Araştırma Makalesi / Research Article

Sağlık Bilimlerinde Değer / Sağlık Bil Değer
Value in Health Sciences / Value Health Sci
ISSN: 2792-0542 sabd@duzce.edu.tr 2025; 15(2): 222-229
doi: https://dx.doi.org/10.33631/sabd.1503247

Associations Between Chronotype, Mindful Eating, and Depression, Anxiety and Stress in Adults: A Cross-Sectional Study in Türkiye

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ABSTRACT

Aim: The relationship between chronotype and mental well-being underscores the importance of considering individual circadian preferences in promoting healthy eating behaviors and overall well-being. This study aimed to investigate the association between chronotype and depression, stress, anxiety, mindful eating, and intuitive eating among Turkish adults.

Material and Methods: This descriptive, cross-sectional study was conducted among adults between October 2023-March 2024 in Istanbul, Türkiye. An online questionnaire including demographic characteristics, Depression, Anxiety, and Stress Scale (DASS-21), Mindful Eating Questionnaire (MEQ), and Intuitive Eating Scale–2nd edition (IES-2) was performed. Additionally, height and body weight were taken with the declaration of the participants. Data were analyzed using SPSS 24.0.

Results: In this study, 250 adults (8% morning type, 46% intermediate type, 46% evening type) participated. DASS-21 scores were higher in evening types and statistically different from morning types ($p<0.001$ for depression and stress scores, $p= 0.004$ for anxiety scores). In contrast, MEQ scores were statistically higher in morning types than in intermediate types ($p = 0.030$). A weak positive correlation was found between chronotype and MEQ scores ($r= 0.228$, $p< 0.001$), whereas weak negative correlations were identified with stress scores ($r= -0.245$, $p< 0.001$), anxiety scores ($r= -0.149$, $p= 0.019$), and depression scores ($r= -0.219$, $p<0.001$). Evening type was associated with higher MEQ scores, depression, stress and anxiety according to logistic regression analysis, after with and without adjustment (95% CI: 0.177, $p= 0.014$, and 95% CI 0.174, $p= 0.008$, respectively).

Conclusion: Depression, stress, anxiety and mindful eating were associated in adults with the evening type.

Keywords: Chronotype; depression; mindfulness; mindful eating.

Yetişkinlerde Kronotip, Yeme Farkındalığı ile Depresyon, Anksiyete ve Stres Arasındaki İlişki: Türkiye Örneğinde Kesitsel Bir Çalışma

ÖZ

Amaç: Kronotip ve ruhsal esenlik arasındaki ilişki, sağlıklı beslenme davranışlarının ve genel esenliğin teşvik edilmesinde bireysel sirkadiyen tercihlerin dikkate alınmasının önemini vurgulamaktadır. Bu çalışmada Türk yetişkinlerde kronotip ile depresyon, stres, anksiyete, yeme farkındalığı ve sezgisel yeme arasındaki ilişkinin belirlenmesi amaçlanmıştır.

Gereç ve Yöntemler: Bu tanımlayıcı ve kesitsel çalışma, Ekim 2023-Mart 2024 tarihleri arasında İstanbul'da yaşayan yetişkinler ile yürütülmüştür. Katılımcılara demografik özellikler, Depresyon, Anksiyete, Stres Ölçeği-21 (DASS-21), Yeme Farkındalığı Ölçeği (MEQ) ve Sezgisel Yeme Ölçeği-2'yi (IES-2) içeren bir anket formu çevrimiçi olarak uygulanmıştır. Ayrıca katılımcıların vücut ağırlıkları ve boy uzunlukları beyana dayalı olarak alınmıştır. Veriler SPSS 24.0 kullanılarak analiz edilmiştir.

Bulgular: Bu çalışmaya 250 yetişkin (%8 sabahcıl tip, %46 orta tip, %46 akşamcıl tipi) katılmıştır. DASS-21 puanları akşamcıl tiplerinde daha yüksek olup, sabahcıl tiplerinden istatistiksel olarak farklı bulunmuştur (depresyon ve stres puanları için $p<0,001$, anksiyete puanları için $p= 0,004$). Buna karşılık, MEQ puanları sabah tiplerinde, ara tiplerden istatistiksel olarak daha yüksek bulunmuştur ($p = 0,030$). Kronotip ile MEQ puanları arasında zayıf pozitif bir korelasyon bulunmuş ($r = 0,228$, $p<0,001$), buna karşılık, stres puanları ($r= -0,245$, $p<0,001$), anksiyete puanları ($r= -0,149$, $p=0,019$) ve depresyon puanları ($r= -0,219$, $p<0,001$) ile zayıf negatif korelasyonlar belirlenmiştir. Akşam tip, ayarlamalar yapılsın ya da yapılmasın lojistik regresyon analizine göre daha yüksek MEQ skorları, depresyon, stres ve anksiyete ile ilişkili bulunmuştur (sırasıyla %95 CI: 0,177, $p= 0.014$ ve %95 CI 0.174, $p= 0.008$).

Sonuç: Bu çalışmada akşamcıl tip olan yetişkinlerde depresyon, stres, anksiyete ve yeme farkındalığı ile ilişki saptanmıştır.

Anahtar Kelimeler: Kronotip; depresyon; farkındalık; yeme farkındalığı.

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Geliş Tarihi / Received: 21.06.2024 Kabul Tarihi / Accepted: 24.02.2025

INTRODUCTION

Chronotype, or circadian preference, describes an individual's inclination for certain times of the day when they feel most alert, active, and ready to sleep. It categorizes individuals along a continuum ranging from "morning types" to "evening types," often known as "early birds" and "night owls" (1). In earlier studies it has been demonstrated that chronotype is associated with various aspects of health and behavior, including eating behaviours, and mental health (1-5). Chronotype has been extensively studied in relation to mental health, including its impact on depression, anxiety, and stress. However, its role in eating behaviors, particularly mindful eating (ME) and intuitive eating (IE), remains less explored.

Mental health conditions, including depression, stress, and anxiety, are prevalent issues worldwide, significantly affecting individuals' quality of life and overall well-being (6,7). According to the World Health Organization (WHO), there has been a 13% increase in mental health disorders in recent years (7). The WHO has reported that mental health conditions have now become the leading cause of disability on a global scale. These conditions have profound ramifications across diverse domains of life, encompassing professional endeavors, academic performance, and interpersonal relationships (6). In Türkiye, the prevalence of mental health disorders is comparable to global trends, with depression and anxiety being among the most common diagnoses (8). Cultural factors in Türkiye, such as dietary habits and societal norms, also influence eating behaviors and chronotypes (9,10). Studies have found that evening chronotypes in Türkiye exhibit a higher propensity for late-night eating, lower adherence to the Mediterranean diet, and an increased risk of poor health outcomes (11,12). However, the interplay between chronotype, eating behaviors, and mental health within Turkish populations remains a relatively understudied area. Earlier research has indicated that individuals with an evening chronotype are more susceptible to mood disorders, a phenomenon that may be attributed to reduced exposure to natural light and the misalignment of their biological rhythms with societal demands (13,14).

Eating behaviors such as ME and IE offer promising frameworks for promoting healthy dietary practices. ME is defined as the act of paying attention to, being aware of, and being focused on the experience of food during food consumption or in a food-related environment. The aim of ME is to help people enjoy the moment and the food and to encourage full presence in the eating experience (15). IE is often used instead of ME, and both concepts are closely related. However, IE does not include the meditation component that ME does (15,16). Like the concept of ME, the practice of IE places a strong emphasis on the importance of listening to internal hunger and satiety indications, rather than engaging in dieting. It also permits the individual to consume food when they are hungry, without any restrictions (16). These concepts have been linked to better physical and mental health outcomes, including reduced eating disorder symptoms and improved dietary habits (17).

Furthermore, literature suggests that the individuals with a morning chronotype exhibited healthier eating behaviours and had better control over overeating than the evening chronotype and were therefore healthier (18). It was found that those who went to sleep later at night had a higher body mass index (BMI), ate less fruit and vegetables, consumed more fast-food at dinner and the total intake of energy was increased (19,20). However, studies specifically linking these patterns to ME and IE are limited.

Chronotype and ME have been studied related to mental health and positive psychological traits. While research is still in its early stages, there is evidence to suggest that chronotype may play a role in influencing mindfulness, self-discipline, and mind wandering (21). This connection between chronotype and mental well-being underscores the importance of considering individual circadian preferences in promoting healthy eating behaviors and overall well-being. Therefore, this study aimed to address these gaps by investigating the primary association between chronotype and mental health outcomes (depression, stress, and anxiety) and the secondary relationship involving eating behaviors (ME and IE). The selection of MEQ and IES-2 scales is particularly relevant, as these tools provide comprehensive insights into individuals' awareness and intuitive regulation of eating, both of which may interact with circadian preferences to influence health.

MATERIAL AND METHODS

This was a cross-sectional descriptive study and was conducted among adults aged 18-64 years between 1 November 2023 and 1 March 2024 in Istanbul, Türkiye.

An online questionnaire including demographic characteristics (gender, age, education, physical activity status, etc.), Depression, Anxiety, and Stress Scale short form (DASS-21), Mindful Eating Questionnaire (MEQ), and Intuitive Eating Scale – 2nd edition (IES-2) was performed. Furthermore, height and body weight were taken with the declaration of the participants. The mean time taken by participants to complete the online questionnaire was approximately 20 minutes, with most participants completing it within a reasonable range. The questionnaire was administered through a secure online platform, ensuring participant anonymity and reducing social desirability bias. Responses with extremely short completion times (indicative of random answering) or incomplete surveys were excluded from the analysis to ensure data quality. While height and body weight were self-reported, participants were provided with clear instructions to ensure accurate reporting.

The ethics committee of Istanbul Gelisim University Ethics Committee with the number: 2023-09, and date: 20.11.2023 approved this study and the principles of the Declaration of Helsinki were followed. Written and verbal informed consent was obtained from all participants.

Morningness-Eveningness Questionnaire

The scale was developed by Horne and Östberg in 1976 (22). Pündük et al. evaluated the validity and reliability of the Turkish version of the scale, and Cronbach's alpha was found to be 0.812 (23). Consisting of 19 questions, this scale evaluates sleep and wakefulness patterns, performance and lifestyle of individuals. According to the

score obtained in the questionnaire, chronotype types of individuals are determined. A total score between 59 and above is categorized as “morning type”, between 42 and 58 as “intermediate type” and between 16 and 41 as “evening type”. Cronbach's alpha was found to be 0.804 in this study.

Depression, Anxiety, and Stress Scale Short Form (DASS-21)

The Depression, Anxiety, and Stress Scale short form (DASS-21), a psychometric instrument developed by Lovibond and Lovibond (24). The Turkish version of the DASS-21 was evaluated for its validity and reliability by Sarıçam, and Cronbach's alpha internal consistency reliability coefficient α= 0.870 for depression subscale, α= 0.850 for anxiety subscale and α= 0.810 for stress subscale (25). The questionnaire was designed to assess levels of depression, anxiety and stress levels and consisted of seven items for each of the three scales. Items 3, 5, 10, 13, 16, 17, and 21 represent the depression score; and according to the total score 0 to 4 means normal, between 5 and 6 of mild depression, 7 to 10 of moderate depression, 11 to 13 of severe depression, and >13 of extremely severe depression. Items 2, 4, 7, 9, 15, 19, and 20 represent the anxiety score; and total scores between 0 to 3 means normal, between 4 and 5 of mild anxiety, between 6 and 7 of moderate anxiety, between 8 and 9 of severe anxiety, and >9 of extremely severe anxiety. Additionally, items 1, 6, 8, 11, 12, 14, and 18 represent the stress score, and the total scores between 0 and 7 means normal, between 8 and 9 of mild stress, 10 and 12 of moderate stress, 13 and 16 of severe stress, and >16 are indicative of extremely severe stress (25). Cronbach's alpha was found to be α= 0.861 for depression subscale, α= 0.815 for anxiety subscale and α= 0.831 for stress subscale in this study.

Intuitive Eating Scale – 2nd edition (IES-2)

The IES-2 was developed by Tylka & Kroon Van Diest (2013) with the objective of measuring individuals' propensity to adhere to their physical hunger and satiety indications when making decisions regarding the timing, quantity, and nature of their food intake (26). Bas et al. evaluated the validity and reliability of the Turkish version of the IES-2, and Cronbach's alpha was found to be 0.820 (27). The IES-2 is comprised of 23 items, divided into four sub-scales. The items are rated on a five-point scale, with 1 indicating strong disagreement and 5 indicating strong agreement. Items 1, 2, 3, 6, 7, 8, and 9 are to be scored in reverse. An average score, ranging from 1 to 5, is then calculated by dividing the total score by 23. A higher level of intuitive eating behaviour is indicated by a higher score on the scale. Cronbach's alpha was found to be 0.823 in this study.

Mindful Eating Questionnaire (MEQ)

The MEQ is designed to investigate the fundamental causes and processes underlying eating behaviour, rather than focusing on the specific foods consumed, which was developed by Framson et al. (28). Köse et al. conducted the validity and reliability study of the Turkish version of the MEQ, and Cronbach's alpha was found to be 0.733 (29). The Likert-5 type scale comprises 30 questions divided into seven subscales. Items 1, 7, 9, 11, 13, 15, 18, 24, 25, and 27 are scored directly, while the remaining questions are reverse scored. An average score, ranging from 1 to 5, is then calculated by dividing the total score by 30. A higher overall score indicates greater eating awareness. Cronbach's alpha was found to be 0.730 in this study.

Statistical Analysis

G*Power was utilized for sample selection, with a prevalence rate of 20%, a type I error rate (α) of 0.05, a type II error rate (β) of 0.5, and a test power (1-β) of 0.95. The sample size for this study was calculated as 208 (30). The data were analyzed using the statistical software package IBM SPSS 24.0. Categorical data was analyzed using Fisher freeman Halton Exact test. The normality of data distribution was assessed using the Kolmogorov–Smirnov test, and anxiety, stress, and depression scores did not show a normal distribution. Descriptive statistics of the data are presented as n (%) and mean±standard deviation if the variable is normally distributed and median (25-75th interquartile range) otherwise. The ANOVA coefficient was employed to compare the mean values of height, weight, BMI, MEQ, and IES-2 scores. Differences between chronotypes were analyzed by Tukey's post hoc coefficient for IES-2, and MEQ scores, whereas depression, stress, and anxiety were analyzed by Kruskall-Wallis coefficient. Additionally, Spearman correlation coefficients was used to determine the relationship between chronotype, BMI, stress, anxiety, depression, IE-2, and MEQ scores (Spearman correlation coefficient was used for stress, anxiety, and depression). The relationships between chronotype and mindful eating, depression, anxiety, and stress were analyzed by logistic regression models and adjusted for gender, BMI, physical activity, occupation, and educational status. For all statistical tests, a p-value of <0.05 was considered statistically significant.

RESULTS

The demographical characteristics of participants are shown in Table 1. In this study, 250 adults (8% morning type, 46% intermediate type and 46% evening type) participated. Most of the participants (69.2%) were male. When the educational status was analyzed, 50% of the participants were graduates of high school or lower education or university or higher education. 66.40% of the participants were not employee and did not have a chronic disease. Mean BMI values were 23.35 ± 4.98 kg/m^2 for the morning type, 23.28 ± 4.80 kg/m^2 for the intermediate type and 25.85 ± 4.82 kg/m^2 for the evening type and did not differ between the groups.

Most of the participants were normal according to stress, anxiety and depression classification (64.00%, 40.00%, and 42.00%, respectively).

Table 1. Demographical characteristics

	Morning type (n = 20)	**Intermediate type (n = 115)**	**Evening type (n = 115)**
	n (%)	**n (%)**	**n (%)**
Age (mean ± SD)	27.10 ± 10.77	24.55 ± 7.05	26.14 ± 9.56
Gender			
Female	5 (25.00)	30 (26.08)	42 (36.52)
Male	15 (75.00)	85 (73.92)	73 (63.48)
Education status			
High school or lower education	14 (70.00)	48 (41.73)	63 (54.78)
University or higher education	6 (30.00)	67 (58.27)	52 (45.22)
Employment status			
Employee	3 (15.00)	37 (32.17)	44 (38.26)
Not employee	17 (85.00)	78 (67.83)	71 (61.74)
Presence of a chronic disease			
No	17 (85.00)	78 (67.83)	71 (61.74)
Yes	3 (15.00)	37 (32.17)	44 (38.26)
Regular physical activity			
No	13 (65.00)	83 (72.18)	96 (83.48)
Yes	7 (35.00)	32 (27.82)	19 (16.52)
Height (cm) (mean ± SD)	165.20 ± 6.82	164.76 ± 9.37	165.16 ± 18.11
Body weight (kg) (mean ± SD)	63.90 ± 14.57	63.40 ± 15.50	64.83 ± 12.83
BMI (kg/m^2) (mean ± SD)	23.35 ± 4.98	23.28 ± 4.80	25.85 ± 4.82
BMI: Body mass index			

Stress, anxiety and depression scores were found to be higher in the evening type, with a statistically significant difference between morning types and evening types ($p < 0.001$ for depression and stress scores, $p = 0.004$ for anxiety score). However, MEQ scores were higher in morning type, and there was a statistical difference between morning type and intermediate type ($p = 0.010$). In the morning type, 15.00% were classified as severe stress, 10.00% as severe and 15.00% as very severe anxiety, and 15.00% as severe depression. In the intermediate type, 1.74% were classified as severe and very severe stress, 7.83% as severe and 4.35% as very severe anxiety, 4.35% as severe and 3.48% as very severe depression. In the evening type, 6.09% were classified as severe and 5.22% as very severe stress, 11.30% as severe and 18.26% as very severe anxiety, 8.70% as severe and 13.04% as very severe depression. (Table 2).

Table 2. Determination of IES-2, MEQ, depression, anxiety, and stress scores of participants according to chronotype

	Morning type (n=20)	**Intermediate type (n=115)**	**Evening type (n=115)**	***p*-value**	***p*^{a}-value**	***p*^{b}-value**	***p*^{c}-value**
	(Mean ± SD)						
IES-2 score	3.19 ± 0.54	3.03 ± 0.52	3.20 ± 0.55	0.567	-	-	-
MEQ score	3.26 ± 0.35	2.99 ± 0.18	3.17 ± 0.40	**0.030**	0.116	**0.010**	0.187
	(Median, 25-75th interquartile range)						
Depression score	4.00 (1.00-7.00)	5.00 (2.00-9.75)	6.00 (3.00-9.00)	**<0.001**	**<0.001**	0.335	1.000
Anxiety score	4.00 (1.00-7.00)	5.00 (1.00-7.75)	6.00 (2.00-8.00)	**0.004**	**0.003**	0.852	1.000
Stress score	6.00 (3.00-8.00)	7.00 (4.25-10.00)	7.50 (5.00-10.00	**<0.001**	**<0.001**	0.135	1.000
	n (%)	**n (%)**	**n (%)**				
Classification of stress				**0.001**			
Normal	10 (50.00)	86 (74.78)	64 (55.65)				
Mild	4 (20.00)	18 (15.65)	13 (11.30)				
Moderate	3 (15.00)	7 (6.09)	25 (21.74)				
Severe	3 (15.00)	2 (1.74)	7 (6.09)				
Extremely severe	-	2 (1.74)	6 (5.22)				
Classification of anxiety				**0.018**			
Normal	7 (35.00)	56 (48.70)	37 (32.17)				
Mild	5 (25.00)	16 (13.91)	18 (15.65)				
Moderate	3 (15.00)	29 (25.22)	26 (22.61)				
Severe	2 (10.00)	9 (7.83)	13 (11.30)				
Extremely severe	3 (15.00)	5 (4.35)	21 (18.26)				
Classification of depression				**0.004**			
Normal	8 (40.00)	62 (53.91)	35 (30.43)				
Mild	3 (15.00)	17 (14.78)	27 (23.48)				
Moderate	6 (30.00)	27 (23.48)	28 (24.35)				
Severe	3 (15.00)	5 (4.35)	10 (8.70)				
Extremely severe	-	4 (3.48)	15 (13.04)				

[a]: differences between morning type and evening type, [b]: differences between morning type and intermediate type. [c]: differences between intermediate type and evening type
IES-2: Intuitive Eating Scale – 2nd edition; MEQ: Mindful Eating Questionnaire

Table 3 shows the correlation between chronotype, BMI, IES-2, MEQ, stress, anxiety, and depression scores. A weak positive correlation was found between chronotype and MEQ scores (r=0.228, p<0.001). Conversely, weak negative correlations were found with depression scores (r=-0.219, p<0.001), anxiety scores (r=-0.149, p=0.019), and stress scores (r=-0.245, p<0.001). BMI was not correlated with chronotype, IES-2, MEQ, depression, anxiety, and stress scores.

Table 3. Correlation coefficients between chronotype, IES-2, MEQ, depression, anxiety, and stress scores, and BMI

	1		**2**		**3**		**4**		**5**		**6**	
	r	**p**	**r**	**p**	**r**	**p**	**r**	**p**	**r**	**p**	**r**	**p**
1. Chronotype score	-											
2. IES-2 score	0.55	0.383	-									
3. MEQ score	0.228	**<0.001**	0.274	**<0.001**	-							
4. Depression score	-0.219	**<0.001**	-0.097	0.128	-0.165	**0.009**	-					
5. Anxiety score	-0.149	**0.019**	-0.154	**0.015**	-0.207	**0.001**	0.736	**<0.001**	-			
6. Stress score	-0.245	**<0.001**	-0.088	0.166	-0.252	**<0.001**	0.769	**<0.001**	0.719	**<0.001**	-	
7. BMI	0.045	0.960	-0.087	0.075	0.070	0.431	-0.062	0.203	-0.067	0.270	-0.010	0.526

IES-2: Intuitive Eating Scale – 2nd edition; MEQ: Mindful Eating Questionnaire; BMI: Body mass index

According to the logistic regression analysis, evening type was associated with higher MEQ, depression, stress, and anxiety scores (OR=0.169, p=0.004; OR=0.183, p=0.007; OR=0.166, p=0.006, and OR=0.192, p=0.013, respectively). The results were similar after adjustment for gender, BMI, physical activity, occupation and educational level (OR=0.174, p=0.008; OR=0.178, p=0.010; OR=0.156, p=0.007, and OR 0.177, p=0.014, respectively).

Table 4. Chronotype and its association with mindful eating, depression, anxiety, and stress (p: 0.001)

n = 250	**Chronotype classification**	**UOR (95% CI)**	**p-value**	**AOR[a] (95% CI)**	**p-value**
Model 1	Morning (n = 20)	Reference		Reference	
	Intermediate type (n = 115)	0.536 (0.268-1.074)	0.079	0.492 (0.234-1.034)	0.061
	Evening type (n =115)	0.169 (0.050-0.567)	**0.004**	0.174 (0.048-0.628)	**0.008**
Model 2	Morning (n = 20)	Reference		Reference	
	Intermediate type (n = 115)	0.662 (0.319-1.371)	0.267	0.605 (0.279-1.313)	0.204
	Evening type (n = 115)	0.183 (0.053-0.628)	**0.007**	0.178 (0.048-0.664)	**0.010**
Model 3	Morning (n = 20)	Reference		Reference	
	Intermediate type (n: 115)	0.683 (0.328-1.422)	0.308	0.603 (0.277-1.313)	0.202
	Evening type (n = 115)	0.166 (0.046-0.592)	**0.006**	0.156 (0.041-0.601)	**0.007**
Model 4	Morning (n = 20)	Reference		Reference	
	Intermediate type (n = 115)	0.753 (0.356-1.592)	0.457	0.671 (0.302-1.490)	0.327
	Evening type (n = 115)	0.192 (0.052-0.703)	**0.013**	0.177 (0.045-0.706)	**0.014**

[a]Adjusted for gender, BMI, physical activity, occupation, and educational status. *p* for trend was obtained using multivariate logistic regression analyses. Model 1: MEQ score, Model 2: Model 1 + Depression score, Model 3: Model 2 + Anxiety score, Model 4: Model 3 + stress score

DISCUSSION

Chronotype, which expresses the individual's preference for activity and sleep timing during the day, may be related to mental health and eating behaviors. To the best of our knowledge, this is the first study to determine the association between chronotype and depression, stress, anxiety, ME, and IE among Turkish adults. We demonstrated that evening-type adults displayed higher stress, anxiety, and depression scores and lower ME. Also, after adjusting for gender, BMI, physical activity, occupation, and educational status, the evening type was associated with lower MEQ scores, higher depression, stress, and anxiety scores.

The prevalence of evening chronotypes, characterized by a preference for later sleep and wake times, varies across different populations and age groups. Research found that most of adults were intermediate types in Türkiye (31,32). Additionally, studies indicate that evening chronotypes are particularly common among young adults and adolescents (33). In this study, 8% of the participants were morning type, 46% were intermediate type and 46% were evening type. The high prevalence of evening and intermediate types could be influenced by the age group of the participants as younger individuals often show a tendency toward eveningness compared to older adults.

The relationship between chronotype and depression is well documented in the literature. Tsomokos et al. (2024) reported that evening type adolescents were being more strongly related to depressive symptoms, especially in female gender (14). Walsh et al. (2022) showed that evening chronotypes had more severe depression symptoms than morning and intermediate chronotypes (21). According to our findings, evening types had higher depression scores, and 21.7% of them were classified as having severe or extremely severe depression symptoms.

Additionally, a weak negative correlation was found between chronotype and depression scores. Previous studies have suggested that the link between chronotype and mood may be partly due to the fact that evening types are less exposed to light (34). Another study has shown that the vulnerability of evening chronotypes to mental health problems may also be due to the incompatibility of eveningism with the standard work or school schedule between 9am and 5pm. This incompatibility is associated with sleep disturbance in evening types and, when combined with daytime insomnia, seems to mediate the association between depression and eveningness (35).

There have been inconsistent results in studies that have focused on the relationship between chronotype and anxiety. One study indicated that evening type was associated with higher anxiety levels (36). Similarly, a relationship was observed between evening chronotype and high levels of anxiety (21). In contrast, it was reported that there was no association between anxiety and chronotype (37). In addition, a negative correlation between morning chronotype and anxiety was observed in women, but not in men (38). We found that anxiety scores were higher in evening types, and there was a weak negative correlation between chronotype and anxiety scores. Including chronotype and depression as covariates may help to clarify these mixed findings on anxiety.

The relationship between chronotype and stress is complex and multifaceted. One study found that evening types tend to experience higher levels of stress and negative effect than morning types (39). It was also observed that later chronotypes were found to correlate with severe stress in Indonesian university students (40).

We found that stress scores were higher in evening types, and there was a weak negative correlation between chronotype and stress scores. It was observed that evening chronotype is associated with poor sleep quality, and this has been observed to be related to higher stress levels. In addition, the mediating role of sleep quality in the chronotype-stress association may also be evident in broader emotional outcomes (41).

Mindfulness correlates with both physical and mental health and represents an adaptive self-regulatory skill. However, there are not many studies linking chronotype and mindfulness. A study showed that individuals with morning chronotypes had higher levels of 'mindfulness' than those with intermediate and evening chronotypes (42). Similarly, in a study, morning types had higher levels of overall social support and mindfulness (21). To our knowledge, one study has investigated the relationship between chronotype and ME; however, there are no studies that have investigated the relationship between chronotype and IE. According to Kabasakal Cetin, there is a positive correlation between chronotype and ME in Turkish undergraduate students (43). Similarly to this study, we found that MEQ scores were higher in morning types, and chronotype and MEQ scores were weakly positively correlated. ME emphasizes eating with increased awareness and paying attention to hunger and satiety signals (15). It is also thought that ME may help to promote healthy eating (44). Therefore, increasing awareness of whether or not one is hungry may help to change the eating habits of evening types to healthy ones.

This study has several strengths. It is among the first to investigate the relationships between chronotype, depression, stress, anxiety, ME, and IE among Turkish adults, offering a novel perspective. The use of validated tools such as the Morningness-Eveningness Questionnaire, DASS-21, MEQ, and IES-2 ensures the reliability and validity of the findings. By examining both mental health outcomes and eating behaviors, the study adopts a multidimensional approach, highlighting the broader implications of chronotype on overall health and behavior. However, this study has several limitations. Firstly, it is a cross-sectional study, so it does not indicate the direction of relationships. Secondly, we used an online form to determine depression, anxiety, stress, IE, and ME, rather than a clinical interview. Thirdly, most of the participants were male. Therefore, the results cannot be generalized. Fourthly, BMI was calculated by taking height and body weight from participant declarations. Self-reported data may be less reliable than directly measured data, which may limit the generalisability of the study.

CONCLUSION

In conclusion, being an evening type may influence depression, stress, anxiety and mindful eating behavior. In addition, after adjusting for gender, BMI, physical activity, occupation, and educational status, the evening type was associated with higher depression, stress, and anxiety scores, and lower MEQ. These findings suggest that developing effective strategies such as chronotype-based counseling, flexible work schedules, targeted behavioral interventions, education and awareness programs, physical activity schedules personalized nutrition plans, or cognitive behavioral therapy, etc. that take chronotype into account may help to reduce mental health problems such as depression, anxiety and stress and increase mindful eating.

Authors's Contributions: Idea/Concept: H.M.B., Z.M.Ç.; Design: H.M.B., Z.M.Ç.; Data Collection and/or Processing: H.M.B.; Analysis and/or Interpretation: H.M.B.; Literature Review: H.M.B., Z.M.Ç.; Writing the Article: H.M.B., Z.M.Ç.; Critical Review: H.M.B., Z.M.Ç.

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