Determination of Nutritional Status Via Food Frequency Consumption (FFQ) and Serum Proteins and Anemia Parameters in Multiple Sclerosis (MS) Patients

Multiple Sklerozlu (MS) Hastalarda Besin Tüketim Sıklığı ile Beslenme Durumunun ve Serum Proteinleri ile Anemi Parametrelerinin Saptanması

Gamze Akbulut¹, Gurdal Orhan², Erdem Gurkas², Nevin Sanlier¹, Makbule Gezmen-Karadag¹, YesimSucullu Karadag²
Hilal Yıldiran¹, Fikri Ak²

¹Gazi University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Ankara, Turkey
²Ankara Numune Education and Research Hospital, Department of Neurology, Ankara, Turkey

ABSTRACT

Objectives: The study was aimed to determine the nutritional status, serum proteins (total protein, albumin, prealbumin) and some anemia parameters (hemoglobin, iron, vitamin B₁₂, homocysteine) of the Multiple Sclerosis (MS) patients.

Methods: It was conducted on 63 MS patients (41 female, 22 male) who have applied to Ankara Numune Education and Research Hospital, Department of Neurology, Turkey. Some anthropometric and biochemical measurements were taken from the study group. Nutritional status was assessed by food frequency consumption results.

Results: The Relapsing/Remitting Multiple Sclerosis (RRMS) was mostly seen in both genders (90.5%). The mean age was found 34.9±8.59 (20-56) years in the study group. The mean body mass index (BMI) was found as 25.2±4.86 kg/m². While the mean albumin (p=0.021), prealbumin (p=0.005), homocysteine (p=0.007), haemoglobin (p=0.001) levels were found to be significantly high; the vitamin B₁₂ measurement (p=0.025) was low in males. The consumption of cheese, red meat, white bread, sugar and carbonated drinks decreased after the diagnosis period in females (p>0.05). There was no change in the consumption of egg, chicken, legumes, vegetable, fruit, margarine, butter and olive oil. Most of the two groups have consumed fish rarely before and after the diagnosis of MS.

Conclusion: It was concluded that nutritional status of MS patients improved after diagnosis and serum proteins which also indicate that adequate and balanced nutrition were in desired levels.

Key Words: Multiple sclerosis, nutrition, albumin, prealbumin, haemoglobin, iron, vitamin B₁₂, folic acid

Received: 03.20.2014 Accepted: 07.27.2014

ÖZET

Amaç: Bu çalışmada Multiple Skleroz’lu (MS) hastalarda beslenme durumunun, serum proteinlerinin (toplam protein, albumin, prealbumin) ve bazı anemi parametrelerinin (hemoglobin, demir, B₁₂ vitamini, homosistein) saptanması amaçlanmıştır.


Bulgular: The Relapsing/Remitting Multiple Sclerosis (RRMS), her iki cinsiyette de en sık görülen MS türüdür (%90.5). Hastaların ortalama yaşları 34.9±8.59 (20-56) yıldır. Beden Kitle İndeksi (BMI) ortalamaları 25.2±4.86 kg/m² olarak bulunmaktadır. Erkeklerde ortalama albumin (p=0.021), prealbumin (p=0.005), homosistein (p=0.007), hemoglobin (p=0.001) düzeyleri önemli düzeyde yüksektirken, B₁₂ vitamininin düşük bulunmuştur (p=0.025). Kadınlarda peynir, kırmızı et, biber, yoğurt ve karbonatlı içecek tüketimleri teşhis sonrası azalmıştır (p<0.05). Her iki cinsiyette de yumurta, tavuk, kurubaklagiller, sebzə, meyve, margarin, tereyağ ve zeytinyağ tüketimlerinin azaldığı tespit edilmiştir. Her iki grubunda büyük ölçüde balığı hem teşhis öncesi hem de sonrasıda seyredegilmiştir.

Sonuç: MS hastalarında tanı sonrası beslenme durumun iyileştiği ve aynı zamanda yeterli ve dengeli beslenmenin bir göstergesi olan serum proteinlerinin de istenilen düzeylerde olduğu sonucuna varılmıştır.

Anahtar Sözcükler: Multiple Sklerozis, beslenme, albumin, prealbumin, hemoglobin, demir, B₁₂ vitamini, folik asit

Geliş Tarihi: 20.03.2014 Kabul Tarihi: 27.07.2014
INTRODUCTION

Multiple sclerosis (MS) is an inflammatory demyelinating disease of the central nervous system that causes neurological impairment which mainly affects young adults (2,6). Multiple sclerosis is rare in tropical areas, but quite common in developed countries. The distribution of the prevalence and incidence of MS is more complex and uneven than previously supposed and little is known about the wide variations among different ethnic groups in any country and areas at the same latitudes (11). MS is more common among women than men. The disease has a prevalence of 30-80 per 100,000 in Canada, northern Europe and the United States (19).

The cause of MS remains so far unknown. Studies revealed different risk levels depending on climate, age and gender (6). Nutritional status and dietary habits in MS patients have not been extensively studied or reported, however individual findings suggest that many patients suffer from various forms of malnutrition (5). The assessment of nutritional status is essential for a diagnosis of nutritional compromise and for the required multidisciplinary management. The assessment of body mass index (BMI) on the other hand has not proven to be a good indicator of nutritional status. It is based on acute phase proteins, producing a situation that would alter the specificity for the diagnosis of visceral protein malnutrition. Albumin and prealbumin, although widely used, should be used with caution. Increased plasma levels of prealbumin with a short half-life- can indicate an adequate response to nutritional support (22,11). Neurobehavioral and cognitive functions are related to the vitamin B12 status. Multiple Sclerosis patients generally present a decrease of neuroprotective and immunoregulatory vitamins and an increase of total homocysteine concentrations (13).

In this present study, it is aimed to determine the nutritional status, serum proteins (total protein, albumin, prealbumin) and some micro parameters (haemoglobin, iron, vitamin B12, homocysteine) of the Multiple Sclerosis (MS) patients.

MATERIALS AND METHODS

This study was conducted on 63 MS patients (41 female, 22 male) who have applied to Ankara Numune Education and Research Hospital, Department of Neurology, Turkey from April to July 2012. The disease was diagnosed by a neurologist. Pregnant women, habitual smokers, alcohol drinkers, and consumers of vitamin-rich products were excluded from the study. Among the cases, individuals with other disorders in addition to MS were also excluded. The participants were informed about the subject and the purpose of the research. Each participant signed a voluntary participation form and gave informed written consent which adhered to Declaration of Helsinki. Folic acid and Vitamin B12, Dose were taken by the patients. All anthropometric measurements were taken by trained dieticians. During the measurement process, participants wore light clothes and had no consumption of food. A validated semi quantitative food frequency questionnaire was used in this study. Food consumption data were collected from each patient during a face-to-face interview with researchers. According to the results, every day or every other day consumption of nutrients was considered as “frequent consumption”, 1 or 2 times a week as “intermittent consumption”, and 1 or 2 times a month/year and no consumption as “rare/no consumption”. Early morning venous blood samples were obtained from each participant for biochemical screening tests, following a twelve-hour overnight fast. Professional staff performed venipuncture by using vacutainers to obtain 15 mL of whole blood. Blood was centrifuged for plasma separation at the hospital where the actual biochemical analyses were performed. Complete hemogram, fasting plasma glucose (FPG), total protein, albumin, vitamin B12, homocysteine, folate levels were measured. The Ubbink method was used to establish plasma levels of homocysteine. Complete hemogram was analyzed by “Sysmex XE-2100 hemogram”. Fasting plasma glucose (FPG), total protein and albumin were analyzed by “Roche MODULAR Analytics P800” (Roche Diagnostics, Indianapolis, IN) and vitamin B12, homocysteine, folate levels were analyzed by Roche MODULAR Analytics E601 (Roche Diagnostics, Indianapolis, IN).

Data Analysis

The data analysis was carried out using SPSS version 15.0 software (SPSS Inc., Chicago, IL, USA). The descriptive statistics of means with 95% CI were used to summarise the data collected. The Kolmogorov-Smirnov test was used to determine whether outcome variables were normally distributed.

Means were analyzed by an independent sample t-test. The level of significance was set as p<0.001.

RESULTS

This study was conducted on 63 (41 females, 22 males) MS patients between the ages of 20-56 years. The mean age was found 35.1±8.90 years for females, 34.6±19.19 years for males (p=0.05). The most of the females (80.5%) and 68.2% of the males were married. The educational status of the males was found higher than the females’. The 63.7% of the males were graduated from high school and/or had a bachelor’s degree while most of the females graduated from primary school (36.6%). When the individuals were evaluated by their professions, the majority of the females were observed be housewives (73.2%) and only 18.2% of the males were found to be retired.

Table 1 shows means±SD. For body weight (BW), body mass index (BMI) and waist-hip ratio (WHR), fasting plasma glucose (FPG), total protein, albumin, prealbumin, homocysteine, haemoglobin, iron, vitamin B12, folic acid measurements. The mean BMI was found as 25.4±8.9 kg/m² for females and 24.8±4.9 kg/m² for males (p=0.05) and the mean WHR was found to be significantly high in men (p<0.001). While the mean albumin (p=0.021), prealbumin (p=0.005), homocysteine (p=0.007), haemoglobin (p=0.001) levels were found to be significantly high; the vitamin B12 measurement (p=0.025) was low in males.

Table 1. Some anthropometric and biochemical parameters of the patients

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Female (n=41)</th>
<th>Male (n=22)</th>
<th>Total (n=63)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>BW (kg)</td>
<td>64.7±11.19</td>
<td>25.4±4.89</td>
<td>69.1±13.49</td>
<td>0.001*</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>0.80±0.06</td>
<td>0.87±0.06</td>
<td>0.82±0.06</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>FPG (mg/dL)</td>
<td>86.1±15.41</td>
<td>78.4±14.46</td>
<td>86±6±13.34</td>
<td>0.659</td>
</tr>
<tr>
<td>T. protein</td>
<td>73.8±4.82</td>
<td>75.5±4.73</td>
<td>74.4±4.82</td>
<td>0.193</td>
</tr>
<tr>
<td>Albumin (g/L)</td>
<td>45.6±3.90</td>
<td>47.8±3.19</td>
<td>46.4±3.86</td>
<td>0.022**</td>
</tr>
<tr>
<td>Prealbumin (g/dL)</td>
<td>24.3±4.84</td>
<td>29.5±7.34</td>
<td>26.1±6.30</td>
<td>0.005**</td>
</tr>
<tr>
<td>Homocysteine (μmmol/L)</td>
<td>10.3±3.04</td>
<td>13.1±4.05</td>
<td>11.3±3.60</td>
<td>0.007**</td>
</tr>
<tr>
<td>Haemoglobin (g/dL)</td>
<td>12.9±1.40</td>
<td>15.2±1.31</td>
<td>13.7±1.75</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Iron (μg/dL)</td>
<td>78.1±41.2</td>
<td>97.8±45.46</td>
<td>84.9±43.29</td>
<td>0.096</td>
</tr>
<tr>
<td>Vitamin B12 (pg/mL)</td>
<td>418.6±346.09</td>
<td>283.8±106.12</td>
<td>371.5±292.04</td>
<td>0.025**</td>
</tr>
<tr>
<td>Folic acid (ng/mL)</td>
<td>8.9±3.60</td>
<td>8.3±2.10</td>
<td>8.69±3.15</td>
<td>0.415</td>
</tr>
</tbody>
</table>

The food consumption frequency of basic nutrients by MS patients has also been determined (Table 2a - 2b). While frequent consumption of milk products like yogurt is high; the milk consumption was low in female patients (p=0.05). Although there was no change in the consumption of egg, legumes, vegetable, fruit, margarine, butter and olive oil, 50% of the females and 13.6% of the males were found to be retired.

DISCUSSION

The Relapsing/Remitting Multiple Sclerosis (RRMS) is the most common form of the disease. The vast majority (>85%) of people presenting with MS are first diagnosed with relapsing/remitting. Twice as many women as men present with this variety. Approximately 50% of patients with RRMS convert to Secondary Progressive Multiple Sclerosis (SPMS) within 10 years of the disease onset (13). In this present study, RRMS was mostly seen in both genders (90.5%). Only 4.9% of the females and 13.6% of the males were diagnosed as Secondary Progressive Multiple Sclerosis (SPMS). When patients were evaluated by the year of diagnosis, only approximately 10% of the whole group (9.7% females, 9.0% males) have been first diagnosed more than 10 years ago. As MS is more common in females than males and frequently affects women during their reproductive years (10,9), the majority of the present study sample consisted of females (65%).
Existing lifestyles and existing consumption behaviours could help to explain the clusters of MS, whereas imported lifestyles and imported consumption behaviours could help to explain the epidemics of MS (10). Dietary factors have been suggested as a possible cause of MS, but without strong evidence (17). There are only a few prospective studies available and most evidence is derived from case-control or epidemiological studies. Population based epidemiological studies indicate a variety of associations between MS and nutrition (17,3). Malnutrition, some vitamin deficiencies, and obesity and weight loss are common and may exacerbate the clinical symptoms in MS (17). In this present study, the mean BMIs of both gender were defined as having abnormally high homocysteine levels. We found significantly higher levels of homocysteine in males than in females’ (p<0.05) as it was previously found in Salemi et al.’s study (16). Williams et al. (22) studied the nutrient intake and biochemical status of 20 severely disabled MS women. The intakes of nutrients were lower than the recommended daily amounts of iron and folate. Also they found that mean plasma levels of albumin and iron were toward the lower end of the normal range in all subjects. In this present study, the mean albumin (p=0.021) and prealbumin (p=0.005) concentrations were low in females, which means that the nutritional status of females was worse than that of the males as <4 ng/mL (4). In addition, patients with the blood homocysteine level >12.4 μmol/L were defined as having abnormally high homocysteine levels. We found significantly higher levels of homocysteine in males than in females’ (p<0.05) as it was previously found in Salemi et al.’s study (16). Williams et al. (22) studied the nutrient intake and biochemical status of 20 severely disabled MS women. The intakes of nutrients were lower than the recommended daily amounts of iron and folate. Also they found that mean plasma levels of albumin and iron were toward the lower end of the normal range in all subjects. In this present study, the mean albumin (p=0.021) and prealbumin (p=0.005) concentrations were low in females, which means that the nutritional status of females was worse than that of the males as <4 ng/mL (4). In addition, patients with the blood homocysteine level >12.4 μmol/L were defined as having abnormally high homocysteine levels. We found significantly higher levels of homocysteine in males than in females’ (p<0.05) as it was previously found in Salemi et al.’s study (16). Williams et al. (22) studied the nutrient intake and biochemical status of 20 severely disabled MS women. The intakes of nutrients were lower than the recommended daily amounts of iron and folate. Also they found that mean plasma levels of albumin and iron were toward the lower end of the normal range in all subjects. In this present study, the mean albumin (p=0.021) and prealbumin (p=0.005) concentrations were low in females, which means that the nutritional status of females was worse than that of the males as <4 ng/mL (4). In addition, patients with the blood homocysteine level >12.4 μmol/L were defined as having abnormally high homocysteine levels. We found significantly higher levels of homocysteine in males than in females’ (p<0.05) as it was previously found in Salemi et al.’s study (16). Williams et al. (22) studied the nutrient intake and biochemical status of 20 severely disabled MS women. The intakes of nutrients were lower than the recommended daily amounts of iron and folate. Also they found that mean plasma levels of albumin and iron were toward the lower end of the normal range in all subjects. In this present study, the mean albumin (p=0.021) and prealbumin (p=0.005) concentrations were low in females, which means that the nutritional status of females was worse than that of the males as <4 ng/mL (4). In addition, patients with the blood homocysteine level >12.4 μmol/L were defined as having abnormally high homocysteine levels. We found significantly higher levels of homocysteine in males than in females’ (p<0.05) as it was previously found in Salemi et al.’s study (16). Williams et al. (22) studied the nutrient intake and biochemical status of 20 severely disabled MS women. The intakes of nutrients were lower than the recommended daily amounts of iron and folate. Also they found that mean plasma levels of albumin and iron were toward the lower end of the normal range in all subjects. In this present study, the mean albumin (p=0.021) and prealbumin (p=0.005) concentrations were low in females, which means that the nutritional status of females was worse than that of the males as <4 ng/mL (4). In addition, patients with the blood homocysteine level >12.4 μmol/L were defined as having abnormally high homocysteine levels. We found significantly higher levels of homocysteine in males than in females’ (p<0.05) as it was previously found in Salemi et al.’s study (16). Williams et al. (22) studied the nutrient intake and biochemical status of 20 severely disabled MS women. The intakes of nutrients were lower than the recommended daily amounts of iron and folate. Also they found that mean plasma levels of albumin and iron were toward the lower end of the normal range in all subjects. In this present study, the mean albumin (p=0.021) and prealbumin (p=0.005) concentrations were low in females, which means that the nutritional status of females was worse than that of the males as <4 ng/mL (4). In addition, patients with the blood homocysteine level >12.4 μmol/L were defined as having abnormally high homocysteine levels. We found significantly higher levels of homocysteine in males than in females’ (p<0.05) as it was previously found in Salemi et al.’s study (16). Williams et al. (22) studied the nutrient intake and biochemical status of 20 severely disabled MS women. The intakes of nutrients were lower than the recommended daily amounts of iron and folate. Also they found that mean plasma levels of albumin and iron were toward the lower end of the normal range in all subjects. In this present study, the mean albumin (p=0.021) and prealbumin (p=0.005) concentrations were low in females, which means that the nutritional status of females was worse than that of the males as <4 ng/mL (4). In addition, patients with the blood homocysteine level >12.4 μmol/L were defined as having abnormally high homocysteine levels. We found significantly higher levels of homocysteine in males than in females’ (p<0.05) as it was previously found in Salemi et al.’s study (16). Williams et al. (22) studied the nutrient intake and biochemical status of 20 severely disabled MS women. The intakes of nutrients were lower than the recommended daily amounts of iron and folate. Also they found that mean plasma levels of albumin and iron were toward the lower end of the normal range in all subjects. In this present study, the mean albumin (p=0.021) and prealbumin (p=0.005) concentrations were low in females, which means that the nutritional status of females was worse than that of the males as <4 ng/mL (4). In addition, patients with the blood homocysteine level >12.4 μmol/L were defined as having abnormally high homocysteine levels. We found significantly higher levels of homocysteine in males than in females’ (p<0.05) as it was previously found in Salemi et al.’s study (16). Williams et al. (22) studied the nutrient intake and biochemical status of 20 severely disabled MS women. The intakes of nutrients were lower than the recommended daily amounts of iron and folate. Also they found that mean plasma levels of albumin and iron were toward the lower end of the normal range in all subjects. In this present study, the mean albumin (p=0.021) and prealbumin (p=0.005) concentrations were low in females, which means that the nutritional status of females was worse than that of the males as <4 ng/mL (4). In addition, patients with the blood homocysteine level >12.4 μmol/L were defined as having abnormally high homocysteine levels. We found significantly higher levels of homocysteine in males than in females’ (p<0.05) as it was previously found in Salemi et al.’s study (16). Williams et al. (22) studied the nutrient intake and biochemical status of 20 severely disabled MS women. The intakes of nutrients were lower than the recommended daily amounts of iron and folate. Also they found that mean plasma levels of albumin and iron were toward the lower end of the normal range in all subjects. In this present study, the mean albumin (p=0.021) and prealbumin (p=0.005) concentrations were low in females, which means that the nutritional status of females was worse than that of the males as <4 ng/mL (4). In addition, patients with the blood homocysteine level >12.4 μmol/L were defined as having abnormally high homocysteine levels. We found significantly higher levels of homocysteine in males than in females’ (p<0.05) as it was previously found in Salemi et al.’s study (16). Williams et al. (22) studied the nutrient intake and biochemical status of 20 severely disabled MS women. The intakes of nutrients were lower than the recommended daily amounts of iron and folate. Also they found that mean plasma levels of albumin and iron were toward the lower end of the normal range in all subjects. In this present study, the mean albumin (p=0.021) and prealbumin (p=0.005) concentrations were low in females, which means that the nutritional status of females was worse than that of the males as <4 ng/mL (4). In addition, patients with the blood homocysteine level >12.4 μmol/L were defined as having abnormally high homocysteine levels. We found significantly higher levels of homocysteine in males than in females’ (p<0.05) as it was previously found in Salemi et al.’s study (16). Williams et al. (22) studied the nutri...
Meat and meat products are good-quality protein resources, and they also include iron. In this study, we have seen that products like red meat, fish and chicken were consumed to a relatively lower extent especially after the diagnosis of MS. Insufficient consumption of meat and meat products may be due to their high prices, especially for people with a relatively lower socio-economic status (SES). It may also be due to the news on media that nutrition is a causative factor, important symptoms that affect energy and nutrient intake and nutritional status in MS patients are: reduced mobility, fatigue, poor sight, dysphagia, cognitive difficulties, depression, pressure sores and the side-effects of drugs such as nausea, vomiting and diarrhoea, dry mouth, weight gain and drug and nutrient interactions. A ‘healthy eating’ diet is recommended especially in RRMS in line with current healthy eating recommendations. The aim is to develop the plasma levels of essential fatty acids, antioxidants, folate and vitamin B₁₂. An approach to weight management, with highly structured menu plans, is rarely appropriate in MS, especially if cognitive function is impaired. The dietary advice provides the opportunity to reinforce the principles of healthy eating and create some changes toward reducing energy intake. It is advised to consume semi-skimmed milk rather than full-fat milk, fresh fruits and vegetables, fresh fruit juices rather than ‘added sugar’ drinks, fish rather than fatty-red meat, and whole wheat bread/cereals.

Acknowledgements

We would like to thank all our participants who devoted their time to participating in this study. Their helpful and wholehearted cooperation is warmly acknowledged.

Conflict of Interest

No conflict of interest was declared by the authors.

REFERENCES