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Impact of DASH and mediterranean diets on mood and happiness in young adult males: a cross-sectional study

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Abstract

Objective The association between the Mediterranean diet (MED) and the dietary approach to stop hypertension (DASH) with some mental disorders is well-documented. However, a consistent relationship with young adults as a vulnerable population has yet to be known. Therefore, we aimed to investigate the relation between Iranian young male adults' mood and happiness state with DASH/MED patterns.

Results Participants' mean age was 23.65 ± 1.74 years, within the age range of 18–28 years, and their BMI was 24.23 ± 3.82 kg/m^2. After adjusting for all covariates, those in the highest DASH tertile had 54% lower odds of poor mood compared to the lowest tertile (OR = 0.46; 95%CI: 0.24, 0.88). An inverse relationship was also found between DASH and low happiness scores (OR T3 vs. T1 = 0.51, 95%CI: 0.27, 0.96). No significant association was found between MED and mood or happiness. Therefore, results showed that participants who adhered more closely to the DASH diet were less likely to report being unhappy or having a poor mood. Further prospective studies are required to confirm these findings.

Keywords DASH, Mediterranean diet, Mood, Happiness, Cross-sectional

Introduction

The transition to university is a crucial phase for students as they leave their family environments and encounter newfound independence [1]. This shift may help explain the higher prevalence of depressive disorders among university students, which affects approximately 30–40% of them globally [2, 3]. Recent research has turned its focus to positive psychology, investigating how positive emotions and traits can influence well-being [4]. Happiness and mood are key indicators for assessing psychological well-being and overall quality of life [5, 6].

An increasing body of research suggests that lifestyle factors, particularly dietary habits, may serve as significant modifiable risk factors for mental health [7–9]. It is widely recognized that maintaining a balanced diet is a

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more reliable way to predict disease risk than focusing on individual foods or nutrients [10]. A well-regarded dietary pattern from the Mediterranean region has been associated with improved mood, a lower likelihood of depression, and protection against mental health issues [11–13]. However, it is important to note that findings in this area have not always been consistent [14–16]. The Dietary Approaches to Stop Hypertension (DASH) is another well-liked healthy eating pattern, which is somewhat distinct from the Mediterranean diet [17]. There is a relationship between oxidative stress, inflammation, high blood pressure, and poor mental health, with various studies suggesting that mentioned diets may help reduce inflammation and oxidative stress [15, 18, 19].

A literature review indicates that numerous studies have explored the links between different dietary patterns and various aspects of psychological health; however, the results have often been inconsistent [13, 20–24]. Additionally, previous research has primarily focused on types of depressive disorders, with limited data available on the relationship between diet and happiness or mood status [9, 25, 26]. It's also crucial to note that the incidence of psychological disorders in university students can differ significantly from that observed in other populations, and this is an area that has received little attention [27]. Given these considerations, we conducted this study to examine the association between the DASH and Mediterranean diets with mood and happiness in a representative sample of Iranian male university students.

Methods

Study design and population

A total of 268 male students from the Tehran University of Medical Sciences in Iran participated in this cross-sectional study. We employed a multistage cluster random sampling method to recruit participants. Assuming a baseline prevalence (p1) of 50% and an odds ratio of 0.46 based on observed outcomes [28], the required sample size was determined to be 242 participants for 80% power and a 5% significance level. After adjusting for design effects (1.5) and accounting for a 10% dropout rate, the final required sample size was 268 participants, ensuring adequate statistical power. To be eligible for enrollment, participants had to meet specific criteria: they needed to be of Iranian nationality, in good health, and have no history of neuropsychiatric, metabolic, or cardiovascular disorders. Additionally, they should not have used mood stabilizers in the preceding three months, received psychotherapy, taken omega-3 supplements, or experienced severe stress in the previous year. Participants were excluded if they (1) were on a special diet, (2) were pregnant or in a lactating period, (3) had missing data, or (4) reported implausible energy intakes (less than 800 or more than 4200 kcal/day). Before the investigation began, each study participant signed a written informed consent form. The study procedure was performed according to the declaration of Helsinki and STROBE checklist. Tehran University of Medical Sciences ethics committee approved this work (IR.TUMS.VCR.REC.1399.593).

Assessment of dietary intakes To assess individuals' dietary consumption, we apply a validated semi-quantitative food frequency questionnaire (FFQ), which includes 168 food items. Previous research has demonstrated that this FFQ is a valid and reliable tool for evaluating the nutritional intake of Iranian adults [29]. By utilizing standard household measurements, the reported portion sizes of the foods consumed were converted into grams per day [30]. Finally, the gram value of every item was entered into the Nutritionist IV software, which subsequently supplied the daily energy and nutritional information for all of the participants.

Assessment of adherence to DASH diet Our method of evaluating participant adherence to the DASH diet was the application of the DASH dietary score, which is based on eight dietary components. Although whole grains scored highly in the original DASH diet [31], the Iranian population's inadequate consumption of whole grains (< 10 g/day) led us to disregard the consumption of whole grains as a healthy option [24, 32, 33]; therefore refined and whole grains were considered as one category of grains for this study. We used the residual approach to calculate energy-adjusted intakes of these foods and nutrients for each participant [34]. After that, individuals were split into deciles according to their energy-adjusted intakes. When it comes to dairy products, vegetables, fruits, legumes and nuts, those in the highest decile scored 10, while those in the bottom decile scored 1. Conversely, individuals in the top decile for sugar-sweetened beverages and sweets, sodium, red and processed meats, and total grains were given a score of 1, and those in the lowest decile received a score of 10. Lastly, the scores from the food and nutrient specified were added together to determine each person's DASH diet score. As a result, each participant's DASH diet score varied between 8 and 80.

Assessment of adherence to mediterranean diet We calculated the Mediterranean dietary score using nine components in line with the methodology suggested by Trichopoulou et al. [35]. We used the residual technique, which allowed us to obtain energy-adjusted intakes of those items [34]. Energy-adjusted estimates have been generated by adding the mean food group intakes to the residuals derived from the regression model. Individuals were then assigned a score of one for each food item if they consumed more fish, fruits, vegetables, nuts, legumes, and the MUFAs/SFAs ratio than the median, and less

meats, dairy products, and grains. A participant's score was zero if their consumption of meats, grains, and dairy products was higher than the median intake and if their consumption of fish, legumes, nuts, vegetables, fruits, and the ratio of MUFAs to SFAs was lower than the median. Individuals' overall score, which varied from 0 to 9, was determined by adding nine individual component scores. The present study did not consider alcohol consumption given the religious and cultural predilections of Iranians. Also, like what we do in the calculation of DASH adherence, whole and refined grains were considered as a single group of grains [32, 33].

Assessment of happiness Participants' happiness levels were evaluated using the Oxford Happiness Questionnaire (OHQ) [36]. This questionnaire consists of 29 statements regarding happiness, and participants indicate their level of agreement on a six-point Likert scale. Higher scores indicate greater happiness. The validity and reliability of this questionnaire have been previously assessed in Iran [37]. Based on the highest possible score and average scores from similar studies, happiness scores were categorized into two groups: a score above 92.08 indicates high happiness, while a score below 92.08 indicates low happiness.

Assessment of mood status The Profile of Mood States (POMS) questionnaire was used to assess the participants' mood states [38]. The validity and reliability of this questionnaire have been evaluated in earlier research on the Iranian population [39]. Higher scores reflect greater mood disturbances. For this study, mood scores were divided into two groups: scores above 41.55 represent weaker moods, while scores below 41.55 indicate better mood states.

Assessment of other variables A variety of variables including age, smoking habits, medical history, dietary supplement use, and marital status were collected through a self-reported questionnaire. Participants' height and weight were measured while they were standing, wearing loose clothing, and without shoes. Weight was measured using a digital scale accurate to 0.1 kg, and height was measured with a wall-mounted tape accurate to 0.1 cm. Socioeconomic status was assessed by considering factors such as family size and income, employment status, personal income, type of car, ownership of computers and laptops, and the number of domestic and international trips taken annually. Total scores were calculated by summing each item's score. Participants' physical activity levels were evaluated using a validated version of the International Physical Activity Questionnaire (IPAQ) [40].

Statistical analysis

Following the computation of each participant's overall MED/DASH score, the participants were classified according to their energy-adjusted MED/DASH tertiles. The participants' General characteristics were displayed as percentages for categorical variables and mean ± SD for continuous variables across all DASH/MED tertiles. ANOVA, one-way analysis of variance, and chi-square tests, respectively, were used to evaluate continuous and categorical variables among DASH/MED tertiles. Additionally, analysis of covariance (ANCOVA) was used to determine the individuals' total energy and age-adjusted dietary intakes of food groups and nutrients among the tertiles of DASH/MED. The OHQ and POMS scores were compared among tertiles of DASH/MED using ANCOVA. By using multivariable logistic regression, the relationship between the tertiles of DASH/MED with happiness and mood state was investigated. Odds ratios (ORs) and 95% confidence intervals (CIs) for DASH/MED were computed in both unadjusted and adjusted models. In the initial model, adjustments were made for total energy intake and age. Further adjustments were made to the second model about the levels of physical activity, marital status, supplement use, current smoking, socioeconomic status, and BMI. The first tertile of DASH/MED was used as the reference group. The overall trend of the odds ratio across increasing tertiles of DASH/MED was obtained by considering these tertiles as an ordinal variable in the logistic regression models. *P*-values below 0.05 were defined as statistically significant. Version 20 of SPSS software was employed for all analyses.

Results

Participants in this cross-sectional study had a mean age of 23.65 years (SD = 1.74) and a mean BMI of 24.23 kg/m2 (SD = 3.82). Furthermore, as shown in Table 1 there were no significant differences in general characteristics of study participants between tertiles of the DASH/MED score.

The dietary intakes of the participants according to tertiles of DASH/MED patterns are shown in Table 2. Individuals who adhered more closely to the DASH and Mediterranean diets also consumed more fruits, vegetables, dietary fibers, vitamin B6, vitamin B9, vitamin C, and magnesium ($P < 0.001$). In addition, persons in the top tertile of the Mediterranean dietary pattern consumed significantly more protein, iron, and total fat than those in the lowest tertile. However, meat intake was significantly higher in the lowest DASH tertiles compared to the highest tertiles.

OHQ and POMS total scores of study participants across tertiles DASH/MED dietary patterns are presented in Table 3. Participants in the top tertile of the

Table 1 General characteristics of study participants across tertiles of the mediterranean and DASH diet score ($n=268$) [†]

Variable	MED				DASH			
	T1 ($n=69$) (0–2 score)	T2 ($n=128$) (3–4 score)	T3 ($n=71$) (5–9 score)	*P*-value[*]	T1 ($n=87$) (16–39 score)	T2 ($n=98$) (40–48 score)	T3 ($n=83$) (49–68 score)	*P*-value[*]
Age (years)	23.61 ± 1.38	23.56 ± 1.79	23.83 ± 2.09	0.59	23.76 ± 1.62	23.50 ± 1.76	23.70 ± 1.96	0.59
BMI (kg/m^2)	24.12 ± 3.74	24.43 ± 4.01	23.95 ± 3.58	0.67	24.38 ± 4.30	24.05 ± 3.17	24.27 ± 4.03	0.84
Physical activity (%)				0.60				0.37
Inactive	27.5%	35.9%	33.8%		31.0%	29.6%	39.8%	
Minimally active	37.7%	31.3%	33.8%		29.9%	38.8%	31.3%	
Active	34.8%	32.8%	32.4%		39.1%	31.6%	28.9%	
Socioeconomic status (%)				0.60				0.87
Poor	42.0%	41.4%	47.9%		44.8%	44.9%	39.8%	
Moderate	31.9%	31.3%	21.1%		29.9%	28.6%	27.7%	
Good	26.1%	27.3%	31.0%		25.3%	26.5%	32.5%	
Marital status (%)				0.46				0.16
Single	94.2%	94.5%	90.1%		90.8%	91.8%	97.6%	
Married	5.8%	5.5%	9.9%		9.2%	8.2%	2.4%	
Smoking status (%)				0.61				0.82
Current smoker	10.1%	6.3%	8.5%		6.9%	9.2%	7.2%	
Non-smokers	89.9%	93.7%	91.5%		93.1%	90.8%	92.8%	

[†]For continuous variables, values are Mean ± SD

[*]Obtained from ANOVA for continuous variables and chi-square test for categorical variables

Abbreviations: BMI: Body Mass Index; DASH: dietary approach to stop hypertension; MED: Mediterranean diet

DASH dietary pattern had a higher happiness score than those in the bottom tertile in the crude ($p = 0.03$) and max-adjusted models ($p = 0.04$). However, there isn't a significant difference between dash adherence and mood score ($p > 0.05$). Furthermore, we found no significant difference in mood and happiness scores across tertiles of Mediterranean dietary pattern either in crude or multivariable adjusted models ($p > 0.05$).

Table 4 provides a multivariable-adjusted odds ratio for poor mood and low happiness across tertiles of the DASH/MED diet. In the crude model, higher adherence to the DASH diet was directly linked with 52% lower odds of poor mood [(OR: 0.48; 95% CI: 0.25–0.90); third vs. the first tertile]. When all confounders were taken into account, individuals in the DASH diet's third tertile had 54% lower odds of poor mood (OR = 0.46; 95%CI: 0.24, 0.88) in comparison with those in the first tertile. Additionally, we found that those with high DASH diet adherence had a 51% lower chance of having a low happiness score [(OR: 0.49; % CI: 0.26–0.91); third vs. first tertile]; this difference was still significant even after adjusting for all possible confounders [OR: 0.51; 95% CI: 0.27–0.96]. Besides, we observed a significant trend for adherence to the DASH diet and odds of having poor mood and low happiness. On the other hand, no significant correlation was seen between happiness [OR: 0.71; 95% CI: 0.35–1.43] or mood status [OR: 0.77; 95% CI: 0.38–1.57] and the top tertile of the MED diet in last adjusted models.

Discussion

Mood disorders, a class of mental health conditions, can significantly affect an individual's motivation, energy levels, and emotions. These disorders often lead to decreased motivation, chronic fatigue, and persistent emotional challenges such as sadness and mood swings. As a result, they impose a considerable socioeconomic burden on society through increased healthcare costs, reduced productivity, and a greater reliance on social welfare systems [41, 42]. Therefore, effective strategies to prevent these conditions are essential [43]. Based on our results, there may be a notable connection between the upper tertile of the DASH diet with a lower risk of low happiness score (OR T3vs T1 = 0.51, 95%CI: 0.27, 0.96) and poor mood (OR = 0.46; 95%CI: 0.24, 0.88). In contrast, our result showed no meaningful association between the Mediterranean diet and the state of happiness or mood. Given the significant impact of mood and happiness on individuals, particularly university students who are often experiencing stress and lifestyle changes, these findings highlight the importance of targeted interventions. Universities could implement programs that focus on balanced diets rich in mental health-promoting nutrients.

Although our study did not find a correlation between adherence to the Mediterranean diet and mood or happiness, numerous studies have linked this diet to improved mood and decreased depressive symptoms [44–47]. Additionally, some recent research suggests that following a Mediterranean diet is associated with a greater sense of subjective happiness and well-being [48, 49]. The contradictory findings between our study and previous research may arise from differences in study design, study populations, statistical methods, data collection strategies (especially regarding food intake), and how potential confounders were considered in our study.

Both the DASH and Mediterranean diets are recognized as healthy dietary patterns with many similarities. However, key differences may explain why their effects on health outcomes can vary. One major distinction is sodium intake; the DASH diet specifically recommends reducing sodium, while the Mediterranean diet does not provide guidelines regarding sodium intake. Furthermore, although both diets encourage the consumption of more vegetable oils and less saturated fat, the Mediterranean diet places greater emphasis on olive oil intake. Another significant difference is in the consumption of dairy products, where the Mediterranean diet suggests consuming fewer dairy items, while the DASH diet promotes low or non-fat dairy intake [35].

The psychological health benefits associated with dietary patterns, such as Mediterranean and DASH diets, can be attributed to various mechanisms. These mechanisms mainly involve increased consumption of whole grains, fruits, vegetables, plant-based proteins, micronutrients (including calcium, potassium, folate, magnesium, and vitamin C), dietary fiber, monounsaturated and omega-3 fatty acids, polyphenols, and other antioxidant agents. One key mechanism relates to inflammation management. The consumption of dietary fiber from the DASH diet may increase the number of microbial species in the colon that produce anti-inflammatory cytokines [50]. Moreover, studies have shown that DASH dietary patterns significantly lower hs-CRP levels [51]. As we previously discussed, there may be components of the DASH diet responsible for this positive impact on hs-CRP levels [52–55]. Additionally, because of their elevated glycemic load and index, starchy foods and sweet beverages induce fast glycemic responses when consumed. High glycemic load and index diets have been demonstrated to cause oxidative stress [56], which may be detrimental to psychological well-being. Thus, another explanation for the positive associations we observed could be the limitation of sugar-sweetened beverages in the DASH scoring methodology we employed. Another possible mechanism was the neural effect of some ingredients of the DASH diet, research has demonstrated that dietary magnesium has an antidepressant impact

Table 2 Multivariable-adjusted intakes of selected food groups and nutrients of study participants across tertiles of mediterranean and DASH diet score ($n=268$)[†]

Variable	MED				DASH			
	T1 ($n=69$)	T2 ($n=128$)	T3 ($n=71$)	*P*-value[*]	T1 ($n=87$)	T2 ($n=98$)	T3 ($n=83$)	*P*-value[*]
	(0–2 score)	(3–4 score)	(5–9 score)		(16–39 score)	(40–48 score)	(49–68 score)	
Energy (Kcal/day)	3954.95 ± 145.49	4135.17 ± 106.87	4027.65 ± 143.63	0.59	4116.05 ± 129.36	3917.44 ± 121.96	4170.5 ± 132.37	0.32
Protein (g/day)	138.31 ± 4.09	148.90 ± 3.03	167.43 ± 4.03	< 0.001	150.±3.80	154.32 ± 3.60	148.4 ± 3.90	0.50
Fat (g/day)	146.10 ± 3.74	139.61 ± 2.75	153.74 ± 3.69	0.01	143.14 ± 3.35	141.12 ± 3.17	151.62 ± 3.44	0.06
Carbohydrate (g/day)	558.5 ± 9.86	560.07 ± 7.24	533.26 ± 9.72	0.07	562.22 ± 8.84	550.34 ± 8.35	545.07 ± 9.50	0.38
Fiber (g/day)	25.1 ± 0.93	30.75 ± 0.69	37.47 ± 0.92	< 0.001	25.9 ± 0.82	30.22 ± 0.77	37.52 ± 0.84	< 0.001
Vitamin B9 (mg/day)	435.12 ± 14.17	511.43 ± 10.41	626.88 ± 13.98	< 0.001	439.65 ± 12.77	521.88 ± 12.06	609.65 ± 13.08	< 0.001
Vitamin B6 (mg/day)	2.90 ± 0.81	3.01 ± 0.06	3.51 ± 0.08	< 0.001	2.96 ± 0.07	3.05 ± 0.07	3.37 ± 0.08	< 0.001
Vitamin E (mg/day)	8.81 ± 0.54	9.40 ± 0.40	9.57 ± 0.53	0.58	9.87 ± 0.48	9.08 ± 0.45	8.93 ± 0.49	0.318
Vitamin C (mg/day)	204.46 ± 11.18	259.80 ± 8.21	289.45 ± 11.02	< 0.001	196.53 ± 8.92	243.79 ± 8.43	324.40 ± 9.13	< 0.001
Magnesium (mg/day)	451.23 ± 11.70	507.69 ± 8.59	610.20 ± 11.54	< 0.001	460.47 ± 11.16	528.26 ± 10.55	573.65 ± 11.43	< 0.001
Iron (mg/day)	26.98 ± 0.68	28.47 ± 0.05	33.45 ± 0.67	< 0.001	28.91 ± 0.66	29.62 ± 0.63	29.67 ± 0.68	0.66
Fruits (g/day)	445.10 ± 34.60	594.88 ± 25.41	720.03 ± 34.12	< 0.001	435.64 ± 28.06	553.06 ± 27.02	793.72 ± 29.29	< 0.001
Vegetables (g/day)	276.16 ± 22.26	379.45 ± 16.35	496.08 ± 21.96	< 0.001	269.58 ± 18.85	374.64 ± 17.81	514.20 ± 19.30	< 0.001
Meats (g/day)	82.80 ± 12.09	100.58 ± 8.89	105.39 ± 11.92	0.36	134.26 ± 10.43	84.08 ± 9.86	74.10 ± 10.69	< 0.001

[†]All values are means ± standard error (SE); energy intake and macronutrients are adjusted for age; all other values are adjusted for age and energy intake

[2]Obtained from ANCOVA

Abbreviations: DASH: dietary approach to stop hypertension; MED: Mediterranean diet

Table 3 OHQ and POMS total scores of study participants across tertiles of mediterranean and DASH diet score ($n=268$)[†]

Variable	MED				DASH			
	T1 ($n=69$)	T2 ($n=128$)	T3 ($n=71$)	*P*-value[*]	T1 ($n=87$)	T2 ($n=98$)	T3 ($n=83$)	*P*-value[*]
	(0–2 score)	(3–4 score)	(5–9 score)		(16–39 score)	(40–48 score)	(49–68 score)	
OHQ								
Crude	90.88 ± 0.87	92.30 ± 0.64	92.84 ± 0.86	0.25	90.64 ± 0.77	92.04 ± 0.73	93.63 ± 0.79	0.03
Model 1	90.83 ± 0.88	92.32 ± 0.64	92.85 ± 0.87	0.23	90.68 ± 0.77	91.96 ± 0.73	93.68 ± 0.79	0.03
Model 2	90.93 ± 0.89	92.28 ± 0.65	92.84 ± 0.87	0.29	90.74 ± 0.78	91.97 ± 0.74	93.62 ± 0.80	0.04
POMS								
Crude	42.71 ± 1.59	41.72 ± 1.17	40.13 ± 1.57	0.50	43.82 ± 1.4	40.7 ± 1.33	40.17 ± 1.44	0.14
Model 1	42.88 ± 1.57	41.71 ± 1.15	39.96 ± 1.55	0.41	43.64 ± 1.39	41.04 ± 1.31	39.97 ± 1.42	0.16
Model 2	42.79 ± 1.57	41.68 ± 1.15	40.11 ± 1.54	0.47	43.67 ± 1.38	41.2 ± 1.31	39.75 ± 1.42	0.14

[†]All values are Mean ± SD

[*]Obtained from ANCOVA

Model 1: Adjusted for age and energy intake

Model 2: More adjustments for physical activity, marital status, socioeconomic status, intake of supplement, smoking status, and BMI

Abbreviations: BMI: Body Mass Index; DASH: dietary approach to stop hypertension; MED: Mediterranean diet; POMS: Profile of Mood States; OHQ: Oxford Happiness Questionnaire

Table 4 Multivariable-adjusted odds ratio for poor mood and low happiness across tertiles of mediterranean and DASH diet score ($n=268$)[†]

Variable	MED				DASH			
	T1 ($n=69$)	T2 ($n=128$)	T3 ($n=71$)	*P*-trend[*]	T1 ($n=87$)	T2 ($n=98$)	T3 ($n=83$)	*P*-trend[*]
	(0–2 score)	(3–4 score)	(5–9 score)		(16–39 score)	(40–48 score)	(49–68 score)	
Low happiness								
Crude	1.00	0.78 (0.43–1.41)	0.70 (0.35–1.37)	0.29	1.00	0.61 (0.34–1.11)	0.49 (0.26–0.91)	0.02
Model 1	1.00	0.76 (0.41–1.39)	0.67 (0.34–1.32)	0.25	1.00	0.65 (0.35–1.18)	0.48 (0.26–0.90)	0.02
Model 2	1.00	0.81 (0.43–1.51)	0.71 (0.35–1.43)	0.34	1.00	0.67 (0.36–1.25)	0.51 (0.27–0.96)	0.04
Poor mood								
Crude	1.00	0.96 (0.53–1.76)	0.79 (0.40–1.58)	0.51	1.00	0.68 (0.38–1.23)	0.48 (0.25–0.90)	0.02
Model 1	1.00	0.96 (0.53–1.77)	0.75 (0.37–1.52)	0.43	1.00	0.71 (0.39–1.29)	0.47 (0.25–0.90)	0.02
Model 2	1.00	0.98 (0.53–1.81)	0.77 (0.38–1.57)	0.47	1.00	0.71 (0.39–1.30)	0.46 (0.24–0.88)	0.02

[†]All values are odds ratios and 95% confidence intervals. Model 1: Adjusted for age and energy intake

Model 2: More adjustments for physical activity, marital status, socioeconomic status, intake of supplement, smoking status, and BMI

[*] P trend was obtained by considering the tertiles of DASH and MED as an ordinal variable

Abbreviations: BMI: Body Mass Index; DASH: dietary approach to stop hypertension; MED: Mediterranean diet

by blocking the Nmethyl-D-aspartate (NMDA) receptor and can lower inflammation by lowering C-reactive protein, which is involved in a variety of brain processes [57]. Folate, as another micronutrient is necessary for the metabolism of amines like dopamine, norepinephrine, and serotonin [58]. The development of various mood disorders, including mania, sadness, anxiety, seasonal affective disorder, and aggression, is believed to be influenced by the serotonergic system [59–62].

Limitations

It is essential to acknowledge some limitations of this study. One important phenomenon to consider is "reverse causality," which arises from the cross-sectional design of our research. Individuals experiencing mood or happiness issues may change their dietary habits in response to these physiological challenges. Consequently, we cannot definitively determine whether lower adherence to a DASH-style dietary pattern leads to poor mood and low happiness scores, or if the opposite is true. Additionally, the Food Frequency Questionnaire (FFQ) utilized to collect dietary adherence data relies on self-reporting, which is prone to recall bias and may lack accuracy. On the other hand, happiness and mood are subjective measures and presented outcomes can be impacted by a variety of physical and social circumstances. In addition, for the assessment of the outcomes, the POMS and the OHQ questionnaires were used. These questionnaires are suitable for screening and could not be valid for clinical diagnosis. Moreover, we can't use variables like sleep patterns, academic performance, substance use, and objective biomarkers, which may affect both diet and psychological outcomes. Extrapolation to other populations should be avoided as our study population was male Iranian university students. Our findings are not generalizable to the entire population since cultural and dietary differences

might influence the results and their applicability. Future research involving both men and women would be highly beneficial.

Conclusions

This cross-sectional study suggests that university students with higher adherence to the DASH diet had lower odds of having negative mood and low happiness. No substantial relation was demonstrated between the Mediterranean diet and the mentioned outcomes. Due to the importance of psychological health as an underlying factor for chronic diseases, more prospective research is required for a better understanding of the relationship between these diets with mood and happiness.

Abbreviations

DASH	Dietary approach to stop hypertension
MED	Mediterranean diet
FFQ	Food frequency questionnaire
SPSS	Statistical package for the social sciences
ANCOVA	Analysis of covariance
ANOVA	Analysis of variance
OR	Odds ratios
95% CI	95% Confidence interval
SD	Standard deviation
BMI	Body mass index
IPAQ	International physical activity questionnaire
POMS	Profile of mood states
OHQ	Oxford happiness questionnaire

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Author contributions
SK and SJ contributed to conception/design of the research; SK, MA, MA, MHM and YJ contributed to acquisition, analysis, or interpretation of the data; SK drafted the manuscript; LA critically revised the manuscript, and LA agrees to be fully accountable for ensuring the integrity and accuracy of the work. All authors read and approved the final manuscript.

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Data availability
The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethical approval and consent to participate
All participants provided informed written consent. The study protocol was approved by the local Ethics Committee of Tehran University of Medical Sciences.

Consent to participate
Informed consent was obtained from all participants involved in the study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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