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Original article

A gender stratified controlled descriptive study to identify how specific food and drink consumption differentiate in MS

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Abstract. *Objective:* There is an ongoing research on the idea that certain diets could make a difference in Multiple Sclerosis (MS) symptoms and progression. This study aimed to investigate the consumption rates of certain food and drinks in MS patients. The association between the presence of MS and the body mass index, sleeping duration, obesity status was also examined. *Methods:* The study was designed as a controlled descriptive study, consisting of 229 females (134 MS patients, 95 healthy volunteers) and 163 males (62 MS patients, 101 healthy volunteers). Blood samples were collected for biochemical evaluation of 25-hydroxy-vitamin D (25(OH)D). Obesity status of the participants was determined. Average 24-hour retrospective food and drink consumption rates were collected. To identify factors associated with MS, multivariate logistic regression analyses were applied for both male and female data. *Results:* Increase in 25(OH)D level was associated with decrease in the odds of having MS. Women were more likely to experience MS if they preferred to wear head and body-covering clothes in their daily lives. For both male and females, increase in the individual consumption rate of herbal tea and coffee was associated with a reduction in the likelihood of having MS. Moreover, men who sleep half an hour more in a day were 16.5% less likely to have MS, adjusted for other factors considered in this study. *Conclusion:* Based on the findings of this study, nutrition contents of the food and drinks associated with MS can be detected, and dietary precautions might be taken.

Key words: Multiple sclerosis, food and drink consumption, sleeping duration, obesity, logistic regression.

Introduction

Multiple Sclerosis (MS) is an inflammatory demyelinating state of the central nervous system. It is estimated that more than 2.5 million people have been affected by MS around the world (1). The precise cause of MS and the immunological targets remain obscure, and the clinical course is highly heterogeneous between patients (2). The etiology of MS is unknown, but it is likely the result of a complex interaction between genetic and environmental factors and the immune system (3).

The diagnosis of the disease is usually made between the ages of 20-40 (4). MS is characterized by pathologic inflammation (5). Inflammation in the first stage of the disease is transient and remyelination occurs; but this remyelination is often unstable (6). Symptoms and signs of MS only reflect the functional anatomy of the impaired conduction in affected areas. The spinal cord affected by the disease often causes

changes in motor, sensory and autonomic functions (7). The disease, which initially usually exacerbates and resolves, results in various neurological signs and symptoms (8).

Research has shown that the course of MS may be influenced by the nutritional status (9). Since diet has a significant impact on body weight, cholesterol levels, and other vascular risk factors that affect MS risk (10), several studies have examined the association between dietary intake, food groups and MS (9-13). So far, there is not a consensus on a particular diet associated to MS therapy. Nevertheless, the majority of patients with MS is looking for complementary and alternative treatments, and in particular is trying to change dietary habits, almost without the advice of the physician (9,14).

Since food is an environmental factor, according to WHO's International Classification of Functioning, Disability and Health (15), the role of food and drinks, so that nutrition, on MS should be examined in detail. There are many yet-unanswered questions such as which foods make people more susceptible to getting MS, which help for a better prognosis, which foods help with symptom management and progression. In such a circumstance, it is believed that any study on food with relation to MS would help develop a consensus statement to be able to reach and influence the broader MS community. This gender stratified controlled descriptive study aimed to make contributions to the literature by investigating the consumption rates of certain food and drinks in MS patients. The association between the presence of MS and the body mass index (BMI), sleeping duration, obesity status was also examined.

Materials and methods

Design

This study was designed as a gender stratified controlled descriptive study. The output was the presence of MS. Two groups, one including the patients having the outcome of interest (MS) and one not having, were compared in terms of the obesity and physical activity status, 25(OH)D and BMI levels, sleeping duration and the consumption of certain food and drinks.

Participants

The study group consisted of patients who applied to a state hospital between the dates of June 28, 2016 - January 5, 2017. All individuals carrying the following characteristics were included in the study group: 1) He/she was eager to participate, 2) His/her age was between 19 and 65 years, 3) He/she did not have any chronical disease other than MS. 4) He/she did not change his/her eating habits after diagnosed with MS. There were 196 patients satisfying the requirements. In order to constitute the control group, a list of patient names who applied to the internal medicine or the endocrinology outpatient clinics of the hospital between the aforementioned time period was recorded. Among these patients, individuals who were between 19-65 years and did not have any chronic health problems were determined and asked to be a volunteer for the current study. 196 of the patients who accepted to be a volunteer were randomly selected. These participants were requested to give their blood samples when they did not have any health problem. Thus, the control group was established.

Measurements

Demographic characteristics and disease histories of the participants were collected by face-to-face interview method through a questionnaire survey. Based on a nine point Likert scale, participants were asked to report their average 24-hour retrospective food consumption of milk/yoghurt, cheese, dairy desserts, red meat, white meat, fish, egg, green leaved vegetable, herbal tea, coffee, fizzy drinks, sugar/honey/jam, chocolate, and saturated fat. Blood samples were collected for biochemical evaluation of 25(OH)D. The body weight and height were measured to calculate body mass index [BMI = body weight (kg)/height (m^2)]. Waist and hip circumferences were measured to specify the obesity status of the participants.

Statistical Analyses

To better identify the factors affecting the MS presence, the data were stratified by gender. Descriptive statistics were presented in terms of frequencies and percentages. Group statistics were expressed as

the median with interquartile range (IQR) and the mean ± standard deviation (SD). Due to the violation of normality assumptions, comparisons between patients with and without MS were performed by using Mann Whitney U test for continuous variables. To identify factors associated with MS, stepwise multivariate binary logistic regression analysis was applied and expressed in Odds ratios (OR) and 95% confidence intervals (95% CI). First, univariate analysis of each variable was performed. Then, based on the Wald test from logistic regression, any variable having a significant univariate test at p-value cut-off point of 0.25 was selected as a candidate for the multivariate analysis (More traditional levels such as 0.05 can fail in identifying variables known to be important). All the statistical calculations were performed using IBM SPSS statistics for windows, version 22.0 (IBM Corp., Armonk, NY, USA) and R (version 3.5.3 for Windows). For all tests, the statistical significance level was taken as 0.05.

Results

Table 1 summarizes the gender-stratified comparison of the potential factors in terms of MS presence. As seen in the table, this study consisted of 229 female and 163 male participants. 134 (58.5%) of the females and 62 (38.0%) of the males were MS patients, respectively. 80 (59.7%) of females and 30 (48.4%) of males had been diagnosed with MS five or less years ago, while rest of them have been an MS patient more than 5 years. Females with and without MS had similar median ages (median, 39 (IQR: 31.00-47.00) vs. 38 (IQR: 38 (IQR: 30.00-45.00) years, p = 0.662). Likewise, there were no significant differences between the median ages of male participants in the control and MS groups (median, 42 (IQR: 31.50-50.00) vs. 38.5 (IQR: 31.75-48.00) years, p = 0.486). 28.4% of the females in the control group and 73.1% of the females in the MS group were wearing head and body-covering clothes in their daily lives. There was a significant association between the presence of MS and the state of wearing head and body-covering clothes (p < 0.001).

In terms of females, sleeping duration and BMI level did not differ significantly in the control and MS groups (p = 0.595 and p = 0.514, respectively). On the other hand, the median 25(OH)D level of the MS group was statistically significantly lower than the control group (median, 7.05 (IQR: 5.08-10.55) vs. 14.00 (IQR: 8.70-21.80) ng/ml; p < 0.001). With

Table 1. Gender-stratified comparison of the potential factors in terms of MS presence

			Age (years)	25(OH)D (ng/ml)	Sleeping Duration (min)	BMI (kg/m^2)
Females (n = 229)	Control (n = 95, 41.5%)	Mean ± SD	38.01 ± 10.39	18.09 ± 15.75	480.32 ± 73.00	26.23 ± 5.42
		Median (IQR)	38.00 (30.00 – 45.00)	14.00 (8.70 – 21.80)	480.00 (420 – 480)	25.28 (22.65 – 28.71)
	MS (n = 134, 58.5%)	Mean ± SD	38.57 ± 10.14	8.55 ± 5.48	470.86 ± 96.48	26.63 ± 5.78
		Median (IQR)	39.00 (31.00 – 47.00)	7.05 (5.08 – 10.55)	480.00 (420.00 – 540.00)	25.46 (22.20 – 30.47)
		p value	0.662	**< 0.001**	0.595	0.514
Males (n = 163)	Control (n = 101, 62.0%)	Mean ± SD	41.21 ± 11.85	20.45 ± 9.63	502.87 ± 77.88	27.74 ± 4.43
		Median (IQR)	42.00 (31.50 – 50.00)	19.10 (13.75 – 24.52)	480.00 (480.00 – 540.00)	26.79 (24.56 – 30.11)
	MS (n = 62, 38.0%)	Mean ± SD	40.21 ± 10.31	9.85 ± 4.35	455.40 ± 116.58	25.93 ± 4.00
		Median (IQR)	38.50 (31.75 – 48.00)	8.80 (6.78 – 12.65)	480.00 (420.00 – 495.00)	24.97 (23.32 – 27.85)
		p value	0.486	**< 0.001**	**0.003**	**0.006**

BMI: Body mass index; SD: Standard deviation.
p < 0.05: Statistically significant.

regard to the males, the results of the present study revealed significant differences between the 25(OH) D level, sleeping duration, and BMI levels of the control and MS groups (p values were < 0.001, 0.003, and 0.006, respectively).

Obesity, abdominal obesity, and the state of regular physical activity were among the other factors that were suspected to differ in the control and MS groups. Based on the univariate logistic regression results presented in Table 2; for females, abdominal obesity (OR = 2.026; 95% CI, 1.187-3.458; p = 0.010) and for males, the state of regular physical activity (OR = 0.313; 95% CI, 0.155-0.630; p = 0.001) were determined to be significantly differ in the compared groups. Moreover, obesity was also found to be a potential risk factor.

When the food consumption results regarding to the nine-point Likert scale were analyzed, it was seen that many categories of the Likert scale were either not chosen or selected by only a few people. Therefore, the Likert scale was collapsed into two consumption levels: at most once per month, less or never (L1); at least once every 2 weeks (L2). Even after this modification, consumption frequencies of some nutrients were not sufficient to be included in the statistical analyses (as a rule of thumb, if the frequency of a consumption level was below 15%, the effect of that nutrient was not assessed since it might lead to fallacious results). As shown in Figure 1, around 90% of both male and female participants of this study stated that they consume milk/yoghurt, sugar/honey/jam, cheese, egg, and green leaved vegetable at least once every 2 weeks. For males, fish was also among the most frequently consumed foods. Due to this fact, these foods could not be included in the following analyses.

For female and male participants of the study, univariate logistic regression analyses regarding to the food and drinks consumption were carried out separately. Table 3 summarizes the obtained results. Both male and female based analyses identified 7 covariates initially as potential candidates for the multivariate model at the 0.25 alpha level based on the Wald chi-square statistic. For females, white meat (p = 0.378) and fizzy drinks (p = 0.779); for males, fizzy drinks (p = 0.660) were not included in the multivariate analyses due to their poor association with the outcome in univariate analyses.

All variables with p values < 0.25 on univariate analyses were evaluated using stepwise multivariate binary logistic regression to obtain two models, one for males and one for females. Since there is some debate about the appropriate strategy to variable selection, both forward stepwise and backward stepwise selection algorithms were used, and the model with the highest classification accuracy was chosen as the final

Table 2. Univariate logistic regression results for the association between obesity, regular psychical activity and the presence of MS.

Female		Obesity				Abdominal Obesity				Regular Physical Activity		
		Control	MS	Total		Control	MS	Total		Control	MS	Total
	No	46 (48.4)	49 (36.6)	95 (41.5)	**No**	57 (60.0)	57 (42.5)	114 (49.8)	**No**	72 (75.8)	105 (78.4)	117 (77.3)
	Yes	49 (51.6)	85 (63.4)	134 (58.5)	**Yes**	38 (40.0)	77 (57.5)	115 (50.2)	**Yes**	23 (24.2)	29 (21.6)	52 (22.7)
	OR	1.628 (0.954-2.779)			**OR**	2.026 (1.187-3.458)			**OR**	0.865 (0.463-1.614)		
	p	0.074			**p**	**0.010**			**p**	0.648		
Male		Obesity				Abdominal Obesity				Regular Physical Activity		
		Control	MS	Total		Control	MS	Total		Control	MS	Total
	No	19 (18.8)	19 (30.6)	38 (23.3)	**No**	66 (65.3)	42 (67.7)	108 (66.3)	**No**	50 (49.5)	47 (75.8)	97 (59.5)
	Yes	82 (81.2)	43 (69.4)	125 (76.7)	**Yes**	35 (34.7)	20 (32.3)	55 (33.7)	**Yes**	51 (50.5)	15 (24.2)	66 (40.5)
	OR	0.524 (0.251-1.094)			**OR**	0.898 (0.459-1.758)			**OR**	0.313 (0.155-0.630)		
	p	0.085			**p**	0.754			**p**	**0.001**		

OR: Odds ratio (95% Confidence Interval). Column frequencies are given in parenthesis.
p < 0.05: Statistically significant.

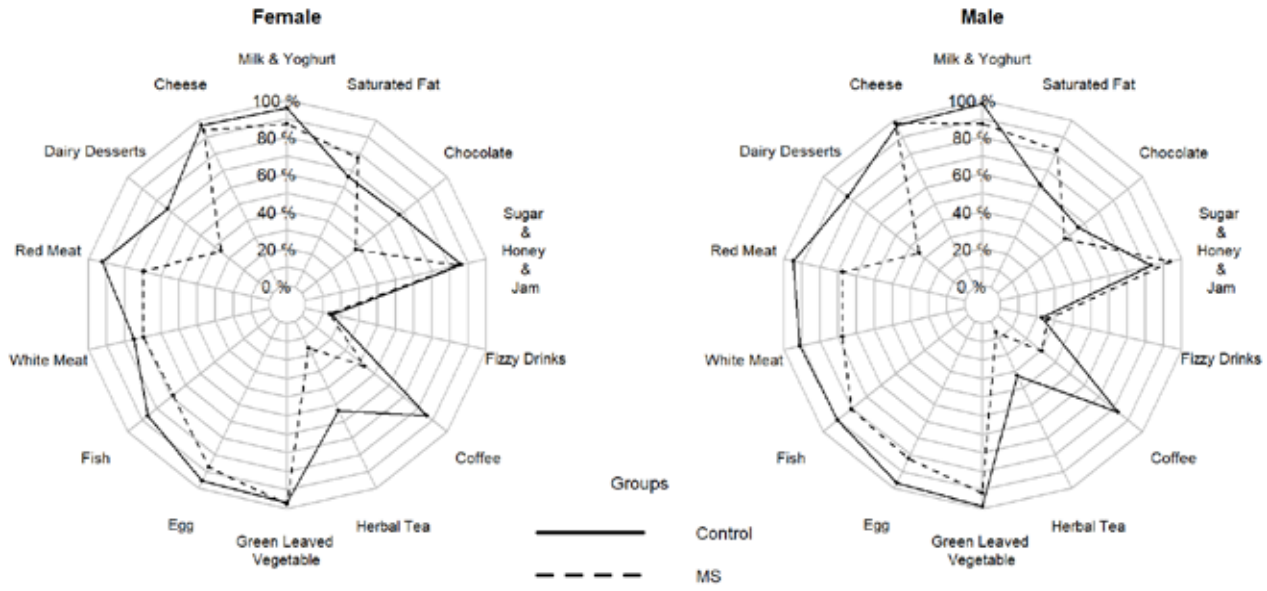

Figure 1. Comparison of food and drinks consumption percentages within the Control and MS groups. The percentages were calculated based on the consumption rate of "at least once every 2 weeks".

model. Table 4 presents the selected variables in the models.

Multivariate Logistic Regression Results for Females

A logistic regression was performed to ascertain the effects of potential variables on the likelihood that female participants have MS. The logistic regression model was statistically significant, $\chi^2 = 120.560$, $p < 0.001$. The model explained 71.1% (Nagelkerke R^2) of the variance in MS and correctly classified 87.1% of cases. On final model, the following variables were found to be associated with the presence of MS: 25(OH)D, state of wearing head and body-covering clothes, fish, dairy desserts, herbal tea, coffee (Odds ratios and regarding p values were given in Table 4). The odds ratio for "state of wearing head and body-covering clothes" indicated that when holding all other variables constant, a woman was 2.674 times more likely to experience MS if she was conservative in terms of clothes. For each one unit increase in 25(OH)D level, there was a 9.5% (OR = 0.905, 95% CI: 0.859-0.953) decrease in the odds of having MS (with other variables held constant). Increase in the individual consumption rate of fish, dairy desserts, herbal tea, and coffee was associated with a reduction in the likelihood of having MS.

Multivariate Logistic Regression Results for Males

A logistic regression was performed to ascertain the effects of potential variables on the likelihood that male participants have MS. The logistic regression model was statistically significant, $\chi^2 = 116.112$, $p < 0.001$. The model explained 53.6% (Nagelkerke R^2) of the variance in MS and correctly classified 81.7% of cases. On final model, the following variables were found to be associated with the presence of MS: 25(OH)D, sleeping duration, red meat, white meat, herbal tea, coffee (Odds ratios and regarding p values were given in Table 4). For each one unit increase in 25(OH)D level, there was a 22.5% (OR = 0.775, 95% CI: 0.690-0.871) decrease in the odds of having MS

Table 3. Univariate logistic regression results for the association between certain food consumption and the presence of MS.

	FEMALE (n = 229) (Control, n = 95; MS, n = 134)						MALE (n = 163) (Control, n = 101; MS, n = 62)					
	Red Meat			White Meat			Red Meat			White Meat		
	Control	MS	Total	Control	MS	Total	Control	MS	Total	Control	MS	Total
L1	7 (7.4)	41 (30.6)	48 (21.0)	24 (25.3)	41 (30.6)	65 (28.4)	5 (5.0)	20 (32.3)	25 (15.3)	9 (8.9)	20 (32.3)	29 (17.8)
L2	88 (92.6)	93 (69.4)	181 (79.0)	71 (74.7)	93 (69.4)	164 (71.6)	96 (95.0)	42 (67.7)	138 (84.7)	92 (91.1)	42 (67.7)	134 (82.2)
OR	0.180 (0.077-0.423)			0.767 (0.425-1.384)			0.109 (0.038-0.311)			0.205 (0.086-0.489)		
p	**< 0.001**			0.378			**< 0.001**			**< 0.001**		
	Fish			Dairy Desserts			Chocolate			Dairy Desserts		
	Control	MS	Total	Control	MS	Total	Control	MS	Total	Control	MS	Total
L1	13 (13.7)	42 (31.3)	55 (24.0)	26 (27.4)	86 (64.2)	112 (48.9)	44 (43.6)	33 (53.2)	77 (47.2)	17 (16.8)	41 (66.1)	58 (35.6)
L2	82 (86.3)	92 (68.7)	174 (76.0)	69 (72.6)	48 (35.8)	117 (51.1)	57 (56.4)	29 (46.8)	86 (52.8)	84 (83.2)	21 (33.9)	105 (64.4)
OR	0.347 (0.174-0.692)			0.210 (0.119-0.373)			0.678 (0.359-1.280)			0.104 (0.049-0.217)		
p	**0.003**			**< 0.001**			0.231			**< 0.001**		
	Chocolate			Saturated Fat			Herbal Tea			Saturated Fat		
	Control	MS	Total	Control	MS	Total	Control	MS	Total	Control	MS	Total
L1	31 (32.6)	84 (62.7)	115 (50.2)	32 (33.7)	30 (22.4)	62 (27.1)	68 (67.3)	58 (93.5)	126 (77.3)	39 (38.6)	11 (17.7)	50 (30.7)
L2	64 (67.4)	50 (37.3)	114 (49.8)	63 (66.3)	104 (77.6)	167 (72.9)	33 (32.7)	4 (6.5)	37 (22.7)	62 (61.4)	51 (82.3)	113 (69.3)
OR	0.288 (0.166-0.502)			1.761 (0.978-3.171)			0.142 (0.048-0.425)			2.916 (1.357-6.266)		
p	**< 0.001**			0.059			**< 0.001**			**0.006**		
	Herbal Tea			Coffee			Fizzy Drinks			Coffee		
	Control	MS	Total	Control	MS	Total	Control	MS	Total	Control	MS	Total
L1	44 (46.3)	112 (83.6)	156 (68.1)	13 (13.7)	76 (56.7)	89 (38.9)	78 (77.2)	46 (74.2)	124 (76.1)	17 (16.8)	43 (69.4)	60 (36.8)
L2	51 (53.7)	22 (16.4)	73 (31.9)	82 (86.3)	58 (43.3)	140 (61.1)	23 (22.8)	16 (25.8)	39 (23.9)	84 (83.2)	19 (30.6)	103 (63.2)
OR	0.169 (0.092-0.312)			0.121 (0.061-0.238)			1.180 (0.566-2.459)			0.089 (0.042-0.189)		
p	**< 0.001**			**< 0.001**			0.660			**< 0.001**		
	Fizzy Drinks											
	Control	MS	Total									
L1	81 (85.3)	116 (86.6)	197 (86.0)									
L2	14 (14.7)	18 (13.4)	32 (14.0)									
OR	0.898 (0.422-1.908)											
p	0.779											

L1: At most once per month, less or never; L2: At least once every 2 weeks; OR: Odds ratio (95% Confidence Interval)
Column frequencies are given in parenthesis. $p < 0.05$: Statistically significant.

Table 4. Stepwise multivariate binary logistic regression results

FEMALE (n = 229) (Control, n = 95; MS, n = 134)			MALE (n = 163) (Control, n = 101; MS, n = 62)		
Variable	Odds Ratio (95% CI)	p	Variable	Odds Ratio (95% CI)	p
25(OH)D	0.905 (0.859-0.953)	< 0.001	25(OH)D	0.775 (0.690-0.871)	< 0.001
State of wearing head and body-covering clothes	2.674 (1.235-5.791)	0.013	Sleeping Duration	0.994 (0.989-0.999)	0.019
Fish	0.338 (0.133-0.857)	0.022	Red meat	0.124 (0.023-0.663)	0.124
Dairy desserts	0.352 (0.166-0.744)	0.006	White meat	0.192 (0.047-0.777)	0.021
Herbal tea	0.397 (0.184-0.858)	0.019	Herbal tea	0.223 (0.044-1.128)	0.070
Coffee	0.335 (0.140-0.803)	0.014	Coffee	0.164 (0.054-0.491)	0.001

Table 5. Classification performance results of the logistic regression models

Female (MS ~ 25(OH)D + state of wearing head and body-covering clothes + fish, dairy desserts + herbal tea + coffee)						
		Predicted			Sensitivity (Recall)	85.82
Observed		Control	MS	Total	Specificity	75.79
	Control	72	23	95	Precision	83.33
	MS	19	115	134	Accuracy	81.66
	Total	91	138	229	F1 Score	84.56
					Area Under the Curve	0.881, 95% CI: 0.835-0.927, p< 0.001
Male (MS ~ 25(OH)D + sleeping duration + red meat + white meat + herbal tea + coffee)						
		Predicted			Sensitivity (Recall)	79.03
Observed		Control	MS	Total	Specificity	92.08
	Control	93	8	101	Precision	85.96
	MS	13	49	62	Accuracy	87.12
	Total	106	57	163	F1 Score	82.35
					Area Under the Curve	0.945, 95% CI: 0.913-0.976, p < 0.001

(with other variables held constant). Sleeping half an hour more in a day reduced the odds of having MS by 16.5%. Increase in the individual consumption rate of red meat, white meat, herbal tea, and coffee was associated with a reduction in the likelihood of having MS.

Classification Performance Results of The Logistic Regression Models

To evaluate the predictive accuracy of the logistic regression models, classification tables were created. In these tables the observed values for the dependent outcome and the predicted values (at a cut-off value of p = 0.50) were cross-classified. Table 5 summarizes the classification tables along with the classification performance results of the logistic regression models. The obtained performance metrics were considerably high. Out of 134 female MS patients, %85.82 of them were classified accurately. For male MS patients, correct classification ratio was 79.03%. The power of the model's predicted values to discriminate between positive and negative cases was quantified by the Area under the Receiver operating characteristic (ROC)

curve (AUC). The obtained AUC scores showed that the selected parameters of the models had predictive ability to discriminate MS from normal subjects (For men, AUC = 0.945, 95% CI: 0.913-0.976, $p < 0.001$; for women, AUC = 0.881, 95% CI: 0.835-0.927, $p < 0.001$).

Discussion

Summary of Main Results

In prospective cohort studies, a group of people are observed over a period of time. In this way, it is aimed to detect any changes in health linked to the possible risk factors that were identified earlier. Although a cohort study design is the best available scientific method to find out possible causes of a disease, it can be very expensive and time consuming. Therefore, it is crucial to determine what data to be collected prior to the study. As a controlled descriptive study, the current study purposes to investigate possible risk factors to be observed in a well-organized cohort study on MS. Only the parameters whose association with MS found statistically significant will be discussed in this section.

Serum concentration of 25(OH)D, as the best indicator of vitamin D status, has been the most widely researched risk factor of MS. Grant (16) showed that increasing serum 25(OH)D concentrations would reduce the vitamin D-sensitive disease (such as MS) mortality rates (that account an estimate for 2-3% of global mortality) by an estimated 20%. Moreover, there was increasing evidence indicating that lower vitamin D levels were associated with increased risk of MS (17,18). Findings of the current study strengthens the literature outcomes such that increase in 25(OH) D level resulted with decrease in the odds of having MS. 25(OH)D levels of female who wear head and body-covering clothes in their daily lives were found to be significantly lower (median, 7.10 (IQR: 5.30-10.30) vs. 13.45 (IQR: 7.78-21.11) years, $p < 0.001$).

Since, it is known that almost all the daily intake of Vitamin D is from sunlight exposure (Ultraviolet B), there is significant concern for women who wear burqa or "full hijab". This style of dress greatly reduces the surface area of the body which sunlight is exposed to and hence reduces the amount of vitamin D synthesized. Due to this reason, serious vitamin D deficiency is widespread in Saudi Arabia and many Middle Eastern countries, especially among women (19). A study performed by doctors at King Fahd University Hospital in Saudi Arabia showed that out of all 52 women tested, all had seriously deficient levels of vitamin D and were at risk of many serious health problems, including MS despite living in one of the sunniest places on the planet (20). The current study had similar findings that when holding all other relevant variables constant, a woman was 2.674 times more likely to experience MS if she was conservative in terms of clothes.

Use of complementary and alternative medicine, in particular herbal remedies, have noticeably risen in MS patients over the last decades (21,22). It has been reported that medicinal plants have several therapeutic effects in neurodegenerative diseases (23). Coffee is thought to have significant effects on MS due to its bioactive compounds. It is reported to have neuroprotective effect through caffeine, chlorogenic acid, caffeic acid, kahweol and trigonelline due to antioxidative and anti-inflammatory activities of these compounds (24). In the study of Hedström et al. (25), the odds of MS were reduced among those who reported high coffee consumption compared with the ones who reported no coffee consumption. In another study, coffee consumption was found to be associated with reduced progression of disability in relapsing onset MS (26). Similar to the findings of these studies, the current study revealed that for both male and females, increase in the consumption rate of coffee was associated with a reduction in the likelihood of having MS.

Herbal teas can include fresh or dried flowers, fruit, leaves, seeds or roots. Curcumin, epigallocatechin gallate, and hypericum perforatum are among the ingredients of herbal teas. These herbs are individually investigated in some studies in terms of their effects on diseases. In their studies on mice, Natarajan and Bright (27) examined the effect and mechanism of action of curcumin on the pathogenesis of CNS demyelination in experimental allergic encephalomyelitis (EAE), an animal model system to study the mechanism of MS pathogenesis. Their findings revealed that curcumin inhibits EAE by blocking IL-12 signaling in T cells and

suggested its use in the treatment of MS and other Th1 cell-mediated inflammatory diseases. In a randomized, double-blinded, placebo-controlled study with 18 MS patients, Mähler et al. (28) observed that epigallocatechin gallate (EGCG), a phenolic antioxidant found in a number of plants such as green and black tea, improved muscle metabolism during moderate exercise in MS patients. EGCG reduced clinical severity when given at initiation or after the onset by both limiting brain inflammation and reducing neuronal damage (29). In an in-vitro study on neutrophils of 9 MS patients, Naziroğlu et al. (30) showed that hypericum perforatum (better known as St John's Worth) had protective effects on oxidative stress in MS patients. People in the current study reported to consume herbal teas, but it was not fully known what kind of herbal ingredients they included. Nevertheless, for both male and females, increase in the consumption rate of herbal tea was associated with a reduction in the likelihood of having MS. Therefore, it is worth to investigate the effects of herbs on diseases.

In literature, there are contradicting results in terms of the association between the consumption of red meat, white meat, fish and MS. In the study of Fitzgerald et al. (31), diets higher in red meat were found to be associated with lower disability levels in people with MS. On the other hand, in a case-control study conducted in Belgrade (Serbia), Pekmezovic et al. (32) reported that frequent consumption of beef, lamb meat, and chicken increased the risk of MS. Although Sepcic et al. (33) and Ghadirian et al. (11) determined significant relationship between meat intake and incidence of MS, some researchers could not observe this association. In two large cohorts of women (the Nurses' Health Study and the Nurses' Health Study II), Zhang et al. (12) revealed that intakes of dairy products, fish, red meats, poultry and processed meats were unrelated to risk of MS. Bagheri et al. (34) supported these results by their findings. In the current study, for females, fish consumption; for males, white meat consumption was found to be in association with MS. Although red meat consumption was also included in the final logistic model conducted on male data, it was not significant ($p = 0.124$).

In addition to the food related factors, sleeping duration and quality was also associated with MS in many studies. Patients with MS frequently report poor sleep, and sleep disorders are more common in MS patients compared to healthy controls (35). Sleep disturbances are common symptoms of MS, and their prevalence ranges from 47 to 62% (35,36). Patients with MS report reduced quality of night sleep more frequently compared with the healthy population (37). In the study of Bamer et al. (36), 33.1% of MS patients had mild to severe sleep problems. In another study, Pokryszko-Dragan et al. (38) evaluated sleep complaint in 49% of MS patients while in the study of Veauthier et al. (39), 25% of MS patients had insomnia. Sleep disorders are thought to be due to depression, anxiety, pain or other problems seen in MS process. In the current study, sleeping duration was significant only in the male based logistic model. The findings of the model revealed that sleeping half an hour more in a day reduced the odds of having MS by 16.5%, holding all relevant variables constant.

Limitations

The study could not be designed at MS onset. All the measurements were taken after the diagnosis of MS in the patient population. Effect of sunlight exposure on vitamin D levels could not be observed. Despite all the findings of this study, there is still ambiguity on whether or not the ethnicity has an effect on the presence of MS since the study includes only the participants from the same nation. The ratio of "male patients to female patients" in the MS group of this study was one third, which may have resulted from the fact that MS is more prevalent in women than men (40).

Conclusion

This gender stratified controlled descriptive study aimed to make contributions to the literature by investigating the consumption rates of certain food and drinks in MS patients. It was concluded that for both males and females, vitamin D is crucial; especially coffee and herbal tea consumption are worth investigating in a well-organized cohort study on MS. Moreover, it was highlighted that sleeping disorder stands as a possible risk factor of MS, specifically for men.

Conflict of interests:
No potential conflict of interest relevant to this article was reported by the authors.

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