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Review Article

The study of the relationship between diet and depression in adults

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Abstract

Introduction: Depression is a kind of common mental disorder and nutrition has a role in its prevention and treatment. In previous studies, a relationship was found between depression and intake of some nutrients and food but the results were contradictory and the reason of these contradictions was ignoring the diet. The purpose of this review study is to determine the relationship between the diet and depression.

Materials and Methods: By using the keywords (depression OR anxiety) AND (diet OR nutrition OR food) AND (pattern OR habit OR behavior in databases of (SID, Science Direct, PubMed, Scopus Elsevier). the number of 352 articles were obtained. After removing the repeated and unrelated articles, 19 articles that were published in the time period of 2009-2015 entered the study.

Results: From the all found studies, 4 studies were cross-sectional, 11 studies were cohort and 3 studies were case-control. In all these studies, diet was tested by food frequency questionnaire, 24 hour recall and food record. Also, depression was tested by CES-D (Centre For Epidemiologic Depression Scale) or diagnosis of doctors. In general, 2 types of diet were identified: healthy diet and unhealthy diet. Healthy diet is significantly associated with the reduction of depression while there was no relationship between unhealthy diet and depression.

Conclusion: The findings suggest that the receiving lots of fruit, vegetable, fish and cereal maybe associated with the reduction of depression. Although it seems that more accurate control and cohort studies are needed to confirm these findings.

Keywords: Depression, Diets, Food groups

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Introduction

Depressive disorder is one of the most common psychiatric diagnoses. According to the announcement of the World Health Organization in 2020, depression ranks fourth among diseases in terms of the burden it imposes on society. In our country, it is one of the 7 leading causes of illness and disability at different ages (1-3).

According to the national study of diseases and injuries in Iran, depression is the third health problem of the country (4).

Among the causes of this disease, we can mention the factors of inheritance, chemical changes of the brain, loss of parents in childhood and unpleasant life events, psychodynamic factors, various physical diseases, use of some

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drugs and malnutrition. Also, diet can be effective in the occurrence of depression (6,7). Drug treatment for depression is successful in 60-80%, although overall less than 25% of depressed patients receive medication. Due to poor treatment in patients and the possibility of disease recurrence after recovery, it seems necessary to pay attention to other factors such as nutrition to prevent and treat depression (8). Nutritional factors play an important role in depression. On the other hand, those who suffer from depression often have improper nutrition and therefore are at risk. Improper nutrition can have a significant effect on the severity, prevalence and duration of depression (9). Many studies have shown a link between a nutrient and depression. For example, vitamin D, zinc and vitamin B supplements are effective for treating depression in adults (2,7,10-14). In past studies, due to examining the relationship of only one nutrient or one type of food with depression, there are some disadvantages, among which several points can be mentioned: A nutrient is not consumed by a person alone, but in the form of a food combination. is used. Second: The effect of a single food item is very small, and measuring its effect is a complex task, while it is easier to measure the effects of a set of nutrients that are a person's dietary pattern. Third: intake of a nutrient is certainly related to a person's eating pattern. For example, a person's low fat intake is associated with the same person's consumption of more fruits and vegetables, fiber, folate, and whole grains. Fourth: Investigating the relationship of a specific nutrient with depression is problematic because there is a possibility of a synergistic effect or interactions in the diet.

Therefore, considering the importance of depression and its high prevalence in the society, and considering the few studies conducted in the field of the relationship between dietary patterns and depression, this review study aims to summarize the results of the studies conducted in this field, to answer the existing questions. and achieving general results for the prevention of depression.

Materials and Methods

352 articles were found in English language databases, Science Direct, PubMed, Scopus Elsevier and Persian language databases SID,

Medlib and Magiran to find relevant sources for this review. The following keywords and operators were used to search in English language databases:

Depression OR anxiety AND diet OR nutrition OR food AND pattern OR habit OR behavior Persian language databases were also searched with the keywords of depression, food pattern, food groups, fruit, vegetable, dairy, fat, meat and grain. The inclusion criteria for this review include 1- human studies that were conducted cross-sectionally, case-control and cohort. 2- Studies that considered the entire diet of the participants. 3- Studies that used methods such as 24-hour recall, food records and food frequency questionnaires, and similar methods to evaluate people's diet, 4- Studies that were conducted on people over 18 years old and patients They were not hospitalized. Exclusion criteria from the review study included 1- studies in which people had other psychiatric diseases. 2- Studies that measured the effect of one type of nutrient on depression and did not consider the whole diet. 3- Studies conducted on a specific population with different nutritional needs that were not representative of the entire population (such as pregnant and lactating women and athletes) 4- Studies conducted on a population with an underlying disease where the disease could be a confounding factor to cause depression were excluded from the study (such as obesity, blood pressure, hypercholesterolemia), clinical trial articles, studies in languages other than English and Farsi, animal and molecular cell studies, and review studies were excluded.

Results

352 articles were identified by searching databases and other sources. By removing 119 duplicate articles and some animal and unrelated articles, 70 articles were selected, of which 19 articles with full text that were published between 2009-2015 were included in the study.

In 3 studies, the participants were only female (15-17), in 7 studies there were both male and female participants (18-24), and in 8 studies the gender of the participants was not considered (1, 25-32). The food groups evaluated in these studies were almost similar and included the group of bread and grains, fruit and vegetables, meat, dairy, and fats and oils. In the studies found

to assess the dietary pattern, FFQ was used to assess the dietary pattern in 15 studies, the number of food items was from 18 to 168, and food records were used in 3 studies to validate the FFQ (18,24, 25) and Brief Self-administered Diet Questionnaire (BDHQ) was used in 3 studies (19,24,33). In one study, they used the FFQ along with a 24-hour reminder at the beginning of the study and a 24-hour reminder 3 to 7 days after the start of the study (27). The method of evaluating depression in people was by a doctor in some studies and by the CES-D questionnaire in some studies.

A study by Nanari and his colleagues in Japan showed that a healthy Japanese diet characterized by a high intake of fruits and vegetables, mushrooms, and soy products was associated with a reduction in depressive symptoms (18). Naguchi and his colleagues observed in 2012 that psychological symptoms of depression in men are associated with insufficient intake of vegetable and fish diet and physical symptoms of depression are associated with insufficient intake of meat (19). In 2014, Dipnal and his colleagues found a direct connection between the sweet diet and depression, in other words, with a high-carbohydrate diet, the possibility of diabetes and, as a result, the possibility of depression increases

(24). In 2013, Rashidkhani and his colleagues suggested that a diet containing high intake of fish, poultry, low-fat and high-fat dairy products, coffee, fruit, nuts, fruit juice, vegetables, legumes, olives and low intake of refined grains, fats And soft drinks are significantly associated with a lower chance of depression in women (15). In 2015, a study by Korina and her colleagues showed that people in the healthy control group had a higher intake of fruit and chocolate, cake, pasta, and also a lower intake of meat and poultry compared to people in the depressed group (25). In 2010, Rinkes and his colleagues showed that a high intake of foods containing omega-3, including fish, olives, and vegetables, in the Mediterranean diet is associated with a reduction in depression (17). Sanchez and colleagues showed that high intake of fish and olives along with nuts reduces depression by 20-30% (14). Akiko and his colleagues showed that the consumption of fruits, vegetables, fish, and olives is related to the reduction of depression and the possibility of suicide (22).

In a cohort study, Leport and his colleagues showed that low-fat diets containing fruits, vegetables, and fish are associated with a reduction in the risk of depression in women and men (23).

Table 1. Studies reviewed on depression and diet

Findings	The type of diet recognized in the study	Study design	Sample size	Study title
In this study no significant relationship was found to increase the risk or reduce the risk of depression and its symptoms by removing or not removing the Confounders	- Healthy - western - Bread and pastries - diet with alcohol	(BDHQ) 52 food groups +food record 16 for 16 days 92 women 92 men	N=971 303 men 488 women Age =22-86	"No association between dietary patterns and depressive symptoms among a community-dwelling population in Japan"
Healthy Diet Has a significant relationship with the decrease of depression. (OR=0.16 CI=0.06-0.44,p=0.00)	- Healthy - Unhealthy	Semi quantitative (FFQ) Includes 125 food and drink	N=135 45 Women with major depression 90 women without mental health problems Age: 45-25	"Dietary patterns and anthropometric indices among Iranian women with major depressive disorder"
No significant difference was found between nutritional quality of the depressed and control subjects.	This study focuses on diet quality and has not detected a pattern.	With 18 food items (FFQ) + food record on 7 days	N = 1660 840 depressed 820 healthy people	"Associations between depression subtypes, depression severity and diet quality: cross-sectional findings from the BiDirect Study"
Low-fat diet (P <0.01), Western (P <0.001), and snacks (P <0.001), with fat and high sweet (P <0.001) in men and low-fat diet (P <0.01, snack diet (P <0.001) in women are	Low-fat diet Western diet Snack diet Fat diet with sweets	With 35 food items (FFQ)	N=12404 Men=9272 Women=3132	"Association between Dietary Patterns and Depressive Symptoms Over Time: A 10-Year Follow-Up"

more associated with depression symptoms.	traditional diet Healthy diet		Age 60-45 years	
Vegetarian diet and fish products have a reverse relationship with physical symptoms ($P < 0.05$) and mental depression ($P < 0.01$) in men. In Western and fish diets no significant association of dietary patterns and depression was found.	Vegetarian diet + fish products Fish diet Western diet and meat	BDHD) With 59 items of food and drink	N=166 Men=104 Women=62	"Relationship between dietary patterns and depressive symptoms: Difference by gender, and unipolar and bipolar depression"
Healthy diet is significantly related to reducing the risk of depression (OR: 0.84; 95% CI: 0.76, 0.92; $P < 0.001$). There was no Significant correlation between the Western diet and depression. (OR: 1.17; 95% CI: 0.97, 1.68; $P = 0.094$) Increased intake of vegetables, fish, whole grains, and fruits may be associated with reduced risk of depression.	-Healthy diet Western diet	(FFQ)	From 6 Social Networks, 21 Articles by 2013 were extracted and the results were extracted from 13 articles	"A systematic review and meta-analysis of dietary patterns and depression in community-dwelling adults"
Healthy Japanese diet of vegetables, fruits, mushrooms and soy is associated with reduced depressive symptoms). P trend = 0.006)	Japanese healthy diet Animal diet Western breakfast diet) BDHD) With 52 food and drink + 16- day food record for 92 women and 92 men	N=521 men=309 women =212	"Dietary patterns and depressive symptoms among Japanese men and women"
A Case-control study alone cannot determine definite relationship between diet and depression. It can only describe the difference in diet of depressed and healthy people.		(FFQ) 168 items	N=330 Case group =110 Control group =220	"Comparing dietary patterns of depressed patients versus healthy people
Healthy diet is related to the reduction of depression in healthy people OR0.68,95% CI [0.52,0.88], $p = 0.006$) And in patients with type 2 diabetes.) OR0.79,95% CI [0.64,0.97], $p = 0.029$)	Healthy diet Unhealthy diet Sweet diet Mexican diet Breakfast diet	FFQ 25 items Initially a food recall was taken by dietitian and 3 to 10 days later another phone call was made.	N=4588 All participants are depressed and some have diabetes.	"The association between dietary patterns, diabetes and depression"
Inflammatory dietary pattern is associated with a higher risk of depression, this suggest that chronic inflammation may be the link between diet and depression. RR Inflammatory regime in depression explicit definition 1.41 (95% confidence interval [CI], 1.22, 1.63; P -trend $< .001$) And RR Inflammatory regime in depression broad definition 1.29 (95% CI, 1.18, 1.41; P -trend $< .001$) were reported.	Inflammatory Diet	FFQ Questionnaire were filled out by people for 6 times during 18 years. In this study three inflammatory factors were assessed for 4692 participants.	N=43685 All the participants were women, and did not have a history of depression in the beginning of the study.	"Inflammatory dietary pattern and risk of depression among women"
People with a history of depression were reluctant to eat healthy food Western diet was associated with non-current depression. In general, the study of the relationship between short-term and long-term depression and does not indicate the diet.	Western diet Healthy diet	(FFQ)	J = 3668 343 = depressed now 1571 = depression 273 = with a high probability of depression	"Does reverse causality explain the relationship between diet and depression?"
- Communication between the Western diet and depression compared to 15 per cent. But by taking confounding physical activity is not significant. (Between dietary patterns and depression are	Rich diet Western diet	(FFQ) 61 items Every 4 years, 161 items (FFQ)	N=2052	"Prospective study on long-term dietary patterns and incident depression in middle-aged and older women"

markers of inflammatory group of women with Western diet was associated with depression, end of life) (P = 0.06)				
Selenium levels were associated with depression before study (R = -0.233 and p = 0.041) Depressed people tend to deteriorate the quality of their life is seen in the group with lower activity on depression was not confirmed.	Groups: a healthy diet, physical activity and regular sleep. Control: no matter what, enjoy live	(FFQ) 21 items	N=77 over 18 years	"The Mediterranean Diet and micronutrient levels in depressive patients"
Diet 3 with depression was statistically significant inverse relationship. (Odds ratio = 0.66 [0.51-0.86], trend P = 0.002) But the relationship between diet 1 and 2 with depress	Fish diet Western diet Japanese diet	(FFQ) 56 items	N = 241 women N = 2025 men	"Japanese dietary pattern consistently relates to low depressive symptoms"
Depression is a prudent diet that reduces suicide preconditions: hazard ratio 0.46 (95% CI 0.28-0.75., P trend = 0.005) Western diet and Japanese diet not associated with suicide risk of suicide.	Prudential diet Western diet Japanese diet	(FFQ) 137 food items and 27 items Beverages	N=101630 men=47408 women=54222	"Dietary patterns and suicide in Japanese adults: the Japan Public Health Center-based Prospective Study"
Diet 1: 20-30% reduction in depression than the low-fat diet Despite this evidence that the Mediterranean diet reduces depression and when diabetics were analyzed but not significant statistically significant (P = 0.04.) (Note: There walnuts in the diet and other physiological factors such as serotonin 1 as a source of inflammatory factors may be involved in this conclusion olive anti-inflammatory)	- Mediterranean diet + olive oil - Low-fat diet (control)	(FFQ) 47 items	N=9324	"Mediterranean dietary pattern and depression: the PREDIMED randomized trial"
Diet 1 prevents the beginning of depression until the next 5 years, Diet 1: contains antioxidants and folic acid, and Adenosyl. (OR = 0.74, 95% CI 0.56-0.99, P trend = 0.04) Diet 2 is harmful for depression: the need to study in the future: (OR = 1.58, 95% CI 1.11-2.23, P trend = 0.01)	Fruit, vegetable, fish diet Chocolate, candy, meat and high-fat diet	(FFQ) 27 items	N=3486 906 women 2579 men	"Dietary pattern and depressive symptoms in middle age"
Mediterranean diet had the lowest prevalence of depression) Odds ratio 0.82 (95% ci 0.77-0.88, P value <0.0001 There is a direct relationship between meat consumption and depression Mediterranean mechanism: 1. serotonin 2. Omega-3 3. Omega 6 4. Homocysteine Folic acid 5	Regime: -Vegetable -Fruit Mediterranean -Meat -dairy -Fat and sugar	(FFQ) 101 items	N = 4000 In 3 age groups 18-23 45-54 70-75	"Mediterranean dietary pattern and prevalence and incidence of depressive symptoms in mid-aged women"
The relationship between fast food consumption and depression were observed (P trend = 0.003.) This effect was attributed to the consumption of trans fatty acids	Consumption of Sausages , burgers and donuts and pizza	Semi-quantitative (FFQ) (136 items	N=8964	"Fast-food and commercial baked goods consumption and the risk of depression"

Table 2. The relationship between healthy diet and depression

The inverse relationship between healthy diet and depression	Study type	Author name
-	Cross sectional	Sugawara N
+	Case control	Rashidkhani B, et.al
+	Cohort	Rienks J, et.al
+	Cohort	LePort A, et.al.
+	Cohort	Tasnim N, et.al.
+	Review study	Lai JS, et.al.
+	Cross sectional	Nanri A, et.al.
-	Cohort	Almudena, et.al
+	Cross sectional	Dipnall JF, et.al
-	Case control	Ibarra O,et.al
+	Cohort	Suzuki T,et.al

Table 3. The relationship between unhealthy diet and depression

The relationship between unhealthy diet and depression	Study type	Author name
-	Cross sectional	Sugawara N, et al.
+	Cohort	Center for health sciences
-	Cohort	Rienks J, et al.
-	Cohort	LePort A, et al.
-	Cohort	Tasnim N, et al.
-	Review study	Lai JS, et al.
-	Cohort	Nanri A, et al.
-	Cohort	Suzuki T, et al.
-	Cohort	Jacka F, et al.
+	Cohort	Willett WC, et al.

+: there is a relationship

- : there is not a relationship

Discussion

Most of the patterns examined in the collected studies contained fruits and vegetables, grains and fish, which we considered healthy food patterns due to the similarity of these patterns. In general, two types of diets were identified in this review study: 1- healthy diet and 2- unhealthy diet. According to the studies conducted, there is a relationship between a healthy eating pattern and the chance of depression, while no relationship has been seen between an unhealthy

diet and depression. The lack of a relationship between depression and unhealthy eating patterns can be attributed to the fact that the number of studies conducted on the relationship between unhealthy diet and depression was small. A healthy diet pattern is actually in accordance with the food guidelines and is rich in fruits, vegetables, whole grains, poultry, fish and low-fat dairy products. Many review studies acknowledge that this diet has reduced mortality from many diseases.

There are several basic mechanisms in this regard. It seems that the Mediterranean diet has an inverse effect on the occurrence of depression symptoms. In the study of Ibara and his colleagues, the study sample was small (77 people) and the duration of the study period was 6 months, which is short compared to other studies and is the main limitation of this study (30). In the study of Sugawara and his colleagues, all the participants were volunteers, and because they were interested in participating in the project, they had good health conditions. As a result, there is a sampling error in this study. 4 main mechanisms of reducing the possibility of depression by a healthy diet: 1- a healthy diet contains a lot of tryptophan (precursor of serotonin), 2- a diet rich in omega-3 and omega-6 compounds, both of which play a role in anti-inflammatory pathways, 3- a diet Healthy contains high folic acid (depression is associated with low level of folic acid).

According to Table 3 and considering the non-uniformity of the results of the studies on the relationship between unhealthy and inflammatory diet and depression, it is difficult to reach a definitive answer. However, in the following, we will examine some proposed mechanisms to show the relationship between inflammatory diet and depression.

Inflammation is associated with the increase of various cytokines, and this increase causes consequences such as changes in the shape of neurotransmitters, changes in the function of neuroendocrine, and changes in the shape of synapses, which leads to symptoms such as: stress, nervous symptoms and lack of emotions.

The most important mechanism in this regard can be attributed to the function of inflammatory mediators released from macrophages. During disease or injury, microglia begin to produce cytokines such as IL1, IL2, INF, etc. These factors stimulate the pathway of tryptophan to kynurenic acid (antagonist of N-methylidiaspartic acid) and chiolinic acid (agonist of N-methylidiaspartic acid) is converted by the indoleamine dioxygenase enzyme and as a result the level of tryptophan decreases and according to the mentioned mechanism the level of serotonin also decreases. In addition, increasing the level of linolenic acid and its accumulation in the cell causes cell death.

It is important to note that most of the articles in this review did not examine causation. In these studies, it is not clear whether a poor dietary pattern causes depression and its development, or whether depression causes a poor dietary pattern. However, many studies have shown that depressed people seek self-treatment of depression to reduce this. Symptoms turn to consumption of high-fat and high-carbohydrate diets. It should be mentioned that there is a wide variety of evaluations in relation to food barge and also depression. (Evaluation tools such as FFQ, diet history questionnaire and 24-hour diary) for epidemiological studies of nutrition when using these evaluation methods, the possibility of measurement errors in diet is always considered. These factors may also have an impact on the identification of food patterns. The FFQ measures food intake in the long term, but its error is high due to dependence on the individual's memory and the different understanding of people in the ratio of measurements. findings, the information of the affected person in the diagnosis of previous depression or the use of anti-depressant drugs, depression assessment questionnaire) which can cause errors in the conclusion. In this review study, based on observational studies, which always indicate the possibility of an intervention, two aspects are considered. In the first stage, the relationship between diet and depression can be due to the effect of diet on the development of depression, on the other hand, depression may lead to a decrease in the quality of diet. Due to this issue, the cause and the effect cannot be clearly separated. This is a limitation of cross-sectional studies and should be considered when interpreting. In the second stage, the problem of confounders remains.

Many studies are done by removing confounding factors, but their effect is not completely removed. (Either not measured, or incorrectly measured, or the intervening factors are completely unknown). Past studies that have been conducted in relation to diet and depression have not distinguished the types of depression and have dealt with this disease in general. Currently, there are no studies considering the types of depression (for example, atypical depression or melancholic depression).

Future research should distinguish between assessment and analysis of depression types. In summary, the available sources show the relationship between food patterns and depression. It seems that healthy and Mediterranean food patterns are related to the reduction of depression, while unhealthy food patterns may be related to a higher probability of depression, but due to the major differences in the characteristics of the study, a high level of heterogeneity and some limitations of the

method. Based on the studies, there are no clear conclusions. To clarify the relationship between diet and depression, more research is needed, especially through prospective studies.

Conclusion

A healthy diet prevents the occurrence of depression symptoms to a large extent, but the effect of an unhealthy diet on the occurrence of depression is still unknown.

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