow water (22%), and episodes of violence, especially firearm injuries (13%).[2,5,6] The non-traumatic causes total about 20% of the cases and involve: intra- and extra-spinal tumors, pathological fractures caused by vertebral metastases, tuberculosis, osteomyelitis and osteoporosis, spinal stenosis, severe spine deformities, herniated disk, ischemia (especially associated with aortic aneurysm), infectious diseases (such as transverse myelitis and tropical spastic paraparesis), and autoimmune diseases (such as multiple sclerosis).[3]

According to the extent of the spinal cord injury, it may be classified either as tetraplegia or paraplegia. Tetraplegia is the impairment of the trunk and upper and lower limbs, while paraplegia is the impairment of the trunk and lower limbs.[3]

The SCI will result in some degree of loss or reduction in muscle activity, sensory deprivation, and reduction of the autonomic function, with these factors depending on the severity of the injury.[5] It is noteworthy that the reduction in physical activity may lead to a reduction of muscle mass by atrophy, in addition to reducing bone mass (especially below the injury location) and increasing fat mass.[7,8]

Physiological, pathological, psychological, dietary, and environmental factors may influence the nutritional status of individuals with SCI,[9] with pressure ulcers and osteoporosis as the frequent complications that can affect the nutritional profile of these patients even more.[10-12] Pressure ulcers are present in approximately 35% of these individuals, resulting in serious medical and psychosocial complications, as well as in the increase of health costs, interfering in the quality of life.[13] As for osteoporosis, it is known that, except for the cranium, bone loss is present in the entire skeleton, especially in the lower extremities, which are osteopenic as much in paraplegic as in tetraplegic patients. Studies show that in people with chronic spinal cord injury, the bone mineral content when compared with normal individuals decreases in the proximal femur by 25% and in the proximal tibia by 50%.[12]

Metabolic complications, either biochemical or physiological, can also affect these individuals, due to their being more susceptible to such problems, which generate a series of acute and chronic changes in the organism. These changes are linked to the appearance of diseases such as obesity, *diabetes mellitus* type 2, systemic hypertension, and dyslipidemia.[14]

The SCI also interferes in the digestive process, which is controlled by the brain through reflexes and voluntary actions, and may block the messages that come from the digestive system to the brain and that, from there, go to the spinal cord, going back to the intestines. Under normal conditions, the colon is responsible for storing feces until they are expelled by peristalsis. When the feces are pushed to the rectum, a reflex action is triggered that provokes the contraction of the anal sphincter, keeping it closed so that the feces cannot escape. Patients with spinal cord injury do not feel the feces in their rectum and there is thus no anal sphincter control. The effects of the lack of peristalsis in the intestinal musculature and the way it will be affected depend on the level and extent of the injury.[15-17] In addition to that, due to the interruption in the spinal cord nerves, these patients' brains do not receive the messages coming from the rectum, which makes it impossible to notice the urge to empty the bowels (even with the presence of feces in the rectum) and even the defecation itself.[18] This condition, called neurogenic bowel, is present in a great number of these individuals and is characterized as a condition that affects the bodily process for storing and eliminating solid residues from non-digested foods. It can generate abdominal discomfort, increase spasticity, and intestinal dilation, among other changes that affect the quality of life and that can dampen social activities.[15]

Urological complications are responsible for great part of the morbidity indices and for 10 to 15% of deaths in patients with SCI,[6] with the neurogenic bladder being a frequent change. The normal urination process must allow the storage of urine, the perception of a full bladder, and its voluntary elimination with low vesical pressure. The bladder is controlled by voluntary and involuntary mechanisms and right after a spinal cord trauma it loses its tone and cannot contract by reflex activity.[19]

For adequate emptying of the bladder, the voluntary relaxation of the sphincter must happen, synchronized with the detrusor muscle contraction (involuntary). In that way, if relaxation of the external sphincter is not possible, there is an involuntary contraction of the detrusor muscle and the consequent increase in intravesical pressure, with the risk of vesicoureteral reflux and long term renal failure by post-renal obstruction.[3,6] The urinary stasis caused by neurogenic bladder, therefore, can lead to complications such as infections in the urinary tract, renal function deterioration, renal lithiasis, autonomic hyperreflexia, and bladder cancer.[6]

In the SCI initial phase, patients tend to lose weight due to the hypercatabolism and hypermetabolism caused by the trauma. However, in the acute phase, their energetic needs diminish due to the reduction in muscular metabolic activity. Consequently, the sedentary life style caused by the injury, associated with bad eating habits may lead to an increase in Body Mass Index (BMI). It is estimated that approximately 32% of people with SCI show an increase in BMI, as well as other health problems related to excess weight. It is known that an elevated BMI is associated with unfavorable changes in the lipid profile and, consequently, with cardiovascular diseases.[20]

The inadequate ingestion of nutrients is influenced by many factors such as difficulty in the mastication and deglutition, difficulty in obtaining and preparing foods, immobility, negligence, depression, and anorexia, and in many cases, assistance during meals is necessary.[21,22] The evaluation and the appropriate nutritional handling of a patient with SCI can, therefore, aid in the adaptation of the nutritional status, minimize the

complications associated with the injury, and favor the long term rehabilitation.[8]

Since individuals with spinal cord injury present a series of changes and complications correlated with their diet and nutritional status and, since these factors interfere with their quality of life and longevity, the importance and relevance of this study is justified and it will help in the adaptation of nutritional assistance given to this population.

OBJECTIVE

This study seeks to evaluate the effect of nutritional intervention measures on the eating habits and nutritional status of individuals with spinal cord injury in a nutritional outpatient clinic.

METHOD

This was a cross-sectional retrospective exploratory study of all SCI outpatients seen in a clinic from April 2012 to October 2013. The information was collected from the Daily Food Consumption database used by the Nutrition and Diet Service at the Institute of Physical Medicine and Rehabilitation of the Hospital das Clínicas, University of São Paulo School of Medicine (IMREA-HCFMUSP), located in the district of Vila Mariana, in the city and state of São Paulo. The study variables come, therefore, from the clinic's internal protocols, which are collected at the beginning and end of the nutritional intervention. Among them are: anthropometric data (weight and BMI); classification of nutritional status; age and sex; bowel movement habits; number of meals per day; diseases (hypertension, diabetes, dyslipidemia) and symptoms; consumption of salt, sugars and sweets, fats, refined grains, whole grains, vegetables, fruits, legumes, milk and dairy products (whole, partly skimmed milk, and skim milk); meats (lean or fat), and liquids (healthy and unhealthy); including the number of nutritional consultations already made, if any.

The nutritional intervention happens through weekly consultations and addresses the following issues: energetic, regulating, and building foods using the Food Guide; diet care in intestinal obstipation and in chronic non-transmissible diseases (*diabetes mellitus*, hypertension, and dyslipidemia); and how to interpret food labels. Therefore, in the rehabilitation program, the nutritional orientations happen once a week for at least 8 sessions with the number of consultations varying with the need of the patient and can be either in group or individual. A group could be formed either with up to 4 patients with Paraplegia due to SCI or up to 2 patients with Tetraplegia due to SCI.

In the first consultation, either in a group or individually, the individual protocol of nutritional evaluation and investigation of improper eating habits is applied, lasting about one hour per patient. This instrument guides the nutritionist in establishing objectives and conducts to be adopted in the nutritional intervention of each patient. Thus, the nutritional intervention has the objectives of adjusting body weight to facilitate the rehabilitation process, of adjusting the ingestion of macro and micronutrients to the age, as recommended by the "Brazilian Population Dietary Guide," of giving guidance on hygiene and the correct preparation of foods, of orienting about the reading of food labels and its importance, of preventing or treating dyslipidemias (DLP), of preventing or treating Diabetes, of preventing or treating Systemic Hypertension, and of favoring the protection of the gastric mucosa and one's intestinal motility.

After the objectives are established, classes on nutrition are given in simple language on the following themes:

- Class on Gastrointestinal Tract: it discusses habits that will aid in good digestion, the absorption of nutrients, intestinal functioning, and the protection of the gastrointestinal mucosa.
- Class on Food Pyramid: it introduces the concept of a food pyramid, calories and the energetic foods group, examples and information on portion sizes, healthier options within the group, consumption recommendations for their age, guidance on food purchase, and recommendations for diabetes and intestinal obstipation.
- Class on Body Regulating Foods: this class seeks to stimulate the consumption of vegetables and fruits, with examples and information on portion sizes and recommendations for their age, in order to consume the appropriate amount of vitamins, minerals, and fibers. Recommendations are given for diabetes and intestinal obstipation and the patient is also oriented on the hygiene of vegetables, fruits, and poultry, and on the best way to prepare these foods.
- Class on Body Building Foods: in this class, the functions of body building foods are discussed, with examples and information of portion sizes and recommendations for age to adjust the ingestion and to prevent the excess of fats and proteins. Patients are oriented on their purchase, conservation, and preparation of these foods. At the end of this class, a food diary of 3 days is requested to re-evaluate the eating habits of the patient.
- Class on the Treatment or Prevention of Dyslipidemias: this class guides patients on the dietetic treatment or prevention of dyslipidemias. In this class the patients are guided on what foods should be avoided, reduced, and consumed according to each type of dyslipidemia.
- Class on the Prevention or Treatment of Diabetes: the patients are guided on the dietetic treatment and prevention of Diabetes. It emphasizes the importance of a balanced and fractioned diet, of restricting sugars, and of controlling weight in the prevention and treatment of diabetes, of new strokes, and of amputations caused by decompensation of diabetes.
- Class on the Prevention or Treatment of Systemic Hypertension: in this class, the patients are guided on the dietetic treatment or prevention of hypertension. They receive instructions on foods that should be avoided to treat or prevent hypertension. At the end of this class, they are asked to bring food labels for the next class.
- Class on Food Labels: the patients are shown how to understand food labels and thereby make better choices when buying foods. The relationship between nutrients and diseases such as diabetes, hypertension, and coronary disease is revisited.

In addition to the educational classes, a dietary plan is prepared for patients with pressure ulcers and for those who need to lose weight. When they should hand in the dietary plan is at the discretion of the nutritionist.

After the educational program is concluded, the evaluation protocol is finalized with each individual through a re-evaluation with the corrections of the remaining misunderstandings. Patients with chronic diseases are seen individually every 15 days and later on, monthly, until they get a clean bill of health.

In these individual sessions, 24-hour food diaries are requested for analysis and correction, in addition to the evaluation of bowel movement habits, blood pressure, glycaemia, laboratory exams, and reinforcement of information pertinent to the moment. If the patient does not show any interest, it is suggested that he be discharged from the nutrition program.

When the patient is discharged from the nutrition program, he receives a final evaluation describing the entire nutritional intervention made, including a space for criticisms and suggestions. After the discharge from the program, the data contained in the evaluation is transferred to the Daily Food Consumption Database and then the evaluation is annexed to the patient's records.

The inclusion criteria for the study were that the patients of either gender, be older than 18 years of age, not pregnant or having recently given birth, not be amputees, and who have not abandoned treatment or been discharged before completing the entire nutritional intervention program.

The information contained in the database was transferred to spreadsheets in the Microsoft Excel® program (Microsoft Windows 7) to organize the data collection and to facilitate the tabulation of the results. The variables are shown in the form of tables and stratified by age bracket and gender. The statistical analysis of the results was made through absolute and relative frequencies, obtained using Excel®.

The study was submitted to the Research Ethics Committee with a request for authorization of data collection with the CAPPesq (*Comissão de* Ética *para Análise de Projetos de Pesquisa do HCFMUSP*/HCFMUSP Ethics Committee for the Analysis of Research Projects), and approved under the number 385.597.

RESULTS

The sample was composed of 30 patients with an average age of 46 ± 15.29 years (minimum of 18 and maximum of 75 years) and had a majority of males (70%; n = 21). From the total sample, 7 individuals (23.33%) were elderly adults-that is, they were aged at or over 60 years.

The average number of nutritional consultations was 21 ± 5.53 days (between 14 and 36 consultations).

Figure 1 shows the distribution of the number of comorbidities present in the individuals evaluated. From the total sample, 11 individuals (37%) showed comorbidities, and of those, 4 were afflicted by more than one comorbidity: 3 patients between 40 and 60 years old (27%) and 1 between 70 and 80 years old (9%). From all the individuals with comorbidities (N = 11), 9% had Systemic Hypertension (N = 7); 36% had *Diabetes Mellitus* (N = 4); and 45% (N = 5) had Dyslipidemia.

Among the patients with comorbidities, 18% (N = 2) were elderly aged between 70 and 80 years and 9% (N = 1) were elderly between 60 and 70 years. However, it is noteworthy that most individuals did not present associated comorbidities (63%; N = 19).

The average value of BMI of the sample, before the nutritional intervention was 24.01 ± 3.96 kg/m^2, corresponding to the eutrophy diagnosis.

Table 1, shown below, presents the classification of the nutritional status by the BMI according to age brackets and gender of the participants in the sample, before the nutritional intervention.

Although the sample studied has been classified as eutrophic, some nutritional deviations were found in the diagnosis. The analysis of the results in Table 1 shows that Underweight is present in 18.67% of the total individuals evaluated (n = 5), afflicting only males and being more frequent among the elderly (60% of the total of Underweight), especially those between 60 and 70 years old (40% of the individuals with this nutritional deviation).

The majority of the sample, according to their BMI, was classified as eutrophic (n = 18; 60.6%), and mostly prevalent among the adult males, representing 66.67% of this total (n = 12).

Of the sample evaluated, 7 individuals were overweight (23.33%), especially the females (n = 4; 57.14% of this total) and adults (n = 3; 42.86%). Thus, the most frequent nutritional deviation was overweight.

After the nutritional intervention, which happened within the average period of 21 ± 5.53 days, there was increase in the average value of the sample's BMI by 0.43kg/m^2, going from 24.01 ± 3.96 kg/m^2 to 24.44 ± 3.92 kg/m^2, a result that still classifies the participants in this study as eutrophic.

Table 2 shows the classification of the nutritional status by BMI, according to gender and age bracket of the sampled participants, after nutritional intervention.

The results shown in Table 2 show that the total number of underweight individuals did not change (n = 5), and that the greatest occurrence of this diagnosis was among males (n = 4; 80%). Due to the appearance of one underweight adult female, this category is not the most frequent among the elderly any more (going from 60% to 40% of the total underweight individuals).

Weight increase was observed among this study's participants (n = 7; 23.33% to n = 9; 30%), especially among adult males, going from 8.70% (n = 2) to 21.74% (n = 5). This diagnosis, which previously applied to 4 females, decreased to just 3 because one of the participants, aged between 40 and 60 years, came to be underweight.

The most frequent nutritional deviation continued being of excess weight and this diagnosis increased, going from a total of 7 (23.3%) to 9 (30%).

Among the elderly, the presence of overweight was maintained (n = 2). However,

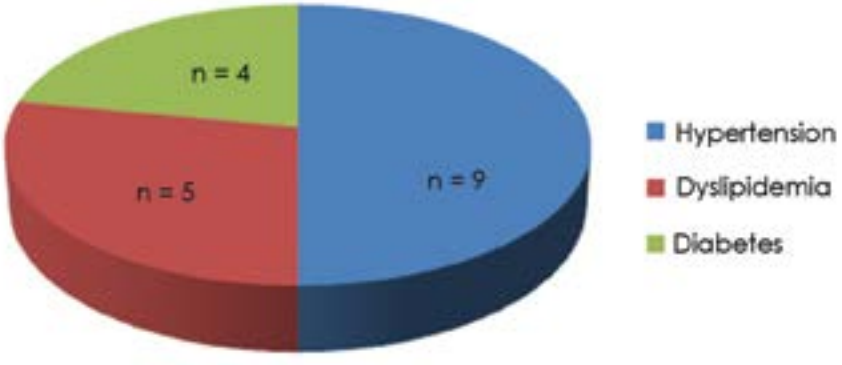

Figure 1. Distribution of the number of comorbidities occurrences shown by the patients evaluated

Table 1. Initial nutritional status of the patients analyzed, by their BMI, according to gender and age bracket

		Underweight				Eutrophy				Overweight				Obesity			
	BMI	Male		Female		Male		Female		Male		Female		Male		Female	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
18 ∟ 40 years (n = 13)	23.33 ± 4.54	2	6.7	0	0	7	23.3	2	6.7	0	0	1	3.3	1	3.3	0	0
40 ∟ 60 years (n = 10)	24.10 ± 3.17	0	0	0	0	5	16.7	2	6.7	1	3.3	1	3.3	0	0	1	3.3
60 ∟ 70 years (n = 4)	25.62 ± 4.39	2	6.7	0	0	1	3.3	0	0	0	0	0	0	0	0	1	3.3
70 ∟ 80 years (n = 3)	24.54 ± 4.66	1	3.3	0	0	0	0	1	3.3	0	0	0	0	1	3.3	0	0

Table 2. Nutritional status by BMI, according to gender and age bracket, after nutritional intervention

		Underweight				Eutrophy				Overweight				Obesity			
	BMI	Male		Female		Male		Female		Male		Female		Male		Female	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
18 ∟ 40 years (n = 13)	24.22 ± 4.58	2	6.7	0	0	4	13.3	2	6.7	2	6.7	1	3.3	2	6.7	0	0
40 ∟ 60 years (n = 10)	23.89 ± 3.53	0	0	1	3.3	5	16.7	2	6.7	1	3.3	0	0	0	0	1	3.3
60 ∟ 70 years (n = 4)	26.38 ± 3.44	1	3.3	0	0	1	3.3	0	0	0	0	0	0	1	3.3	1	3.3
70 ∟ 80 years (n = 3)	24.61 ± 3.65	1	3.3	0	0	1	3.3	1	3.3	0	0	0	0	0	0	0	0

one elderly participant aged between 70 and 80 years became eutrophic and another in the same age bracket became obese.

The evaluation of the bowel movement habits is represented in Figure 2 and it shows the improvement of this variable in 50% of the patients (n = 15) after the nutritional intervention.

The eating habits evaluation, as seen in Table 3, revealed improvement in the fractioning of meals after the nutritional orientation, going from 4 to 5 meals/day. A decrease was also seen in the consumption of salt from 3 to 0.74 portions/day, as well as of sugars (from 2 to 1 portion) and of fats (reduced from 4 to 3 portions). However, it is noteworthy that 2 participants were unable to measure their initial consumption of salt, sugars, and fats and 3 individuals were unable to answer about their consumption of these foods in the final evaluation.

After the nutritional intervention, a reduction in the consumption of refined grains was also confirmed (from 4 to 2 portions). However, the consumption of whole grains was kept at one portion.

As for the consumption of vegetables, the average initial consumption was of 1 and 2 portions, respectively, improving to 2 and 3 portions a day after the intervention.

The patients maintained the consumption of legumes (1 portion a day). Regarding the consumption of meats, there was a reduction in the consumption of those with visible fat and with skin, of organ meats, of industrialized meats (hamburger, chicken steak) and processed meats; going from 1 to 0.4 portions a day.

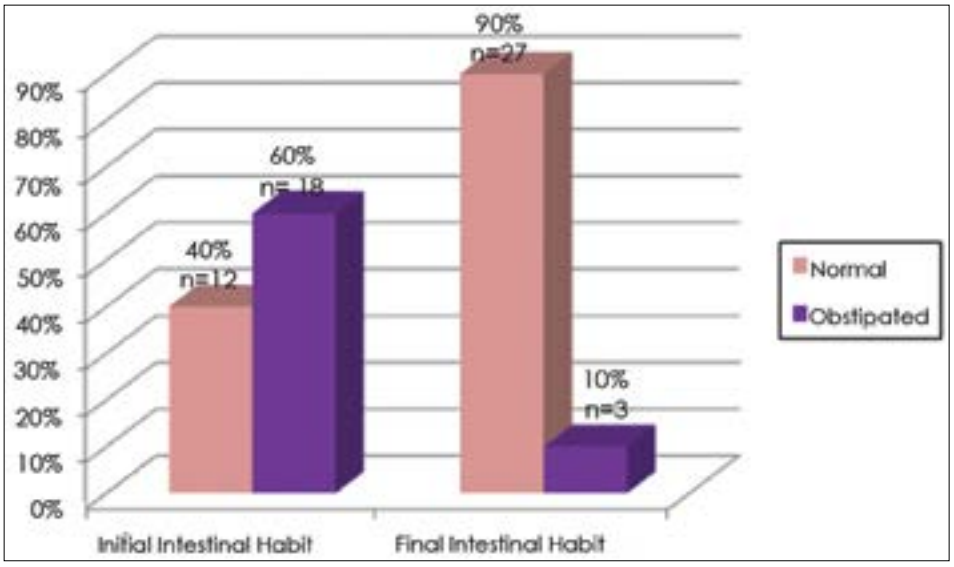

Figure 2. Initial and final intestinal habits of the patients analyzed

Nevertheless, the consumption of lean meats, which are those without visible fat, as well as of fish, eggs, turkey meat cold cuts, pork leg and back without fat were maintained at 2 portions a day.

The daily consumption of milk and milk products increased from 2 to 3 portions a day, especially the skim milk products.

Considering 200 ml as one portion of liquid, the initial consumption of healthy liquids went from 7 to 8 portions after the nutritional intervention. The liquids considered healthy were: water, coconut water, light teas without sugar (chamomile, fennel, mint, etc.), and juices (natural, pulp, or concentrated without sugar). The consumption of other liquids such as sugary drinks, alcohol, sodas, and juices was kept at 1 portion a day.

Tables 4 and 5 show the food consumption of adults and of elderly according with gender and age bracket, before and after the nutritional intervention.

The consumption of salt was of 1 portion a day for all the age brackets analyzed. The consumption of sugars and sweets was greater among the adults, especially in the age bracket between 40 and 60 years, with an increase in both genders: 4 portions before and,

Table 3. Initial and final food consumption of the patients analyzed, according to the number of portions

	Average Initial Consumption	Average Final Consumption
Fractioning (number of meals)	4	5
Salt (number of portions)	3	0.74
Sugars and Sweets (number of portions)	2	1
Fats (number of portions)	4	3
Refined Grains (number of portions)	4	2
Whole Grains (number of portions)	1	1
Total Grains (number of portions)	4	3
Vegetables (number of portions)	1	2
Fruits (number of portions)	2	3
Legumes (number of portions)	1	1
Milk and Whole Milk Products (number of portions)	1	1
Milk and Partly Skimmed Milk Products (number of portions)	0.07	0.17
Milk and Skim Milk Products (number of portions)	1	2
Total Milk and Milk Products (number of portions)	2	3
Lean Meats (number of portions)	2	2
Fat Meats (number of portions)	1	0.4
Healthy Liquids (number of portions)	7	8
Other Liquids (number of portions)	1	1

Table 4. Food consumption of the patients analyzed (18 to 60 years old) by the number of portions, according to gender and age bracket, before and after the nutritional intervention

	18-40 years (n = 13)				40-60 years (n = 10)			
	Initial		Final		Initial		Final	
	Male	Female	Male	Female	Male	Female	Male	Female
Fractioning (number of meals)	5	5	5	5	4	5	4	5
Salt (number of portions)	1	1	1	1	1	1	1	1
Sugars and Sweets (number of portions)	3	1	2	1	4	4	5	5
Fats (number of portions)	3	4	3	2	5	4	3	4
Refined Grains (number of portions)	4	3	3	2	4	4	2	3
Whole Grains (number of portions)	0	0	0	1	1	2	1	1
Total Grains (number of portions)	4	4	3	2	4	5	3	4
Vegetables (number of portions)	1	1	2	3	2	1	4	3
Fruits (number of portions)	2	1	3	2	3	2	3	3
Legumes (number of portions)	1	1	1	2	2	0	1	1
Milk and Whole Milk Products (number of portions)	2	0	1	1	1	1	1	0
Milk and Partly Skimmed Milk Products (number of portions)	0	0	0	0	0	0	0	0
Milk and Skim Milk Products (number of portions)	0	0	1	1	2	2	2	3
Total Milk and Milk Products (number of portions)	2	0	2	1	2	3	3	4
Lean Meats (number of portions)	2	1	2	1	3	2	2	2
Fat Meats (number of portions)	1	1	1	0	0	0	0	0
Healthy Liquids (number of portions)	9	6	9	8	8	4	10	5
Other Liquids (number of portions)	2	2	1	0	1	1	1	1

NC: Not Collected

after the intervention, 5. Among the elderly male participants there was a reduction in the consumption of that food-group.

The consumption of fats decreased in all the age brackets analyzed, especially for the elderly males (between 60 and 80 years), from 6 to 3 portions of fats a day.

The consumption of refined grains was greater for adult males (between 18 and 40 years of age) and the elderly (between 60 and 70 years of age), with reduction after the nutritional intervention. Only the males between 18 and 40 years of age did not ingest whole grains before and after the nutritional intervention, with the elderly males including this food after the intervention, as well as the females (between 18 and 40 years of age).

As for the consumption of vegetables, there was an increase in the consumption in all groups analyzed, except for the elderly males and females between 70 and 80 years old, maintaining 1 and 0.5 portion, respectively. The consumption of fruits before the nutritional intervention was smaller for adults between 18 and 40 years old and for the elderly between 70 and 80 years old, with 1 to 2 portions a day. After the intervention, among those who showed low ingestion, there was an increase of at least 1 portion, especially for elderly males between 70 and 80 years old, going from 2 to 4 portions a day.

The consumption of legumes was of 1 to 2 portions before and after the nutritional intervention in all the age brackets analyzed, with exception of the females between 70 and 80 years old.

The consumption of milk and milk products was greater among the elderly between 70 and 80 years old (from 3 to 4 portions a day) and among adults (from 2 to 4 portions a day), before and after the nutritional intervention. Females between 18 and 40 years old consumed this food less.

The ingestion of lean meats was greater for elderly females (70 and 80 years old): 4 portions a day. The consumption of fat meats was present only in adults between 18 and 40 years old.

The analysis of the results shown in the tables also demonstrates that elderly females betwen 60 and 70 years old fractioned their meals more and, finally, that the elderly had less ingestion of healthy liquids both before and after the nutritional intervention. The consumption of other liquids, considered unhealthy, was of 1 to 2 portions for all the age brackets analyzed.

Table 5. Dietary consumption of the elderly patients (60 to 80 years old) analyzed by the number of portions, according to gender and age bracket, before and after the nutritional intervention

	60-70 years (n = 4)				70-80 years (n = 3)			
	Initial		Final		Initial		Final	
	Male	Female	Male	Female	Male	Female	Male	Female
Fractioning (number of meals)	4	6	5	6	4	4	5	5
Salt (number of portions)	1	1	1	1	1	NC	1	NC
Sugars and Sweets (number of portions)	2	0	1	0	3	NC	1	NC
Fats (number of portions)	3	3	3	2	6	NC	3	NC
Refined Grains (number of portions)	4	2	3	2	3	3	2	3
Whole Grains (number of portions)	0	1	1	1	1	0.5	1	1
Total Grains (number of portions)	4	3	3	2	4	3	3	4
Vegetables (number of portions)	1	3	1	4	1	0.5	1	0.5
Fruits (number of portions)	2	3	2	4	2	1	4	1
Legumes (number of portions)	1	1	1	0	1	0	1	0
Milk and Whole Milk Products (number of portions)	1	0	0	0	3	0,5	2	0.5
Milk and Partly Skimmed Milk Products (number of portions)	0	0	1	0	0	2	0	0
Milk and Skim Milk Products (number of portions)	1	2	3	2	1	0	1	2
Total Milk and Milk Products (number of portions)	2	2	4	2	4	3	4	3
Lean Meats (number of portions)	1	0	1	1	1	4	1	4
Fat Meats (number of portions)	0	0	0	0	0	0	0	1
Healthy Liquids (number of portions)	4	5	7	8	7	1	8	6
Other Liquids (number of portions)	2	1	1	1	0	1	0	1

NC: Not Collected

DISCUSSION

A study by Andrade & Gonçalves,[23] developed with 93 SCI patients admitted to the Physiatric Service of the *Hospital Geral de Santo Antonio*, in Portugal, showed that 87% of those individuals were males. However, the study by Gupta et al.[24] developed with 408 SCI patients, treated at the Spinal Cord Injury Unit in the Milwaukee VA Medical Center, USA, verified that 98.28% of their sample were males. Thus, the result found in the present study is confirmed, since most of the sample (70%) was also composed of males.

In the study by Costa & Oliveira,[10] made with 15 SCI patients, treated at a public institution in the city of Fortaleza, in the state of Ceará, 86.7% of them were also males. As for the age bracket, 53.5% of those patients were between 20 and 40 years old and 6.7% of them were younger than 20 years old, and of these patients, 39.8% were older than 40 years old. However, in the study by Bühler et al.,[25] made through a data survey of 76 medical records from the *Centro de Atendimento à Deficiência (CAD)*/Disability Care Center of SCI patients, in the city of Passo Fundo in state of Rio Grande do Sul, confirmed that the age bracket with the highest frequency of affliction was that from 18 to 35 years of age (44.89%), followed by the age of 52 years (32.65%), and of age interval between 53 and 70 years (22.44%).

Therefore, the data found in the present study corroborates what is described in the literature, with spinal cord traumas considered a problem that affects males most frequently at a proportion of 4:1, and young adults between 20 and 40 years old, which is to say the youth or young adult range, due to their having the greatest exposure to car accidents, firearm injuries, diving into shallow water, sporting accidents, and falls.[10,25]

It should be noted that the systematic review by Van Den Berg et al.[26] made through the analysis of 13 articles, which included a total of 7,262 cases evaluated in the populations of Western Europe, Canada, Australia, Turkey, USA, and Taiwan, showing that, although a larger number of SCI cases was still seen among young adults, the elderly now constituted a growing representative population among those also afflicted by SCI, and increasingly approaching the number of young people with SCI. This is due to the worldwide growth of the elderly population,[27] associated with the falls and non-traumatic injuries very common among those individuals.[26] Thus, the fact of 23.33% of the sample evaluated in the present study being composed of the elderly (n = 7) is justified.

The percentage found of individuals with associated comorbidities is justified by the SCI patients showing higher risk of presenting chronic non-communicable diseases (NCDs), for this situation leads to a series of metabolic changes, with this vulnerability being aggravated when they present excess weight.[28,29] Changes in the bodily composition, appropriate for this population, characterized especially by the accumulation of fatty tissue in the abdomen[30] and associated with physical inactivity and dietary inadequacies, are responsible for excess weight and for disorders in the metabolism of carbohydrates and fats.[28,29] Thus, in these patients, cardiovascular risk factors such as glucose intolerance, insulin resistance, hyperinsulinemia, obesity, dyslipidemia, and hypertension are common, with type 2 diabetes and cardiovascular diseases considered important morbidities and mortality causes and reduction in the life expectancy of this population.[28,29] In the present study individuals were found afflicted especially by dyslipidemia, followed by *diabetes mellitus* and by hypertension. In this way, the nutritional intervention is of utmost importance to control and prevent these comorbidities, which are very frequent in this population.

The occurrence of being underweight before the nutritional intervention was greater among the elderly patients. A multicentric study made in the United Kingdom by Wong et al.[7] showed that 1 in every 5 patients hospitalized in a spinal injury treatment center, were aged 60 years or older and 1 in every 3 were at risk of malnutrition. The reason for malnutrition among the elderly is multifactorial and includes physiological and psychological factors as well as social changes associated with aging

that affect the ingestion of foods and body weight, which is aggravated with the presence of disease.[7]

Groah et al.[31] made a study at the National Rehabilitation Hospital in Washington and at the Miami University School of Medicine in the USA, whose objective was to examine the consumption of nutrients and the body mass index (BMI) of patients with SCI, according to their level of injury and gender. The study was made with 61 males (84%) and 12 females (16%), with an average age of 38 years (between 19 and 73 years). The BMI of males with paraplegia was slightly greater than the males with tetraplegia: 25.2kg/m^2 and 24.7 kg/m^2 respectively. However, the group of females with paraplegia showed a BMI lower than all the other groups: 21.2 kg/m^2. Most of the females evaluated (about 80%) showed a BMI within eutrophy range and approximately 18% of them were diagnosed as either overweight or obese. For the males, 12.5% and 0.8% were classified as obese in the groups with tetraplegia and paraplegia, respectively. In the study by Tomey et al.,[32] made with 95 males residing in a community in Chicago (USA), the BMI average for males with paraplegia was 26.2 kg/m^2 (sd = 6.5), with 19% of the participants classified as obese, 57% as overweight, and more than 7% classified as underweight (BMI lower than 18.5 kg/m^2). These results justify the present study finding excess weight as the most frequently occurring nutritional deviation before and after the nutritional intervention, with the females being more afflicted only before the intervention.

It must be considered that although excessive body fat is associated with a series of comorbidities, an appropriate proportion of fat and muscle mass is necessary to protect these individuals in other conditions, such as pressure ulcers.[31] However, an ongoing increase of body fat in individuals with a long-term SCI must be avoided or, at least delayed through dietetic interventions that may be useful in reducing the risk of cardiovascular diseases in this population.[28] Nevertheless, in this study it was observed that, after the nutritional intervention, there was an increase in the cases of overweight and obesity, especially among the adults.

Dietary Consumption

Salt

The dietary consumption analysis showed that all the age brackets maintained the consumption of 1 portion a day, before and after the nutritional intervention, corresponding to 5 g of salt or 2 g of sodium. In the study by Groah et al.[31] the daily ingestion of sodium for all the groups of patients analyzed exceeded the maximum ingestion limit of 2400mg/d in the sodium total. In the study by Tomey et al.[32] less than 35% of the participants met the recommendations for sodium.

The World Health Organization (WHO)[33] recommends that the ingestion of salt not surpass 5 g a day or 2 g of sodium to prevent chronic diseases. In the present study the patients showed the recommended ingestion. Considering that SCI patients are more at risk of developing chronic-especially the cardiovascular diseases,[34,35] it is indispensable that the consumption of salt be monitored.

Carbohydrates and the Ingestion of Liquids

The consumption of refined grains was greater among younger adult males between 18 and 40 years old and among the elderly between 60 and 70 years old, which decreased after the nutritional intervention. The Brazilian Dietary Guide[36] recommends the consumption of up to 6 daily portions of grains, roots, and tubers (sources of carbohydrates). In the present study, after nutritional intervention, there was a reduction in the consumption of refined grains from 4 to 2 portions. It is known that the excessive consumption of refined grains can increase the risk of insulin resistance. These foods have a high glycemic load (GL) and there is evidence suggesting that a diet high in GL will increase the risk of obesity, glucose intolerance, dyslipidemia, type 2 diabetes, and coronary disease.[37,38]

In the study by Perret & Stoffel Kurt[28] made in Zurich, whose objective was to compare the nutritional ingestion of 20 patients hospitalized with acute SCI (mean age: 27.7 years) and of 12 patients with chronic SCI (mean age: 28.8 years), it was found that for the patients with acute SCI, the daily consumption of carbohydrates such as sodas was 15.6%, while for the patients with chronic SCI it was 7.6%. The patients with chronic SCI, when compared with patients with acute SCI consumed only half the amount of non-alcoholic liquids. In the study by Groah et al.[31] the ingestion of caffeine was greater for males with paraplegia and the ingestion of alcohol was greater for male patients, both with paraplegia and with tetraplegia. In the present study, the consumption of other liquids such as sugary drinks, alcoholic, sodas, and juices was kept at 1 to 2 portions a day, without any differences between the age brackets and genders analyzed.

A diet with the appropriate amount of foods with whole grain carbohydrates-those that preserve the dietary fiber-aids in the intestinal function, protecting against constipation and possibly against diverticulitis and colon cancer.[36] Only the younger males (between 18 and 40 years old) did not ingest whole grains before and after the nutritional intervention. However, the consumption of these foods after the intervention went from 0.5 to a maximum of 2 portions a day in the other groups analyzed. Although the Brazilian Dietary Guide[36] has no specific recommendation for the daily quantity of whole grains to be consumed, it highlights that these foods are very important due to their amount of fibers. The American Dietary Guide recommends that at least half of the grains ingested be whole.[39]

In the study by Perret & Stoffel Kurt[28] the average ingestion of daily food fiber for the acute SCI group was 14.4 g, with 15.6 g in the chronic SCI group. Even so, the study by Tomey et al.[32] found an average consumption of fibers of 17.1 g and the study by Groah et al.[31] found the consumption below what was recommended: 12.7 g and 14.5 g. The present study did not calculate the total consumption of fibers. However, even without any significant increase in the ingestion of whole grains, there was a significant improvement in the bowel movements after the nutritional intervention. This is due, probably, to the increase in the consumption of vegetables and fruits, which are foods rich in fibers, associated with the appropriate consumption of liquids.

Fibers are related with controlling gastrointestinal motility and modulating the metabolic activity of intestinal bacteria. In addition, fiber has a hydrophilic capacity, promoting water retention and increase in the fecal bolus weight.[40] The increase in volume favors the softening of the feces in the colonic lumen, which promotes mechanical stimulation of the peristalsis, leading to an increase in the fecal progression and in the frequency of defecations.[41] Proper hydration is very important, so that in order for the fibers to change the weight and softness of the feces, it is essential to ingest at least 8 glasses of liquids a day, such as water and natural juices.[42]

In the SABE[43] study made in 2006, from a total of 1115 elderly, 58% (n = 664) reported drinking at least 5 glasses of liquids a day, with 60% (n = 430) being females and 54% (n = 234) being males. When evaluated according to their age bracket, 53% (n = 231) of the 66 to 80 year-old group and 64% (n = 433) of the 81

year-old group consumed less than 5 glasses of liquids a day.[43] Similar to the SABE study, in the present study, the elderly from both age brackets showed a better ingestion of healthy liquids before and after the nutritional intervention in relation to the younger and middle-aged adults-except in relation to females in the 40 to 60 year-old bracket. The consumption of other liquids considered unhealthy was of 1 to 2 portions for all the age brackets analyzed.

Fruits and Vegetables (Vitamins and Minerals)

The Brazilian Dietary Guide[36] recommends the daily consumption of 3 portions of fruits and 3 portions of vegetables and legumes in daily meals, since they are foods rich in vitamins and minerals. Perret & Stoffel Kurt,[28] in a study already mentioned, verified the low ingestion of the vitamins C, D, E, and folic acid, as well as iron and potassium. In the study by Tomey et al.[32] less than 35% of the participants met the recommendations for fruit and vegetable portions.

In the study by Groah et al.[31] all the groups showed appropriate ingestion of zinc, vitamins, C, B6, B12, phosphorus, iron (except for the female group with paraplegia), but the ingestion of vitamin D, calcium, and folic acid were below the recommended, except for one patient with tetraplegia. In this study, only the females consumed the recommended amount of vegetables after the intervention, including all age brackets except for the elderly females between 70 and 80 years old. However, all the age brackets consumed at least 2 portions of fruit a day after the intervention, except for the elderly of both genders.

Fats and Proteins

As for fats, all the age brackets in the present study showed a reduction in the consumption of this nutrient after the nutritional intervention, especially the elderly males. Even so, they still consumed more than 1 portion a day, which is the amount recommended by the Brazilian Dietary Guide.[36] In the study by Perret & Stoffel Kurt,[28] it was observed that the two groups analyzed (acute and chronic SCI) showed a high ingestion of fat (32% and 36%, respectively) and an insufficient consumption of carbohydrates. The ingestion of proteins remained around 17% for the two groups, representing an average of 1.1g/kg/day.

In the study by Groah et al.[31] for all the participants, paraplegic as well as the tetraplegic, the ingestion of proteins was within the recommended allowance, but the consumption of fats and carbohydrates was above the ideal. For all the groups, the proportion of saturated fats was above the 7% preconized by the American Heart Association (AHA).[44] The consumption of this type of fat was greater in the male tetraplegic group with 10.9%, followed by the male paraplegic group with 9.9%.

In the present study, the consumption of saturated fats was evaluated by the ingestion of foods such as meats, milk, and dairy products that have high contents of these fats.[45] Tomey et al.[32] verified in their study that most participants reached the ingestion recommended of calories and proteins, but only 18% consumed 30% or less of the energy coming from fats. Only one third of the participants consumed saturated fats within the recommended allowance and two thirds presented the appropriate amount of cholesterol. In the present study, the consumption of lean meats was above the 1 portion recommended.[36]

According with the Brazilian Dietary Guide[36] the consumption of beans and other vegetable foods rich in protein should be 1 portion a day; milk and dairy products, 3 portions a day, and 1 portion of meat, fish, or eggs, all rich in protein. The consumption of foods that are sources of proteins, especially those that have little fat, is essential, for muscular atrophy is very common after the SCI.[32] In the present study, it was possible to observe that the ingestion of foods that are sources of proteins met what is preconized by the Brazilian Dietary Guide.[36]

The consumption of milk and dairy products is important, not only because of the proteins, but also because of calcium. In the present study, the total consumption of milk and milk products was greater than what is recommended for the 70 and 80 year-old group and for adults before and after the nutritional intervention. However, only the elderly males between 60 to 70 years old, the elderly of both genders, the 70 to 80 year-old group, and the adults between 40 and 60 years old met the recommendation of at least 3 portions a day after the nutritional intervention. In the study by Tomey et al.[32] only 57% of the participants consumed at least 670 mg of calcium, which is considered the "safety level."

It is very important that the low consumption of vitamin D and calcium be monitored in these patients, for osteoporosis and the increased risk of falling are known as the main complications stemming from SCI.[28,31,32]

In relation to the fractioning of meals, it was seen that the elderly females from 60 to 70 years of age did the most fractioning. Some studies show that the meals' frequency could be associated with the increase in body weight, although the results are still uncertain.[46,47] In this study, no relationship was found between the frequency/fractioning of meals and excess weight. The non-elderly patients were those who showed the greatest overweight and obesity, but these same patients had an appropriate fractioning, with 4 to 5 meals a day. Although the present study did not relate fractioning meals with nutritional status, this is a factor that must be considered in the nutritional evaluation, since patients with SCI have more risk of becoming overweight.

In the present study, the patients were not evaluated according to their level of injury, but Groah et al.[31] suggests that the caloric consumption of tetraplegic individuals would be different from those with paraplegia, partly due to the lack of mobility in upper limbs, greater limitations on mobility, greater need for assistance, and greater impact of barriers (such as transportation).

It should be considered that males and females tend to show different dietary profiles and these differences become more evident when the dietary ingestion is stratified by age, income, and education, and that females tend to have a more healthy diet than males.[48] In our study, it was noticed that, during the nutritional evaluation made before the nutritional intervention, approximately 25% of the patients reported financial difficulties and showed difficulty understanding some orientations given, due to their low level of education. In addition, it was noted that the concern with appearance, especially in relation to body weight, was a frequent complaint among the females. The low income and poor access to transportation, factors very common to all people with disabilities, probably make it difficult to access quality foods.[32] Barriers to eating, in the case of women with physical disabilities, associated with difficulties in cooking, the high cost of nutritious foods (fresh foods, leaner meats), as well as the difficulty and lack of time to go shopping and to prepare foods[32] are factors commonly reported by patients during the nutritional consultation and were noted in the development of this study.

In view of all that, many factors can influence the food intake of patients with SCI. Therefore, it is essential that all of them be considered during the evaluation and nutritional intervention, for they will influence the dietary habits of these patients.

CONCLUSION

The development of this study has shown that, although spinal cord injuries present a series of associated complications, few studies have been made to evaluate the food consumption of this population, despite this investigation being essential to preparing strategies to improve the nutritional service given to these individuals.

After the nutritional intervention, a reduction was observed in the consumption of saturated fats, especially those present in fat meats and milk and dairy products; lower salt intake; reduction in the intake of refined grains, and increase in the consumption of vegetables and fruits. These changes in dietary habits help in the control and prevention of diseases such as hypertension, dyslipidemia, *diabetes mellitus*, and constipation, which are comorbidities reported frequently by these patients, and which were confirmed in this study. Thus, the importance of the nutritional intervention in the adequacy of dietary habits of these individuals was evident, and this should happen soon after the injury to prevent any secondary complications.

It was also noted how important it is to associate the dietary education program to orientations referring to the number of portions per food group in order to favor not only the improved quality but also the adequacy of the amount of food consumed by these individuals. These nutritional orientations seek especially to control weight and dietary adequacy in the consumption of salt, fibers, and water; as well as the quality and quantity of fats.

The dietary changes achieved in this study after the nutritional intervention are, therefore, important to prevent and control comorbidities associated with the injury and provide longevity with a better quality of life.

Nevertheless, it should be pointed out that the non-stratification according with the level of injury could be considered a limitation of this study, since this factor could also influence the dietary habits and nutritional status, as reported by other studies.

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