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Original article

Interactions between dietary inflammatory index, nutritional state and Multiple Sclerosis clinical condition

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SUMMARY

Background & aims: The Dietary Inflammatory Index (DII) consists of a tool that assesses dietary inflammatory potential based on the assignment of an inflammatory score to a variety of nutrients, seasonings and bioactive compounds. Pro-inflammatory diets are associated to weight and abdominal fat excess. High Body Mass Index (BMI) and Waist Circumference (WC) seem to contribute to a worse prognosis in Multiple Sclerosis (MS) patients. Therefore, this study seeks to investigate the relation between anthropometric indexes and body adiposity with the clinical condition and the Dietary Inflammatory Index of MS individuals.

Methods: This is a cross-sectional, analytical study that included 137 MS patients residing in the Brazilian northeast. Through a structured questionnaire and medical records consultation, we collected data on demographics, nutritional state, arterial pressure, clinical and dietary variables. Clinical variables included the MS type, number of pulse therapies and attack rate in the last two years, number of days of most recent pulse therapy and muscular strength assessment scores (MRC) and most recent disability level (EDSS). The nutritional state was evaluated based on BMI, WC, waist-hip ratio (WHR), Body Roundness Index (BRI), Body Shape z score Index (ABSIz) and body fat percentage (%BF). The DII was calculated according to a validated methodology.

Results: The ABSIz presented a positive correlation with regards to the EDSS score ($r = 0.294$. $p = 0.001$). WC and WHR presented a negative correlation in relation to the number of pulse therapy days ($r = -0.255$. $p = 0.022$ and $r = -0.251$. $p = 0.024$). BMI and %BF were not correlated to clinical variables ($p > 0.05$). The DII was positively correlated to the BMI in people with progressive MS ($r = 0.556$. $p = 0.025$).

Conclusions: The DII may interfere in the nutritional state of MS patients and the nutritional state may affect disability levels but it is necessary to establish which nutritional indicator can better predict the relation between DII and the clinical condition of MS patients.

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1. Introduction

Multiple Sclerosis (MS) is a demyelinating [1], inflammatory and chronic Central Nervous System (CNS) disease [2] that has a significant impact on the financial and social wellbeing of sick individuals, their spouses and relatives [3], and it is also quite costly for global public health [4].

For the Brazilian Health Care System, the general cost for each diagnosed person reaches the current amount of USD 19,012.32, being 85.50% of this amount attributed to specific MS medication, 2.66% corresponds to symptomatic medication, 2.51% to medical consultations or assistance provided by other health professionals, 0.68% is due to complementary exams and 0.30% corresponds to emergency care services [5].

Therefore, the more diverse the symptoms and the higher the disability level of affected individuals, the more adverse the impact on quality of life and therefore, on personal and public economy [6].

Environmental factors such as the nutritional state may affect the clinical course of this neurodegenerative disease [7]. There is evidence that a high Body Mass index (BMI) and waist circumference (WC) after a first demyelinating episode may imply a higher risk of subsequent attacks. Also, high BMI, WC and Hip Circumference (HC) seem to be associated to a worsening disability level measured through the Expanded Disability Status Scale (EDSS) [8]. Excessive fatty mass, especially when located in the abdominal region, contributes to a state of a low-grade chronic inflammation [9]. Metabolic complications such as arterial hypertension (SAH) [10], insulin resistance, a larger production of pro-inflammatory cytokines and the exacerbation of oxidative stress seem to intermediate these interactions [11,12].

The Dietary Inflammatory Index (DII) consists of a tool that assesses dietary inflammatory potential based on the assignment of an inflammatory score to a variety of nutrients, seasonings and bioactive compounds [13]. Current findings demonstrate that individuals with an inflammatory diet have higher BMI, BF and waist/hip ratio (WHR), which may denote that a diet-induced inflammation may contribute to the maintenance or exacerbation of obesity, especially in the abdominal area [14].

Consequently, this study aims at investigating the relation between anthropometric and body adiposity indexes with the clinical state of MS and DII patients.

2. Materials and methods

This is a quantitative, cross-sectional and analytical study carried out from September 2014 to February 2017 at the Neurology Outpatient Department of Fortaleza General Hospital (FGH) in Ceará, Brazilian northeast. This institution is one of the two reference centers in the state for MS diagnosis and patient follow-up. This research was developed in agreement with guidelines established in the Helsinki Statement and all procedures were duly approved by the Ceará State University Research Ethics Committee under regulation Nº 365.222.

2.1. Population, sample, and data collection

The studied population was composed of patients who until late April 2016 were assisted at the afore mentioned health unit, totalizing 188 individuals. The sample included patients who agreed to participate in the research by signing a free an informed consent agreement, were aged 19 to 64 years-old, had not been submitted to methylprednisolone pulse therapy in the last 15 days or to surgery in the last 30 years, did not suffer from any other autoimmune disorder, were not pregnant or lactating and had an awareness level good enough to precisely respond questions. Individuals excluded from the sample were those who did not show at the blood collection venue, were diagnosed with Clinical Isolation Syndrome (CIS), did not arrange for or did not show to a medical appointment for a year and those who abandoned treatment.

Therefore, out of the 188 patients, twenty-six (13.8%) had not appointed a medical consultation in the referred period of time; fifteen (8%) failed to show at medical consultations; three (1.6%) refused to participate; two (1.0%) were more than 64 years-old; one (0.5%) moved to a different health care center, one (0.5%) said to have discontinued treatment; another one (0.5%) was not able to participate due to cognitive damage; one (0.5%) was younger than 19 and one (0.5%) was lactating, finally reaching a total sample of 137 people (Fig. 1).

2.2. Demographic, anthropometric, body composition and lifestyle variables

Through interview, we collected data on demographics (sex and age) and lifestyle, which included current smoking habits, type and frequency of physical activity. Weight, height, WC and HC were measured following standard techniques [15,16]. Weight and height subsidized Body Mass Index calculation (BMI) for nutritional diagnosis [17,18]. Waist circumference was analyzed separately [19], in association with HC in order to obtain WHR categorization [20], Body Shape Index (ABSI) [21] and Body Roundness Index (BRI) [22] estimations. For BRI calculation purposes we considered height parameters and for ABSI, height and BMI. ABSI values were then converted into z score (ABSIz), based on means and standard deviations for the American population [21].

The percentage of body fat (%BF) was assessed with bioimpedance equipment (BIA) and ultrasound (US). As BIA we used a tetrapolar *Biodynamics®*, model 450 (TBW, São Paulo, Brazil), after ensuring that participants had not practiced intense physical activity or consumed heavy meals in the four previous hours and that they had not consumed alcohol, caffeine or diuretics within the last 24 h before the test. The US equipment used was a *Bodymetrix®* device applied in anatomic measurement points on abdominal skin folds, being the iliac and triceps selected for women and the pectoral, scapular and triceps preferred for men. Obtained values allowed for a second nutritional diagnosis [23].

2.3. Blood pressure and clinical variables

Through interview and medical records consultation we collected data on recent blood pressure (BP) and clinical data including MS type, number of pulse therapies, number of days of most recent pulse therapy, mean of episodes in the last two years and most recent scores in the Medical Research Council (MRC), muscular strength evaluation and in the Expanded Disability Status Scale (EDSS).

The EDSS evaluates the MS degree of neurological compromise through the assessment of eight Functional Systems. Scores vary from zero to 9.5 and a 10 score stands for death. A score above 4.5 is consistent with gait impairment [24].

The MRC score is set through the evaluation of six bilateral movements of the upper and lower limbs. Strength grading varies from zero (plegia) to five points (normal strength) totalizing a maximum of 60 points according to Kleyweg et al. [25]. A MRC score lower than 48, suggests muscular weakness according to Connoly et al. [26]. Blood pressure was categorized according to cut points set for the Brazilian population [27].

2.4. Food intake data collection and analysis

Food intake data was obtained through home measurements based on three 24-h food reminders (RA24h), applied to

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