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Breakfast consumption in relation to lowered risk of psychological disorders among Iranian adults

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ABSTRACT

Objectives: This study aims to find whether breakfast consumption is associated with human mental health.

Study design: This cross-sectional study was conducted to investigate the association between breakfast consumption and psychological disorders, including depression and anxiety, among Iranian adults.

Methods: This cross-sectional study was conducted on 4378 general public adults in Isfahan, Iran. Breakfast consumption was assessed using a validated detailed dietary habits' questionnaire. Depression and anxiety were screened using an Iranian validated Hospital Anxiety and Depression Scale questionnaire. Psychological distress was examined by means of Iranian validated version of General Health Questionnaire (GHQ-12 items). Depression, anxiety, and psychological distress were defined based on standard criteria.

Results: Overall, 13.95% (n = 611) of study participants had anxiety, 28.62% (n = 1253) were depressive, and 23.18% (n = 1015) had psychological distress. After controlling for potential confounding variables, participants with every day breakfast consumption had lower odds for depression (odds ratio [OR]: 0.49, 95% confidence interval [95% CI]: 0.36–0.66) compared with those with the least frequent intake of breakfast, even after further adjustment for body mass index [BMI] (OR: 0.47, 95% CI: 0.34–0.63). Frequent breakfast consumption was inversely associated with anxiety before (OR: 0.53, 95% CI: 0.37–0.76, $P < 0.001$) and after controlling for BMI (OR: 0.52, 95% CI: 0.36–0.75, $P < 0.001$). The same findings were obtained for psychological distress (OR: 0.46, 95% CI: 0.33–0.62, $P < 0.001$).

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Conclusion: We found an inverse association between breakfast consumption and depression, anxiety, and psychological distress among Iranian adults. Further prospective studies are needed to confirm these findings.

Introduction

Prevalence of mental disorders, including depression and anxiety, is increasing worldwide.[1,2] Depressive disorders have been estimated to be the second leading cause of disease burdens throughout the world in 2020.[3] Epidemiologic studies from Iran have shown that anxiety and severe depressive symptoms affect approximately 29.5% and 10.39% of the adult population, respectively.[4] Psychological disorders are very costly and impose a huge burden to the societies and governments.[2]

Several factors, including dietary intakes, have been linked to mental disorders.[5,6] For instance, consumption of a healthy diet, including high intakes of fish, vegetables, fruits, and whole grains, may be related to the reduced risk of psychological disorders.[7] In addition to dietary intakes, some dietary habits including breakfast consumption have been related to mental disorders.[8–10] For example, breakfast consumption has been found to have the potential to alleviate insomnia and improve quality of life.[9,10] Therefore, it may be expected that breakfast consumption is associated with psychological disorders including depression and anxiety. Breakfast consumption has also been related to obesity.[11] On the other hand, numerous studies have also reported a positive association between obesity and risk of developing depression and anxiety.[12–14] Therefore, it could be hypothesized that breakfast consumption might also be related to psychological disorders. In addition, it seems that breakfast intake provides some essential macronutrients and micronutrients after a long fasting. Some of these nutrients are necessary for mental health.[15] Furthermore, it has been found that breakfast skipping increases hypothalamic–pituitary–adrenal axis activity, which subsequently elevates production of stress hormones.[16] Therefore, it has been hypothesized that breakfast consumption may reduce production of such hormones, including glucocorticoids, and modulate psychological disorders[16]

Although, studies investigating the association of breakfast consumption with psychological disorders are scarce, a new study has shown a bidirectional relation between breakfast eating and psychological disorders, including depression and anxiety.[17] Other studies have investigated the association of breakfast consumption with the other aspects of mental health including cognitive behavior.[15,18–20] For instance, a systematic review of the studies revealed cognitive and learning benefits of breakfast eating in children and adolescents.[15] However, some studies did not find any beneficial relation between breakfast eating and cognitive behavior.[18–20] Taken together, it seems that data on the association of breakfast intake and cognitive behaviors are convincing.

To the best of our knowledge, no study is available linking breakfast skipping to the psychological disorders in Iranian adults. The prevalence of psychological disorders is relatively high in Iran.[4,21] It might be due to the busy life of the people, which commonly results in frequent skipping of meals. Moreover, earlier studies have mostly focused on depression, and data on the association between breakfast skipping and psychological distress are scarce. Furthermore, confounding variables including lifestyle related and socio-economic factors have not taken into account in most previous studies. Given these limitations in earlier publications, the present study was conducted to investigate the relation between breakfast consumption and psychological disorders among Iranian adults.

Methods

Study population

This study was based on a data from SEPAHAN (Studying the Epidemiology of Psycho-Alimentary Health and Nutrition) project, which is a cross-sectional study on apparently healthy adults who were non-academic healthy personnel in Isfahan province, Iran. Isfahan is a big province in the central part of Iran. Detailed information about the SEPAHAN study as well as its aims and objectives have been given elsewhere.[22] The whole data in SEPAHAN study were collected using self-administered questionnaires at two separate phases between April 2010 and May 2010. At the beginning of the study, participants were educated how to complete the questionnaires. During the first phase, data on demographic variables as well as on dietary habits were collected, and during the second phase, required information on psychological health was collected. The response rate for the first phase was 86% and for the second phase, 64%. General characteristics were not significantly different between responders and non-responders. After merging data from these two phases, complete information was available for 4763 participants. In the current analysis, we excluded subjects who had missing data on any of the relevant variables including depression, anxiety, and psychological disorders (n = 385). Therefore, the data from 4378 persons (1909 men and 2469 women) were included in this analysis. The study has been approved by the Bioethics Committee of Isfahan University of Medical Sciences, Isfahan, Iran (#189069, #189082, and #189086).

Assessment of exposure

Frequency of breakfast consumption was assessed using a detailed self-administrated questionnaire. Participants were asked to report how many days in a week they are having breakfast. They were able to choose one of these choices: never or once a week, 2–4 days/week, 5–6 days/week, or every

day. Breakfast consumption defined as the consumption of any food, beverage, or both of them between 5:00 and 10:00. In our previous publications, we showed that our dietary habits' questionnaire, that included questions on breakfast consumption as well, provides reasonably valid data of participants' long-term diet-related behaviors.[23] In the present study, breakfast skippers were defined as those who had reported never consuming breakfast or consuming it only once a week.

Assessment of psychological health

Depression and anxiety were screened using an Iranian validated Hospital Anxiety and Depression Scale (HADS) questionnaire.[24] HADS is an easy to complete, brief (14 items), and also useful tool for the assessment of psychological disorders as well as depression and anxiety, their presence and severity. The HADS consists of both anxiety and depression subscales. Each of the questions in the HADS questionnaire includes a four-point scale. Higher scores indicate the increase in anxiety and depression severity, with a maximum score of 21. In the present study, the scores between 0 and 7 in either subscale were considered as 'normal,' and the scores of 8 or more as 'psychological disorder'.[25]

The validity and reliability of the Persian translated HADS questionnaire was examined with 167 Iranian adults by measuring the correlation between each items with their predicted scales. Pearson correlation coefficients of each item with its hypothesized scale were 0.47–0.83 ($P < 0.001$) for anxiety and 0.48 to 0.86 ($P < 0.001$) for depression subscales, respectively. Therefore, findings from that study indicated that the questionnaire was relatively valid for psychological health assessment in Iranian adults.[24]

Assessment of psychological distress was carried out with the Iranian validated version of General Health Questionnaire (GHQ-12 items). The GHQ-12 questionnaire is a brief, easy to use, and simple tool for the assessment of mental health, which asks participants about the experience of behavior changes or psychological distress.[26] Each question consisted of four scales (less than usual, at usual, more than usual, or much more than usual). The scoring could be conducted either by bimodal (0–0–1–1) or Likert (0–1–2–3) scoring methods. In this study, we used the bimodal method, which gives a score between 0 and 12. Individuals with a score of 4 or more were considered as having psychological distress.[27] Higher scores mean greater degree of psychological distress. The convergent validity and reliability of GHQ-12 has been assessed in a sample of 748 Iranian young people, using a subscale derived from the validated Iranian version of the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30). An inverse and significant correlation was shown between the GHQ-12 and general quality of life scores ($r = -0.56$, $P < 0.001$).[26]

Assessment of other variables

Demographic and medical history questionnaires were completed to obtain information about age, sex, marital status, smoking, existence of hyperlipidemia, hypertension, gallstone, Crohn's disease, diabetes, cancers, stroke, myocardial infarction, heart failure, colitis, and asthma, medication use including antidepressant use (fluoxetine, fluvoxamine, citalopram, sertraline, nortriptyline or amitriptyline, and imipramine), and supplement (vitamins and minerals) use. Socioeconomic status (SES) was assessed using family size (≤4, >4 persons), education status (academic or non-academic), and house ownership (yes, no). Participants were given the score of 1 in the case of having family members of ≤4, academic educations, and house ownership. If they had family members of >4, had non-academic educations, or were not house owners, they were given the score of 0. Then, these scores were summed up, and the SES score of 0 (poor), 1 (middle class), and 2 (high) was obtained. Physical activity was assessed using the General Practice Physical Activity Questionnaire (GPPAQ).[28] Since previous studies have shown that even 1 h of walking per week can reduce the risk of chronic diseases,[29] participants were classified as physically active (≥1 h/week) and inactive (<1 h/week). A validated self-administered questionnaire was used to assess anthropometric measures, including weight, height, and waist circumference (WC).[30] Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Selected information on dietary habits including number of meals per day (one, two, or three times/day) and the regularity of meals consumption (never, occasionally, often, or always) was also examined.

Statistical methods

Participants were classified into four categories based on their frequencies of breakfast consumption. To compare general characteristics across different categories of breakfast consumption, we used one-way ANOVA for continuous and Chi-squared test for categorical variables. To find the relation between breakfast consumption and odds of depression, anxiety, and psychological distress, multivariable logistic regression was used in different models. First, we controlled for age (years) and sex (male/female). Additional adjustments were done for marital status (single/married), socio-economic status (high/moderate/low), smoking (yes/no), presence of chronic conditions (yes/no), physical activity (less/more than 1 h per week), supplement use (yes/no), and antidepressant use (yes/no). Finally, further adjustment for BMI (kg/m^2) was done in the third model. These confounders were selected due to their association with diet or psychological disorders.[5,6] In these analyses, the first category of breakfast consumption was considered as reference. To calculate the trend of odds ratios across increasing categories of breakfast consumption, we considered the categories as ordinal variable. *P* values less than 0.05 were considered as statistically significant. All analyses were performed using Statistical Package for Social Sciences (SPSS Corp, version 18, Chicago, IL, USA).

Results

Characteristics of the study population

Overall, 13.95% (n = 611) of study participants had anxiety or were at the borderline, 28.62% (n = 1253) were depressive or at the borderline, and 23.18% (n = 1015) had psychological

distress. General characteristics of the study population across categories of breakfast consumption are shown in Table 1. Participants with frequent breakfast consumption were older, more likely to be physically active and less likely to be female than those with less frequent breakfast consumption. A lower percentage of them had antidepressant use and chronic conditions than those with less frequent breakfast consumption. No significant difference was seen in mean BMI as well as in the distribution of participants in terms of marital status, obesity prevalence, SES, smoking status, and supplement use across categories of breakfast intake.

Breakfast consumption and mental health

As shown in Fig. 1, participants who consumed breakfast every day were less likely to have depression, anxiety, and psychological distress than those who never consumed breakfast or consumed it once a week; such that the prevalence of depression among those with lack of breakfast consumption was 45.7% and among those with regular breakfast intake was 25.0% ($P < 0.001$). The corresponding figures for anxiety were 23.8% and 11.7%, respectively ($P < 0.001$). Psychological distress was also highly prevalent among those with lack of breakfast consumption (39.3%) than those with regular breakfast intake (19.6%) [$P < 0.001$].

Multivariate-adjusted odds ratios (ORs) for anxiety, depression, and psychologic distress across categories of breakfast consumption are indicated in Table 2. Before adjustment for confounding factors, participants with every day breakfast consumption had lower odds for depression (OR: 0.39; 95% confidence interval [95% CI]: 0.31–0.49) compared with those with the least frequent intake of breakfast. After controlling for age, sex, marriage status, SES, smoking, presence of chronic conditions, physical activity, supplement use, and antidepressants use, this association remained significant. Even after further adjustment for BMI, the associations did not alter significantly. This was also the case with anxiety and psychological distress; such that after adjustment for all potential confounders, frequent breakfast consumption was inversely associated with anxiety (OR: 0.52, 95% CI: 0.36–0.75, $P < 0.001$) and psychological distress (OR: 0.46, 95% CI: 0.33–0.62, $P < 0.001$).

Discussion

In this cross-sectional study, we found an inverse association between the frequency of breakfast consumption and odds of depression among the adult population. This association remained significant after controlling for a wide range of potential confounders. Such association was also seen between breakfast consumption and prevalence of anxiety and psychological distress even after adjustment for different confounding factors.

Studies on the relationship between breakfast consumption and mental health are rare; however, huge data are available linking dietary intakes to psychological health.[5,6] As obesity has been associated with psychological disorders, including depression and anxiety,[12–14] as well as with lack of breakfast consumption in earlier studies,[11] there might be a link between breakfast consumption and psychological disorders. However, it should be noted that differences in chronic conditions between categories of breakfast consumption is significant in our study. Furthermore, breakfast consumption has been found to reduce cortisol production, therefore, may decrease psychological disorders.[16]

Table 1 – General characteristics of study population across categories of breakfast consumption.[a]

Characteristic	Frequency of breakfast consumption				P-value[b]
	Never or once/wk	2–4 times/wk	5–6 times/wk	Every day	
Age (year)	35.52 ± 7.87	35.02 ± 7.55	34.80 ± 7.81	36.92 ± 8.05	<0.001
BMI (kg/m^2)	25.00 ± 5.13	25.12 ± 5.31	24.90 ± 4.15	25.03 ± 4.55	0.90
Females (%)	65.7	61.8	51.2	54.9	<0.001
Married (%)	80.2	81.0	79.5	81.0	0.55
Obesity[c] (%)	9.4	10.8	8.8	8.7	0.43
SES (%)					
Poor	38.5	41.7	39.9	36.3	
Medium	57.2	55.1	55.1	59.3	0.26
High	4.2	3.1	5.0	4.5	
Current smoker (%)	4.1	4.5	3.6	3.2	0.45
Chronic conditions[d] (%)	21.3	17.1	11.1	14.5	<0.001
Physically active[e] (%)	29.3	29.6	34.6	35.7	0.01
Supplement use[f] (%)	6.9	7.8	6.4	7.5	0.82
Antidepressant use[g] (%)	11.1	6.2	4.3	5.0	<0.001

BMI, body mass index; SES, socio-economic status.
[a] All data are means ± standard deviations unless indicated.
[b] Obtained using one-way ANOVA for continuous variables and Chi-squared test for categorical variable.
[c] Obesity was defined as BMI ≥ 25 kg/m^2.
[d] Hyperlipidemia, hypertension, gallstone, Crohn's disease, diabetes, cancers, stroke, myocardial infarction, heart failure, colitis, asthma.
[e] Participants with physical activity of ≥1 h per week were considered as physically active.
[f] Supplements of vitamins and minerals.
[g] Fluoxetine, fluvoxamine, citalopram, sertraline, nortriptyline or amitriptyline, imipramine.

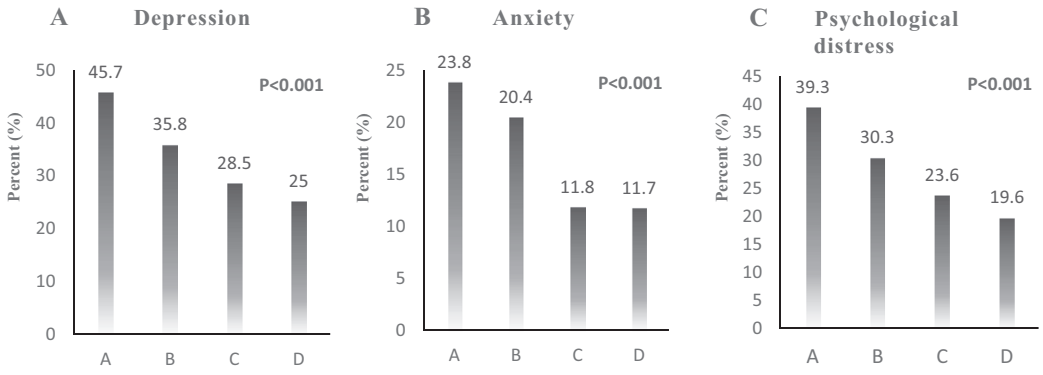

Fig. 1 – Prevalence of depression (A), anxiety (B), and psychological distress (C) across categories of breakfast consumption. Individuals with the score of 8 or more in the HADS questionnaire were considered as having depression or anxiety. Participants with the score of 4 or more in the GHQ-12 questionnaire were considered as having psychological distress.

Table 2 – Multivariate-adjusted odds ratios and 95% confidence intervals (95% CIs) for psychological disorders across categories of breakfast consumption.[a]

Psychological disorder	Frequency of breakfast consumption				P-value[b]
	Never or once/wk	2–4 times/wk	5–6 times/wk	Every day	
Depression					
Crude	1	0.66 (0.50–0.86)	0.47 (0.35–0.63)	0.39 (0.31–0.49)	<0.001
Model 1	1	0.69 (0.51–0.92)	0.50 (0.36–0.68)	0.40 (0.31–0.52)	<0.001
Model 2	1	0.74 (0.52–1.05)	0.54 (0.37–0.79)	0.49 (0.36–0.66)	<0.001
Model 3	1	0.71 (0.50–1.01)	0.51 (0.35–0.75)	0.47 (0.34–0.63)	<0.001
Anxiety					
Crude	1	0.82 (0.60–1.12)	0.42 (0.29–0.61)	0.42 (0.32–0.55)	<0.001
Model 1	1	0.84 (0.60–1.18)	0.41 (0.27–0.62)	0.46 (0.34–0.62)	<0.001
Model 2	1	0.84 (0.55–1.27)	0.45 (0.27–0.75)	0.53 (0.37–0.76)	<0.001
Model 3	1	0.82 (0.53–1.25)	0.45 (0.27–0.75)	0.52 (0.36–0.75)	<0.001
Psychological distress					
Crude	1	0.66 (0.51–0.87)	0.47 (0.35–0.64)	0.37 (0.29–0.47)	<0.001
Model 1	1	0.67 (0.50–0.90)	0.46 (0.33–0.64)	0.37 (0.29–0.48)	<0.001
Model 2	1	0.84 (0.59–1.19)	0.56 (0.38–0.83)	0.48 (0.35–0.65)	<0.001
Model 3	1	0.78 (0.55–1.12)	0.56 (0.37–0.83)	0.46 (0.33–0.62)	<0.001

BMI, body mass index; SES, socio-economic status.
Model 1: adjusted for age and sex. Model 2: adjusted for age, sex, marriage status, SES, smoking, presence of chronic conditions, physical activity, supplement use, and antidepressants use. Model 3: adjusted for age, sex, marriage status, SES, smoking, presence of chronic conditions, physical activity, supplement use, antidepressants use, and BMI.

[a] Participants with the score of 8 or more in the HADS questionnaire and those with the score of 4 or more in the GHQ-12 questionnaire were considered as having depression or anxiety and psychological distress, respectively.

[b] The P for trend across increasing categories of breakfast consumption was calculated using multivariable logistic regression by considering the categories as ordinal variable.

We found an inverse association between breakfast consumption and depression in the present study. These findings were in a line with a previous cross-sectional study on children and adolescents. In a study on secondary school children, those with frequent breakfast omission were more likely to suffer from anxiety and depression.[17] However, one of the major limitations of that study might be lack of a significant ability of children and adolescents to clearly understand the differences between each of the mental problems to tell what degree they had suffered from. Moreover, the investigators of that study used non-validated tools to examine mental disorders. Lack of breakfast consumption was associated with depression among Korean adults with different socio-economic factors.[31] A cross-sectional study on a group of Iranian students linked breakfast eating to higher happiness.[32] Breakfast consumption has also been associated with lower anxiety/depression as a domain of the health-related quality of life measure in elderly people.[33] Other studies have investigated the association of breakfast consumption with the other aspects of mental health including cognitive behavior.[18–21,34,35] A systematic review of earlier studies has revealed some cognitive and learning benefits of breakfast eating in children and adolescents. Consumption of breakfast was reported to be more beneficial than breakfast skipping;

however, the benefits were more apparent in children with compromised nutritional status.[15] Other investigations did not find any significant association between breakfast consumption or omitting and cognitive disorders.[18–20] Taken together, it seems that data on the association of breakfast intake and cognitive behaviors are convincing; however, further information are required to shed light on the relationship between breakfast intake and psychological disorders.

The mechanisms through which breakfast skipping might influence psychological disorders are lacking. It seems that breakfast intake provides some essential macronutrients and micronutrients after a long fasting. Some of these nutrients are necessary for mental health.[15] In addition, breakfast preparation is an active behavior that may also be a way to participate in a social activity;[36] through which it might further help in preventing depression. Breakfast consumption also might reduce the activity of hypothalamic–pituitary–adrenal axis and subsequently the secretion of stress hormones such as cortisol, which can modulate psychological disorders[16]

Several strengths of the present study need to be highlighted. The study is the first from a Middle Eastern country containing a large sample size investigating the relation between breakfast consumption and anxiety, depression, and psychological distress. In this study, we considered several psychological disorders and have not focused on only depression. In addition, a wide range of potential confounders were controlled for to reach an independent association between breakfast intake and psychological health. Given these strengths, some limitations must also be taken into account. Because of the cross-sectional design of the study, it is impossible to confer causality. Further studies, in particular of prospective design, are required to confirm these findings. Psychological disorders and anthropometric measures in this study were examined based on a self-reported questionnaire, not by a clinician. Moreover, no validated questionnaire was used to assess SES of participants. Although we used validated questionnaires, misclassification of study participants in terms of psychological health cannot be excluded. Lack of information of non-responders may be another limitation of this study. In addition, the study was conducted on a population from Isfahan province, and some cautions should be taken when generalizing our findings to Iranian adults. Furthermore, undoubtedly dietary intakes can influence psychological health. We did not adjust our analysis for dietary intakes in the present study.

Conclusion

In conclusion, breakfast consumption was significantly inversely associated with psychological disorders including anxiety, depression, and psychological distress. Further prospective studies are required to confirm these findings.

Author statements

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Ethical approval

The study protocol was approved by the Isfahan University of Medical Sciences Ethical Committee. All participants signed a written informed consent prior to their inclusion in the study.

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Competing interests

The authors have no conflicts of interest to declare.

Author contributions

A.M. wrote the manuscript. A.E. analyzed and interpreted the data. A.H.K., H.R., H.A., P.A., and A.E. designed the study and contributed to data collection and interpretation. P.A. and A.E. revised the manuscript.

REFERENCES

1. Kessler RC, Ustun TB. The World Mental Health (WMH) survey initiative version of the World Health Organization (WHO) composite international diagnostic interview (CIDI). *Int J Meth Psychiatr Res* 2004;**13**:93–121.
2. Whiteford HA, Degenhardt L, Rehm J, Baxter AJ, Ferrari AJ, Erskine HE, et al. Global burden of disease attributable to mental and substance use disorders: findings from the Global Burden of Disease Study 2010. *Lancet* 2013;**382**:1575–86.
3. Anushiravani M, Manteghi AA, Taghipur A, Eslami M. Depression from the perspective of modern and Persian medicine. *Electron Physician* 2018;**10**(2):6372.
4. Noorbala AA, Faghihzadeh S, Kamali K, Bagheri Yazdi SA, Hajebi A, Mousavi MT, et al. Mental health survey of the iranian adult population in 2015. *Arch Iran Med* 2017;**20**:128–34.
5. Rahmani J, Milajerdi A, Dorosty-Motlagh A. Association of the Alternative Healthy Eating Index (AHEI-2010) with depression, stress and anxiety among Iranian military personnel. *J Roy Army Med Corps* 2017. jramc-2017–20000791.
6. Poorrezaeian M, Siassi F, Milajerdi A, Qorbani M, Karimi J, Sohrabi-Kabi R, et al. Depression is related to dietary diversity score in women: a cross-sectional study from a developing country. *Ann Gen Psychiatr* 2017;**16**(1):39.
7. Quirk SE, Williams LJ, O'Neil A, Pasco JA, Jacka FN, Housden S, et al. The association between diet quality, dietary patterns and depression in adults: a systematic review. *BMC Psychiatr* 2013;**13**:175.
8. Maridakis V, Herring MP, O'Connor PJ. Sensitivity to change in cognitive performance and mood measures of energy and fatigue in response to differing doses of caffeine or breakfast. *Int J Neurosci* 2009;**119**:975–94.

9. Kaneita Y, Ohida T, Osaki Y, Tanihata T, Minowa M, Suzuki K, et al. Insomnia among Japanese adolescents: a nationwide representative survey. *Sleep* 2006;**29**:1543–50.
10. Huang C, Hu H, Fan Y, Liao Y, Tsai P. Associations of breakfast skipping with obesity and health-related quality of life: evidence from a national survey in Taiwan. *Int J Obes* 2010;**34**:720.
11. Watanabe Y, Saito I, Henmi I, Yoshimura K, Maruyama K, Yamauchi K, et al. Skipping breakfast is correlated with obesity. *J Rural Med* 2014;**9**:51.
12. Luppino FS, de Wit LM, Bouvy PF, Stijnen T, Cuijpers P, Penninx BW, et al. Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies. *Arch Gen Psychiatr* 2010;**67**:220–9.
13. Lykouras L, Michopoulos J. Anxiety disorders and obesity. *Psychiatrike* 2011;**22**:307–13.
14. André C, Dinel A-L, Ferreira G, Layé S, Castanon N. Diet-induced obesity progressively alters cognition, anxiety-like behavior and lipopolysaccharide-induced depressive-like behavior: focus on brain indoleamine 2, 3-dioxygenase activation. *Brain Behav Immun* 2014;**41**:10–21.
15. Hoyland A, Dye L, Lawton CL. A systematic review of the effect of breakfast on the cognitive performance of children and adolescents. *Nutr Res Rev* 2009;**22**:220–43.
16. Smith AP. Stress, breakfast cereal consumption and cortisol. *Nutr Neurosci* 2002;**5**:141–4.
17. Richards G, Smith AP. Breakfast and energy drink consumption in secondary school children: breakfast omission, in isolation or in combination with frequent energy drink use, is associated with stress, anxiety, and depression cross-sectionally, but not at 6-month follow-up. *Front Psychol* 2016;**7**:106.
18. Adolphus K, Lawton CL, Champ CL, Dye L. The effects of breakfast and breakfast composition on cognition in children and adolescents: a systematic review. *Adv Nutr* 2016;**7**(3):590S–612S.
19. Galioto R, Spitznagel MB. The effects of breakfast and breakfast composition on cognition in adults. *Adv Nutr* 2016;**7**(3):576S–89S.
20. Lopez I, De Andraca I, Perales C, Heresi E, Castillo M, Colombo M. Breakfast omission and cognitive performance of normal, wasted and stunted schoolchildren. *Eur J Clin Nutr* 1993;**47**:533–42.
21. Vandad Sharifi M, Hajebi A, Radgoodarzi R. Twelve-month prevalence and correlates of psychiatric disorders in Iran: the iranian mental health survey, 2011. *Arch Iran Med* 2015;**18**:76.
22. Adibi P, Keshteli AH, Esmaillzadeh A, Afshar H, Roohafza H, Bagherian-Sararoudi R, et al. The study on the epidemiology of psychological, alimentary health and nutrition (SEPAHAN): overview of methodology. *J Res Med Sci* 2012;**17**:292–8.
23. Keshteli AH, Feizi A, Esmaillzadeh A, Zaribaf F, Feinle-Bisset C, Talley NJ, et al. Patterns of dietary behaviours identified by latent class analysis are associated with chronic uninvestigated dyspepsia. *Br J Nutr* 2015;**113**:803–12.
24. Montazeri A, Vahdaninia M, Ebrahimi M, Jarvandi S. The Hospital Anxiety and Depression Scale (HADS): translation and validation study of the Iranian version. *Health Qual Life Outcome* 2003;**1**:14.
25. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983;**67**:361–70.
26. Montazeri A, Harirchi AM, Shariati M, Garmaroudi G, Ebadi M, Fateh A. The 12-item General Health Questionnaire (GHQ-12): translation and validation study of the Iranian version. *Health Qual Life Outcome* 2003;**1**:66.
27. Schmitz N, Kruse J, Heckrath C, Alberti L, Tress W. Diagnosing mental disorders in primary care: the General Health Questionnaire (GHQ) and the Symptom Check List (SCL-90-R) as screening instruments. *Soc Psychiatr Psychiatr Epidemiol* 1999;**34**:360–6.
28. Physical Activity Policy and Health Improvement Directorate [2017-12-23]. webcite The general practice physical activity questionnaire (GPPAQ): a screening tool to assess adult physical activity level, within primary care. http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_063812.
29. Oguma Y, Shinoda-Tagawa T. Physical activity decreases cardiovascular disease risk in women: review and meta-analysis. *Am J Prev Med* 2004;**26**:407–18.
30. Aminian-far S, Saneei P, Nouri M, Shafiei R, Hassanzadeh-Keshteli A, Esmaillzadeh A. Validation study of self-reported anthropometric indices among the staff of the Isfahan University of Medical Sciences, Isfahan. *Iran J Isfahan Med Sch* 2015;**33**:1318–27.
31. Lee SA, Park EC, Ju YJ, Lee TH, Han E, Kim TH. Breakfast consumption and depressive mood: a focus on socioeconomic status. *Appetite* 2017;**114**:313–9.
32. Lesani A, Mohammadpoorasl A, Javadi M, Esfeh JM, Fakhari A. Eating breakfast, fruit and vegetable intake and their relation with happiness in college students. *Eat Weight Disord* 2016;**21**:645–51.
33. Kim JY. Health-related quality of life according to breakfast in elderly. *J Kor Acad Ind Coop Soc* 2015;**16**:4668–78.
34. Wesnes KA, Pincock C, Richardson D, Helm G, Hails S. Breakfast reduces declines in attention and memory over the morning in schoolchildren. *Appetite* 2003;**41**:329–31.
35. Vaisman N, Voet H, Akivis A, Vakil E. Effect of breakfast timing on the cognitive functions of elementary school students. *Arch Pediatr Adolesc Med* 1996;**150**:1089–92.
36. Graham PL, Russo R, Defeyter MA. The advantages and disadvantages of breakfast clubs according to parents, children, and school staff in the North East of England, UK. *Front Publ Health* 2015;**3**:156.