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Macronutrients Intake in Iranian Multiple Sclerosis Patients

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The objective of this study was to assess intake of macronutrients in MS patients. 108 MS patients were randomly selected from Iranian MS society in Tehran in 2005. Two questionnaires regarding personal and medical information were filled for each patient. Food intake was assessed by three 24 h recalls and a semi-quantitative food frequency questionnaire. The recorded data were converted to values in grams using Manual for Household Measures and then to nutrient ingredients by nutritionist 3 application. Data was analyzed by SPSS; mean and standard deviation of each macronutrient was calculated; student's t-test was applied to compare the results with reference values. Protein and carbohydrate intake in Iranian MS patients were less than recommended, while their daily intake of total and saturated fat were higher than reference values. Their intake of polyunsaturated fat and dietary fiber was shown to be less than recommended. Body mass index in 14.8% of patients was lower than normal and in 38% of them showed to be higher than normal. It seems nutritional assessment, counseling and education to improve diet is necessary in Iranian MS patients.

Key words: Multiple sclerosis, nutrition, diet, macronutrient, Iran

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INTRODUCTION

Multiple Sclerosis (MS) is the most prevalent autoimmune disease of central nervous system, beginning most often in late adolescence. Its clinical manifestations include fatigue, paralysis and numbness of limbs, visual loss, bladder and bowel dysfunction, dysphagia and psychological disorders (Brandao *et al.*, 2005). The disease is divided to relapsing-remitting, primary progressive and secondary progressive types according to its course and progression (Victor and Ropper, 2002). There are more than 40,000 diagnosed MS cases in Iran (Mohseninia, 2004) and the number is increasing. One study in Tehran (capital of Iran) revealed the average age of onset to be 27 years and female to male ratio 2.5 (Kalanie *et al.*, 2003). Another study in Isfahan (a central major city) showed a prevalence of 35.5 per 100000, average age of onset 26 and female to male ratio of 3.6 (Etemadifar *et al.*, 2006).

One well-cited assertion in the literature is that nutritional factors play a role in MS morbidity and mortality (Swank and Dugan, 1990; Gusev *et al.*, 1999). Nutritional interventions specially at early stages of the disease, when there is minimal disability, improve disease course and prognosis (Schwarz and Leweling, 2005).

Nutritional recommendations for MS patients include lower intake of total fat due to consuming less animal fat and hydrogenated oils. Consuming polyunsaturated fats especially fish oil, antioxidant rich foods, sufficient intake of calcium, cobalamin, vitamin D and dietary fiber is recommended (Payne, 2001). Data suggests that MS patients are predisposed to malnutrition due to physical limitations, anorexia, depression and drug side effects, while their need to certain nutrients is high due to over-activity of immune system (Schwarz and Leweling, 2005).

Little is known about macronutrients intake in MS patients. Hewson *et al.* (1984), in a study conducted in England, found that total energy intake in MS patients was below recommended values. They showed that their energy provided by proteins was normal, while their energy intake by fats was above recommended values and energy provided by carbohydrates was below it. Their research also showed that major part of fat intake in MS patients was saturated fats and their intake of dietary fiber was well below than recommended. Timmerman and Stuifbergin (1999) investigated macronutrients intake in 67 American female MS patients and showed that their intake of total energy, carbohydrate and fiber is below than recommended, while their intake saturated fat and protein is above recommended values. There is no published data regarding macronutrients intake in Iranian

MS patients. The purpose of this study was to assess daily intake of total calorie, carbohydrate, protein and fat in Iranian MS patients and compare it with reference values recommended by Food and Nutrition Board.

MATERIALS AND METHODS

This was a descriptive study conducted on 108 MS subjects randomly selected from Iranian MS society patients' list in Tehran in 2005. The patients were adults of both sexes who had been living in Tehran for at least 10 years. All had a definite diagnosis of relapsing-remitting type of MS for less than 10 years. None was in relapse period or undergoing steroid pulse therapy at the time of investigation. All had an Expanded Disability Status Scale (EDSS); 1: No disability, 2: Minimal disability, 3: Moderate disability, 4: Relatively severe disability, 5: Walking unaided upto 500 m, 6: Needs assistance for walking, 7: Wheelchair bounded, 8: Restricted to bed, 9: Helples and bedridden, 10: Death (Hohol *et al.*, 1997) equal to or less than 5.5. None was diagnosed to have any other serious medical condition including: cardiovascular disease, renal or hepatic failure, metabolic or endocrine disorder, cancer and other neuropsychological disease. None of women was expecting or nursing a baby.

After the proposal was approved by the Iranian MS society regarding methodology and medical ethics, patients were admitted upon appointments. During the first visit the purpose and method of research was explained in detail and their questions were answered individually. They were supplied with measuring dishes, cups and spoons to ensure that household scales are understood by every participant. A questionnaire regarding personal information and a second one including their medical history were filled afterwards by a trained physician.

Daily nutrient intake was assessed by three 24 h recalls for three non consecutive days of a week including one weekend. A semi-quantitative food frequency questionnaire which was restructured according to our pilot study on MS patients, including 300 items regarding last 365 days was also completed for each patient.

To minimize inter-examiner variation, all questionnaires were filled by the same trained nutritionist during 2 to 3 interviews. For patients who did not personally purchase grocery or cook themselves, a family member responsible, attended the sessions. Also subjects were asked to attend the sessions with a partner if unable to answer questions precisely. Another session was scheduled if patients became tired. All forms were checked by an expert regularly.

Data recorded in household scales changed to values in grams using The Manual for Household Measures (Gafarpoor *et al.*, 2000). After summarizing the data on sheets, Nutritionist-3 application was used to turn the crude data to macronutrient values. Mean and standard deviation for protein, carbohydrates and fats were calculated using SPSS and compared to Recommended Dietary Allowances (RDA) from Food and Nutrition Board and average intake of Iranian normal population (Kalantary and Gafarpoor, 2005). Student's t-test was used to compare the results with reference values. Pearson correlation was employed to check the relationship between quantitative variables p-values of below 0.05 were considered significant.

RESULTS

Average age of participants and average disease duration were 32.2 and 4.3 years, respectively (Table 1). Average age of onset was 27 and female to male ratio was 3 to 1. Sixty four percent of patients who participated the study were married. 47.2% of patients had a normal body mass index (BMI), while 14.8% were underweight, 30.6% were overweight and 7.4% showed to be obese (Table 2).

Patients were divided into three groups according to EDSS. Disability was mild, moderate and severe in 54.6, 23.1 and 22.2% of participants, respectively.

Daily energy provided by each macronutrient in women afflicted with MS, are compared to reference values recommended by Food and Nutrition Board in Table 3. Absolute amount of each macronutrient ingested by these women are compared to reference values in (Table 4).

Table 4 shows that energy provided by total and saturated fats in women afflicted with MS, is above recommended values while the energy provided by monounsaturated fatty acids is below recommended levels. Also their intake of total energy and dietary fiber is less than reference values.

As Table 5 and 6 indicate, daily energy provided by total and saturated fats is above recommended levels and energy provided by monounsaturated fatty acids is below recommended values. Absolute daily intake of protein, carbohydrate and cholesterol is more than reference levels and daily intake of dietary fiber is less than recommended levels.

Table 7 compares the amount of energy provided by each macronutrient with that of Iranian population average intake, which indicates that consumption of protein and total fat in MS patients is higher than normal Iranian population while their intake of carbohydrate and saturated fat is less.

Table 1: Personal characteristics of Iranian MS patients who participated in present study

Characteristics	Female MS patients N = 82	Male MS patients N = 26	Total N = 108
Age (year)	32.16±8.2	33.96±9.1	33.15±8.2
Weight (kg)	61.38±11.45	69.73±10.6	63.39±11.77
Height (m)	1.61±0.16	1.73±0.06	1.63±0.07
Disease duration (year)	4.45±2.7	3.85±2.5	4.31±2.65

Table 2: Categorizing patients who participated in present study based on their BMI

	Frequency in MS patients		
BMI	Female N = 82	Male N = 26	Total N = 108
<19.5 (Underweight)	13.4%	19.5%	14.8%
19.5-24.5 (Normal weight)	50%	38.5%	47.2%
24.5-30 (Overweight)	28%	38.5%	30.6%
>30 (Obese)	8.5%	3.8%	7.4%

Table 3: Comparison of energy provided by each macronutrient with reference values recommended by Food and Nutrition Board in female MS patients*

Macronutrient	Female MS patients Mean±SD	Recommended daily allowance	p-value
Protein	13.43±5.81	10-35%	0.423
Carbohydrate	51.79±9.05	45-65%	0.769
Total fat	37.05±10.10	Max 30%	0.000
Saturated fat (SFA)	10.22±4.18	Max 7%	0.000
Monounsaturated fat (MUFA)	12.88±5.08	Max 20%	0.000
Polyunsaturated fat (PUFA)	9.02±4.98	Max 10%	0.079

* Student's t-test is used

Table 4: Comparison of macronutrients and energy intake in female MS patients with reference values recommended by Food and Nutrition Board *

Macronutrient	Female MS patients Mean±SD	Recommended daily allowance	p-value
Protein (g)	53.00±31.25	46	0.046
Carbohydrate (g)	203.11±81.79	195	0.375
Cholesterol (mg⁺)	212.30±262	Max 200	0.674
Fiber (g)	5.78±5.24	25	0.000
Energy (Kcal)	1601.58±742	2000	0.000

*Student's t-test is used, ⁺Based on Food and Nutrition Board recommendations, absolute intake of fat is not determined and only absolute amount of cholesterol is calculated

Table 5: Comparison of energy provided by each macronutrient with reference values recommended by Food and Nutrition Board in male MS patients*

Macronutrient	Female MS patients Mean±SD	Recommended daily allowance	p-value
Protein	13.48±2.92	10-35%	0.885
Carbohydrate	53.61±9.20	45-65%	0.448
Total fat	34.21±9.48	Max 30%	0.033
Saturated fat (SFA)	9.15±2.59	Max 7%	0.000
Monounsaturated fat (MUFA)	11.16±3.91	Max 20%	0.000
Polyunsaturated fat (PUFA)	8.31±5.06	Max 10%	0.102

*Student's t-test is used

In the present study an inverse relationship was found between disease duration with total fat and cholesterol intake (r = -0.197 and p = 0.04, r = -0.212 and

Table 6: Comparison of macronutrients and energy intake in male MS patients with reference values recommended by Food and Nutrition Board *

Macronutrient	Female MS patients Mean±SD	Recommended daily allowance	p-value
Protein (g)	81.37±34.26	56	0.001
Carbohydrate (g)	326.48±141	195	0.000
Cholesterol (mg⁺)	321.76±238	Max 200	0.015
Fiber (g)	7.57±4.51	38	0.000
Energy (Kcal)	2473.17±1079	2500	0.900

*Student's t-test is used, ⁺Based on Food and Nutrition Board recommendations, absolute intake of fat is not determined and only absolute amount of cholesterol is calculated

Table 7: Comparison of energy provided by each macronutrient in MS patients with Iranian normal population (Kalantary and Gafarpoor, 2005)*

Macronutrient	MS patients Mean±SD	Iranian normal population	p-value
Protein	13.04±3.2	10%	0.000
Carbohydrate	52.23±9.0	65%	0.000
Total fat	36.36±9.9	25%	0.000
Saturated fat (SFA)	9.96±3.8	21.5%	0.000
Energy (Kcal)	1811.41±910	2541	0.000

*Student's t-test is used

p = 0.02, respectively). Also a positive relationship between body mass index (BMI) with age and marital status was found (r = 0.285 and p = 0.000, r = 0.408 and p = 0.000).

DISCUSSION

The present study showed that Iranian female MS patients consume less dietary fiber while their daily intake of total and saturated fat is higher than recommended.

Timmerman and Stuifbergin (1999) investigated macronutrient intake in 67 American female MS patients and showed that their intake of carbohydrates and dietary fiber is less than recommended, while their intake of saturated fat and protein is more than recommended values. Our results support Timmerman's results regarding saturated fat, protein and dietary fiber, while it's in discrepancy with Timmerman's regarding carbohydrates. Timmerman and Stuifbergin found an inverse correlation between daily fat intake and patients age, however we found an inverse relationship between the length of time since diagnosis with daily intake of fat.

Hewson *et al.* (1984), in a study conducted in England, found that energy provided by carbohydrates in female MS patients was less and that of fat more than recommended levels, while energy provided by protein was in normal range. Also their intake of dietary fiber was below reference values. Our results are in agreement with Hewson's regarding fat and dietary fiber consumption.

Hewson's study showed that energy provided by fat in men affected with MS is more than recommended and that of carbohydrates is less than reference values. Also fiber intake showed to be below recommended values. Our results are in agreement with Hewson's regarding dietary fiber and fat.

In this study more than one third of Iranian patients had BMI equal to or higher than 25, however in Hewson study 41% of patients had same values of BMI. Female to male ratio was reported 3.1 to 1 which is in agreement with other research in Iran who reported 2.5 and 3.6 to 1 (Kalanie *et al.*, 2003; Etemadifar *et al.*, 2006).

Iranian MS patients consume more total and saturated fat and cholesterol than reference values. We know that animal fat is a saturated fat and also based on previous research animal fat due to arachidonic acid causes central nervous system destruction through synthesis of pro-inflammatory and inflammatory mediators (Field, 1975). Therefore decreasing total and animal fat consumption and substituting plant oils decrease MS mortality and morbidity (Swank and Dugan, 1990).

Dietary fiber intake was below reference values in Iranian MS patients. Whole grains, beans, fruit and vegetables are good sources of fiber. Whole grains also contain thiamin which plays a key role in energy metabolism, hence decrease fatigue (Suzuki and Itokawa, 1996). Fruit and vegetables are beneficial in MS course due to antioxidants (Van Meeteren *et al.*, 2005). Beans are good sources of low glycemic index sugar which prevents MS fatigue and it is also a good source of arginine which prevents MS progression due to immune modulatory activity (Mayer, 1999).

Also dietary fiber prevents constipation which is common in MS patients (El-Maghraby *et al.*, 2005). It also helps weight regulation, it is important as many MS patients are overweight or obese due to physical limitations, depression or drug side effects (Schwarz and Leweling, 2005). In this study more than one third of patients were obese or overweight as well.

The present study showed that MS patients consume more fat and protein and less carbohydrate comparing to Iranian normal population consumption (Kalantary and Ghafar poor, 2005). As Iranian typical diet is based on rice and wheat (carbohydrates) and research shows that MS patients tend to consume ready to eat and fast food due to physical limitations (Payne, 2001) which contain more fat, it may be the cause of this difference.

Some strengths of our study were its larger sample size comparing to previous studies, restructuring a food frequency questionnaire for MS patients according to our pilot study and invitation a partner if patients did not personally purchase grocery or cook themselves or unable to answer questions precisely which makes our results more accurate. As many MS patients suffer from

fatigue, some of them became exhausted during interviews. To prevent lower accuracy in answering our questions another session was scheduled.

RECOMMENDATIONS

Based on the results of present study, decreasing consumption of animal and saturated fat and sufficient fiber intake seems in order. Further investigation is needed to assess effect of these nutritional recommendations on long term outcome and prognosis of MS patients.

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