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The Association of Potato Consumption and Psychological Disorders in Women: A Cross-Sectional Study

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ABSTRACT

Background: Previous studies reported controversial findings regarding the association of potato consumption with the risk of chronic diseases. The purpose of this study was to determine the relationship of potato consumption with depression, anxiety, and stress in Tehrani women. **Methods:** In this cross-sectional study, 488 women aged 20-50 years old who referred to health centers affiliated with Tehran University of Medical Sciences were selected by multistage cluster sampling. Their usual dietary intake in the past year was evaluated using a semi-quantitative food frequency questionnaire containing 168 items with confirmed validity and reliability. Psychological disorders were assessed using a validated Depression, Anxiety, and Stress Scales (DASS) questionnaires with 21-items. In the logistic regression analysis, the results were adjusted to the confounding factors. **Results:** After adjustment of the confounding variables, consuming potatoes had no significant association with depression (P = 0.12), anxiety (P = 0.19), and stress (P = 0.63). Furthermore, consuming boiled potatoes had no significant association with depression (P = 0.59), anxiety (P = 0.19), and stress (P = 0.37). Intake of fried potatoes had no relationship with depression (P = 0.16), anxiety (P = 0.27), and stress (P = 0.97). **Conclusion:** Potato consumption has no significant relationship with depression anxiety and stress in Tehrani women.

Keywords: *Potato; Depression; Anxiety; Stress; Women*

Introduction

According to the World Health Organization, the prevalence of mental disorders is increasing (Murphy *et al.*, 2004). Mental disorders, like anxiety and depression are associated with heavy economic costs, disability, and early death (Olesen *et al.*, 2012). Depression and anxiety with prevalence rate of 10-20% are the most common psychological disorders (Davis *et al.*, 2003). Based on a meta-analysis, the prevalence of depression in Iran is about 25%. On

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average, mental disorders occur in Iranian women 1.95 times higher than men (Sadeghirad *et al.*, 2010). The prevalence of anxiety was estimated at 15-35% in the general population (Kessler *et al.*, 1994). Based on the epidemiological studies, the prevalence of the anxiety changed from 11.9% to 30.2% in Iran (Mohammadi *et al.*, 2005).

The response rate of depressive persons to medical therapy was about 60-80%. In addition, 25% of the depressive patients received medication. Due to the poor reception of medical treatment and the possibility of the disease recurrence, nutritional factors may have an important role in the prevention and treatment of depression (Penckofer *et al.*, 2010). Several studies indicated the relationship between diet, depression, anxiety, and stress (Jacka *et al.*, 2010). Studies reported that consumption of fruit, vegetables (Saghafian *et al.*, 2018), and micronutrients such as vitamin C, B, D, E, and mineral such as calcium, potassium, magnesium, zinc, iron, and chromium as well as bioactive compounds such as phenolic compounds can reduce mental diseases (Kaplan *et al.*, 2007).

Potato is known as one of the most popular foods all over the world. This starchy vegetable is a fundamental part of the most nation's food supplies because of its fruitfulness properties and favorable taste (Zaheer and Akhtar, 2016). Traditionally, potatoes are identified as a vegetables; however, they are best classified as a refined starch because of their large amount of starch and unfavorable impact on the risk of diseases (Chiuve and Willett, 2007). Potato is a rich source of potassium and vitamin C; both play a role in reducing blood pressure (Camire *et al.*, 2009). It also contains other minerals including magnesium, phosphorus, as well as dietary fiber (King and Slavin, 2013). Due to its high amounts of water, potato is considered as a food with low energy density (Anderson *et al.*, 2013). However, high glycemic index and glycemic load of potato have caused some concerns about its growing consumption (Pagidipati and Gaziano, 2013). Several studies showed significant associations between potato consumption and risk of cardiovascular disease, diabetes, high blood pressure, obesity, and some cancers (Asli *et al.*, 2017, Pietinen *et al.*, 1996, Schwingshackl *et al.*, 2018). However, potato consumption had no significant association with mortality (Darooghegi Mofrad *et al.*, 2019, Osella *et al.*, 2018).

In a cross-sectional study, Azadbakht et al. investigated 205 Iranian girls and found a significant relationship between potato consumption and obesity. However, potato consumption had no significant association with blood pressure (Heidari-Beni *et al.*, 2015). In another study over 4774 Iranian women, potatoes were associated with an increased risk of diabetes. However, no relationship was observed between potato and other cardiovascular risk factors, such as high blood lipids and metabolic syndrome (Khosravi-Boroujeni *et al.*, 2012). Another study conducted by Farhadnejad et al. demonstrated that potato consumption reduced the risk of diabetes in Iranian women (Farhadnejad *et al.*, 2018).

According to our knowledge, no study has ever examined the relationship between potato consumption and mental disorders in the world. Due to the increasing prevalence of mental disorders in Iran, especially in women, the purpose of this study was to investigate the relationship of potato consumption with depression, anxiety, and stress in Iranian women.

Materials and Methods

Study design and participants: This cross-sectional study was conducted on 488 women who referred to the health centers affiliated to Tehran University of Medical Sciences. The participants were selected by multistage cluster sampling method in 2018. The health centers were randomly selected from 29 health centers in the south of Tehran. In each selected health center, we defined the number of required participants in proportion to the total number of persons attending the center. Women who were in the age range of 20-50 years old, Iranian, healthy, not pregnant and lactating, non-menopausal, not on any particular diet, and filled the consent

forms entered the study. Furthermore, the participants were required to have no history of diabetes, cardiovascular, cancer, depression, lung, thyroid, kidney, liver, hypertension, multiple sclerosis (MS), and epilepsy disease and should not have the history of using anti-anxiety and anti-depressant drugs. The participants who did not complete the consent forms, did not cooperate in completing the questionnaires, and consumed less than 500 or more than 3500 kilo calorie of the energy were excluded from the study.

Assessment of dietary intake and potato consumption: Dietary intake was evaluated using a semi-quantitative food frequency questionnaire (FFQ) containing 168 food items that had already been validated (Esfahani *et al.*, 2010). Potatoes in this questionnaire included boiled potato, fried potato, and potato chips. In dietary assessment, a subtitle should be devoted to potato consumption. Grilled, steamed, backed, and microvawed potatoes were not included in the questionnaire. Therefore, we did not consider these kinds of potato in our study. All questionnaires were completed by trained dietitians. Dietary behaviors on food preparation (especially in potato preparation) were asked from participants.

Participants were asked to report the frequency of each food during the past year on a daily, weekly, monthly, and annually basis. The amount of each food was converted to gram using household measures. Later, the consumed gram of each food item was converted to daily intake. Each food item was coded and nutrients were analyzed using the NUTRITIONIST IV software for Iranian foods (version 7.0; N-Squared Computing, Salem, OR, USA).

Assessment of psychological profile: Psychiatric disorders were assessed using the Depression, Anxiety and Stress Scale (DASS-21), which reliability was previously confirmed (Samani and Joukar, 2007). To complete the questionnaire, one should identify the status of a symptom during the past week. Each of the three DASS subscales consists of 7 questions and its final score is obtained as the total score of the three subscales. The answers are divided into four categories of zero, low, medium, and high within the range of 0–3, respectively. Since the DASS-21 is the short-form of the original scale (42 questions), the final score achieved from each of these subscales should be doubled (Lovibond and Lovibond, 1995). Based on the total score, participants were ranked into five groups of normal, mild, moderate, severe, and very severe regarding their depression, anxiety, and stress status. However, due to the limited number of cases in some groups, they were divided into two groups of normal and mild/moderate/ severe/very severe. Depressive, anxiety, and stress symptoms were defined as score of equal or higher than 10, 8, and 15, respectively.

Assessment of other variables: General information was collected and recorded: age, marital status, socioeconomic status (home and welfare status), frequency of travels abroad, occupational status, education status, head of family educational status, number of family members, number of employed family members, number of children, head of family occupational status, number of deliveries, smoking, number of rooms, number of hours out of the home, satisfaction with the physical form, using supplementation or medication, adherence specific diet, having history of diabetes, cancer, cardiovascular, pulmonary, kidney, liver, high blood pressure, depression, thyroid, epilepsy, MS disease, and family history of the mentioned disease.

The participants' height was measured in standing position without shoes by an inflexible meter to the nearest 0.5 cm. The participants' weight was measured by a digital scale (SECA, Hamburg, Germany) without shoes with a minimum of clothes and accuracy of 0.1 kg. Body mass index (BMI) was calculated by dividing the weight (kg) by height squared (m^2). Physical activity was determined based on metabolic equivalents × h/d (Met.h/d) by recording physical activity over 24 hours. Moreover, the individuals' level of physical activity was calculated as

Met.h/d (Ainsworth *et al.*, 2000).

Data analysis: The variables' distributions were checked for normality using the Kolmogorov-Smirnov test. General characteristics across tertiles of potato intake were expressed as means ± SDs for continuous variables as well as numbers and percentages for the categorical variables. To examine the differences across tertiles, we used ANOVA for continuous variables and Chi-square test for categorical variables. Dietary intakes of study participants across tertiles of potatoes were compared using ANCOVA and all values were adjusted for energy intake. We used binary logistic regression to estimate ORs considering 95% CIs for psychological profile across tertiles of potatoes in crude and multivariable-adjusted models. In these analyses, age and total energy intake were controlled in the first model. Further adjustment was made for age, energy intake, socioeconomic status (low, medium and high), marital status (married, single), physical activity, supplement use (yes/no), drug use (yes/no), family history of chronic disease (yes/no), sleep time, out of home time, and body size image (normal, abnormal). In the final model, BMI was added to the adjustment. The P for trend was determined by considering tertiles of potatoes as ordinal variables in the logistic regression analysis. All statistical analyses were performed using the Statistical Package for Social Sciences (version 21; SPSS Inc.). in addition, P-value < 0.05 was considered to be statistically significant.

Ethical considerations: This study was approved by the Research Council and Ethics Committee of the School of Nutrition and Food Science, Tehran University of Medical Sciences, Tehran, Iran. All participants declared their willingness to participate in the study by providing written informed consent forms.

Results

In this study, 488 women aged 20-50 years with a mean age of 31.85 ± 7.67 years were included. The average BMI was 24.46 ± 4.10 kg / m^2. The prevalence of depression, anxiety, and psychological stress among participants was 34, 40, and 42%, respectively. In the third tertile of potato intake, women were younger than the first tertile. No significant difference was observed with regard to other demographic factors among potato intake tertiles. The distribution of demographic variables among potato tertiles can be seen in **Table 1**.

The average dietary intakes in each potato tertile showed that energy intake, thiamine, vitamin B6, and refined grains were significantly higher in the third terile than the first tertile of potato intake. In addition, consumption of the calcium, protein, vitamin C, fruit, dairy, sweet beverages, and red meat reduced significantly in the third tertile than the first tertile of potatoes. Dietary intakes of study participants across tertiles of potato are provided in **Table 2**.

Tables 3-5 show the odds ratio of depression, anxiety, and stress among potato tertiles. After adjustment of confounding variables, consuming potatoes had no significant association with depression (P = 0.12), anxiety (P = 0.19), and stress (P = 0.63). Furthermore, no significant association was found between eating boiled potatoes and depression (P = 0.59), anxiety (P = 0.19), and stress (P = 0.37). Fried potatoes had no relationship with depression (P = 0.16), anxiety (P = 0.27), and stress (P = 0.97).

Table 1. General characteristics of participants across the tertiles of Potato intake

Variables	Total (N=488)	Potato tertiles			
		T1 ≤24 (n = 164)	T2 24< to 32 (n = 164)	T3 ≥32 (n = 160)	
Quantitative variables (mean ± SE)					P-value[a]
Age (year)	31.85 ± 7.67	32.83 ± 7.96	32.02 ± 7.83	30.69 ± 7.08	0.04
Body mass index (kg/m^2)	24.46 ± 4.51	24.90 ± 4.36	24.00 ± 3.81	24.50 ± 5.24	0.19
Weight (kg)	64.44 ± 11.99	65.54 ± 11.76	63.21 ± 10.43	64.60 ± 13.59	0.21
Physical activity (METhr/d)	39.90 ± 6.65	40.02 ± 7.51	40.24 ± 5.90	39.41 ± 6.46	0.50
Sleeping time (hrs)	7.78 ± 1.50	7.64 ± 1.41	7.74 ± 1.43	7.96 ± 1.66	0.14
Out time (hrs)	6.15 ± 3.72	6.15 ± 3.72	6.14 ± 3.76	6.18 ± 3.71	0.99
Qualitative variables	N (%)	N (%)	N (%)	N (%)	P-value[b]
Socioeconomic status					
Low	150 (34)	50 (33)	46 (30)	54 (37)	0.55
Medium	193 (36)	59 (30)	69 (36)	65 (34)	
High	145 (30)	53 (37)	51 (35)	41 (28)	
Overweight or obesity	186	71(38)	58 (31)	57 (31)	0.18
Marital status					
Single	191 (39)	54 (28)	63 (33)	74 (39)	0.05
Married	297 (61)	104 (35)	103 (35)	86 (30)	
Education status					
≤Diploma	164 (34)	52 (32)	59 (36)	53 (32)	0.79
>Diploma	324 (66)	110 (34)	107 (33)	107 (33)	
Head of household education					
≤Diploma	254 (52)	78 (31)	85 (33)	91 (36)	0.28
>Diploma	234 (48)	84 (36)	81 (35)	69 (29)	
Supplement use	183 (37)	62 (34)	62 (34)	59 (32)	0.96
Drug use	40 (8)	16 (40)	15 (37)	9 (23)	0.33
Family history of chronic disease	268 (55)	87 (32)	95 (35)	86 (33)	0.76
Body size satisfaction	327 (67)	109 (33)	110 (36)	108 (31)	0.96
Depression	169(34)	50(29)	61(36)	58(30)	0.46
Anxiety	198(40)	59(30)	68(34)	71(36)	0.34
Psychological distress	207(42)	64(31)	72(35)	71(34)	0.64

[a] : One-way ANOVA; [b]: Chi-square test

Table 2. Multivariable-adjusted daily dietary intakes across the tertiles of Potatoes intake

Variables	Potatoes tertile			P-value[a]
	T1 ≤24 (n = 164)	T2 24< to 32 (n = 164)	T3 ≥32 (n = 160)	
Energy intake(kcal)	1955.21 ± 37.81[b]	2011.80 ± 37.35	2290.55 ± 38.05	<0.001
Protein(g/day)	77.91 ± 1.14	76.50 ± 1.12	72.79 ± 1.17	0.007
Carbohydrate (g)	287.86 ± 2.49	288.20 ± 2.44	294.66 ± 2.55	0.112
Fat(g)	76.70 ± 1.06	76.97 ± 1.04	74.88 ± 1.09	0.346
Saturated fatty acid (g)	23.52 ± 0.46	23.47 ± 0.45	22.821± 0.47	0.504
Poly unsaturated fatty acid (g)	16.24 ± 0.40	16.61 ± 0.39	16.89 ± 0.41	0.532
Mono unsaturated fatty acid (g)	23.03 ± 0.47	22.77 ± 0.46	21.60 ± 0.48	0.091
Cholesterol (mg)	217.75 ± 6.29	223.46 ± 6.17	217.66 ± 6.45	0.751
Vitamin A (RAE)[c]	1482.47 ± 63.29	1337.83 ± 62.02	1304.35 ± 64.80	<0.001
thiamine (mg)	1.51 ± 0.01	1.49 ± 0.01	1.60 ± 0.01	<0.001
Vitamin B6 (mg)	1.27 ± 0.02	1.35 ± 0.02	1.39 ± 0.02	0.008
Vitamin B12 (µg)	4.84 ± 0.19	4.66 ± 0.19	4.17 ± 0.20	0.055
Vitamin C(mg)	151.63 ± 5.30	147.79 ± 5.20	126.47 ± 5.43	0.002
Calcium(mg)	1079.91 ± 22.48	1081.93 ± 22.03	999.38 ± 23.02	0.017
Magnesium(mg)	270.28 ± 4.03	271.12 ± 3.95	304.91 ± 4.12	0.380
Potassium(mg)	3458.68 ± 62.10	3496.32 ± 60.86	3313.24 ± 63.59	0.102
Zinc(mg)	9.23 ± 0.23	9.21 ± 0.22	8.69 ± 0.23	0.191
Fe(mg)	23.21 ± 1.60	21.86 ± 1.57	21.24 ± 1.64	0.683
Fruit (g)	340.85 ± 15.62	331.83 ± 15.31	254.58 ± 16.00	<0.001
Vegetable(g)	353.61 ± 15.25	12.98 ± 0.95	10.39 ± 0.99	0.093
Nuts (g)	13.16 ± 0.97	7.98 ± 0.88	13.72 ± 0.89	0.093
Legumes(g)	43.03 ± 2.84	40.95 ± 2.78	44.89 ± 2.91	<0.001
Red meat (g)	46.98 ± 2.65	43.80 ± 2.60	36.65 ± 2.71	0.025
Fish (g)	8.35 ± 1.24	6.17 ± 1.22	4.68 ± 1.27	0.126
Whole grains(g)	9.81 ± 1.02	10.96 ± 1.00	10.37 ± 1.04	0.724
Refined grains (g)	294.69 ± 8.03	289.57 ± 7.78	333.73 ± 8.22	<0.001
Dairy (g)	449.14 ± 16.85	473.08 ± 16.51	398.72 ± 17.25	0.008
Sugar sweetened beverages (g)	23.06 ± 3.76	32.12 ± 3.69	15.23 ± 3.85	0.007

[a]: ANCOVA ; [b]: Values are mean ± SE. All values are adjusted for energy intake, except for total energy.; [C]: RAE: Retinol activity equivalents

Table 3. Multiple-adjusted odds ratio (OR) and 95% confidence intervals of depression across the tertiles of potato intake

Variables	Potato tertiles			P-trend[e]
	T1 ≤24 (n = 164)	T2 24< to 32 (n = 164)	T3 ≥32 (n = 160)	
Total potatoes				
Crude	1.00	1.30 (0.82-2.05)[d]	1.27 (0.80-2.02)	0.306
Model I[a]	1.00	1.37(0.86-2.20)	1.49 (0.91-2.45)	0.111
Model II[b]	1.00	1.35 (0.83-2.17)	1.38 (0.83-2.31)	0.211
Model III[c]	1.00	1.32 (0.81-2.13)	1.38 (0.83-2.31)	0.211
Boiled potatoes				
Crude	1.00	1.00 (0.61-1.64)	1.28 (0.74-2.21)	0.361
Model I	1.00	0.94 (0.57-1.56)	1.29 (0.74-2.26)	0.361
Model II	1.00	0.86 (0.51-1.44)	1.16 (0.65-2.07)	0.605

Model Ⅲ	1.00	0.83 (0.49-1.40)	1.16 (0.65-2.08)	0.598
Fried potatoes				
Crude	1.00	0.85 (0.53-1.36)	1.12 (0.71-1.79)	0.609
Model Ⅰ	1.00	0.91 (0.56-1.47)	1.43 (0.87-2.36)	0.155
Model Ⅱ	1.00	0.88 (0.54-1.44)	1.47 (0.87-2.47)	0.145
Model Ⅲ	1.00	0.86 (0.52-1.41)	1.44 (0.85-2.42)	0.168

[a]: Adjusted for age and energy intake; [b]: Additionally, adjusted for SES, physical activity, marriage status, supplement use, drug use, family history of chronic disease, satisfaction with the physical form, number of sleeping hours, and number of outside hours; [c]: Additionally, adjusted for body mass index; [d] : These values are odds ratios (95% CIs);[e]: Obtained from logistic regression by considering tertiles of potato as ordinal variable.

Table 4. Multiple-adjusted odds ratio (OR) and 95% confidence intervals (CI) of anxiety across the tertiles of potato intake

Variables	potato tertiles			P-trend[e]
	T1 ≤24 (n = 164)	T2 24< to 32 (n = 164)	T3 ≥32 (n = 160)	
Total potatoes				
Crude	1.00	1.21 (0.77-1.89)[d]	1.39 (0.89-2.17)	0.146
Model I[a]	1.00	1.23(0.78-1.93)	1.43 (0.89-2.29)	0.136
Model II[b]	1.00	1.21 (0.76-1.93)	1.38 (0.84-2.25)	0.193
Model III[c]	1.00	1.23(0.77-1.95)	1.38 (0.84-2.26)	0.192
Boiled potatoes				
Crude	1.00	1.22 (0.75-1.98)	1.59 (0.93-2.72)	0.084
Model Ⅰ	1.00	1.20 (0.73-1.94)	1.54 (0.89-2.64)	0.118
Model Ⅱ	1.00	1.10 (0.67-1.82)	1.44 (0.82-2.53)	0.198
Model Ⅲ	1.00	1.11 (0.67-1.84)	1.44 (0.82-2.53)	0.198
Fried potatoes				
Crude	1.00	1.15 (0.73-1.81)	1.22 (0.77-1.92)	0.384
Model Ⅰ	1.00	1.18 (0.75-1.86)	1.29 (0.79-2.10)	0.294
Model Ⅱ	1.00	1.13 (0.71-1.82)	1.31 (0.79-2.17)	0.287
Model Ⅲ	1.00	1.15 (0.71-1.84)	1.32 (0.80-2.20)	0.271

[a]: Adjusted for age and energy intake; [b]: Additionally, adjusted for SES, physical activity, marriage status, supplement use, drug use, family history of chronic disease, satisfaction with the physical form, number of sleeping hours, and number of outside hours; [c]: Additionally, adjusted for body mass index; [d] : These values are odds ratios (95% CIs);[e]: Obtained from logistic regression by considering tertiles of potato as ordinal variable

Table 5. Multiple-adjusted odds ratio (OR) and 95% confidence intervals (CI) of stress across the tertiles of potato

Variables	Potato tertiles			P-trend[e]
	T1 ≤24 (n = 164)	T2 24< to 32 (n = 164)	T3 ≥32 (n = 160)	
Total potato				
Crude	1.00	1.17 (0.75-1.82)[d]	1.22 (0.78-1.90)	0.376
Model I[a]	1.00	1.18 (0.75-1.83)	1.20 (0.75-1.91)	0.436
Model II[b]	1.00	1.16 (0.73-1.84)	1.12 (0.69-1.83)	0.631
Model III[c]	1.00	1.16 (0.73-1.84)	1.12 (0.69-1.83)	0.631
Boiled potato				
Crude	1.00	1.00 (0.62-1.61)	1.41 (0.83-2.38)	0.196
Model Ⅰ	1.00	0.99 (0.61-1.59)	1.35 (0.79-2.31)	0.259
Model Ⅱ	1.00	0.91 (0.55-1.50)	1.28 (0.73-2.23)	0.378
Model Ⅲ	1.00	0.91 (0.55-1.49)	1.28 (0.73-2.23)	0.378
Fried potato				
Crude	1.00	0.94 (0.60-1.47)	0.97 (0.62-1.52)	0.974
Model Ⅰ	1.00	0.94 (0.60-1.47)	0.94 (0.60-1.47)	0.801
Model Ⅱ	1.00	0.92 (0.57-1.47)	0.99 (0.60-1.64)	0.982
Model Ⅲ	1.00	0.92 (0.57-1.47)	0.99 (0.60-1.63)	0.974

[a]: Adjusted for age and energy intake; [b]: Additionally, adjusted for SES, physical activity, marriage status, supplement use, drug use, family history of chronic disease, satisfaction with the physical form, number of sleeping hours, and number of outside hours; [c]: Additionally, adjusted for body mass index; [d] : These values are odds ratios (95% CIs);[e]: Obtained from logistic regression by considering tertiles of potato as ordinal variable

Discussion

This study was conducted on Iranian adult women to investigate the relationship of potato intake with depression, anxiety, and stress. According to the findings, the total intake or different kinds of potato (boiled, fried potato) had no significant relationship with depression, anxiety, and stress in women.

Depression and anxiety are very common psychiatric disorders that impose a huge burden on both the individuals and the community. Depression is predicted to be the first cause of illness and disability by 2030 (Davis *et al.*, 2003). Diet and lifestyle changes are good approaches to prevent mental disorders. Potato is known as one of the most popular foods around the world. This starchy vegetable is one of the essential food items of Iran due to its beneficial properties and favorable taste (Zaheer and Akhtar, 2016).

In the present study, total potato consumption or boiled and fried potatoes had no association with depression, anxiety, as well as stress. Although no studies have ever investigated the relationship between potato consumption and mental health, a number of studies investigated the relationship between potato components and psychiatric disorders.

Potatoes can have beneficial or harmful effects on health. One of the reasons for non-significant relationship between potatoes and mental disorders in the present study can be the contradictory effects of different components of potato. Potato is rich in vitamin C and potassium and is also a good source of fiber, magnesium, calcium, vitamin B6, niacin, iron, and folate (Anderson *et al.*, 2013, Camire *et al.*, 2009). Studies indicated that use of these micronutrients is associated with reduction of psychiatric disorders (Kaplan *et al.*, 2007). On the other hand, potatoes have high glycemic load and glycemic index. Based on the literature, a diet with high glycemic index increases the risk of developing mental illness by inducing oxidative stress (Liu *et al.*, 2002).

The method of preparing and cooking potato affects its nutritional content. Fried potatoes contain high levels of dietary fats, in particular,

trans-fatty acids and salts. A research showed that oiling, backing, and microwaving methods can reduce the amount of vitamin C, thiamine, riboflavin, niacin, folic acid, and vitamin B6 in potatoes (Augustin *et al.*, 1978). One study showed that backing or roasting could increase the availability of minerals (Gahlawat and Sehgal, 1998). It should be mentioned that heating the potato breaks the starch granules and makes starch more accessible to digestive enzymes. Therefore, among different kinds of potatoes, boiled potatoes have a higher glycemic index (García-Alonso and Goni, 2000). Consequently, contradictory effects can provide a good reason for observing no significant relationship between potato intake and mental health.

To the best of our knowledge, this was the first study on the association of potato consumption with psychological disorders. Adjustment of the known confounders such as age, energy intake, physical activity, socioeconomic status, sleep time, out of home time, body size image medication and supplement use, family history of chronic diseases, and BMI is one of the other strengths of this study.

Due to the cross-sectional nature of this study, it was not possible to fully explain the exposure-outcome association and the mechanism of this correlation. To meet this, a prospective study will help to accurately investigate this mechanism. In this study, we tried to control all known confounders. However, it is possible that we excluded unknown confounders. Regarding the exclusion criteria, the participants' medical conditions were self-reported; so, they could have introduced some levels of bias. Moreover, we did not investigate the causes of depression, anxiety, and stress, which is another limitation of this study.

As a result of this research, we found that increased levels of total potato intake, either boiled or fried, the risk of developing depression, anxiety, and stress was not elevated significantly. Further prospective studies can help the researchers to explain the physiological and psychological relationships in this issue.

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Authors' contributions

Darooghegi Mofrad M, Siassi F, Guilani B, and Azadbakht L contributed to conception, design, data collection, statistical analyses, data interpretation, manuscript drafting, and approval of the final version of the manuscript and agreed upon all aspects of the work.

Conflict of interest

The authors declared no conflict of interest.

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