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NUTRITIONAL STATUS OF NEUROLOGICAL PATIENTS WITH REDUCED MOBILITY

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Abstract

Objective: to assess the nutritional status of neurological patients in physiotherapy treatment. **Methods**: this is a descriptive and transversal research in which all patients treated in an university physical therapy clinical at metropolitan region in Sao Paulo were invited to participate. After signing the informed consent by participants or their parents or guardians, nutritional consultation was scheduled to collect identification data and anthropometric data for the examination of bioelectrical impedance analysis and classification of nutritional status. We evaluated 24 patients of both sexes, aged between 3 and 62 years, divided into two groups (children and youth, and adults n = 10, n = 14) who underwent physical therapy in the clinic and who had limited mobility. **Results:** regarding socio-demographic variables, most of the patients had rated socioeconomic status between B1 and C1. The gastrointestinal symptoms most related were gastritis and gastro esophageal reflux. The most adult patients showed: normal weight (64.3%) followed by obesity (21.4%) and overweight (7.1%). They also submitted cardiovascular risk among moderate and high, according to waist circumference. The prevalence of malnutrition was 20% in children and adolescents. The percentage of body mass averaged 24.2%. **Conclusion:** this is a sample that shows anthropometric commitments and important nutritional need for systematic monitoring of health education.

Key words: nutritional status, body composition, evaluation, neurology.

INTRODUCTION

The etiology of central nerve injury can vary from a congenital anomaly, vascular accidents, spinal cord injuries to degenerative illnesses. These clinical cases, apart from their seriousness and irreversibility in most cases, demand a long rehabilitation program, generating high cost for the government and resulting in major changes in the patient's lifestyle[1].

Neurological disorders arising from injuries to the central nerve system may compromise the nutritional status depending on the affected area, having sometimes a detrimental effect on the physical and cognitive capacities required for a proper nutrition.

Brainstem injuries can, for example, infiltrate any of the cranial nerves that innervate facial and head structures, having an effect on nutrition, due to the fact that the patient is often unable to eat without running the risk of directing food or liquid into the lungs[2].

Children with neurological damage are often affected by one or more factors that hamper proper food ingestion, such as alterations to chewing and gastric emptying, gastroesophageal reflux, motor incoordination, inability to feed oneself, which lead to nutritional and growth anomalies[3].

Malnutrition is one of the factors that helps the most to delay growth, because of inadequate nutrient intakes, themselves affected by oral and motor dysfunctions[4].

Patients with acute and chronic neurological illnesses can suffer dysphagia given the absence of swallowing reflexes, resulting in a high risk of malnutrition. Thus, so as to prevent aspiration, pneumonia or sepsis complications - which can all arise from the detrimental effects of the illness - nutritional support is highly advisable. Enteral

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tube feeding may be necessary when there is a high risk of food aspiration or when the patient does not ingest enough to meet nutritional needs[2].

Kuperminc and Stevenson[5], after reviewing the literature, claim that suction, chewing and swallowing disorders are common in patients with cerebral palsy and explain inadequate food intakes, exacerbating thereby the risk of malnutrition. In addition, many children with functional motor limitations are kept on inappropriate diets for their age for long periods, resulting in deficiency anaemia (mainly for lack of iron), malnutrition and repetitive infections, due to the unvaried offer of certain types of food (milk and dairy products, flour foods or juices after the age of six.) Malnourished children do not grow normally and their reply to the stimuli that promote development is hindered and increase nutritional risk.

Thus, a diet must be planned according with the clinical characteristics and the limitations of each patient, so as to, among others, help swallowing and reduce the reflux of gastric content into the esophagus. It is recommended that the child's head and body are kept in an uptilted position for a few minutes following a meal. In children with gastroesophageal reflux, meals must be of smaller amounts and served at shorter intervals so as to prevent loss of overall daily nutritional intakes. Children with difficulties to ingest liquid must be fed small amounts of mildly-consistent meals and given juice thickened with fruits and jelly, ensuring, thereby an adequate level of hydration[6].

Another common complication in neurological patients is intestinal constipation. This is so because the longer the faeces remain in the colon, the harder they get, and more water absorption is needed; hence constipation. Chronic intestinal constipation is the result of, among others, a number of factors, such as, limited intake of fiber and liquids, few physical activities and use of antacids and anti-epileptic medicine[7].

If the colon (large intestines) is not yet dilated (megacolon)[8], families must be encouraged to offer a diet based on the adequate intake of liquids in general, foods rich in fiber, such as fruits (papaya, pineapple, orange with bagasse, black plum, mango, water melon) vegetables (mainly those of raw leaves) pulses (beans, peas, lentils) and wholemeal foods.

Some neurological patients often suffer digestive complications, pressure ulcers and weight gain. This weight gain usually occurs a few months after loss of body mass associated with the recovery from serious injuries, compromising sometimes basal metabolism by 10 to 30%, when compared to a person of the same age range, which reduces the energy needs in these patients. These two agents facilitate, thus, weight gain[9].

The study of nutritional management of neurological patients has developed in the last years since the nutritional condition greatly affects the body's physiological responses and the state of injury in which they find themselves.

Growth disturbances are related to restricted mobility which results from neurological or biomechanical constraints. One hypothesis about disturbances to growth is related to nutritional factors, including inadequate diet, a result of swallowing and speech motor control difficulties. The application of physical force to the bones leads to a significant gain in bone mass[10] irrespective of an individual's age and gender[11]. A decrease in strain, which is characterized by the mechanical pressure on the bones, resulting from extended periods of immobility is also related to a decrease in bone formation[12]. Lack of active mobility, therefore, affects different aspects of a neurological patient's life, justifying therefore research into nutritional aspects.

Anthropometry measures in a static way the different body parts. It includes weight, height, skin folds and limbs circumference. Among the advantages of anthropometric measurement, low cost, simple equipment and ease of result attainment stand out[13]. It is recommended to patients of different ages and levels of nutrition. These measures are extensively used in the assessment of nutritional status on an individual and broad population level, due especially to the ease with which measurements can be checked, the low-cost involved and to the vast availability of data on these. The most common measurements used in the nutritional diagnosis are weight and height. Generally, these measurements are used together, giving rise to indexes, such as the body mass index – BMI[14].

BMI is recommended by the World Health Organization – WHO[15] as a fast and cheap means to measure body fat. Despite all the advantages, recent studies have called into question the use of BMI on patients with spinal cord injuries because of changes in the body composition (loss of lean body mass and its replacement by fat mass). One of the examples was a review study carried out by Buchholz and Bugaresti[16] on patients with spinal cord injuries, in which BMI average measurements between 20 and 27 kg/m^2 were found, supposedly similar to those recommended by WHO[17] to classify overweight and obesity. However, it is not known yet if these cut-off points could be used with patients with spinal cord injuries or other neurological impairment. This is because BMI may be underestimated due to difficulties in the collection of weight and height data, which are many times given by the patients themselves, putting under question the reliability of the results. Therefore, one alternative means of nutritional assessment is the electrical bioimpedance method through which the percentage of body fat can be obtained. Although the test does not reveal how fat is spread in the body, it allows us to find out if the values are within those recommended with regards to health standards and the prevention of chronic diseases in adult life[18].

Obesity is directly related to body fat percentage (%F); however it is not possible to quantify it within the minimum error rates possible. In the last years, researchers in the area have developed and validated different techniques of evaluation of body composition. Yet, most of these meant high costs, rendering unfeasible their use[19].

Because of all this, determining the nutritional condition and the body composition of neurological patients is of crucial importance, since they are vulnerable to weight gain and to an increase in the percentage of body fat, which can directly affect their mobility and degree of independence, hampering or limiting physiotherapeutic treatment and the continuity of assistance.

Thus, the aim of this study is to assess the nutritional status of individuals with neurological injuries, as well as describing their nutritional status from measurements of body mass index and body fat percentage.

Methods:

This was a cross-sectional study with primary data collection, in which patients treated at the physiotherapy clinic of a community university in São Paulo were assessed within the months of March 2011 and February 2012. The criteria for inclusion was the submission of a medical diagnosis of neurological damage and limited mobility, of gait abnormality and use of means of support such as crutches, walking sticks, walkers or wheelchairs.

At the beginning, a socio-demographic and lifestyle questionnaire was used containing, among others, questions on age, gender, educational background, marital status, smoking and drinking habits, gastrointestinal health and place and duration of injury. The socio-economic questionnaire recommended by the Brazilian Association for Demographic Studies – ABEP[20] was used with the aim of describing more precisely the socioeconomic level.

Data on anthropometric variables, nutritional status classification and the bioimpedance analysis test were individually collected, at a time set with the patients and their legal guardians. The project was submitted to and approved by the Committee for Ethics in Research of the Mackenzie Presbyterian University under no. 1340/04/2011 and CAAE no. 0035.0.272.000-11.

Anthropometric Variables: The following criteria were adopted for the collection of anthropometric variables:

a) Weight:

• Children: those patients who could remain in an upright position were weighed on the scales, but when this was not possible, the accompanying adult was individually weighed prior to being weighed with the child on their lap. The child's weight was then obtained by deducting the amounts found. The weight was measured in Kilograms, using Filizola® platform scales for a maximum weight of 150 kilograms and a minimum of 100 grams. The patients wore light clothes and were barefoot when weighed.

• Adults: the patients were carried by physiotherapy team members and placed on a stretcher, so that the wheelchair could be weighed separately on the scales provided for this purpose. Then, the patients were put back in their respective wheelchairs and weighed. The patient's weight was obtained by deducting the value of the wheelchair. When weighing was not possible, the weight was provided verbally by the patients or their guardians.

b) Height

Height was calculated on the length of arm, which was arrived at by having one of the arms stretched out in a 90º angle with the body, measuring the distance between the wishbone and the tip of the middle finger. A flexible metric tape measure was used for this. Estimated height was obtained through the Kwok and Whitelaw[21] equation, that is, the length between the wishbone and the arm (cm) multiplied by 2. In the cases this method could not be applied, height was given verbally from the patients or their guardians.

c) Waist Circumference

The abdominal circumference (AC) measurement was used around the umbilical button with the help of a 2mt-long inextensible tape measure and with a 1mm precision as measurement of waist circumference (WC) was impossible since most patients were on a wheelchair.

Classification of the nutritional status and the risk of metabolic diseases:

Classification of the nutritional status was realized following the body mass index (BMI) using the classification criteria recommended by the World Health Organization[17] for adults and the growth curves of this index for children and adolescents[15], using values of percentiles as reference. The patients' nutritional status was classified as malnutrition, eutrophy, overweight and obesity, based on the weight (kilograms) and height (meters) anthropometric variables.

As for the risk of cardiovascular diseases and the presence of abdominal obesity, the criteria used was the one proposed by Taylor et al[22] for children and adolescents with AC above the 80th percentile, according to age and gender. For adults, references by the International Diabetes Federation (IDF)[23] and the National Cholesterol Education Program (NCEP)[24] were used and defined as:

• No risk: below 80 cm in adult women and below 94 cm in adult men

• Moderate risk: above 80 cm in adult women and above 94 cm in adult men

• High risk: above 120 cm in adult men; there are no reference values for children and adolescents.

Bimpedance Testing:

Following the collection of anthropometric data, all the patients underwent a bioelectrical impedance analysis (BIA), which is based on the conduction of low intensity electric current and estimates the percentage of lean body mass, fat mass, percentage of water and the basal metabolic rate. Prior to the execution of the test, all patients and their accompanying family members received the necessary instructions for the performance of the test so as to ensure the reliability of the data obtained.

The bioelectrical impedance analysis was carried out using a TANITA® model TBF-305 analyzer of corporal composition, with the patient lying on a non-conducting stretcher, with their arms and legs stretched at the surface's level. Then, the patient's skin was cleaned with alcohol-soaked cotton wool on the electrodes' contact areas, be they the left foot, ankle, hand and wrist so that the analyzer could be programmed to send low density electric current. The patient's data (age, gender, weight and height) was fed to the machine that provided the percentages of body fat (BF), lean body mass (LBM) in kilograms and the basal metabolic rate (BMR). All the patients were advised to observe the following recommendations: to refrain from consuming alcohol within 48 hours prior to the test, any food or liquid within 2 hours prior to the test and caffeine-based drinks; from hard physical exercise within 24 hours prior to the test; from taking diuretic medicine (if agreed with the doctor) within 7 days prior to the test; to remove all metal objects such as watches and jewelry during the test and, in the case of women, not to do the test during their menstrual period.

RESULTS AND DISCUSSION

The sample used in this study comprised 24 patients of both genders, with an age range of 3 and 62 years, all patients presenting a type of neurological disease and attending the physiotherapy clinic of a community university in São Paulo, between the months of February and December 2011. The diagnoses were varied, with brain injury, cerebral palsy, progressive diseases like multiple sclerosis or myopathies, spinal cord injury, congenital malformation and connective tissue diseases.

For the analysis of certain data, the 24 patients were divided into two groups: Group 1 (G1), of children and adolescents between the ages of 3 and 17 years (n = 10); and Group 2 (G2), of adults between the ages of 24 and 62 years. (n = 14).

It must be noted that in the study sample 45.8% (n = 11) of patients were female and 54.2% (n = 13) were male. The average age was 21.1 years (sd ± 17.4) and 25% (n = 6) of all patients were married.

Table 1 summarizes the socioeconomic profile of the sample studied, showing that 50% of the participants belonged to B2 class, followed by B1 together with C1 classes.

Table 1: Percentage distribution of neurological patients treated at a university physiotherapy clinic in the city of São Paulo, according to their socioeconomic profile, São Paulo, 2011-2012

Socioeconomic class	n	%
A1	1	4.2
A2	1	4.2
B1	4	16.7
B2	12	50
C1	4	16.7
C2	2	8.2
Total	**24**	**100**

Table 2 shows the length of time for diagnosis and the characteristics of duration and frequency of physiotherapeutic treatment carried out at the clinic. It can be noted that the average time for diagnosis and physiotherapy treatment was 7.5 and 5.5 years, respectively. As a result of a neurological injury, 62.5% of patients had to undergo a type surgery after their diagnosis.

Table 2: Average and Standard Deviation (SD) of physiotherapy treatment characteristics in neurological patients, São Paulo, 2011-2012

Treatment characteristics	Average	SD
Length of time for diagnosis*	7.5	8.8
Duration of physiotherapy*	5.5	6.7
Number of sessions per week	2.2	0.8

* *years*

Figure 1 point to the prevalence of dis-comfort and/or gastrointestinal complications in the patients seen. It was found that 33.3% of all patients suffered gastritis and 20.8 gastro-

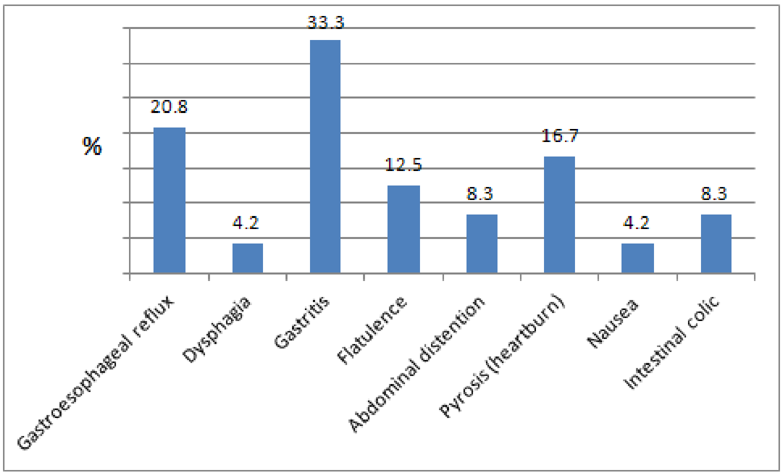

Figure 1: Percentage distribution of gastrointestinal symptoms of neurological patients treated at a university physiotherapy clinic in the city of São Paulo, São Paulo, 2011-2012

esophageal reflux. These findings coincide with those in the medical literature, which claim that the presence of these gastrointestinal symptoms affect mainly patients with spinal cord injury, due to the need of surgeries, use of nasogastric tubes, as well as to the prevalence of parasympathetic tonus[25,26], though the same symptoms may be present in patients with other neurological diagnoses.

It is important to mention that such complications cause discomfort in the patient and can affect directly their nutritional status, since frequent changes in diet are necessary to avoid or lessen the symptoms[27].

Table 3 shows data of two cases of malnourishment in children and adolescents (G1) and a high percentage of overweight and obesity in adult patients (G2). As to cardiovascular risks, based on waist circumference in all age ranges, especially in adults, the presence of risk was observed. Nevertheless, this observation must be treated with caution, as circumference was measured while patients were lying, a position in which an error may have been incurred during execution.

Table 3. Percentage distribution according to the classification of the nutritional status of neurological patients through anthropometric indexes, São Paulo, 2011-2012.

	Children and Adolescents		Adults	
	n	**%**	**n**	**%**
BMI				
Malnutrition[a]	2	20	1	7.1
Eutrophy[b]	8	80	9	64.3
Overweight[c]	-	-	1	7.1
Class I Obesity[d]	-	-	3	21.4
WC				
No risk[e]	7	70	6	42.9
Moderate risk[f]	3	30	3	21.4
High risk[g]	-	-	5	35.7

a refers to BMI below the 5th percentile in children and adolescents, and below 18.5 kg/m2 in adults.
b refers to BMI between the 5th and 85th percentile in children and adolescents, and between 18.5 and 24.9 kg/m2 in adults.
c refers to BMI between the 85th and the 95th percentile in children and adolescents, and between 25 and 29.9kg/m2 in adults.
d refers to BMI above the 95th percentile in children and adolescents, and between 30 and 34.9 kg/m2 in adults.
e refers to WC below the 80th percentile in children and adolescents, and below 80 cm in adult women and below 94 cm in adult men.
f refers to WC above the 80th percentile in children and adolescents, and above 80 cm in adult women and above 94 cm in adult men.
g refers to WC above 88 cm in adult women and above 102 cm in adult men; there are no reference values for children and adolescents.

Countless studies[18,28,29] have noted the prevalence of overweight and obesity, based on BMI, in patients with neurological injury, although some writers point out that BMI is little sensible to evaluate obesity in this group of population. This is because, due to physical inactivity, these patients are prone to show high percentages of body fat with high risks of metabolic diseases and therefore health complications[30].

Currently, there is no BMI optimal cut off points to diagnose the nutritional status of neurological patients, since BMI is a tool made to evaluate individuals in good health conditions[15]. That is why the use of bioelectrical impedance analysis can be considered a more precise method to aid in the analysis of body composition.

Table 4 shows data on body composition and basal metabolic rate (BMR) of neurological

Table 4. Average of variables reviewed by bioelectrical impedance analysis, based on the age group and nutritional status of neurological patients treated at a physiotherapy clinic of a private university in the city of São Paulo, São Paulo, 2011-2012.

	BMR (kcal/day)	LBM(kg) (kg)	Water (liters)	Water (%)	Fat (kg)	Fat (%)
Children and Adolescents (G1)						
Malnutrition	307.5	10.1	7.1	69.9	1.2	7.5
Eutrophy	540.5	17.8	13.6	80.6	6.6	21.7
Overweight	-	-	-	-	-	-
Class I Obesity	-	-	-	-	-	-
Adults and the Elderly (G2)						
Malnutrition	1310.0	48.3	36.9	76.6	6.7	12.2
Eutrophy	1506.1	49.6	35.4	71.9	16.4	24.4
Overweight	2045.5	59.2	45.1	76.1	15.0	20.7
Class I Obesity	1745.7	57.4	39.2	68.1	37.3	39.8

patients in this study, through bioelectrical impedance analysis according to their nutritional state. The result bear relationship with those expected in healthy individuals, since in states of malnourishment, BMR is low. The physiological explanation for this resides in the fact that the body starts to save energy in an effort to preserve the wellbeing of all vital organs and tissues. The reverse occurs in the case of obesity, characterized by the increase in body mass (both, fat mass and lean body mass) and, as a result, an increase in the daily basal caloric needs. It was interesting to find out that contrary to such claim, average BMR of overweight patients was higher than the average BMR in obese patients. This can be explained by the small sample size: 1 overweight patient and 3 obese patients, which prevents a more convincing explanation.

The data provided by the bioelectrical impedance test are only descriptive, due to the shortage of validated reference values in literature to classify the body composition of neurological patients. However, the data from the bioelectrical impedance test described in this study are pioneer and can corroborate the elaboration of future reference values for the adequate body composition of these patients.

CONCLUSION

We can conclude, based on the data collected, that there are several complications in these patients in relation to nutritional status, and the adult group had a higher prevalence of obesity and consequently a higher percentage of body fat. These results point to the peculiarities of this population, which needs constant review and guidance to increase their wellbeing and quality of life.

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