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A cross-sectionally analysis of two dietary quality indices and the mental health profile in female adults

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Abstract

Some studies have pointed out that several dietary patterns could be associated with a reduced risk of depression. The association of overall dietary quality incidences with risk of mental health disorders is limited. We investigated associations of current mental health outcomes with two diet quality indices. We included 977 female participants who came to the social facility of the Ankara Metropolitan Municipality. Dietary intake was collected with a 24-h dietary recall interview, which was used to develop a Healthy Eating Index (HEI)-2015. A Mediterranean diet adherence was measured with the Prevention with Mediteranean Diet (PREDIMED) and the depression, anxiety and stress scale (DASS)-42 was used to assess common psychological disorders. Associations between mental health outcomes and the diet indices were analysed by logistic regression models. Inverse and significant associations were observed between the two diet quality scores and mental health disorders. After fully adjustment, participants in the high group of PREDIMED score had diminished odds of depression (Odds ratio (OR): 0.39, 95% confidence interval (CI): 0.25–0.58), anxiety (OR: 0.68, 95% CI: 0.46–1.00), and stress (OR: 0.42, 95% CI: 0.28–0.65) than those in the low group. A lower HEI-2015, which shows a weaker relationship with mental health results according to PREDIMED results, showed persisted depressive and anxiety symptoms after fully adjustment. Our study suggests that mental health outcomes and symptoms are associated with a poorer diet quality, particularly in PREDIMED.

Keywords Mental health · Diet quality · PREDIMED · HEI-2015 · Depression

Introduction

Mental health problems affect most of the population during a lifetime and account for nearly a quarter of global disease burden. In addition, mental health disorders are considered a major public health problem, as they have increased dramatically in recent years (Vos et al. 2012). As a result, the mental health action plan was accepted by the World Health Organization between 2013 and 2020 (Saxena et al. 2013).The results of mental health components, especially depression, could not be significantly reduced, despite this consideration. It has been revealed that factors (e.g., dietary pattern, physical activity, or vitamin-mineral supplements) other than medical and psychotherapy can affect the mental health burden (Dimov et al. 2019). Dietary pattern affects the physiological factors that form the basis of depression, such as neurotransmitter pathways, inflammation, oxidative stress processes, and plasticity in the brain and, therefore, can play a role in the occurrence and course of these diseases (Dauncey 2012).

Diet quality is associated with common mental disorders, such as depression, across countries and cultures. In the many studies now published from observational evidence, there are consistent associations between a higher diet quality and a reduced risk for depression, while poorer quality diets with higher intakes of unhealthy "Western" type foods are independently associated with an increased risk for depression (Açik and Çakiroğlu 2019; Akbaraly et al. 2009; Lucas et al. 2014). This association seems to be consistent across countries, cultures, and populations according to several systematic reviews and meta-analyses (Baskin et al. 2015; Elstgeest et al. 2019; Molendijk et al. 2018). In addition, there are enough studies showing the positive relationship between the inflammatory burden of the diet and mental disorders (Bergmans and Malecki 2017; Haghighatdoost et al. 2019; Phillips et al. 2018).

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Notably, a recent study published by Elstgeest et al. (2019) reported that diet quality indices were associated with depressive symptoms in a large sample of Dutch middle-aged and older adults. In addition, the studies reported that changes in diet quality were associated with changes in mental health or depression (Jacka et al. 2011a; Kulkarni et al. 2015; Sánchez-Villegas et al. 2015). Improvements in diet quality were associated with higher mental health scores at follow-up. However, reports evaluating the relationship by considering both dietary quality incidences and the mental health of individuals are limited.

Therefore, we aimed to study the association between mental health disorders (depression, anxiety, and stress symptoms) outcomes and two a priori diet quality indices: Prevention with Mediterranean Diet (PREDIMED) and Healthy Eating Index (HEI)-2015. We chose these indices as they all measure a healthy diet and are used worldwide in relation to disease. Furthermore, because they differ in dietary components, it is possible to gain some insight into which food groups may be associated with mental health disorders by comparing the indices.

Materials and Methods

Study Design

The cross-sectional study data were collected between January and March 2019. In this context, a survey was conducted in 19 out of 23 social facilities of Ankara Metropolitan Municipality and 1015 women aged between 19 and 65 years old were included in the study. Participants were questioned by dieticians. The questionnaire consisted of general information, PREDIMED, depression, anxiety, and stress scale-42 (DASS-42) and 24-h (24 h) dietary recall sections.

Participants who had severe psychiatric disorders (e.g., psychotic disorder, bipolar disorder, post-traumatic stress disorder, or bulimia), who were not diagnosed with any neurodegenerative disease, who operated bariatric surgery or used antiobesity medical therapy, who were outside of predefined limits for energy intake (less than 1000 kcal/d or more than 3500 kcal/d in women), and those who us antidepressants or thyroid medications were excluded from the study. Data from 20 participants obtained from the survey were not included in the study because of absent dietary intake records and 18 participants were excluded as their daily calorie intake was not in the 1000–3500 kcal range. As a result, the study was completed with 977 individuals.

Measures

Scoring of Dietary Patterns (HEI-2015 and Mediterranean Diet Adherence Scale)

A trained interviewer assessed dietary intake using a single 24 h interview. HEI-2015 dietary quality criterion unit was calculated. The HEI-2015 score (ranging from 0 to 100 possible points) was created to assess adherence to the 2015–2020 US Dietary Guidelines for Americans (DGA) (Health and Services 2015). The HEI-2015 contains 13 components which are scored on a density basis out of 1000 cal, with the exception of fatty acids, which is a ratio of unsaturated to saturated fatty acids (SFAs). Total fruits, whole fruits, total vegetables, greens and beans, total protein containing foods, and seafood and plant proteins scored 5 in the highest consumption and 0 in the lowest consumption. The highest consumption of three components including whole grains, dairy, and fatty acids (ratio of poly- and monounsaturated fatty acids to SFAs) scored 10 and the lowest consumption scored 0. A maximum of 10 points was given to the lowest consumption of four moderation components including refined grains, sodium, added sugars, and saturated fats. Higher overall HEI-2015 scores show greater alignment with DGA recommendation and better diet quality (Krebs-Smith et al. 2018). In our study, the groups were divided into tertiles. The groups with the lowest and highest dietary quality was determined as tertile 1 and tertile 3, respectively.

Adherence to the Mediterranean diet was assessed with the PREDIMED score. The PREDIMED score of consisted of 14 items, 12 of them with food consumption targets (olive oil as the principal source of fat for cooking, >3 tablespoons of olive oil/day, ≥2 serving/day of vegetables, ≥3 servings/day of fruit, <1 serving/day of red meat, <1 serving/day of butter or margarine, <1 serving/day of sugar-sweetened beverages, ≥1 cup/day of wine, ≥3 servings/week of legumes, ≥3 servings/week of fish, <2 servings/week of commercial pastry, and ≥ 3 servings/week of nuts), and two additional items with targets for consumption habits characteristic of the Mediterranean diet in Spain: preference for white meat over red meat and consumption of dishes with sofrito (a tomato sauce with garlic, onion, or leeks sautéed in olive oil) ≥2 times/week. According to the answers given to the questions, individuals can get a maximum of 14 points. A Mediterranean diet was classified as low (≤5 points), moderate (6–9 points), and high (≥10 points) according to their MDS (Schröder et al. 2011).

Mental Health Measures

The DASS is a 42-item self-reporting measure of depression, anxiety and stress. It consists of three 14-item subscales with each item scored on a 4-point Likert scale, ranging from 0 (did not apply to me at all) to 3 (applied to me very much or most

of the time). Total scores are calculated by summing the items on each subscale, giving a score range of 0–42 on each subscale. Scores above 10, 8, and 15 on the depression, anxiety and stress subscales respectively are indicative of mild or above levels (Lovibond and Lovibond 1995). In studies conducted in Turkey, DASS shows good convergent and discriminant validity, and high internal consistency and reliability with Cronbach's alpha being reported at 0.91 for depression, 0.84 for anxiety, and 0.86 for stress (Akkuş Çutuk and Kaya 2018).

Covariate Assessment

Information on sociodemographic (e.g., age, education, and menopausal status) and lifestyle-related variables (e.g., smoking status and physical activity), body mass index (BMI), and disease status were obtained from the questionnaire. Individuals were questioned for physical activity on a weekly basis, regardless of type and duration (None, 1–2 times per week, 4–5 times per week, and daily). BMI was calculated as weight (kg) divided by the square of height (m) using data collected.

Statistical Analyses

All data analyses were conducted using Statistical Package for the Social Sciences version 21 for Windows (SPSS Inc., Chicago, IL). Continuous variables were expressed as means ± standard deviation (SD) and categorical variables as percentages. Variables were assessed for normality of distribution and skewed variables were normalised as appropriate. To judge the significance among variables, analysis of variance was perfomed for continuous variables, and a Chi-squared test was performed for categorical variables. Pearson's correlation was used to assess the strength of association between HEI-2015, PREDIMED, and mental health outcomes. Unadjusted and multivariable-adjusted binary logistic regression models were used to calculate odds ratios (OR) and 95% confidence interval (CI) for the association among tertiles of HEI-2015 or PREDIMED groups and depressive, anxiety, and stress symptoms. Covariates included in multivariable-adjusted models were variables that significantly differed among tertiles of HEI-2015 or PREDIMED groups. Age (continuous), BMI (continuous), education (primary, middle school, high school, and undergraduate), menopausal status (non-menopausal and post-menopausal), smoking status (non-smoker/former smokers and current smokers), physical activity (N°, 1–2 times a week, 4–5 times a week, and daily), and a subjective health assessment (best, good, moderate, and poor) were controlled for in the multivariable-adjusted model. For all analyses, a p value of <0.05 was considered significant (Sümbüloğlu and Sümbüloğlu 2012).

Results

Table 1 reports the demographic characteristics of the study sample according to PREDIMED and HEI-2015. In total, 977 adult women completed the baseline questionnaires. Participants in the highest tertile or group of adherence to these dietary patterns were more likely to have a higher education level and had subjectively better health conditions. Moreover, these participants reported higher levels of physical activity. Regarding BMI and age, those participants belonging to the category of maximum adherence to the PREDIMED showed the lowest BMI and age, whereas those in the category of maximum adherence to the HEI-2015 were similar compared to others. Women with high group on PREDIMED were also less frequent, post-menopausal individuals. Compared with women in the highest tertile, those in low scores of the HEI-2015 were more likely to be a smoker. Individuals in the highest group of PREDIMED had lesser scores of depression, anxiety, and stress compared with those in the lowest group. Participants in the second and third tertile of HEI-2015 showed lower levels of depression, anxiety, and stress than participants in tertile 1.

Figure 1 shows linear regression formulation and correlation relationships between mental health outcomes and the scores of the different diet qualities indices. Pearson correlation coefficients for the HEI-2015 score were − 0.107 for depression (p = <0.001), −0.128 for anxiety (p = <0.001), and − 0.095 for stress (p = <0.001). In total, HEI-2015 explained 1.1% of depression, 1.6% of anxiety, and 1.0% of the stress. Moreover, PREDIMED score was negatively correlated with depression (r = −0.220, p = <0.001), anxiety (r = −0.160, p = <0.001), and stress (r = −0.160, p = <0.001) and explained 4.8% of depression and 2.5% of anxiety or stress.

The association between adherence to PREDIMED and the symptoms of depression, anxiety, and stress is shown in Table 2. We observed a significant negative association between PREDIMED score and depression in the unadjusted model (OR: 0.32, 95% CI: 0.22–0.49, p = <0.001); however, this association persisted significantly after adjustment for potential confounders (OR: 0.39, 95% CI: 0.25–0.58, p = <0.001). In addition, PREDIMED score was negatively associated with anxiety (OR: 0.61, 95% CI: 0.41–0.90, p = 0.013), however, this association also persisted significantly in the fully adjusted model (OR: 0.68, 95% CI: 0.46–1.00, p = 0.043). A significant negative association was seen between PREDIMED score and stress either before (OR: 0.42, 95% CI: 0.28–0.64, p = <0.001) or after adjustment for covariates (OR: 0.42, 95% CI: 0.28–0.65, p = <0.001).

Table 3 shows the relationship between healthy eating and mental health. Logistic regression analysis revealed that the highest HEI-2015 tertile was associated with a decreased risk of having depressive symptoms (OR: 0.67, 95% CI: 0.49–0.92, p = 0.015) and anxiety (OR: 0.67, 95% CI: 0.49–0.92,

Table 1 Characteristics (mean ± SD or percentage) and mental health outcomes of participants according to tertiles of different diet quality scores

	PREDIMED				HEI-2015			
	Low ($n = 248$)	Moderate ($n = 546$)	High ($n = 183$)	p	Tertile 1 ($n = 330$)	Tertile 2 ($n = 326$)	Tertile 3 ($n = 331$)	P
Medyan (25-75th quartile)	4.0 (3.0–5.0)	7.0 (6.0–9.0)	10.0 (10.0–11.0)		36.2 30.7–39.4	45.8 (42.5–48.9)	59.0 (55.2–63.4)	
Age (mean ± SD)	45.5 ± 11.1	41.2 ± 11.2a	40.1 ± 10.8ab	**<0.001***	41.9 ± 11.3	42.5 ± 10.5	41.7 ± 11.7	0.649
Education status, n (%)								
Primary	51 (20.6%)	85 (15.6%)	20 (10.9%)		72 (21.8%)	52 (16.2%)	32 (9.8%)	
Middle School	29 (11.7%)	76 (13.9%)	20 (10.9%)	**21.986***	40 (12.1%)	41 (12.8%)	44 (13.5%)	**20.774***
High School	104 (41.9%)	175 (32.1%)	67 (36.6%)	**0.001**	108 (32.7%)	123 (38.3%)	115 (35.3%)	**0.002**
Undergraduate	64 (25.8)	210 (38.4%)	76 (41.5%)		110 (33.4%)	105 (32.7%)	135 (%41.4)	
Smoking status, n (%)								
Never	148 (59.7%)	342 (62.6%)	103 (56.2%)	4.894	197 (59.7%)	198 (60.7%)	198 (60.7%)	**11.669***
Former	55 (22.2%)	93 (17.0%)	38 (20.8%)	0.298	49 (14.8%)	65 (20.2%)	72 (22.1%)	**0.020**
Current	45 (18.1%)	111 (20.4%)	42 (23.0%)		84 (25.5%)	58 (18.1%)	56 (17.2%)	
Menopausal status, %(n)								
No	144 (58.1%)	404 (74.0%)	135 (73.8%)	**22.164***	223 (70.6%)	220 (68.5%)	230 (70.6%)	0.428
Yes	104 (41.9%)	142 (26.0%)	48 (26.2%)	**<0.001**	97 (29.4%)	101 (31.5%)	96 (29.4%)	0.807
BMI (kg/m^2)	27.9 ± 5.2	27.0 ± 5.0a	25.8 ± 4.9ab	**<0.001***	27.2 ± 5.4	27.2 ± 4.9	26.5 ± 4.9	0.155
Physical activity status, n(%)								
No	80 (32.3%)	152 (27.8%)	60 (32.8%)		116 (35.2%)	91 (28.3%)	85 (26.1%)	
1–2 times a week	79 (31.9%)	152 (27.8%)	35 (19.2%)	**16.075***	86 (26.0%)	96 (29.9%)	84 (25.8%)	**13.623***
4-5 times a week	70 (28.1%)	164 (30.0%)	59 (32.2%)	**0.013**	97 (29.4%)	94 (29.3%)	102 (31.3%)	**0.034**
Everyday	19 (7.7%)	78 (14.4%)	9 (15.8%)		31 (9.4%)	40 (12.5%)	55 (16.9%)	
Disease status, n (%)								
No	108 (43.5%)	322 (59.0%)	104 (56.8%)	–	182 (55.2%)	172 (53.6%)	180 (55.2%)	–
Cardiovascular disease	18 (7.3%)	25 (4.6%)	7 (3.8%)		15 (4.5%)	18 (36.0%)	17 (5.2%)	
Type 2 diabetes	28 (11.3%)	51 (9.3%)	13 (7.1%)		28 (8.5%)	27 (8.4%)	37 (11.3%)	
Hypertension	31 (12.5%)	36 (6.6%)	17 (9.3%)		27 (8.25)	30 (9.3%)	27 (8.3%)	
Subjective health assessment								
Best	8 (3.2%)	56 (10.3%)	17 (9.3%)		16 (4.8%)	29 (9.0%)	36 (11.0%)	
Good	112 (45.2%)	273 (50.0%)	105 (57.4%)	**24.219***	165 (50.0%)	164 (51.1%)	161 (49.4%)	**16.361***
Moderate	110 (44.3%)	189 (34.6%)	56 (30.6%)	**<0.001**	132 (40.0%)	118 (36.8%)	105 (32.2%)	**0.012**
Poor	18 (7.3%)	28 (5.1%)	5 (2.7%)		17 (5.2%)	10 (3.1%)	24 (7.4%)	
Mental health components (mean ± SD)								
Depression	12.4 ± 9.0	8.4 ± 6.6	7.3 ± 7.2	**<0.001***	10.2 ± 7.3	9.1 ± 7.6	8.4 ± 7.9	**0.008***
Anxiety	10.4 ± 8.3	7.5 ± 6.1	7.2 ± 6.7	**<0.001***	9.2 ± 7.0	7.9 ± 5.2	7.3 ± 6.6	**0.003***
Stress	14.3 ± 8.7	11.4 ± 6.6	11.0 ± 7.0	**<0.001***	13.0 ± 7.1	11.7 ± 7.3	11.6 ± 7.6	**0.033***

Continuous variables are expressed as means ± standard deviation (SD); categorical variables are expressed as percentages. ANOVA is used for continuous variables and Chi-Square test is used for categorical variables. BMI: body mass index; yrs.: years; %: percentage

* Indicates a tendency ($p < 0.05$) to be statistically different

$p = 0.015$), and a lower likelihood of stress (OR: 0.70, 95% CI: 0.50–0.97, $p = 0.037$), compared to the lowest tertile of HEI-2015 adjusted for age and BMI. Additional adjustment for physical activity, education, and menopausal status little attenuated these findings, comparing top versus bottom tertiles, and the association between HEI-2015 and depressive and anxiety symptoms persisted.

Discussion

As the prevalence of psychological disorders increases, intervention and epidemiological research are required on modifiable lifestyle behaviors that positively affect mental health. To the best of our knowledge, this is the first cross-sectional study to examine the relationship of multiple dietary quality indices to depressive symptoms, anxiety, and stress in the adult female population. In this cross-sectional study, we provide evidence for the relationship between high HEI-2015 and PREDIMED scores and low depression, anxiety, and stress scores. Individuals with a high dietary quality were less likely to experience symptoms of depression, anxiety, and stress after adjustment for confounding factors including their level of education, physical activity status, and menopausal status. The relationship between the PREDIMED and mental health components was found to be statistically stronger than HEI-2015.

Based on global estimates, psychological disorders, such as depression and anxiety, are the fifth highest cause of disability. Furthermore, previous studies have shown that depression and anxiety patients are at high risk for all non-fatal diseases or mortality (Whiteford et al. 2013). Diet is a potential risk factor among the environmental factors that affect this

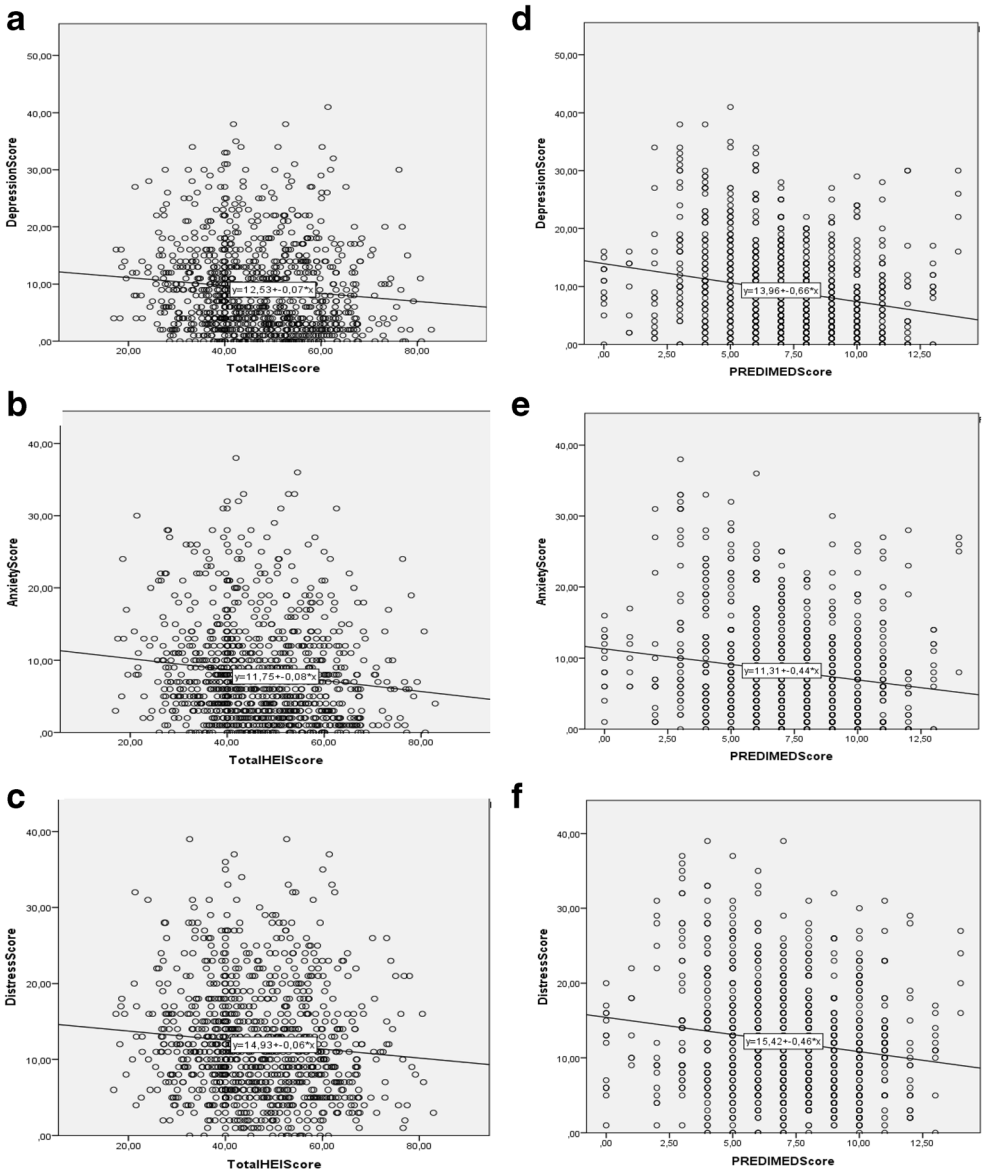

Fig. 1 Association between mental health outcomes and HEI-2015, PREDIMED scores. Scatter-plots showing HEI-2015 (**a**, **b**, **c**) and PREDIMED (**d**, **e**, **f**) the negative correlation between HEI-2015 and depression, anxiety and stress scores, and (**b**) the negative correlation between PREDIMED and depression, anxiety and stress

Table 2 Unadjusted and multivariable-adjusted odds ratios and 95% CIs for mental health disorders across groups of PREDIMED score

	Depression		Anxiety		Stress	
Total ($n = 977$)		p		p		p
Unadjusted						
Low	1 [Reference]		1 [Reference]		1 [Reference]	
Moderate	0.49 (0.36–0.67)	**<0.001***	0.63 (0.47–0.86)	**0.003***	0.47 (0.34–0.64)	**<0.001***
High	0.32 (0.22–0.49)	**<0.001***	0.61 (0.41–0.90)	**0.013***	0.42 (0.28–0.64)	**<0.001***
Model 1						
Low	1 [Reference]		1 [Reference]		1 [Reference]	
Moderate	0.52 (0.38–0.71)	**<0.001***	0.65 (0.48–0.89)	**0.008***	0.44 (0.32–0.61)	**<0.001***
High	0.36 (0.24–0.55)	**<0.001***	0.67 (0.45–0.99)	**0.045***	0.41 (0.26–0.63)	**<0.001***
Model 2						
Low	1 [Reference]		1 [Reference]		1 [Reference]	
Moderate	0.56 (0.39–0.74)	**<0.001***	0.67 (0.49–0.92)	**0.014***	0.46 (0.33–0.64)	**<0.001***
High	0.39 (0.25–0.58)	**<0.001***	0.68 (0.46–1.00)	**0.043***	0.42 (0.28–0.65)	**<0.001***

Values were found to be statistically significant were indicated in bold

Data are presented as OR (95% CI). DII values were stratified by groups. Reference group refers to that within the same comparative group. Model 1: Adjusted for age and BMI. Model 2: Additionally adjusted for physical activity, education, menopausal status and subjective health assessment

Low group (n) = 248, Moderate group (n) = 546, High group (n) = 183

* Indicates a tendency ($p < 0.05$) to be statistically different

situation (Anjom-Shoae et al. 2018). Although, important research has been carried out on individuals' nutrients and food intakes in this context, whilst research on all dietary patterns has been given very limited attention (Richard et al. 2014; Saneei et al. 2016).

The Mediterranean diet and HEI are known as a lower risk-related health diet for various metabolic diseases including cardiovascular diseases, diabetes, and hypertension (Aigner et al. 2018; Khalili-Moghadam et al. 2019; Schwingshackl et al. 2018). However, the relationship between these diet quality indices and psychological disorders has been less studied. We found that compliance with the Mediterranean and HEI dietary pattern was associated with a lower probability of depression. Healthy diets, the Mediterranean diet, and HEI,

Table 3 Unadjusted and multivariable-adjusted odds ratios and 95% CIs for mental health disorders across tertiles of HEI-2015 score

	Depression		Anxiety		Stress	
Total (n = 977)		p		p		p
Unadjusted						
Tertile 1	1 [Reference]		1 [Reference]		1 [Reference]	
Tertile 2	0.79 (0.58–1.07)	0.136	0.70 (0.51–0.96)	**0.028***	0.69 (0.50–0.96)	**0.030***
Tertile 3	0.66 (0.48–0.90)	**0.009***	0.66 (0.48–0.90)	**0.009***	0.69 (0.49–0.95)	**0.027***
Model 1						
Tertile 1	1 [Reference]		1 [Reference]		1 [Reference]	
Tertile 2	0.80 (0.58–1.06)	0.119	0.70 (0.51–0.95)	**0.026***	0.69 (0.50–0.98)	**0.041***
Tertile 3	0.67 (0.49–0.92)	**0.015***	0.67 (0.49–0.92)	**0.015***	0.70 (0.50–0.97)	**0.037***
Model 2						
Tertile 1	1 [Reference]		1 [Reference]		1 [Reference]	
Tertile 2	0.81 (0.59–1.12)	0.207	0.72 (0.52–0.98)	**0.036***	0.72 (0.51–1.00)	0.054
Tertile 3	0.74 (054–0.99)	**0.035***	0.71 (0.52–0.98)	**0.038***	0.76 (0.54–1.06)	0.108

Data are presented as (OR, 95% CI). DII values were stratified by tertiles. Reference group refers to that within the same comparative group. Model 1: Adjusted for age and BMI. Model 2: Additionally adjusted for physical activity, education, menopausal status and subjective health assessment

Tertile 1 (n) = 330, Tertile 2 (n) = 326, Tertile 3 (n) = 331

* Indicates a tendency ($p < 0.05$) to be statistically different

which are characterised by a high intake of fruits, vegetables, whole grains, fish and meat have been associated with a reduced risk of depressive symptoms (Katherine and Gee 2020; Shafiei et al. 2019). On the other hand, Western or unhealthy diets characterised by highly refined grains, processed meat, high-fat products, high-sugar products, and alcohol intake has been associated with an increased risk of depression (Li et al. 2017). However, systematic reviews and meta-analyses have not yet confirmed this evidence but this may have been due to too few studies (Lai et al. 2014; Quirk et al. 2013).

We came across two studies examining the relationship between depression and two or more dietary quality indices (Gibson-Smith et al. 2018; Sánchez-Villegas et al. 2015). In one of the studies, the relationship between depression and a Mediterranean diet, Pro-vegetarian Dietary Pattern, and Alternative Healthy Eating index (AHEI)-2010 was investigated. As a result of the 4-year follow-up study, all three diet patterns had a protective effect on depression, but these diet patterns were not found to be superior to each other (Sánchez-Villegas et al. 2015). In the cohort study conducted by Gibson-Smith et al. (2018), it was observed that depression or anxiety increased as the Mediterranean diet and AHEI-2010 score decreased. However, the relationship between the Mediterranean diet and clinical outcomes was stronger compared to the AHEI. These results are consistent with the findings of our study. However, more research is needed since different findings have been reported.

In this study, we found a significant inverse relationship between increased compliance with PREDIMED and HEI and anxiety score. These findings were in line with a previous study reporting a significant inverse association between a Mediterranean dietary pattern and anxiety in Iranian adults (Sadeghi et al. 2019). There is also evidence that there is a positive correlation between the proinflammatory burden of the diet and anxiety scores (Ghazizadeh et al. 2020; Phillips et al. 2018). The mechanisms of nutrition's impact on anxiety are still unclear. However, studies conducted on rats showed that Western diets, characterised by high-fat and sugary foods, trigger anxiety behaviors (Dutheil et al. 2016; Sharma and Fulton 2013). This is thought to be due to impaired intracellular cascades and increased inflammatory cytokines in the insulin signal/glucose homeostasis (Dutheil et al. 2016).

In addition, the protective associations of a Mediterranean and HEI dietary pattern with anxiety might be attributed to its fruits and vegetables content. Earlier publications have revealed that vegans had less stress and anxiety than omnivores. These food groups are rich sources of dietary magnesium which is beneficial in influencing mildly anxious individuals and those reporting pre-menstrual syndrome-related anxiety (Boyle et al. 2016; Boyle et al. 2017). The study conducted by Masana et al. (2019) on the Greek population was found to be associated with a higher level of anxiety, saturated fat, and added sugars diet pattern. However, such a relationship could not be established with energy intake. Thus, more studies are needed to examine the relationship between diet quality indexes and anxiety, which provide information about diet pattern regardless of energy intake.

In this study, it was observed that stress decreased more as the compliance with the PREDIMED score increased compared to HEI-2015. In line with our findings, Hodge et al. (2013) reported that high adherence to a healthy dietary pattern, which was similar to a Mediterranean dietary pattern, was associated with lower odds of having psychological distress. In women with psychological distress, studies were associated with an unhealthy diet characterised by more hypercaloric foods and salty snacks and a lower protein, fruit, and vegetable intake (Groesz et al. 2012; Isasi et al. 2015). However, there are reports in which there is no relationship between stress and diet, contrary to our findings.

Fat accumulation increases directly in response to increased stress and it causes the activation of neuroendocrine and inflammatory pathways that promote abdominal fat and the release of appetite hormones that increase food consumption (Björntorp 2001). As a result, it leads to a positive energy balance in the individual. In addition, individuals tend to increase their diets rich in sugar and fat as the reward system in the brain is more active in stressful individuals (Adam and Epel 2007). Therefore, the protective effect of healthy diet models on stress is still controversial. In particular, it is reported in the current study that diet quality and stress should focus on how much impact depression and anxiety can have on development (Gibson-Smith et al. 2018).

Overall, stronger associations of mental disorders (especially in depression and stress) were found with the PREDIMED score compared to the HEI-2015 score. Both scores include intakes of fruit, vegetables, whole grains, total protein foods, legumes, refined grains, and added sugar drinks. However the PREDIMED score also includes fish, olive oil, red wine, and antioxidant compounds such as garlic, onions, and spices. Fish, olive oil and red wine are known as the most remarkable foods on brain health (Martínez-Huélamo et al. 2017; Bat 2019). It has been reported that the uptake of these nutrients increases the anti-inflammatory and antioxidant effect in neuronal cells, thereby providing a protective effect against neurodegenerative and neuropsychiatric diseases (Farooqui and Farooqui 2018; Knight et al. 2017). In addition, it has been observed that, together with the Mediterranean diet intervention, extra fish oil, resveratrol (the most important phenolic compound in wine), and olive oil give a better response to mental health parameters and also increase the quality of life (Parletta et al. 2019). Thus, the Mediterranean diet supports the stronger relationship with mental disorders compared to HEI-2015.

This study has some strengths and limitations. The strengths of the study are the fact that the population of the participants is consisted of women only, investigating the relationship between

these variables after evaluating both mental health conditions and diettary pattern in many ways, and including the impact of secondary potential variables that may affect these results. Moreover, the inclusion of a large number of participants in the study and the validation of the scale used in the assessment of mental health can be interpreted as another strength (Akkuş Çutuk and Kaya 2018). However, there are some limitations that should be taken into account in the interpretation of these findings. One of the important limitations in this study is the cross-sectional study design. This study design prevents the possibility of determining cause-effect relationships. Another potential limitation is the measurement error of the 24 h diet recall used for the evaluation of the HEI. Although the 24 h diet recall method is valid for epidemiological studies, it may not represent the overall dietary intake of individuals. Generally, this method is known that participants tend to report lower diet records (Konttinen et al. 2010). Thus, this is thought to decrease the strength of the study rather than the direction of the relationship in the study. Finally, the DASS-42 scale, which evaluates the symptoms of mental disorders in accordance with their own statements, not clinically, was used in our study.

We observed a relationship between an unhealthy diet pattern and common mental disorders in Turkish adult women. However, these results support the view in current studies that low-quality diets may be a risk factor for common mental disorders in adults and adolescents (Appelhans et al. 2012; Jacka et al. 2011b; Quirk et al. 2013). On the other hand, studies are very limited while the Mediterranean diet offers a strong relationship with mental disorders compared to the HEI (Elstgeest et al. 2019; Sánchez-Villegas et al. 2015). In this context, more studies are needed to evaluate the relationship between different healthy diet models and mental disorders. The evidence based on exercise and dietary change is well developed as a treatment strategy for common mental disorders such as depression. However, there are uncertainties regarding which diet model may be more effective on mental disorders. Therefore, there is a need for quality longitudinal studies that will examine the role of different dietary quality indices detected simultaneously on mental disorders. Such research will assist in the development of both the prevention and treatment strategies of the dietary model that may be effective for mental disorders.

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Author's Contribution MA and MA contributed in conception, design, search, statistical analyses, data interpretation and manuscript drafting. MA and FPÇ contributed in design and data interpretation. All authors approved the final version.

Compliance with Ethical Standards

Conflict of Interest This study was performed without any financial support. The authors have no conflict of interest to disclose.

Ethical Approval and Informed Consent The study was conducted in accordance with the Declaration of Helsinki and participants who read and signed the consent form were included in the study. The study protocol was ethically approved by Non-Clinical Ethics Committee (Approved no. 56786525–050.04.04/23692).

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