# Original Article

# Emotional Appetite is Associated with Chronotype and Burnout in Senior Undergraduate Students

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**Abstract**

**Background**: Chronotype changes and academic burnout are two negative conditions that manifest later in university life.

**Objective:** This study aimed to examine the association of chronotype and burnout with emotional appetite among senior undergraduate students.

**Methods:** The Emotional Appetite Questionnaire (EMAQ), Morningness–Eveningness Questionnaire (MEQ), and Maslach Burnout Inventory-Student Survey (MBI-SS) were used to measure emotional eating, chronotype, and burnout status, respectively. Additionally, measurements of height, body weight, waist circumference, and dietary intake (three-day food consumption) were recorded.

**Results:** Significant differences were found between morning and evening type participants concerning EMAQ sub-scores, except for positive emotions ($p<0.05$). Additionally, the MEQ score was negatively correlated with the EMAQ negative situation and negative total scores ($p<0.05$). Multiple linear regression analysis showed that the evening type increased the EMAQ negative total score and decreased the EMAQ positive total score compared to the morning type when controlling for body mass index (BMI), waist circumference, dietary energy, dietary protein, MBI-SS sub-scores, and intermediate chronotype ($p<0.05$). On the other hand, emotional exhaustion (EE), one of the MBI-SS sub-scores, was positively correlated with EMAQ negative scores and negatively correlated with EMAQ positive scores ($p<0.05$). The depersonalization (DP) sub-score was positively correlated with the EMAQ negative scores, and the personal accomplishment (PA) sub-score was positively correlated with the EMAQ positive scores ($p<0.05$). Lastly, multiple linear regression analysis showed that EE and DP predicted greater EMAQ negative total scores and lower EMAQ positive total scores when controlling for other parameters in the models.

**Conclusions:** These findings show that both academic burnout and late chronotype are associated with negative emotional eating. This points to the need for policymakers to develop strategies to raise awareness about healthy lifestyles among undergraduate students. *[Ethiop. J. Health Dev*.2024; 38(2): 00-00]

**Keywords:** Eating Behavior, Emotional Eating, Eveningness Chronotype, Emotional Exhaustion, University Students.

## Introduction

The start of college life brings major lifestyle changes for young adults. Along with the stress of leaving home, mental and behavioral disorders increase during this time. Eating disorders are at the forefront of these behavioral disorders (1). Emotional eating is one of the most common eating disorders among college students and is often defined as a change in eating behavior to cope with negative emotions (2). Emotional eating behavior is triggered by motives other than hunger and inevitably leads to weight gain (3, 4). It has been reported that emotions can alter food intake by up to 48% (4). Students who lack effective coping mechanisms may turn to food to manage their emotions and stress (5).

The change in chronotype is one of the main causes of disorders and comorbidities in university students (6). Chronotype can be defined as individual preferences for when one is active and one sleeps. It also refers to the times preferred for peak cognitive and physical performance, as well as psychological aspects, such as affect (7). Individuals are generally catagorize into three chronotypes: morningness, intermediate, and eveningness (8). In students, bed time can be controlled by social norms. This means that they have to stay awake at their usual bedtime. This condition, called social jet lag, may result in a shift to the eveningness chronotype. Evening-type people tend to have less, shallower, and non-refreshing sleep. Anxiety, negative mood, and low self-esteem tendencies are more common in evening-type individuals (9). Chronotype also affects academic performance. It has been shown that students who belong to the evening-type perform worse academically than students who belong to morning-type (10). In addition, the eveningness chronotype has been associated with fewer dietary restrictions, unhealthy eating habits, and higher body mass index (BMI) (11). Even among shift and night workers, eating at night may contribute to the development of overweight and obesity (12).

During their university years, students try to cope with academic and social demands. Especially, the last academic year is a period in which comprehensive graduation examinations are undertaken intensively (13). In Turkey, central examinations such as public personnel selection, specialization (medical and dentistry), academic personnel and graduate education, and foreign language proficiency are also included in

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this term (14). Students regret their past negligence. In addition, concerns about finding a job after graduation also manifest in the last academic year (13). At this point, the concept of academic burnout emerges. Academic burnout refers to feelings of fatigue due to increased academic demands and requirements, indifference toward the research field, and a sense of inadequacy in education (15). Academic burnout, which usually occurs as a result of not being able to cope with the curriculum, is characterized by a severe lack of motivation and performance (16). A recent meta-analysis that examined 55 unique articles to determine the pooled prevalence of burnout among university students reported that approximately one-third of students experience burnout (17). Eating disorders are one of the conditions associated with academic stress and burnout. Shelton and Valkyrie (18) argued that students who struggle with intense academic stress are more vulnerable to developing eating disorders accompanied by burnout. Kristanto et al. (19) reported that the severity of eating disorders among university students differed according to their burnout levels.

Two studies reported an association between emotional eating and chronotypes. One of these studies was conducted on university students (20), and the other on a Finnish population aged 25–74 (21). However, no studies have focused on the association between emotional eating and burnout among university students. Therefore, this study aimed to examine the association of chronotype and burnout with emotional eating in senior undergraduate students who are exposed to an intensive academic education curriculum.

## Methods

### *Subjects and ethics*

This descriptive and cross-sectional study was performed between April and July 2022 with senior undergraduate students studying at Karamanoğlu Mehmetbey University. The G-Power 3.1.9.7 software was used to determine the sample size. The sample size was determined based on a study on the effects of diet and sleep quality on chronotype in students (22). The effect size (0.217) was found by considering the mean and standard deviation of dietary energy levels of three different chronotypes. The sample size required 333 participants for 95% statistical power. Therefore, it was aimed to interview a maximum number of students by the end of the academic semester, with a sample size of not less than 333.

The aim of the study was explained to 942 senior students in personal interviews, 689 students signed a voluntary declaration of participation that complied with the the protocols of the Declaration of Helsinki (World Medical Association). Finally, 17 students were excluded due to missing data, and the data of 672 students were analyzed (Figure 1). Ethical approval (no.03–2022/22) was obtained from the Karamanoğlu Mehmetbey University Non-Interventional Clinical Research Ethics Committee.

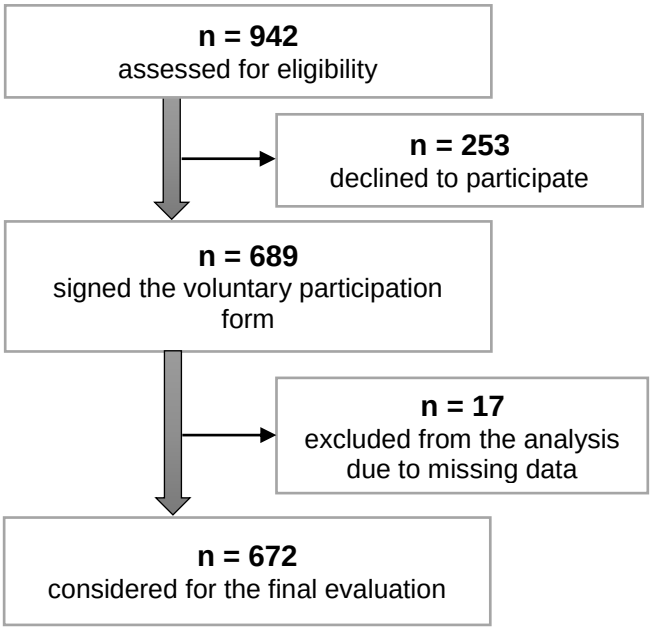


Figure 1: **Flow diagram of participants**

### *Anthropometric measurements and dietary assessment*

Anthropometric measurements were taken according to validated protocols. Body weight, height, and waist circumference were recorded. Height was measured in the Frankfort horizontal plane using a portable stadiometer (0.1 cm precision). The body weight of the subject wearing thin clothes and no shoes was measured using a calibrated electronic scale (0.1 kg precision). Body mass index (BMI) was calculated by dividing body weight by height squared (kilograms / meter$^2$) (23). Waist circumference (WC) was measured at the mid-axillary line between the top of the iliac crest and the lower margin of the last palpable rib.

Three-day food consumption records were used to determine dietary energy and nutrient intake. Portion sizes were confirmed using a Turkish photographic atlas of foods and meals (24). Daily average energy and nutrient intakes were analyzed using the BEBIS v. 8.0 food analysis software based on the national food composition database. Daily nutrient intake was evaluated by comparing it with the recommended dietary allowance (RDA), which was reported by the National Institutes of Health Office of Dietary Supplements (25).

### *Measures*

The Emotional Appetite Questionnaire (EMAQ), Morningness–Eveningness Questionnaire (MEQ), and Maslach Burnout Inventory-Student Survey (MBI-SS) were used to assess emotional appetite, chronotype, and burnout, respectively.

### *EMAQ*

The EMAQ was developed by Geliebter and Aversa (3), and its construct validity was established by Nolan et al. (26). The EMAQ consists of 22 items showing a tendency to eat according to emotions (14 items) and emotional situations (eight items). Each item is rated on a 9-point Likert scale, ranging from 1 to 9. A "5 points" rating indicates that there is no difference in eating behavior according to the emotion or emotional situation. Much less eating is indicated by 1–4 points, while much more eating is indicated by 6–9 points. The EMAQ provides four sub-scores: negative emotion (NE; nine items), negative situation (NS; five items), positive emotion (PE; five items), and positive situation (PS; three items). The sum of NE and NS scores is calculated as "negative total score," and the sum of PE and PS scores is calculated as "positive total score." Validity and reliability analyses of the EMAQ for the Turkish sample were conducted by Demirel et al. (27). The Cronbach's alpha reliability coefficients were 0.874 (negative emotion), 0.801 (negative situation), 0.897 (positive emotion), and 0.732 (positive situation).

### *MEQ*

The 19-item MEQ was developed by Horne and Östberg (28) to determine lifestyle regarding sleep-wake status. The scale evaluates individuals with scores between 16–86. The cut-off points were 42 and 59 points. Therefore, the scale classifies individuals into three circadian types: evening type (16–41 points), intermediate type (42–58 points), and morning type (59–86 points). Pündük et al. (29) have assessed the validity and reliability of the Turkish version of the scale. The scale has a Cronbach's alpha of 0.816.

### *MBI-SS*

The Maslach Burnout Inventory (MBI), designed to measure different dimensions of burnout syndrome, consists of 22 items (30). The 15-item MBI-SS was developed by Schaufeli et al. (31) to adapt the MBI to the student population and was validated by Yavuz and Doğan (32) to measure burnout in Turkish students. The MBI-SS, rated on a 7-point Likert scale ranging from 0 (never) to 6 (always), consists of three domains: emotional exhaustion (EE; five items), depersonalization (DP; four items), and personal accomplishment (PA; six items). Cronbach's alpha reliability coefficients were 0.908 (EE), 0.825 (DP), and 0.841 (PA).

### *Statistical analysis*

Statistical analyses were performed using the SPSS (v. 25.0) statistical package program. Data are presented as "n (%)" or "mean ± SD." Shapiro-Wilk and Levene's tests were used to evaluate normality and homogeneity, respectively. A one-way ANOVA test was used to examine EMAQ scores according to chronotype, and Bonferroni was used as a post hoc test to identify groups that differed from each other. Pearson correlation coefficients were considered when examining the relationships between the EMAQ scores and other variables. Finally, a multiple linear regression analysis was performed to predict EMAQ negative and positive total scores by BMI, waist circumference, dietary energy, dietary protein (RDA %), MBI-SS, and MEQ. The accepted limit for a type-I error was 0.05.

## Results

The mean age of participants was 22.6±1.06 years 71.0% of them were female (n=477), and 29.0% were male (n=195). Table 1 presents anthropometric measurements and dietary intakes. Body weight and waist circumference are indicated separately for men and women. Table 2 shows the EMAQ sub- and total scores, MEQ scores and chronotype distributions, and MBI-SS sub-scores of the participants.

Table 1: **Anthropometric measurements and dietary intakes of participants**

| | Mean±SD |
|---|---|
| **Anthropometric measurements** | |
| Weight (kg) | |
| Women | 58.5±9.8 |
| Men | 75.9±9.6 |
| BMI (kg/m$^2$) | 22.5±3.3 |
| Waist circumference (cm) | |
| Women | 71.1±8.9 |
| Men | 84.6±9.0 |
| **Dietary energy and protein intakes** | |
| Energy (kcal) | 1908.7±704.5 |
| Protein (g/kg) | 1.1±0.5 |
| **RDA ratio of nutrient intakes** | |
| Protein (RDA %) | 141.0±58.5 |
| Vitamin A (RDA %) | 128.6±112.7 |
| Vitamin D (RDA %) | 23.0±27.9 |
| Vitamin E (RDA %) | 80.8±54.1 |
| Total folate (RDA %) | 69.9±33.8 |
| Vitamin $B_{12}$ (RDA %) | 161.8±128.0 |
| Vitamin C (RDA %) | 102.4±78.0 |
| Calcium (RDA %) | 66.5±31.0 |
| Iron (RDA %) | 93.8±65.5 |
| Zinc (RDA %) | 121.4±64.6 |
| Dietary fiber (RDA %) | 74.9±35.5 |

BMI: Body mass index, RDA: Recommended dietary allowance

Table 2: **EMAQ sub- and total scores, MBI-SS sub-scores, MEQ score, and chronotype distributions of participants**

| | Mean±SD / n (%) |
|---|---|
| **EMAQ** | |
| Negative emotions (NE) | 32.3±13.3 |
| Negative situation (NS) | 14.9±6.8 |
| Positive emotions (PE) | 28.8±7.7 |
| Positive situation (PS) | 16.2±4.8 |
| Negative total score | 47.1±18.4 |
| Positive total score | 44.8±11.6 |
| **MEQ** | |
| MEQ score | 47.5±9.4 |
| Morning type | 78 (11.6%) |
| Intermediate type | 412 (61.3%) |
| Evening type | 182 (27.1%) |
| **MBI-SS** | |
| Emotional exhaustion (EE) | 17.8±8.8 |
| Depersonalization (DP) | 7.3±5.2 |
| Personal accomplishment (PA) | 16.1±6.4 |

EMAQ: Emotional Appetite Questionnaire; MEQ: Morningness-Eveningness Questionnaire; MBI-SS: Maslach Burnout Inventory- Student Survey

The EMAQ scores according to chronotype are shown in Figure 2. The NE and negative total scores of the morning-type participants were found to be significantly lower than those of the other two groups ($p<0.05$). There were significant differences between morning- and evening-type participants in terms of NS, PS, and positive total scores ($p<0.05$); morning-type participants had lower NS scores and higher PS and positive total scores. There was no significant difference in PE scores among the three chronotypes ($p>0.05$).

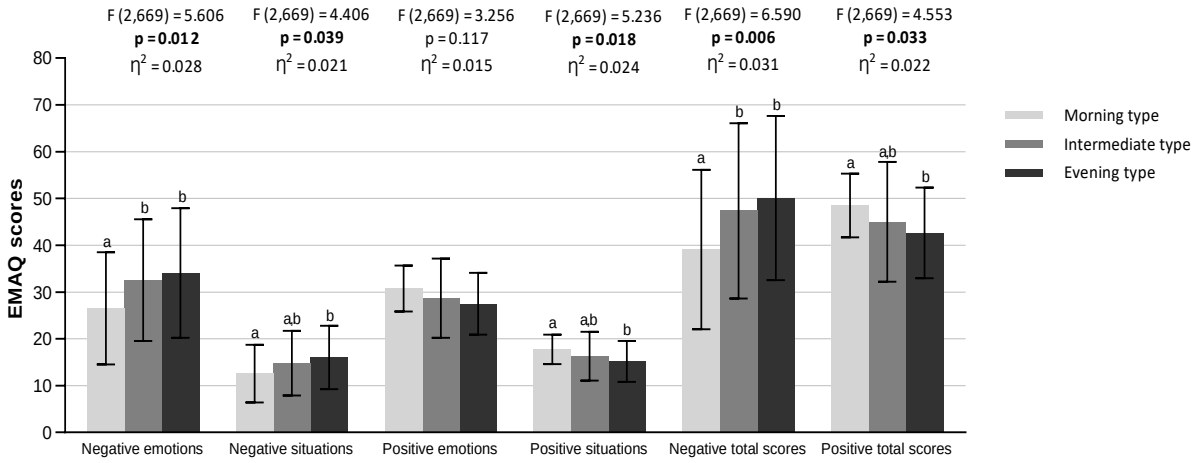


Figure 2: **The EMAQ scores according to chronotypes. [a,b]: Different letters for the same parameter indicate statistically significant differences between the groups (p<0.05; One-Way ANOVA test), $\eta^2$: eta squared**

Table 3 shows the correlation coefficients between EMAQ scores and other variables (BMI, waist circumference, dietary energy, dietary protein, MBI-SS, and MEQ score). BMI was positively correlated with NE, NS, and negative total scores and negatively correlated with PE, PS, and positive total scores (p<0.05). Waist circumference was also positively correlated with NE, NS, and negative total scores (p<0.05). Dietary energy and protein (g/kg) were positively correlated with NS scores (p<0.05). Dietary energy was also positively correlated with NE and negative total scores (p<0.05). The MEQ score was negatively correlated with the NS and negative total scores (p<0.05). The MBI-SS sub-scores EE and DP were positively correlated with NE, NS, and negative total scores and negatively correlated with the PS score (p<0.05). Additionally, EE was negatively correlated with PE and positive total scores (p<0.05). In contrast, positive correlations were found between PA and EMAQ positive scores (PE, PS, and positive total scores; p<0.05).

Table 3: **Correlation between EMAQ scores and other variables (BMI, waist circumference, dietary intakes (energy, protein, CHO, fat), MEQ, and MBI-SS scores)**

| | | EMAQ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Negative emotion (NE)** | | **Negative situation (NS)** | | **Positive emotion (PE)** | | **Positive situation (PS)** | | **Negative total score** | | **Positive total score** | |
| | | **r** | ***p*-value** | **r** | ***p*-value** | **r** | ***p*-value** | **r** | ***p*-value** | **r** | ***p*-value** | **r** | ***p*-value** |
| BMI | | 0.226 | **<0.001*** | 0.100 | **0.039*** | -0.130 | **0.006*** | -0.107 | **0.027*** | 0.197 | **<0.001*** | -0.133 | **0.006*** |
| Waist circumference | | 0.222 | **<0.001*** | 0.160 | **0.001*** | -0.051 | 0.284 | -0.033 | 0.498 | 0.219 | **<0.001*** | -0.056 | 0.249 |
| Dietary energy | | 0.106 | **0.037*** | 0.172 | **0.001*** | 0.058 | 0.247 | 0.034 | 0.507 | 0.150 | **0.003*** | 0.056 | 0.270 |
| Dietary protein | | 0.045 | 0.371 | 0.111 | **0.028*** | 0.078 | 0.119 | 0.083 | 0.104 | 0.077 | 0.126 | 0.089 | 0.081 |
| MEQ score | | -0.080 | 0.098 | -0.164 | **0.001*** | 0.065 | 0.183 | 0.090 | 0.071 | -0.135 | **0.005*** | 0.075 | 0.134 |
| MBI-SS | EE | 0.230 | **<0.001*** | 0.120 | **0.013*** | -0.168 | **0.001*** | -0.126 | **0.010*** | 0.219 | **<0.001*** | -0.169 | **0.001*** |
| | DP | 0.160 | **0.001*** | 0.117 | **0.017*** | -0.059 | 0.215 | -0.098 | **0.047*** | 0.167 | **0.001*** | -0.083 | 0.090 |
| | PA | -0.007 | 0.885 | -0.022 | 0.655 | 0.208 | **<0.001*** | 0.251 | **<0.001*** | -0.011 | 0.827 | 0.255 | **<0.001*** |

*p<0.05; EMAQ: Emotional Appetite Questionnaire; BMI: body mass index; CHO: Carbohydrate; MEQ: Morningness-Eveningness Questionnaire; MBI-SS: Maslach Burnout Inventory-Student Survey; EE: Emotional exhaustion, DP: Depersonalization; PA: Personal accomplishment

BMI, waist circumference, dietary energy, dietary protein (RDA %), MBI-SS sub-scores (EE, DP, and PA), MEQ-1, and MEQ-2 were selected as explanatory variables to predict EMAQ negative total scores using a multiple linear regression model (Table 4). Morning type was accepted as the reference to test whether chronotype is an explanatory variable for the EMAQ negative total score. Therefore, MEQ-1 represents the intermediate type, and MEQ-2 represents the evening type as the explanatory variable. All these nine variables explained 14.3% of the variation in the EMAQ negative total score ($F_{(9,662)} = 6.856$, p<0.05). The EE, DP, and MEQ-2 variables included in the model were significant predictors of the EMAQ negative total score (p<0.05). A one-point increase in EE and DP scores increased the EMAQ negative total score by 0.328 and 0.470 points, respectively. In addition, the evening type increased the EMAQ negative total score by 6.979 points compared with the morning type.

Table 4: **Multiple linear regression analysis of the variables that can affect EMAQ negative total score**

| EMAQ (Negative total score) | | *B* | SE | 95% CI for *B* | | β | t | *p*-value |
|---|---|---|---|---|---|---|---|---|
| | | | | Lower bound | Upper bound | | | |
| Constant | | 2.479 | 8.018 | -13.287 | 18.245 | | 0.309 | 0.757 |
| BMI | | 0.564 | 0.421 | -0.263 | 1.391 | 0.104 | 1.341 | 0.181 |
| Waist circumference | | 0.164 | 0.129 | -0.089 | 0.418 | 0.099 | 1.274 | 0.204 |
| Dietary energy | | 0.002 | 0.002 | -0.001 | 0.006 | 0.090 | 1.349 | 0.178 |
| Dietary protein (RDA %) | | 0.035 | 0.021 | -0.006 | 0.077 | 0.114 | 1.695 | 0.091 |
| | EE | 0.328 | 0.099 | 0.135 | 0.522 | 0.187 | 3.333 | **0.001*** |
| MBI-SS | DP | 0.470 | 0.229 | 0.020 | 0.921 | 0.113 | 2.052 | **0.041*** |
| | PA | -0.313 | 0.161 | -0.629 | 0.003 | -0.099 | -1.947 | 0.052 |
| MEQ-1 | | 5.202 | 2.933 | -0.566 | 10.969 | 0.139 | 1.773 | 0.077 |
| MEQ-2 | | 6.979 | 3.275 | 0.538 | 13.420 | 0.171 | 2.131 | **0.034*** |

$R^2$: 0.143
*p<0.05
SE: standard error; CI: confidence interval; EMAQ: Emotional Appetite Questionnaire; BMI: body mass index; MBI-SS: Maslach Burnout Inventory-Student Survey; EE: Emotional exhaustion, DP: Depersonalization; PA: Personal accomplishment; MEQ: Morningness-Eveningness Questionnaire
MEQ-1: 0 others, 1 intermediate type
MEQ-2: 0 others, 1 evening type

Multiple linear regression analysis also showed that the model including the same variables explained 16.7% of the variation in the EMAQ positive total score ($F_{(9,662)} = 8.340$, $p<0.05$; Table 5). Dietary energy, EE, DP, PA, and MEQ-2 were significant predictors of the EMAQ positive total score ($p<0.05$). A one-point increase in dietary energy and PA scores increased the EMAQ positive total score by 0.002 and 0.533 points, respectively. In contrast, a one-point increase in EE and DP scores decreased the EMAQ-positive total score by 0.313 and 0.349 points, respectively. Finally, the evening type decreased the EMAQ positive total score by 4.268 points compared to the morning type.

Table 5: **Multiple linear regression analysis of the variables that can affect EMAQ positive total score**

| EMAQ (Positive total score) | | *B* | SE | 95% CI for *B* | | β | t | *p*-value |
|---|---|---|---|---|---|---|---|---|
| | | | | Lower bound | Upper bound | | | |
| Constant | | 54.688 | 4.964 | 44.928 | 64.449 | | 11.017 | **<0.001*** |
| BMI | | -0.475 | 0.258 | -0.981 | 0.031 | -0.138 | -1.844 | 0.066 |
| Waist circumference | | 0.031 | 0.078 | -0.123 | 0.185 | 0.030 | 0.399 | 0.690 |
| Dietary energy | | 0.002 | 0.001 | 0.000 | 0.004 | 0.134 | 2.050 | **0.041*** |
| Dietary protein (RDA %) | | 0.002 | 0.013 | -0.024 | 0.027 | 0.008 | 0.124 | 0.901 |
| | EE | -0.313 | 0.061 | -0.433 | -0.193 | -0.282 | -5.130 | **<0.001*** |
| MBI-SS | DP | -0.349 | 0.142 | -0.628 | -0.070 | -0.132 | -2.456 | **0.014*** |
| | PA | 0.533 | 0.100 | 0.338 | 0.729 | 0.266 | 5.358 | **<0.001*** |
| MEQ-1 | | -2.148 | 1.850 | -5.786 | 1.490 | -0.091 | -1.161 | 0.246 |
| MEQ-2 | | -4.268 | 2.047 | -8.293 | -0.243 | -0.167 | -2.085 | **0.038*** |

$R^2$: 0.167
*p<0.05
SE: standard error; CI: confidence interval; EMAQ: Emotional Appetite Questionnaire; BMI: body mass index; MBI-SS: Maslach Burnout Inventory-Student Survey; EE: Emotional exhaustion, DP: Depersonalization; PA: Personal accomplishment; MEQ: Morningness-Eveningness Questionnaire
MEQ-1: 0 others, 1 intermediate type
MEQ-2: 0 others, 1 evening type

**Discussion**

The transition from home to university life has been found to be associated with changes in dietary behavior (33). Fast-food restaurants and accessible junk foods come first among the environmental stimuli that change students' dietary behavior. In addition, conforming to the diet of others in the context of socialization is a major factor affecting dietary behavior (34). Other factors affecting the dietary behavior of students are different stressors, such as academic examinations and anxieties. Stress is the primary trigger for emotional eating (2). Internal cues, such as stress and anxiety, have been shown to cause a greater urge to eat than external cues, such as exposure to highly palatable foods (35). Controlling environmental, social, and psychological factors is important in the development of healthy eating behaviors. Dietary lifestyle is a major factor that directly affects the quality of life at all ages (36-38).

In the present study, BMI, waist circumference, and dietary energy were positively correlated with EMAQ negative scores. This indicates a positive energy balance in emotional eaters. The association between emotional eating and BMI in undergraduate students has been highlighted in several previous studies. Lopez-Moreno et al. (39) reported a significant positive correlation between BMI and emotional eating scores in undergraduate students. Işık and Cengiz (4) also confirmed an association between BMI and emotional eating in undergraduate students. Aoun et al. (40) reported that obese university students (BMI>30 $kg/m^2$) were more commonly emotional eaters than other students. However, Lazarevich et al. (41) reported, from a different perspective, that emotional eating may act as a mediator between depression and BMI. Therefore, it is thought that depression screening in obese emotional eaters is important to determine the cause of emotional eating behavior.

The eveningness chronotype in the general population has been reported to be associated with eating disorders, uncontrolled eating, and reduced dietary restraint (11). The effect of chronotype on eating behavior and dietary intake is more pronounced in university students as chronobiology is another factor that is associated with academic stress. Sleep debt and eveningness chronotype are associated with perceived stress severity (42). Previous studies have indicated that the eveningness chronotype is associated with excessive consumption of sugary/caffeinated beverages and a higher dietary intake (energy, CHO, and fat) in university students (43-45). Eating addiction, night eating syndrome, skipping breakfast, and less dietary restriction were also found to be associated with the eveningness chronotype in university students (11, 20, 46, 47). In addition, Schubert and Randler (11) indicated that morningness is negatively associated with disinhibition and perceived hunger among university students. Although all of these reported findings point to chronotype as a potential factor affecting nutritional status in university students, to our knowledge only Budkevich et al. (20) mentioned the relationship between emotional eating and chronotype. They reported that emotional eating is negatively related to the morning chronotype in female university students. Consistent with the findings of this study, chronotype and emotional appetite were also found to be associated with the present study. The MEQ score was negatively associated with the EMAQ NS and negative total scores. Additionally, multiple linear regression analysis showed that the eveningness chronotype (MEQ-2) predicted a greater EMAQ negative total score and lower EMAQ positive total score when controlling for BMI, waist circumference, dietary energy, dietary protein, MBI-SS scores (EE, DP, and PA), and intermediate chronotype. These findings indicate that the eveningness chronotype may trigger emotional eating. Eveningness chronotypes can cause delays in mealtimes (48, 49). Late-chronotype students have a higher risk of skipping breakfast because of the early schedules of most schools. In this case, it would not be inconsistent to estimate that skipping meals was compensated by emotional eating behavior.

Academic burnout, which decreases motivation and negatively affects learning quality, is directly related to sadness and a loss of interest (16, 50). In the present study, emotional exhaustion (EE), which is a major dimension of burnout syndrome, was positively correlated with EMAQ negative scores and negatively correlated with EMAQ positive scores. In addition, multiple linear regression analysis results showed that EE and DP predicted greater EMAQ negative total scores and lower EMAQ positive total scores when controlling for other parameters in the models. These findings suggest that emotional appetite arises because of the inability to cope with academic stress factors that trigger academic burnout. As mentioned above, university students often face regrets of the past and anxieties of the future in the last academic year. During this period, students who struggle with exam stress experience intense unemployment anxiety (13, 51). To the best of our knowledge, no study has examined the association between burnout and emotional appetite in undergraduate students. Therefore, we believe that these findings will make an important contribution to the literature on the effect of academic burnout on eating disorders.

The present study has some limitations. Severe burnout is often accompanied by depression. Evaluation of depression in participants would enrich the present findings. However, it should be noted that the ethics committee that approved the study was cautious about the existing depression scales. The lack of data on food consumption frequencies, which accurately determines the consumption status of healthy/unhealthy foods, is another limitation. It would also be interesting to determine the levels of saturated fatty acids and alcohol consumption. Finally, comparative findings on the current parameters between freshmen and senior undergraduate students would undoubtedly make this study more remarkable.

## Conclusion

Considering the whole picture, the present results indicate the importance of information and awareness raising even counseling services about the late chronotype and burnout among senior undergraduate students. It might be a good strategy for the relevant institutions to develop some policies for studies to raise awareness of chronotype, burnout, and eating behavior in college students. Nevertheless, the fact that this was a cross-sectional study involving only 672 participants, should be considered in terms of causality. Repeating the research in a comprehensive longitudinal study with a large sample is important to confirm causality.

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