# Environmental risk factors in the aetiology of multiple sclerosis in Kayseri: a case control study

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## ABSTRACT

**BACKGROUND:** our purpose is to evaluate the possible relationship between multiple sclerosis (MS) and environmental factors in Kayseri.

**METHODS:** this case control study was conducted on 100 patients with MS and 100 sex-aged and residential area matched control. Data was collected by using face to face interviews. Questionnaire consisted of two parts. The first part was comprised of items related with the participants' socio-demographic features. The second part was related with factors thought to be involved in the occurrence or aggravation of the disease. The Chi-square test and logistic regression were used for analysis.

**RESULTS:** logistic regression analysis revealed the following as possible risk factors in MS cases: economic status (Odds Ratio (OR): 0.14 adjusted 7.19; Confidence Interval 95% (CI): 0.05-0.43), having a sensitive personality (OR:4.51; 95% CI: 1.10-18.45), familial history of MS (OR:3.28; 95% CI: 1.3-8.27), history of cranial and spinal injury (OR: 2.99; 95% CI: 1.11-8.08), cooking oil consumption (OR:0.07 adjusted 13.5; 95% CI: 0.03-0.20), consumption of legumes and grains (OR: 0.11 adjusted 8.9; 95% CI: 0.03-0.41), and living in dwellings within a distance of 500 meters from transformer base-stations (OR: 6.5; 95% CI: 1.54-28.21).

**CONCLUSIONS:** we believe that it is necessary to inform the individuals about the risk of MS and their relatives of the results of large-scale joint studies and to offer suggestions based on the data obtained.

*Key words: Multiple sclerosis; Environmental risk factors*

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## INTRODUCTION

Characterized by widespread demylinizing lesions of the central nervous system, and often affecting young adults, multiple sclerosis (MS) is a chronic and disabling disease. Though its etiology is not precisely known, genetic and environmental factors are implicated [1-5]. The

incidence of MS in women is twice as great as in men [6], varies from region to region in the world and increases in countries nearer to the poles. Studies on immigrants demonstrate that MS is less common among those who have migrated from a region with high incidence of MS, especially in those under 15 years of age [1].

Individuals who have first degree relatives with MS in their family have a 10-25 times greater risk of MS than the normal population, and this risk is closely associated with the degree of the relationship and the sex of the relative [2, 4, 7, 8]. Although genes are effective in the development of MS, genetic and epidemiologic studies indicate that environmental factors also play an important role in determining MS risk [4, 7, 8].

Some studies have suggested that a multitude of viruses, such as Epstein-Barr, may be the cause of MS [1, 4, 9]. Among environmental factors contributing to MS development are nutrition [10, 11], infections [9], trauma [5], surgical operations [5, 12], vaccines [1, 5, 13], chemical agents and metals [1, 14, 15], smoking [16], sunlight [1, 2, 17], keeping pets [7, 18], and stress [19, 20].

The European total mean MS prevalence rate is estimated to be 83 cases per 100 000/year [21]. Although one local study was conducted by Türk Börü et al. on MS in the regions of Marmara and the Black Sea, there is no study in the literature on the incidence and prevalence of MS in Turkey. In that study, the prevalence of MS was found to be 101.4/100 000 for Maltepe in Istanbul, and 51/100 000 on average for 3 coastal cities on the Black Sea [22, 23]. These findings have increased our sensitivity to MS. Our objective in this study is to detect what joint environmental risk factors affect MS patients in the province of Kayseri.

## METHODS

### Geographical characteristics of the field

This is a case-control study performed in Kayseri. Kayseri, one of the major industrial and commercial centers in Turkey, is located in the Central Anatolian Region between the northern latitudes of 38° 18´, and the eastern altitudes of 36° 58´ (Figure 1). Its elevation is 1094 m. A continental climate is prevalent in the province.

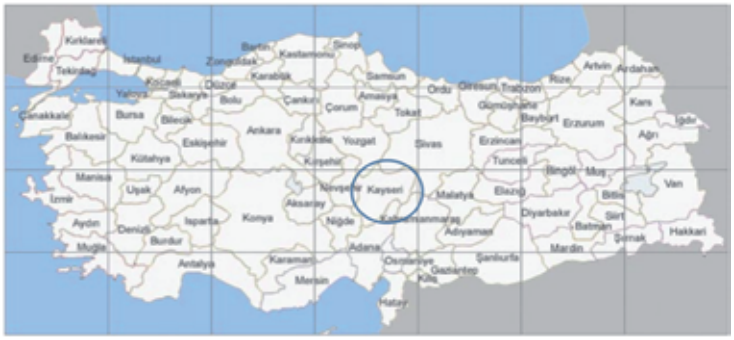
### Study participants

Most of the patients in Kayseri were followed up in the university hospital while some went to other hospitals in Kayseri or other cities.

The study was conducted on 100 patients enrolled at the Neurology Policlinic of the Erciyes University Medical Faculty Hospital, all with a definitive diagnosis of MS, between February and December 2010. Patients were followed-up routinely at the MS Policlinic. During the period of this study, there were 310 registered patients attending this Policlinic. It was planned to include all these MS patients in the study. However, some patients refused to participate on the grounds that they would feel uncomfortable about their identities being publicized, or that they did not believe that their participation would provide any contribution to their recovery. As a result, only one in every three patients agreed and these were included in the study.

FIGURE 1

THE MAP OF TURKEY (CITY OF KAYSERI IS CIRCLED)



### Control ascertainment

The control group was selected from among 100 health personnel and their relatives with special attention to their being matched by age, gender and residential area.

### Ethical approval

Ethical approval for the study was obtained from the Health Sciences Research Ethics Committee of the Medical Faculty of Erciyes University.

### Questionnaire

The questionnaire was administered to all the participants, following a preliminary trial, by the same physician using the face-to-face technique. It consisted of 2 parts.

The first part consisted of items related to the participants' socio-demographic features such as age, gender, birthplace, residence during the first 15 years of life, the order of the child in the family, blood type, economical-marital status, social security, schooling level, duration of breastfeeding, employment, smoking, sleep regulation, and dwelling.

The second part was related to factors thought to be involved in the occurrence or aggravation of the disease, such as parental kinship, history of MS in the relatives, cranial or spinal injury, pets, dental fillings, radiation, personality type, infections and viral disorders during childhood, vaccines, drugs, operation, stress and nutritional habits.

The items related with nutritional habits in the questionnaire were prepared in consultation with Erciyes University's Nutrition and Dietetics Department.

After a review of literature [24], the participants' dwellings were divided into 2 groups, depending on the distance from the transformer base stations or power lines ( ≤500 m, and >500 m).

### Statistical analysis

The data were recorded in the SPSS packet program (SPSS, version16.0) for analysis, which was performed in 2 stages. In the first stage, the Chi-square test and, where necessary, the Chi-square Fisher's exact test were used for the comparison of the proportional differences between the groups. In the second stage, a logistic regression analysis was used to evaluate which possible environmental risk factors were associated with MS. However, since the quantitative levels of some data in the study (such as employment, vaccinations, history of paediatric diseases, consumption of dairy products, fruit and water, blood types and dwellings) were less than desired (i.e. those at the level of 10 and below in the table), they were not included in logistic regression analysis. OR (Odds Ratio) was calculated within the confidence interval of 95% for each risk factor. The patients' ages were presented as mean ± SD (Standard Deviation). For the assessment of differences between the age groups, t-test was used. $P<0.05$ values were taken as statistically significant.

## RESULTS

The socio-economic status of the study group is presented in Table 1. Intergroup comparisons revealed no statistically significant difference in age, sex, the order of the child in the family and social security status. However, smoking ($p=0.001$), marital status ($p=0.037$), employment status ($p<0.001$), blood types ($p=0.007$), sleep regularity ($p=0.047$), educational status ($p=0,041$) and economic status ($p<0.001$) were found to be statistically significant. Although both groups had been breastfed, we determined that the subjects in the control group had been breastfed for a longer period ($p=0.001$).

We observed that the dwellings of the participants in the control group were outside the city centers ($p=0.001$), away from the transformer base-stations ($p<0.001$).

The comparison of the MS patients with the controls showed that MS patients are usually those who are easily upset and have sensitive personality traits ($p=0.019$), have relatives with MS ($p<0.001$), history of more head traumas ($p=0.001$) and keep pets ($p=0.029$).

We found (Table 2) that MS patients had pediatric diseases like chickenpox ($p=0.021$), infections during their childhood more acute (especially upper respiratory tract infections) ($p=0.001$), and other disorders like dermal and hormonal diseases more often than their

TABLE 1

| SOCIO-DEMOGRAPHIC FEATURES OF THE PARTICIPANTS | | | |
|---|---|---|---|
| FACTORS | PATIENT GROUP (N=100) | CONTROL GROUP (N=100) | P VALUE |
| AGE | * 37±9.7 | 37.6±10.2 | 0.989 |
| SEX (FEMALE/MALE) | 74/26 | 83/17 | 0.084 |
| MARITAL STATUS | | | |
| MARRIED | 85 | 71 | |
| SINGLE | 14 | 24 | 0.037 |
| SEPARATED/DIVORCED/ WIDOW(ER) | 1 | 5 | |
| EDUCATIONAL STATUS | | | |
| ELEMENTARY | 44 | 40 | |
| MIDDLE SCHOOL | 17 | 11 | |
| SENIOR HIGH SCHOOL | 21 | 19 | 0.041 |
| UNIVERSITY/GRADUATE | 15 | 30 | |
| ILLITERATE | 3 | 0 | |
| EMPLOYMENT | | | |
| HOUSEWIFE | 52 | 53 | |
| UNEMPLOYED | 16 | 0 | |
| CIVIL SERVANT | 7 | 26 | |
| FREELANCE | 4 | 6 | <0.001 |
| RETIRED | 13 | 2 | |
| LABORER | 4 | 6 | |
| STUDENT | 4 | 7 | |

counterparts in the control group. We also determined that MS patients were vaccinated less, except for vaccines against diphtheria, whooping-cough, and tetanus (DWT) (p<0.001). Parental kinship (p=0.012) was found to be statistically significant.

Table 3 shows the nutritional features of the study groups. We found that MS patients consumed more fizzy drinks, like cola, (p=0.002), more saturated fat (p<0.001), more red meat (p=0.001), more food like sausages and processed meats (P<0.001), less vegetables (p<0.001), less fruit (P=0.001), less white meat (p=0.005), less milk (p=0.000), less yoghurt (p<0.001), and less legumes and wholegrain products, like chick-peas, lentils, and cracked wheat (p<0.001), than the controls. The water (p=0.012) and sort of oil they used (p=0.002) were found to be statistically significant. Eight patients reported that they used the water from their own wells in their villages.

The results of logistic regression analysis are given in Table 4. We observed that MS patients' economic status (OR: 0.14 adjusted 7.19; 95% CI: 0.05-0.43) was 7 times inferior to that of the control group. Having a sensitive personality (OR: 4.51; 95% CI: 1.10-18.45) was found to be 4 times greater, familial history of MS (OR: 3.28; 95% CI: 1.3-8.27), and the history of cranial and spinal injury (OR: 2.99; 95% CI: 1.11-8.08) 3 times greater in the patient group than in the control group. It was also observed that the consumption of unsaturated fat was 13 times greater than that of the subjects in the control group (OR: 0.07 adjusted 13.5; 95% CI: 0.03-0.20), while the consumption of legumes and wholegrain products (OR: 0.11 adjusted 8.9; 95% CI: 0.03-0.41) was approximately 9 times greater than in MS patients. The dwellings or workplaces of the MS patients were found to be located 6 times nearer to transformer base-stations than those of the controls (OR: 6.5; 95% CI: 1.54-28.21). In addition, it was detected that the MS patients used mobile phones more (p<0.001).

TABLE 1 (CONTINUED)

| SOCIO-DEMOGRAPHIC FEATURES OF THE PARTICIPANTS | | | |
|---|---|---|---|
| ECONOMIC STATUS | | | |
| GOOD | 12 | 48 | <0.001 |
| FAIR | 88 | 52 | |
| SMOKING | | | |
| 1-10 CIGARETTES DAILY | 22 | 30 | |
| 20 AND OVER DAILY | 25 | 6 | 0.001 |
| NON-SMOKER | 53 | 64 | |
| DURATION OF BREASTFEEDING | | | |
| ≤ 6 MONTHS | 46 | 22 | |
| 12 MONTHS AND OVER | 54 | 78 | |
| SLEEP | | | |
| REGULAR, 7-8 HOURS | 70 | 82 | 0.047 |
| IRREGULAR | 30 | 18 | |
| DWELLING | | | |
| CITY CENTER | 65 | 19 | |
| OUT OF THE CITY | 24 | 81 | 0.001 |
| VILLAGE | 11 | 0 | |
| BLOOD TYPE | | | |
| A RH+/A RH- | 31/1 | 45/0 | |
| B RH+/B RH- | 9/2 | 10/0 | |
| AB RH+/AB RH- | 3/1 | 9/0 | 0.007 |
| O RH+/O RH- | 20/6 | 23/3 | |
| UNKNOWN TO THE SUBJECT | 27 | 10 | |

$X^2$ tests and Fisher's exact method, where necessary, have been used.
* t-test was used

Of the MS patients, 87% reported that they had suffered excessive stress and economic problems prior to the onset of their disease, such as the loss of a parent, sibling or a child, severe illness, imprisonment, divorce, abuse and loss of employment.

## DISCUSSION

It is known that MS is a disease affected by a diversity of genetic and environmental factors [25]. In the present study, we observed that 46% of the MS patients had relatives of the first degree with MS. It has been reported in recent genetic studies that the main susceptible allele in MS is HLADRBI 1501 but it is not the only risk factor [3].

Studies indicate that MS occurs mostly in well-educated individuals with favorable socio-economic status [26]. In our study, however, MS was found in individuals whose education and economic status were both of average level. The number of jobless and retired people among MS patients was significantly high compared to the controls, but the number of state employees was extremely low. Unemployment per se is a chronic risk factor which is known to have an inhibitory effect on the immune system [27]. To be a state employee assures a regular salary and a secure future, factors which we believe prevent stress. We observed that advanced age was a risk factor for MS. However, this needs to be clarified in further studies including larger study groups.

TABLE 2

PRESENCE OF ENVIRONMENTAL RISK FACTORS ASSOCIATED WITH MS IN PARTICIPANTS

| FACTOR | PATIENT GROUP (N=100) | CONTROL GROUP (N=100) | P VALUE |
|---|---|---|---|
| HISTORY OF MS IN THE FIRST-DEGREE RELATIVES | | | |
| YES | 46 | 17 | <0.001 |
| NO | 54 | 83 | |
| PARENTAL KINSHIP | | | |
| YES | 27 | 12 | |
| NO | 73 | 88 | |
| CRANIAL OR SPINAL INJURY | | | |
| YES | 52 | 15 | 0.001 |
| NO | 48 | 85 | |
| PET-KEEPING | | | |
| YES | 30 | 16 | 0.029 |
| NO | 70 | 84 | |
| DENTAL FILLING | | | |
| YES | 49 | 59 | 0.101 |
| NO | 51 | 41 | |
| EXPOSURE TO MOBILE TRANSFORMER BASE STATIONS | | | |
| NO | 33 | 63 | |
| YES, MOBILE OR CORDLESS PHONE | 27 | 10 | <0.001 |
| YES, BASE STATION (≤500 M) | 40 | 27 | |

We observed that MS patients reported that they had suffered severe stress and unfortunate events in relations with their close environment before the onset of their disease, therefore, they seem to have a frail and sensitive disposition. Other studies also corroborate these findings [1, 19].

Head or spinal injuries facilitate the entry into the central nervous system of the cells responsible for immunity by increasing the permeability of the blood-brain barrier. These cells can be activated against certain myelin antigens and produce demyelinized lesions. There are studies reporting that injuries are risk factors in MS [5, 12]. Our findings were also consistent with the findings of those studies.

One of the causes of MS is the magnetic field of the earth. The study of the earth's magnetic field has indicated a strong relationship between the structure of the field and the number of MS cases. It has been observed that the intensity level of the atmospheric electrical field is higher, in particular, in people who live in cloudy places at a high altitude. In addition, electromagnetic pollution, which technology has brought about, is one of the factors that threaten human health. Base stations, lines of high electrical current, mobile phone, radio and TV waves, electromagnetic waves transmitted by computers and other electrical appliances in houses and work places cause pollution, thus creating an unhealthy atmosphere. Since this magnetic pollution raises blood temperature, it may cause a rise in the permeability of the blood-brain barrier. It has been observed in a experiments on rats that even a period of 60 minutes' exposure to radiation with a frequency of 2800 MHz and an intensity of 15mW/cm$^2$ raised cerebral blood flow [28, 29]. Individual variability of the pernicious effects of electromagnetic radiation is an interesting research finding [30]. Moreover, it can impair the immune system of the body by preventing the signals transmitted by the brain to the cells [31, 32]. We observed that MS patients' dwellings were found to be closer to transformer base stations and the patients' usage of cellular or cordless phones was greater than that of the controls.

In a number of studies it has been proposed

TABLE 2 (CONTINUED)

| PRESENCE OF ENVIRONMENTAL RISK FACTORS ASSOCIATED WITH MS IN PARTICIPANTS | | | |
|---|---|---|---|
| FACTOR | PATIENT GROUP (N=100) | CONTROL GROUP (N=100) | P VALUE |
| SELF-DESCRIPTION | | | |
| EASILY UPSET, SENSITIVE | 91 | 78 | 0.019 |
| COMFORTABLE, CAREFREE | 9 | 22 | |
| HISTORY OF PEDIATRIC DISEASES | | | |
| HISTORY OF PEDIATRIC DISEASES | 8 | 9 | |
| CHICKEN-POX | 14 | 9 | |
| MUMPS | 9 | 6 | |
| MEASLES-CHICKEN POX | 7 | 20 | |
| MEASLES-MUMPS | 4 | 2 | 0.021 |
| CHICKEN POX-MUMPS | 1 | 26 | |
| MEASLES- CHICKEN POX-MUMPS | 11 | 18 | |
| NOT REMEMBERED | 46 | 10 | |
| INFECTIOUS DISEASES | | | |
| YES | 19 | 4 | |
| NO | 58 | 79 | 0.001 |
| UNKNOWN TO THE SUBJECT | 23 | 17 | |
| PEDIATRIC VACCINES | | | |
| DWT-POLIO | 70 | 39 | |
| MEASLES-RUBELLA-MUMPS (MRM) | 4 | 13 | |
| DWT-POLIO-MRM | 2 | 32 | <0.001 |
| DWT-POLIO-HEPATITIS | 1 | 1 | |
| DWT-POLIO-MRM-HEPATITIS | 3 | 14 | |
| NOT REMEMBERED | 20 | 1 | |

that the consumption, especially in childhood, of animal fats, dairy products, smoked and nitrate-containing processed meats results in MS development at advanced ages, and that the consumption of vegetable oil and fish has a prophylactic effect [10, 11]. In another study, however, no correlation was found between the consumption of milk, red meat, poultry and MS [33]. Studies on this subject have not yielded consistent results. There are differences depending on the region and individual. Studies on the consumption of vegetables, fruits, legumes, and grains have not been completed yet. The dietary suggestions we have offered are generally desired in many diseases like coronary heart disease and diabetes. It is interesting that in our patient group the frequency of fruit and vegetable consumption is low while the consumption of fizzy drinks is high. In the present study, we observed that MS patients consumed 9 times less legumes and whole grains than the control group did. It is known that legumes and whole grains are recommended in such diseases as diabetes for the fiber, carbohydrate, B complex vitamin, and vegetable proteins they contain [34].

Both omega-6 and omega-3 essential fatty acids are the structural components of brain tissue and the myelin sheath. Seventy-percent of the myelin sheath is made up of lipids, and one-third of this consists of polyunsaturated fatty acids [10]. It has been observed in studies on the erythrocyte cell membrane that membrane essential fatty acids are reduced in MS patients [35]. However, in another study, it is reported that the lack of post-natal

TABLE 3

NUTRITION-RELATED RISK FACTORS AMONG MS PATIENTS AND CONTROLS

| FACTOR | PATIENT GROUP (N=100) | CONTROL GROUP (N=100) | P VALUE |
|---|---|---|---|
| CONSUMPTION OF FIZZY DRINKS | | | |
| 1 CAN PER DAY | 10 | 18 | |
| 3-5 CANS PER WEEK | 21 | 12 | |
| 1-3 CANS PER WEEK | 33 | 15 | 0.002 |
| RARE | 20 | 22 | |
| NONE | 16 | 33 | |
| TYPE OF THE COOKING OIL USED | | | |
| LIQUID OIL | 17 | 71 | |
| MIXED (LIQUID + SOLID) | 83 | 29 | <0.001 |
| VARIETY OF THE OIL USED | | | |
| OLIVE OIL | 11 | 28 | |
| CORN OIL, SUNFLOWER OIL | 89 | 72 | 0.002 |
| CONSUMPTION OF FRUIT JUICE | | | |
| 1 SMALL PACKET, 3-5 TIMES A WEEK | 20 | 34 | |
| 1 SMALL PACKET, 1-3 TIMES A WEEK | 39 | 25 | 0.035 |
| NONE | 41 | 41 | |
| TYPE OF THE WATER CONSUMED | | | |
| BOTTLED WATER | 10 | 14 | |
| SPRING WATER | 8 | 0 | 0.012 |
| TAP WATER (FROM A RESERVOIR) | 82 | 86 | |

essential fatty acids have reduced the specific oligodentrocyte myelin protein mRNA in the brain of rats [36]. It is also reported that omega-3 fatty acid, which is present in sea fish and vegetable oil, with its capacity to produce auto-immune response, is immunomodulatory and anti-inflammatory [10, 35]. In the present study, consistent with other studies, we found that the consumption of unsaturated fats, olive oil in particular, by MS patients is 13 times less, and the consumption of processed sausage and meat varieties rich in nitrate is greater than that of the control group.

In other studies it has been reported that the consumption of dairy products plays a role in MS development [7, 11]. It has been demonstrated that in children fed on cow's milk, both the cellular and humoral immune response to cow' milk is provoked, but this diminishes with increasing age [37, 38]. In one study it is reported that the incidence of MS increases as breast milk intake decreases [39]. In our study findings also showed that MS patients were breastfed for shorter periods than the controls. However, the consumption of such products is recommended after 12 or more months of age [38]. It is known that calcium is necessary for the development, structure, and stability of myelin [40]. Failure to get enough sunlight and insufficient dietary intake of vitamin D lead to vitamin D deficiency, which, in turn, manifests itself in various problems, such as inadequacy of antiviral and antibacterial defense, and impairment of HLA-DRBI-1501 [41]. Moreover, it has been demonstrated that vitamin D reduces MS risk [40]. It is known that milk, yoghurt, and the products of cereal grains contain calcium and vitamin D [41]. In the present study we observed that MS patients consumed less dairy products, notably milk and yoghurt.

It is reported that following a vaccination with a viral peptide activates cross-reactive T cells that recognize myelin antigen. After this activation, they passage through the blood-

TABLE 3 (CONTINUED)

| NUTRITION-RELATED RISK FACTORS AMONG MS PATIENTS AND CONTROLS | | | |
|---|---|---|---|
| FACTOR | PATIENT GROUP (N=100) | CONTROL GROUP (N=100) | P VALUE |
| VEGETABLE CONSUMPTION | | | |
| 1 PORTION PER DAY | 12 | 40 | |
| 1 PORTION 3-5 TIMES PER WEEK | 18 | 27 | <0.001 |
| 1 PORTION 1-3 TIMES PER WEEK | 48 | 20 | |
| RARE | 22 | 13 | |
| FRUIT CONSUMPTION | | | |
| 1 PORTION PER DAY | 38 | 56 | |
| 1 PORTION 3-5 TIMES PER WEEK | 7 | 16 | |
| 1 PORTION 1-3 TIMES PER WEEK | 36 | 20 | 0.001 |
| RARE | 19 | 8 | |
| CONSUMPTION OF RED MEAT | | | |
| 1 PORTION PER DAY | 10 | 10 | |
| 1 PORTION 3-5 TIMES PER WEEK | 34 | 29 | |
| 1 PORTION 1-3 TIMES PER WEEK | 43 | 23 | 0.001 |
| RARE | 13 | 38 | |
| CONSUMPTION OF WHITE MEAT | | | |
| 1 PORTION 3-5 TIMES PER WEEK | 20 | 40 | |
| 1 PORTION 1-3 TIMES PER WEEK | 59 | 49 | |
| RARE | 21 | 11 | 0.005 |
| CONSUMPTION OF SAUSAGE, SALAMI HOT DOG AND SIMILAR FOODS | | | |
| YES | 84 | 53 | <0.001 |
| NO | 16 | 47 | |
| CONSUMPTION OF LEGUME AND WHOLE GRAIN PRODUCTS | | | |
| 1 PORTION, 3-5 TIMES A WEEK | 16 | 63 | |
| 1 PORTION, 1-3 TIMES A WEEK | 59 | 27 | <0.001 |
| 1 PORTION, RARELY | 25 | 10 | |
| MILK CONSUMPTION | | | |
| 2 GLASSES PER DAY | 8 | 24 | |
| 1 GLASS, 3-5 TIMES PER WEEK | 10 | 20 | |
| 1 GLASS, 1-3 TIMES PER WEEK | 26 | 10 | <0.001 |
| RARE, 1 GLASS | 26 | 17 | |
| NONE | 30 | 29 | |
| YOGHURT CONSUMPTION | | | |
| 1 BOWL, DAILY | 18 | 55 | |
| 1 BOWL 3-5 TIMES PER WEEK | 27 | 25 | |
| 1 BOWL 1-3 TIMES PER WEEK | 25 | 7 | <0.001 |
| RARE | 30 | 13 | |

$X^2$ tests and Fisher's exact method, where necessary, have been used

TABLE 4

FACTORS ACTING ON THE RESULTS OF LOGISTIC REGRESSION OF THE STUDY GROUPS

| VARIABLE | B | WALD | SIG | OR | ( CL95%) |
|---|---|---|---|---|---|
| DWELLING WITHIN 500 M OF TRANSFORMER BASE STATIONS | 1.89 | 6.47 | .011 | 6.59 | 1.54-28.21 |
| FAMILIAL HISTORY OF MS | 1.19 | 6.31 | .012 | 3.28 | 1.3-8.27 |
| FAVORABLE ECONOMIC STATUS | -1.98 | 11.75 | .001 | 0 .14 | 0 .05-0.43 |
| OIL CONSUMPTION | -2.61 | 25.75 | <0.001 | 0 .07 | 0 .03-0. 20 |
| SENSITIVE PERSONALITY FEATURES | 1.51 | 4.40 | .036 | 4.51 | 1.10-18.45 |
| CONSUMING LEGUME-WHOLE GRAIN PRODUCTS 3-5 TIMES A WEEK | -2.19 | 11.04 | .001 | 0.11 | 0 .03-0.41 |
| CRANIAL OR SPINAL INJURY | 1.09 | 4.67 | .031 | 2.99 | 1.11-8.08 |

brain barrier and recognize myelin antigens, which triggers an autoimmune reaction. Genetic disposition is thought to play a key role in the development of an autoimmune reaction after vaccination [8]. In this study we observed that MS patients mostly had DWT-polio vaccines, and that they hardly had any other vaccines. The insufficiency of participant numbers, and the failure of 20% of the patients to remember whether or not they had vaccines prevented us from collecting adequate and reliable data. We found that the majority of the MS cohort in the present study had a history of chickenpox. However, 46% of patients failing to remember what diseases they had suffered from was a great disadvantage. It was determined, however, that they had a history of diseases other than pediatric diseases, which is consistent with the findings in other studies [7, 9]. It is reported that MS patients have, at later ages, had at least one pediatric disease [1]. In this study, we showed that a multitude of factors are involved at the same time in the development of MS.

It is known that, in parallel to scientific development, man has distanced himself from his natural life and biological rhythm and become isolated as a result of industrial developments. Such a lifestyle, while offering numerous technological opportunities, forces him to live with the pollution it entails. The impairment of sleep rhythm in addition to a rapid tempo of life has necessitated mostly processed food. As a result of such a lifestyle in this industrialized world children are now used to being protected with drugs without waiting for their bodies to produce antibodies against disease. This occurs as a result of being weaned too early off breast milk, which is essential both physically and emotionally, or as a result of the early start of supplementary foods. We are of the opinion that the reaction of the body to this situation differs from person to person due to changes in lifestyle.

The frequency of MS is increasing in our city. It was our intention to find the common environmental characteristics of MS, our aim being to help reduce the increase of the disease by providing life-style changes.

The most important limitation of this retrospective study design is that related with the definition of past events. It is not always easy to ascertain exactly the presence or absence of exposure to any risk factor. Another limitation of this study is that we were unable to include all patients (i.e those in our hospital and those in nearby hospitals). We think that we could have obtained more significant and reliable results by including a greater number of patients in the study, and by considering the data subject to logistic regression analyses.

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