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Original article

# Relationship between dietary patterns and mild cognitive impairment (MCI) in elderly women

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**Summary.** *Context:* Mild cognitive impairment (MCI) is a transitional stage in cognitive performance between changes seen in normal aging and those observed in dementia. Early diagnosis and intervention during the initial stages of mild cognitive impairment can delay or prevent the onset of dementia. Preventive behavioral interventions, for instance changes in dietary patterns, can play a major role in reducing the burden of this disease. *Aim:* The aim of this study was to determine the association between dietary patterns and MCI in the elderly. *Methods and material:* The present case-control study was performed on 82 cases and 163 controls constituted by 60 year-old or older women. We conducted interviews and completed a general questionnaire, IPAQ, FFQ, and MMSE. We used factor analysis and principal component analysis to derive dietary patterns and the chi-square test, independent t-test, and logistic regression to analyze the data. *Results:* There were significant differences between the two groups in terms of educational level (P = 0.033), employment (p = 0.001), and the number of minutes of study (P =0.020). We identified three dietary patterns including unhealthy, Western, and healthy dietary patterns. There was a statistically significant difference between the two groups only in terms of the healthy dietary pattern (P = 0.004). The odds ratio of developing MCI in people who were in the highest tertile of the healthy dietary pattern was 50% lower than those in the first tertile (OR=0.496, 95%CI: 0.261, 0.943). *Conclusion:* Our present study demonstrated that only the healthy dietary pattern was significantly associated with MCI and reduced the risk of the disease. It is recommended that further prospective studies be conducted to find more robust relationships.

**Key words:** dietary patterns, mild cognitive impairment (MCI), the elderly

## Introduction

Mild cognitive impairment (MCI) is a transitional stage in cognitive performance between changes that are seen in normal aging and those observed in dementia; it provides an opportunity to identify and prevent Alzheimer's disease in advance (1,2). The prevalence of MCI in people aged over 65 years is between 10% and 20% (3-7). Early diagnosis and intervention during the initial stages of mild cognitive impairment can delay or prevent the onset of dementia (10). Up to now, no medication has been introduced for the treatment of mild cognitive impairment (11). Therefore, current studies are mainly focused on preventive behavioral intervention or medicine.

Dietary intake, the modifiable lifestyle factor, may affect cognitive function as well as the development and/or prevention of Alzheimer's. However, the epidemiological data on the relationship between diet and the disease have been contradictory (12, 13-16) and the impact of diet on cognitive decline has not been studied

extensively (17). On the other hand, most of the available studies in this context have examined the effect of a single food or nutrient on cognitive disorder, while it is recommended that meals with multiple nutrient combinations be assessed. Indeed, due to synergistic or antagonist interactions between nutrients, the performance of the food network is different from that of a single nutrient or food item (18). Probably, the effect of a single nutrient may be too small and insignificant; in addition, there may be found some accidental relationships caused due to an increase in the Type I error which is itself generated by correlations and interactions between large numbers of nutrients (19). Therefore, instead of studying the components and ingredients of a diet, studies should be focused on dietary patterns or a combination of nutrients together.

Previous epidemiological studies have found an inverse association for Alzheimer's disease and its early symptom, amnestic MCI, with dietary patterns rich in fruits and vegetables, soybean products, legumes, dairy products, unsaturated fatty acids, and fish, but low in saturated fat and simple carbohydrates (20-25). In addition, higher intake of processed foods is associated with some level of cognitive impairment, whilst whole foods and healthy dietary patterns are associated with better cognitive performance (21, 26). Generally, because of the increasing prevalence of dementia, further studies are needed to identify preventive strategies in the early MCI stage.

To the best of our knowledge, only a few studies have been conducted to explore the link between dietary pattern and cognitive impairment, and there is considerable inconsistency in their findings. In addition, most of the information in this context comes from developed Western countries, and little is known about the Middle Eastern and developing nations, the dietary intake of which is considerably different in comparison. Therefore, the aim of this study was to determine the relationship between dietary patterns and MCI in retired elderly women in Tehran.

## Materials and method

*Study design*

The present research is a case control study carried out in Tehran, Iran, in May 2015 which was approved by the Ethics Committee of Tehran University of Medical Sciences (Project code: 9111468003). This case-control study was conducted on 245 retired elderly women 60 years of age or above who were referred to retirement and health centers in Tehran, Iran. Using a public announcement and direct phone calls to individuals, we invited those who were interested in participating in the study. Eighty two patients with mild cognitive impairment were chosen from among the volunteers and enrolled in the case group and 163 healthy women, who were matched in terms of age and place of residence, were chosen as the control group. All 245 participants were Iranian and had lived in the city of Tehran since birth. Based on our inclusion criteria, only women aged 60 years or above with at least fifth grade education were included. The exclusion criteria were the following: consumption of supplements, being on special diets, taking psychotropic and hypnotic drugs, having been affected by psychiatric diseases, having a history of dementia among family members, having a history of brain surgery or severe trauma to the brain, and addiction to smoking. Samples were voluntarily selected from women who were referred to two retirement centers and the health centers of district six of Tehran Municipality. All participants expressed their willingness to participate in the study with informed written consent.

### Cognitive status assessment

Cognition impairment was confirmed by an expert psychologist and using the mini mental state examination (MMSE) (28). The translated version of this questionnaire has been developed and validated by the Elderly Science Department of the University of Welfare and Rehabilitation Sciences, Tehran, Iran (29).The possible scores for this questionnaire range from 0 to 30. Participants were categorized into the three following groups: dementia, if their score was less than 21, mild cognitive impairment, if it was ≥21 and ≤26 and healthy if it was higher than 26.

### Dietary intake assessment

A validated semi-quantities food frequency questionnaire (FFQ), including 168 food items, was used

to assess usual dietary intake over the past year (30). Daily nutrients and energy intake were estimated using an application designed with Excel software; the application was developed by the Institute of Endocrinology and Metabolism of Shahid Beheshti University of Medical Sciences, Tehran, Iran. To identify dietary patterns and reduce data complexity, we classified the168 food items into 24 food groups based on the similarity of food nutrient profiles, culinary usage, and previous study results (31). In addition, some food items with a unique nutrient profile (such as eggs) or the use of which could represent a special diet (such as French fries, high energy drinks) were classified as a separate food group (Table 1).

## Anthropometric assessments

The height of each subject in standing position without shoes was measured using a wall stadiometer with an accuracy of 0.5 cm. Subjects were weighed without shoes, with minimal clothing, using a digi-

**Table 1.** Food groups used for the factor analysis

| Food groups | Food items |
|---|---|
| 1. Condiments and pickles | Ketchup, lemon juice, pickles |
| 2. Mayonnaise | Mayonnaise |
| 3. Refined grains | White bread, baguette bread, rice, pasta, soup and stew noodle |
| 4. French fries | French fries |
| 5. Non-refined grains | Dark bread (Barbari, Sangak, Taftoon),wholemeal breads, barley, bulgur |
| 6. Full-fat dairy products | Full-fat milk, strained yogurt, full-fat yogurt, cream cheese, cottage cheese and cream, ice cream, curd, chocolate milk |
| 7. Visceral meat | Heart, liver, kidney, tongue, brain, head, legs, tripe & bungs |
| 8. Red meat | Beef and veal, lamb meat, mince meat |
| 9. Processed meats | Sausage, salami, hamburger |
| 10. Egg | Egg |
| 11. High energy drinks | Soft drinks,Non-natural juice |
| 12. Vegetables | Cabbage, carrots, tomatoes, spinach, lettuce, cucumbers, eggplant, onions, stewed vegetables, raw vegetables, green beans, green peas, stewed zucchini, mushrooms, green peppers and bell peppers, turnip, corn, garlic, cooked potatoes, squash, celery, etc. |
| 13. Legumes | Lentils, split peas, beans, peas, lima beans, mung bean, soybean, etc. |
| 14. Fruits and Juices | Cantaloupe, watermelon, melon, prunus, apple, apricot, yellow and red plums, cherries, cherries, sour cherry, nectarines, peaches, pears, fresh figs, dates, grapes, kiwi, pomegranate, strawberry, banana, persimmon, fresh berries, pineapple, citrus, dried fruits, natural juices, etc. |
| 15. Liquid oils | Liquid oils other than olive oil |
| 16. Olive group | Olives, olive oil |
| 17. Fish and poultry | Any fish, canned fish, poultry |
| 18. Low-fat dairy products | Low-fat milk, low fat yogurt and regular yogurt, white cheese, yogurt drink (dough), etc. |
| 19. Solid Oils | Solid vegetable oils, animal fats, butter, margarine |
| 20. Salt | Salt |
| 21. Junk Food | Snacks, chips, crackers |
| 22. Sweets and desserts | Cookies, sweeter, Gaz, Sohan, chocolate, cakes and pastries, honey, jam, sugar, candy, pudding, Halva Shekari, biscuits, fruit compote |
| 23. Tea and coffee | Tea, coffee, espresso |
| 24. Nuts | Almonds, peanuts, walnuts, pistachios, hazelnuts, seeds, etc. |

tal scale with an accuracy of 0.1 kg; the subjects were weighed by a trained nutritionist.

### Assessment of other variables

To assess the physical activity of the subjects, the short version of the international physical activity questionnaire (IPAQ) (27) was used. General characteristics were determined using the demographic questionnaire.

### Statistical analysis

Dietary patterns were identified with the factor analysis method (principal component analysis). The chi-square test was used to compare qualitative variables and the independent t-test was used to compare the quantitative variables between case and control subjects.

We used varimax rotation to obtain a matrix of simple and interpretable table components and to classify separate and non-correlated dietary patterns. The number of dietary patterns (factors) was determined based on the Eigen value>1.5, scree plot and their feasibility. A factor loading of 0.3 was considered to determine the food groups in each dietary pattern. Using factor analysis, three major dietary patterns were identified: an unhealthy dietary pattern (loaded with eggs, processed meat, sweets and desserts, high energy drinks, visceral meat, French fries, solid oils, snacks, and mayonnaise), a Western dietary pattern (loaded with French fries, liquid oil, salt, refined cereals, con-

**Table 2.** Food groups and their loading factors in each dietary pattern

| Food groups | Unhealthy dietary pattern | Western dietary pattern | Healthy dietary pattern |
|---|---|---|---|
| Egg | 0.607 | | |
| Processed meat | 0.592 | | |
| Sweets and desserts | 0.581 | | |
| High energy drinks | 0.549 | | |
| Visceral meat | 0.492 | | |
| French fries | 0.462 | 0.309 | |
| Natural Oils | 0.344 | | |
| Junk Food | 0.326 | | |
| Mayonnaise | 0.308 | | |
| Liquid oils | | 0.683 | |
| Salt | | 0.556 | |
| Refined grains | | 0.511 | |
| Whole grains | | -0.413 | |
| Condiments and pickles | | 0.370 | |
| Fish and poultry | | -0.358 | 0.318 |
| Tea and coffee | | -0.340 | |
| Red meat | | 0.333 | |
| Vegetables | | | 0.707 |
| Fruits and Juices | | | 0.528 |
| Low-fat dairy products | | | 0.528 |
| Nuts | | | 0.449 |
| Full-fat dairy products | | | -0.353 |
| Olive group | | | 0.338 |
| Legumes | | | 0.334 |
| % of total variance explained | 12.535 | 8.309 | 7.206 |

*Loading factors less than 0.3 are deleted to simplify the table.*

diments, pickles, and red meat), and a healthy dietary pattern (loaded with poultry and fish, vegetables, fruits, low-fat dairy products, nuts, the olive group, and legumes) (Table 2). The last pattern was responsible for 28.050% of the total variance. The scores of the dietary patterns were computed by summing up the intakes of the food groups weighted by their factor loadings, and a factor score was given to each participant for each recognized pattern (54). The general characteristics of the case and control subjects were compared using the independent sample t-test for continuous variables or the Chi-square test for categorical variables. We categorized the subjects based on the tertiles of the dietary patterns. To examine the differences in age- and energy-adjusted dietary intake across the tertiles of the dietary patterns, we used covariance analysis (ANCOVA). Multiple logistic regression was performed to estimate the ORs and 95% of the CIs for the presence of cognitive impairment across the tertiles of the dietary patterns in crude and multivariable-adjusted models. We used SPSS V. 160 software for data analysis and set the P-value < 0.05 as the significant level.

## Results

The relative and absolute frequency of the qualitative characteristics in the case and control groups is shown in Table 3. There was a statistically significant difference between the two groups in terms of the status of their education and employment before retirement (P < 0.05); additionally, the controls had better employment and higher levels of education as compared with the case group.

Table 4 presents the mean and standard deviation of the quantitative characteristics of the subjects in terms of their MCI status. There was a significant difference between the two groups in terms of the number of minutes of study (P = 0.020). The difference between the two groups in terms of sleep hours per day was not statistically significant; however, the observed difference was important and (Difference = 0.32, P = 0.098). The relative and absolute frequencies of the case and control groups in the tertiles of food pattern scores are presented in Table 5. In the highest tertile of the unhealthy dietary pattern as compared with the lowest tertile, the percentage of the patients

**Table 3.** Comparison of relative and absolute frequency of case and control groups in terms of qualitative characteristics using chi-square test

| Variable name | | Case | Control | Pvalue* | Total |
|---|---|---|---|---|---|
| | | N(%) | N(%) | | N(%) |
| Education | Elementary school | 10(12.2) | 8(4.9) | 0.033 | 18(7.3) |
| | Middle school | 8(9.8) | 6(3.7) | | 14(5.7) |
| | High school diploma | 39(47.6) | 89(54.6) | | 128(52.2) |
| | University | 25(30.5) | 60(36.8) | | 85(34.7) |
| Employment status before retirement | Worker | 23(28) | 18(11) | 0.001 | 41(16.7) |
| | Employee/Expert | 58(70.7) | 144(88.3) | | 202(82.4) |
| | Manager/Boss | 1(1.2) | 1(0.6) | | 2(0.8) |
| Marital status | Married | 59(72) | 124(76.1) | 0.191 | 183(74.7) |
| | Single | 1(1.2) | 5(3.1) | | 6(2.4) |
| | Widow | 21(25.6) | 27(16.6) | | 48(19.6) |
| | Divorced | 1(1.2) | 7(4.3) | | 8(3.3) |
| Physical activity level | High | 18(22) | 29(17.8) | 0.321 | 47(19.2) |
| | Moderate | 56(68.3) | 107(65.6) | | 163(66.5) |
| | Low | 8(9.8) | 27(16.6) | | 35(14.3) |

** The P-value < 0.05 is considered significant.*

**Table 4.** Comparison of mean and standard deviation of quantitative characteristics of the subjects in terms of their MCI status using independent T test

| Variable name | Case | Control | Pvalue* |
|---|---|---|---|
| | N=82 | N=163 | |
| Age (years) | 63.94±4.72 | 63.57±4.32 | 0.551 |
| BMI (Kg/m²) | 26.80±3.52 | 27.08±3.07 | 0.543 |
| Family size | 2.74±1.28 | 2.82±1.05 | 0.661 |
| Sleep hours (h) | 6.80±1.45 | 7.12±1.26 | 0.098 |
| Study duration (min) | 42.23±53.43 | 59.23±53.56 | 0.020 |
| MMSE score | 25.05±1.21 | 27.85±0.98 | 0.00 |
| Total physical activity (MET min/week) | 2294.03±1697.21 | 2083.7±0.98 | 0.376 |
| Education (%) | | | 0.033 |
| Elementary school | 10(12.2) | 8(4.9) | |
| Middle school | 8(9.8) | 6(3.7) | |
| High school diploma | 39(47.6) | 89(54.6) | |
| University | 25(30.5) | 60(36.8) | |
| Employment status before retirement | | | 0.001 |
| Worker | 23(28) | 18(11) | |
| Employee/Expert | 58(70.7) | 144(88.3) | |
| Manager/Boss | 1(1.2) | 1(0.6) | |
| Marital status | | | 0.191 |
| Married | 59(72) | 124(76.1) | |
| Single | 1(1.2) | 5(3.1) | |
| Widow | 21(25.6) | 27(16.6) | |
| Divorced | 1(1.2) | 7(4.3) | |
| Physical activity level | | | 0.321 |
| High | 18(22) | 29(17.8) | |
| Moderate | 56(68.3) | 107(65.6) | |
| Low | 8(9.8) | 27(16.6) | |

** The P-value < 0.05 is considered significant. Abbreviations: BMI: Body Mass Index, MMSE: Mini–Mental State Examination, MET: Metabolic Equivalent of Task*

was higher and that of the controls was lower. However, there was no significant difference between the distribution of the cases and the controls in the different tertiles of the unhealthy and Western dietary patterns (P < 0.05). Compared with the people who were not affected by the disease, in the first tertile of the healthy dietary pattern, the percentage of people with MCI was higher and in the second and third tertiles, it was lower. There was a significant relationship between the healthy dietary pattern and the risk of MCI (P = 0.004).

The adjusted odds ratios and 95% confidence intervals for the risk of MCI in the different tertiles of the healthy dietary pattern are presented in Table 6. To facilitate data analysis and interpretation, educational levels were classified into two more general categories: below high-school diploma, high-school diploma and higher. As shown in Table 6, the relationship between the healthy dietary pattern and MCI was significant and even after adjusting the variables, the effect of education remained significant. Compared with those in the first tertile, the subjects in the third tertile of

**Table 5.** Comparison of relative and absolute frequency of case and control groups in tertiles of food pattern scores using chi-square test

| Dietary pattern | Dietary pattern's tertile | Case N(%) | Control N(%) | Pvalue* | Total |
|---|---|---|---|---|---|
| Unhealthy dietary pattern | First tertile | 24(29.3) | 57(35) | 0.170 | 81(33.1) |
| | Second tertile | 24(29.3) | 58(35.6) | | 82(33.5) |
| | Third tertile | 34(41.5) | 48(29.4) | | 82(33.5) |
| Western dietary pattern | First tertile | 30(36.6) | 52(31.9) | 0.710 | 82(33.5) |
| | Second tertile | 27(32.9) | 54(33.1) | | 81(33.1) |
| | Third tertile | 25(30.5) | 57(35) | | 82(33.5) |
| Healthy dietary pattern | First tertile | 38(46.3) | 43(26.4) | 0.004 | 81(33.1) |
| | Second tertile | 19(23.2) | 63(38.7) | | 82(33.5) |
| | Third tertile | 25(30.5) | 57(35) | | 82(33.5) |

** The P-value < 0.05 is considered significant.*

**Table 6.** Calculation of Adjusted odds ratios and 95% confidence intervals for the risk of MCI in different tertiles of healthy dietary pattern using logistic regression†

| Healthy dietary pattern | First tertile (reference) | Second tertile | Third tertile | P-trend |
|---|---|---|---|---|
| Model 1 | 1 | 0.341 (0.174-0.669)‡ | 0.496(0.261-0.943) | >0.05 |
| Pvalue* | | 0.002 | 0.032 | |
| Model 2 | 1 | 0.344 (0.173-0.682) | 0.513(0.267-0.986) | >0.05 |
| Pvalue | | 0.002 | 0.045 | |

*† In model 1, the effects of confounding variable are unadjusted. In model 2, the effect of literacy is adjusted.*
** The P-value < 0.05 is considered significant.*
*‡ The values are reported based on their odds ratio (95% confidence interval).*

the healthy dietary pattern had an approximately 50% lower risk of developing MCI (P < 0.05). As presented in the Table, the risk of developing MCI in the second tertile of the healthy dietary pattern was less than that in the third. This finding suggests that the relationship between MCI and the healthy dietary pattern does not follow a linear model and those who follow a moderately healthy dietary pattern are less at risk of developing MCI.

## Discussion and conclusion

In the present study, we found that a healthy dietary pattern was inversely associated with the risk of MCI. This relationship remained significant even after adjusting for potential confounders. No significant relationship was observed between an unhealthy and a Western dietary pattern with the risk of MCI.

In this study, there was no significant relationship between an unhealthy and a Western dietary pattern and MCI. Consistent with the results of our study, Ashby-Mitchell et al. showed that dietary patterns rich in snacks, processed foods and red meat, as well as the Western dietary pattern were not significantly related to the risk of cognitive impairment (32). Nevertheless, some studies have reported a significant relationship between unhealthy and Western dietary patterns and the risk of cognitive impairment. Direct links between processed foods, dietary pattern and relative risk of cognitive impairment (33), level of cognitive impairment and poor physical function (26) have been shown in epidemiological studies. In a case-control study, people with Alzheimer's were habituated to an unhealthy dietary pattern (34).

The difference between the results of the mentioned studies and those of our study can be attributed to differences in the type of study, sample size,

and characteristics of the studied subjects. In addition, most of the previous studies have combined the features of unhealthy and Western dietary patterns and considered them collectively as a more general dietary pattern called either the unhealthy dietary pattern or the Western dietary pattern. In our study, however, the umbrella term "unhealthy dietary pattern" was itself divided into two categories i.e. the unhealthy dietary pattern and the Western dietary pattern. If in future research these features are combined and put in a more general pattern, the combination of the unhealthy and Western dietary patterns would probably show a relationship with cognitive impairment.

The direct relationship between an unhealthy dietary pattern and MCI can be attributed to different mechanisms. The increment of free radicals and oxidative stress can damage nerve cells and lead to impaired cognitive function (35); moreover, it is well established that higher fat intake is associated with increased oxidative stress (36), atherosclerosis and thrombosis, the conditions which are probably associated with dementia and cognitive impairment (37). Moreover, Apo Egene, involved in the pathogenesis of Alzheimer's disease, has a strong relationship with lipid metabolism and changes in cholesterol concentration in response to dietary fat (38). There is also some evidence suggesting that saturated fat and refined carbohydrates are associated with neurologic changes in the hippocampus and consequently disrupt cognitive function

According to the results of our study, there was a significant inverse relationship between a healthy dietary pattern and the risk of MCI. The healthy dietary pattern in this study, like the Mediterranean dietary pattern, was loaded with fish, vegetables, fruits, nuts, olives and olive oil, and legumes; as the only difference, the healthy dietary pattern in our study included poultry and low-fat dairy products. In line with the results of our study, many studies have shown a significant inverse association between healthy dietary patterns and cognitive impairments. Several observational studies have reported a negative association between a healthy dietary pattern, which is mainly characterized by high intake of salad dressing, nuts, fish, tomatoes, poultry, cruciferous vegetables, fruits, dark green leafy vegetables, and low intake of high fat dairy products, red and visceral meat and butter, and the risk of Alzheimer's disease (23) and cognitive impairment (33), but a positive association with MMSE scores (39) and cognitive function (40).However, other investigators have failed to find any significant association between healthy patterns and MCI (26).Perhaps, due to the small sample size of the mentioned study and the exclusive assessment of patients with MCI, the results did not show any relationship between dietary pattern as a whole and cognitive function (26). In a longitudinal study, higher adherence to the Mediterranean dietary pattern was associated with slower reduction in the MMSE score, but was not associated with other cognitive tests and the risk of dementia (22). In another prospective study by Cherbuin et al, adherence to the Mediterranean dietary pattern had no protective effect against cognitive impairment (41).Generally, the discrepancies between our findings and earlier studies might be related to the differences in study design, the studied samples, or the different methods used to identify dietary patterns. For instance, most of the mentioned studies are prospective studies and use the scoring method of the Mediterranean dietary pattern to examine the relationship between dietary pattern and cognitive function.

The favorable link between a healthy dietary pattern and cognitive function might be related to the higher consumption of fruits and vegetables which prevent oxidative damage (42-44) through their high content of beta-carotene. Vitamin E which has a powerful antioxidant effect can have an impact on Alzheimer's disease (16). Dietary fatty acids which play a role in atherosclerosis, thrombosis, or inflammation can affect the evolution of the brain, the membrane function, and the accumulation of amyloid beta; accordingly, they may have an impact on dementia or cognitive functioning (37). Some studies have reported evidence of the beneficial effects of PUFA fats like fish and MUFA fatty acids (12, 47). Omega-3 fatty acids which have anti-inflammatory, antioxidant, and antithrombotic features are useful for brain health (48). Another likely connection between diet and cognitive function is attributed to the presence of high levels of homocysteine, an intermediate component in the methionine metabolic cycle in patients with Alzheimer's disease and cognitive impairment (49). Homocysteine is directly linked to the cognitive function and plays

a role in the occurrence of this disease (49). Vitamins B6, B12 and folate can reduce the amount of circulating homocysteine with methyl transport or deamination with the production of methionine or cysteine and consequently cause a decrease in Alzheimer's disease (16). Inflammation is another factor affected by dietary intake (35, 50) and can mediate the relationship between cognitive problems and diet (51).

This study has some limitations. First, the sample size in this study was small, while in case-control studies on dietary patterns a larger sample size is usually needed. Some variables that may be associated with cognitive performance such as income were not evaluated in this study, so they might have had confounding effects. In this study, dietary patterns were assessed using the FFQ. This is a suitable tool for collecting food data in epidemiological studies but might generate some errors such as over-reporting or under-reporting (19, 52). Another common limitation of dietary pattern analysis is the fact that the results of this method are dependent on the characteristics of the population such as geographic region, race, and culture. In addition, there is no golden standard in factor analysis to determine the number of factors and name the patterns. Finally, the researchers can make discretionary decisions about food groupings and the number of factors; such decisions may affect the findings and their interpretation (53). Another limitation of this study was its exclusive focus on women; consequently, generalizing the results to the entire population of the elderly is not possible.

One of the strengths of this research is that it is the first study examining the relationship between dietary pattern and MCI in Iran. Another strength of the study is that our findings justified a high variance of consumption (28.05 for the three dietary patterns). Moreover, in this study we checked and controlled the effect of many variables that could have acted as confounding factors.

This study showed that only the healthy dietary pattern, characterized by high intake of poultry and fish, vegetables, fruits, low-fat dairy products, nuts, olives, and cereals, was inversely associated with the risk of MCI. No other significant association was found between an unhealthy and a Western dietary pattern and MCI.

It is suggested that further studies be conducted on other factors that can affect cognitive function, such as the age of menopause, ~~hormonal status~~, income level, welfare, etc. Future studies are recommended to use various cognitive tests to assess the cognitive status of the subjects. We recommend further prospective studies to overcome the mentioned limitations and to find stronger relationships between the related factors.

To summarize, our present study demonstrated that only a healthy dietary pattern was significantly associated with MCI and reduced the risk of the disease. Lower educational levels (less than high-school diploma) were also associated with a higher risk of developing MCI. Additionally, in our study there was a high statistical correlation between employment status, study hours, and level of education; it was concluded that the significant relationship between employment status and MCI, and between study hours and MCI, was under the influence of educational level which was also significant.

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