Araştırma Makalesi – Original Article

Determination of Salivary Cortisol Levels and Nutrition, Smoking and Physical Activity Status of University Students during the Exam Period*

Sınav Döneminde Üniversite Öğrencilerinin Tükürük Kortizol Düzeyleri İle Beslenme, Sigara İçme, Fiziksel Aktivite Durumlarının Belirlenmesi

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ABSTRACT

Objective: The aim of this study is to determine the salivary cortisol levels and nutrition, smoking and physical activity status of university students during the exam period.

Method: This study was conducted at Bayburt University Faculty of Health Sciences during the 2023-2024 final exam period. A questionnaire determined the demographic characteristics, dietary and physical activity behaviors, while anthropometric measurements were taken and nutritional status was evaluated. ELISA analyzed the cortisol hormone levels in saliva samples taken before and after the final exam.

Results: The study was conducted on 120 volunteer students between the ages of 18-25 who had no clinical health problems. In the study, a significant difference was found between the students' salivary cortisol levels before and after the exam ($p<0.05$). Cortisol levels were found to be lower in male students (n=60) than in female students (n=60) ($p<0.05$). Cortisol levels were found to be higher in smokers than in non-smokers ($p<0.05$) Exam anxiety was found to be higher in female students ($p<0.05$). No significant change was observed in terms of physical activity, nutritional behaviors or food preferences during the exam period ($p>0.05$).

Conclusion: One of the important stress factors for students is the exam period. It is important to examine the effects on nutrition, physical activity and smoking during this period. Cortisol levels are an important marker for such studies and are thought to contribute to the evaluation of the effectiveness of stress prevention strategies.

Keywords: Nutritional Behavior, Physical Activity, Smoking, Cortisol, Hormone

ÖZET

Amaç: Bu çalışmanın amacı, sınav döneminde üniversite öğrencilerinin tükürük kortizol düzeyleri ile beslenme, sigara ıçme fiziksel aktivite durumlarının belirlenmesidir.

Yöntem: Bu çalışma Bayburt Üniversitesi Sağlık Bilimleri Fakültesi'nde 2023-2024 final sınav döneminde yürütülmüştür. Bir anket ile katılımcıların demografik özellikleri, beslenme ve fiziksel aktivite davranışları belirlenirken, antropometrik ölçümler alınmış ve beslenme durumları değerlendirilmiştir. Final sınavından önce ve sonra alınan tükürük örneklerinde kortizol hormonu seviyeleri ELISA ile analiz edilmiştir.

Bulgular: Çalışma, klinik olarak herhangi bir sağlık problemi bulunmayan 18-25 yaş aralığındaki toplam 120 gönüllü öğrenci üzerinde yürütülmüştür. Çalışmada, öğrencilerin sınav öncesi ve sonrası tükürük kortizol düzeyleri arasında anlamlı bir fark bulunmuştur ($p<0.05$). Kortizol düzeyleri erkek öğrencilerde (n=60) kız öğrencilerden (n=60) daha düşük bulunmuştur ($p<0.05$). Sigara içenlerin kortizol düzeyleri içmeyenlere göre yüksek bulunmuştur ($p<0.05$). Sınav kaygısı kız öğrencilerde daha yüksek bulunmuştur ($p<0.05$). Sınav döneminde fiziksel aktivite, beslenme davranışları veya besin tercihleri açısından anlamlı bir değişiklik gözlenmemiştir ($p>0.05$).

Sonuç: Öğrencilerin için önemli stress etmenlerinden birisi olan sınav dönemidir. Bu dönemde beslenme, fiziksel aktivite ve sigara kullanımı üzerindeki etkilerinin incelenmesi önemlidir. Kortizol seviyeleri bu tür çalışmalar için önemli bir belirteçtir ve stres önleme stratejilerinin etkinliğinin değerlendirilmesine katkı sağlayacağı düşünülmektedir.

Anahtar Kelimeler: Beslenme Davranışı, Fiziksel Aktivite, Sigara Kullanımı, Kortizol, Hormon

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Introduction

Cigarette addiction is one of the preventable causes of death and one of the substance addictions whose prevalence is gradually increasing all over the world. Cigarette is an easily obtained, legal object that is addictive due to the psychotropic substance in tobacco content and nicotine, a strong alkaloid.[1] Cigarettes and cigarette smoke contain more than 4,000 highly toxic chemicals such as nicotine, tar, carbon monoxide, ammonia, arsenic, hydrogen cyanide, formaldehyde and methane.[2] Due to the excess of carcinogens in cigarettes, smoking is reported to be associated with many types of cancers such as lung cancer, mouth, pharynx, esophagus, larynx, pancreas, bladder by stimulating oxidative and inflammatory responses by changing gene expression of respiratory organs and structures due to its strong effect on the transcriptome.[3-5] Due to the negative health effects of smoking, it is important to determine the prevalence of smoking, which is a global threat to public health, and continuous efforts to reduce the prevalence and toxicity of smoking. In this context, the World Health Organization (WHO) Framework Convention on Tobacco Control, which was adopted in 2003 and to which 182 countries and the European Union are parties, is the first global health agreement. In the global report on the prevalence of tobacco use between 2000 and 2030, it is reported that the rates of tobacco smoking among people aged 15 years and older in Turkey in 2022 will be 41.2% for males and 19.6% for females. It is reported that between 12.9% and 45.4% of university students in Turkey smoke.[6]

Youth is a critical period in an individual's life cycle, marked by rapid physiological and psychological changes, environmental factors that shape identity development, and risky behaviors. During this period of significant transitions, including university youth, being away from family for the first time and exposure to a new environment, individuals often tending towards in negative behaviors.[7] Risky habits often include smoking behavior, which poses a threat to health. Smoking is the most common type of substance addiction due to its widespread use, health risks, ease of access, and legal status.[8] Although it is reported by smokers that smoking alleviates feelings of stress and helps mood control, studies have reported that stress levels are higher with cigarette consumption compared to non-smokers, and stress levels decrease with cessation of cigarette consumption.

Smoking increases the production of reactive oxygen species (ROS) that impair the antioxidant defense system.[9] Hormones have a significant impact on human behavior and cognitive functions.[10] Cortisol, known as the stress hormone, is a corticosteroid hormone produced in the adrenal gland shell region and is associated with the body's response to stress.[11,12] Persistently high levels of the cortisol hormone are associated with various mental disorders such as anxiety, depression, and post-traumatic stress disorder.[13] Serum cortisol concentration and smoking have a positive correlation with stress.[14,15] Examination is a method used to measure a person's knowledge or experience about a certain subject. University students often experience exam anxiety as a significant stress factor. Exam anxiety causes students to forget what they know at the time of the exam, not use their knowledge effectively, and fail.[16] During the exam period, students' eating, and physical exercise habits may change.[17] During this period, it is reported that students decrease and increase depending on their physical activity status and increase their consumption of saturated fat, salt, and high-calorie sugary foods as a result of their food orientation.[18,19]

Numerous factors contribute to smoking, including stress, a friendlier environment, feelings of curiosity and envy, and psychological and economic issues.[6,20-23] Individuals with proper eating habits and physical activity are expected to decrease the rate of cigarette addiction. These individuals tend to consume cigarettes in the face of stress. This study aims to investigate how the exam period affects physical activity, nutritional status, and cortisol hormone levels in both smoking and non-smoking university students.

Method

Types of Research

The research was carried out using a descriptive and cross-sectional research model.

Research Population and Sample

The study randomly included 120 clinically healthy 18–25-year-old male and female smokers (n = 30) and non-smokers (n = 30) studying at Bayburt University Faculty of Health Sciences. The study excluded university students who had cardiovascular disease, chronic disease, or were taking medication for any reason. A general information form prepared to obtain demographic data such as age, anthropometric measurements, educational status, place of residence, smoking status, and a form consisting of nine questions to examine physical activity, nutrition behaviors, and food orientations during the exam period were applied to the volunteer participants.

The sample size was determined using G*Power 3.1 software in this investigation. The "One-way ANOVA" analysis yielded the following results: an effect size (f) of 0.40, a power (1-β) of 0.95, and an alpha error rate (α) of 0.05. According to these criteria, it is essential to collaborate with a total of 4 distinct groups, each consisting of 30 students. Hence, the overall sample size was determined to be 120 students. The sample size calculation was meant to be adequate for the other planned analyses to be utilized in the study. By following this approach, the study's results will be guaranteed to be reliable and legitimate. The calculated sample size is adequate for testing the study hypotheses and conducting statistical analyses.

The collection of research data

The data were collected by face-to-face interviews with the participants using the "Personal Information Form." Anthropometric measurements such as body weight and height were taken from the students, and BMI was calculated.

Personal Information Form: The form included demographic characteristics of the students, such as age, gender, educational status, class, smoking status, and questions to determine their nutrition and physical activity behaviors, as well as food preferences during the exam period.

Anthropometric Measurements: Body weight (kg) and height (cm) measurements were taken by the researchers as anthropometric measurements. A portable Tanita BC 731 Digital Weighing Device was used for weight measurement, and a height meter was used for height measurement. Body Mass Index (BMI), a parameter frequently used to determine nutritional status, was calculated by dividing body weight by the square meter of height [body weight (kg)/height^2(m)]. The results were evaluated according to the World Health Organization's (WHO) classification.

Collection of Saliva Samples: The study instructed the students not to consume anything for 1 hour before saliva collection and not to smoke for at least half an hour before the exam. Saliva samples were collected in Salivette tubes (Sarstedt, Germany) by the passive drooling method (5 cc) at 08:00–09:00 in the morning. Saliva samples were centrifuged in a refrigerated centrifuge (NF 1200R, NÜVE, Ankara, Turkey) at 1500 g for 15 minutes and stored at -80 °C until analyses for cortisol hormone levels were performed.

Measurement of salivary cortisol hormone levels: The study utilized the Human Cortisol ELISA Kit (BT LAB, Cat.No E 1 003Hu, China) to quantify the amounts of cortisol hormone in saliva samples. The ELISA kit was used to determine concentrations ranging from 31.25 to 2000 pg/mL. The intra-assay coefficients were 8.0% and the inter-assay coefficients were 10.0%. The protocol followed was as indicated in the manufacturer's catalog.

Ethical Approval: Ethics committee approval (16.12.2022/Decision No. 332/13) and institutional permission were obtained before the study. Participants were informed about the study in line with the Declaration of Helsinki, and their consent was obtained for the Informed Consent Form. The study included voluntary participants. Every stage of the study adhered to research and publication ethics.

Statistical analysis: Data were evaluated using the Statistical Package for the Social Sciences (SPSS) 27.0 for Windows (SPSS, Chicago, IL, USA). Number, percentage, mean ($\bar{X}$), and standard deviation (SD) for continuous variables were used for descriptive statistics . The chi -square, T-test, and paired sample test were used in the evaluation of the data . Number, percentage, mean ($\bar{X}$), and standard deviation (SD) for continuous variables were used for descriptive statistics. A chi-square, T-test, and paired sample test were used to evaluate the data. A one-way ANOVA test was used to compare students' BMI classification, physical activity change status during the exam period, and salivary cortisol values before and after the exam. The statistical significance levels were $p<0.001$ and $p<0.05$.

Limitations of the Study

Experts in the field prepared this study, but they used measurement tools that could potentially lead to biased evaluations. The exam period prevents generalizing the results of this descriptive, cross-sectional study using a convenience sampling method. Despite these limitations, the study also has strengths. This study is valuable in terms of examining the effect of the exam period on the nutritional and physical activity status, as well as salivary cortisol hormone levels, of smoking and non-smoking university students.

Results

Table 1 presents the demographic characteristics of the participants, which include anthropometric measurements such as weight and height, BMI categories, education level, place of living, and daily smoking status.

Table 1. Demographic information of the participants

	Male		Female		Total	
Variables	**n**	**%**	**n**	**%**	**n**	**%**
Age (x±S)	22,05±3,929		21,03±2,299		21,54±3,246	
Height (x±S) (cm)	178,8±5,128		163,95±5,95		171,38±9,284	
Weight (x±S) (kg)	74,67±12,193		57,6±8,903		66,13±13,654	
BMI (x±S)	23,3±3,306		21,39±2,863		22,35±3,227	
Underweight	2	3,3	11	18,3	13	10,8
Normal	45	75,0	44	73,3	89	74,2
Overweight	11	18,3	5	8,3	16	13,3
Obese	2	3,3	0	0,0	2	1,7
Education status						
Formal education	48	80	46	76,7	94	78,3
Second teaching	12	20	14	23,3	26	21,7
Classroom						
Grade 1	29	48,3	35	58,3	64	53,3
Grade 2	15	25,0	5	8,3	20	16,7
Grade 3	9	15,0	16	26,7	25	20,8
Grade 4	7	11,7	4	6,7	11	9,2
Place of residence						
Home alone	4	6,7	4	6,7	8	6,7
At home with family	31	51,7	37	61,7	68	56,7
Dormitory	25	41,7	19	31,7	44	36,7
Daily cigarette consumption (x±S)	7,92±9,848		7,32±9,78		7,62±9,778	

BMI: Bady Mass Index

The average age of the participants was 21.54 ± 3.246 years. The average weight and height of the subjects were 66.13±13.654 kg and 171.38±9.284 cm, respectively. The average BMI, used to assess nutritional status, was calculated to be 23.3±3.306 for male students and 21.39±2.863 for female students. The

majority of males (75%) and girls (73.3%) were classified as having a normal weight based on their BMI. The analysis of the students' educational status indicated that 78.3% were enrolled in formal education, while 21.7% were attending secondary education. The study found that 53.3% of the participants were in their first year, 16.7% were in their second year, 20.8% were in their third year, and 9.2% were in their fourth year. Out of the participants, 6.7% resided alone in their own homes, 56.7% resided in their homes with their families, and 36.6% resided in dormitories. The mean daily cigarette consumption of male and female students was 7.92±9.848 and 7.32±9.78, respectively (***Table 1***).

Table 2. Dietary behaviours and attitudes and salivary cortisol levels of the participants before and after the exam according to gender

	Male		Female		Total		p value
Variables	**n**	**%**	**n**	**%**	**n**	**%**	
Thinking about an exam makes me anxious							
Yes	38	63,3	54	90,0	92	76,7	**,002****
No	11	18,3	4	6,7	15	12,5	
Undecided	11	18,3	2	3,3	13	10,8	
I tend to eat more sugary foods during the exam period							
Yes	25	41,7	36	60,0	61	50,8	,132
No	20	33,3	14	23,3	34	28,3	
Undecided	15	25,0	10	16,7	25	20,8	
I tend to eat salty foods more during the exam period							
Yes	12	20,0	20	33,3	32	26,7	,251
No	29	48,3	25	41,7	54	45,0	
Undecided	19	31,7	15	25,0	34	28,3	
I tend to eat more fatty foods during the exam period							
Yes	17	28,3	25	41,7	42	35,0	,159
No	28	46,7	27	45,0	55	45,8	
Undecided	15	25,0	8	13,3	23	19,2	
I consume more fast food during the exam period							
Yes	24	40,0	26	43,3	50	41,7	,860
No	26	43,3	26	43,3	52	43,3	
Undecided	10	16,7	8	13,3	18	15,0	
I constantly feel the need to eat something during the exam period							
Yes	23	38,3	26	43,3	49	40,8	,720
No	26	43,3	26	43,3	52	43,3	
Undecided	11	18,3	8	13,3	19	15,8	
I gain above my normal weight during the exam period							
Yes	17	28,3	15	25,0	32	26,7	,789
No	31	51,7	30	50,0	61	50,8	
Undecided	12	20,0	15	25,0	27	22,5	
If I had a bad exam, I turn to sugary foods even though I am full							
Yes	23	38,3	25	41,7	48	40,0	,918
No	24	40,0	22	36,7	46	38,3	
Undecided	13	21,7	13	21,7	26	21,7	
I can easily return to my normal diet after the exam period							
Yes	24	40,0	26	43,3	50	41,7	,507
No	22	36,7	25	41,7	47	39,2	
Undecided	14	23,3	9	15,0	23	19,2	
Salivary cortisol levels							
Before the exam (x±S)	4,21±1,359		5,18±1,066		4,69±1,309		**0,000****
After the exam (x±S)	2,75±0,717		3,82±0,963		3,29±1,000		
Total	60	50,0	60	50,0	120	100	

Chi-square test was used to analyse the data according to gender. *p<0.05 **p>0.01

Table 2 presents the dietary behaviors, attitudes, and salivary cortisol levels of the participants before and after the exam, categorized by gender. Regarding the participants' exam anxiety, the majority of males and females (63.3% and 90.0%, respectively) reported that the thought of taking an exam made them anxious. It was discovered that female students' exam anxiety was higher than that of male students, and this difference between the students' anxiety about the thought of taking the exam according to gender was statistically significant (p<0.05). During the exam period, the participants' tendencies towards sugary, salty, and fatty foods differed from normal times, with half (50.8%) showing a greater tendency towards sugary foods, 26.7% towards salty foods, and 35.0% towards fatty foods. In males and females, the rates of tendency towards sugary foods during the exam period were 41.7% and 60.0%, respectively; the rates of tendency towards salty foods were 20.0% and 33.3%, respectively; and the rates of tendency towards fatty foods were 28.3% and 41.7%, respectively. These differences in the rates of participants' tendency towards sugary, salty, and fatty foods compared to normal times during the exam period according to gender were not statistically significant (p > 0.05) (***Table 2***).

Analysis of the participants' changes in nutritional status during the exam period revealed that 41.7% consumed more fast food, while 43.3% did not. After evaluating the students who reported consuming more fast food during the exam period based on their gender, we found no statistically significant differences between the rates (p > 0.05). 40.8% of the students stated that they felt the need to eat something constantly during the exam period, 43.3% stated that they did not, and 15.8% stated that they were undecided. While 26.7% of the students stated that they gained more than their normal weight during the exam period, half of them (50.8%) stated that they did not gain weight, and 22.5% were undecided. The differences between the groups were not found to be statistically significant (p > 0.05) when the situations of feeling the need to eat something continuously during the exam period and exceeding the normal weight of the students during the exam period were evaluated according to gender. In the questions asked to examine the nutritional behaviors of the students after the exam, 40.0% of the participants stated that they turned to sugary foods even though they felt full due to the bad exam, while 38.3% stated that they did not. It was found that 41.7% of the students could easily return to their normal eating pattern after the end of the exam period, while 39.2% could not complete this process easily. The differences between the groups were not found to be statistically significant (p > 0.05) when the students' tendency towards sugary foods despite feeling full due to a bad exam and their ability to easily return to normal eating patterns after the end of the exam period were evaluated according to gender. When the salivary cortisol levels of the students were analyzed, the mean pre-test salivary cortisol levels of males and females were 4.21±1.359 and 5.18±1.066, respectively, and the mean post-test salivary cortisol levels were 2.75±0.717 and 3.82±0.963, respectively. It was found that salivary cortisol levels before and after the exam were higher in females than in males, and this difference between the averages was statistically significant (p<0.05) (***Table 2***).

The results of the comparison of the mean salivary cortisol difference before and after the exam according to smoking status and cortisol values of the participants are presented in the table below (***Table 3***).

Table 3. Comparison of salivary cortisol levels of the participants before and after the exam

Variables	Groups	N	X	ss	t test		
					t	*sd*	*p*
Smoking Status	Yes	60	-1,62	0,999	-2,413	116,253	0,017*
	No	60	-1,20	0,883			
Cortisol (ng/ml)	Before	120	4,7	1,31	16,078	119	0,001**
	After	120	3,29	1			

*p<0.05 **p<0.01

When Table 3 is examined, the mean differences in salivary cortisol levels before and after the exam according to the smoking status variable of the participants were -1.62 and -1.20, respectively. According to the results of the independent sample t-test, a statistical difference was found between these two groups ($p<0.05$). This confirms the statistically significant difference in salivary cortisol levels between smokers and non-smokers before and after the exam. This difference was in favor of smokers, and salivary cortisol levels of smokers were found to be higher than those of non-smokers. According to the participant salivary cortisol values, the mean differences in salivary cortisol levels before and after the exam were 4.7 and 3.29, respectively. According to the results of the dependent sample t-test, a statistical difference was found between these 2 groups ($p<0.01$). This confirms that there was a statistically significant difference in the mean difference between the salivary cortisol values of the participants before and after the exam ($t = 16,078$, $p = 0.001$) (***Table 3***).

The table, including the comparison of the mean difference of salivary cortisol before and after the examination of participants' BMI and physical activity classification, is given below (*Table 4*).

Table 4. Comparison of the mean difference of salivary cortisol before and after the examination of participants' BMI and physical activity classification

	n	X	Ss	Source of Variance	KT	sd	KO	F	p	Significance
BMI										
Underweight	13	-1,52	,914	G. Between	,740	3	,247			
Normal	89	-1,37	,989	G. Inside	109,384	116	,943			
Overweight	16	-1,57	,881	Total	110,124	119		.2615	.853	-
Obese	2	-1,49	1,301							
Total	120	-1,41	,962							
Physical Activity										
Increased	91	-1,42	0,985	G. Between	0,502	2	0,251			
Decreased	14	-1,25	0,809	G. Inside	109,622	117	0,937	0,27	0,77	-
No change	15	-1,50	0,992	Total	110,124	119				
Total	120	-1,41	0,962							

BMI: Bady Mass Index

Upon examining Table 4, the ANOVA test results show no statistically significant difference in the mean differences of salivary cortisol values before and after the exam, based on the participants' BMI classification ($p > 0.05$). The ANOVA test results revealed no statistically significant difference between the participants' mean salivary cortisol values before and after the exam and their physical activity status ($p > 0.05$) (***Table 4***).

Discussion

Stress causes mental and physiological processes in the organism. While mild stress can be beneficial for cognitive tasks and performance, sustained high levels of stress can lead to neuropsychiatric disorders such as anxiety and depression. Exams serve as a tool to assess an individual's knowledge or expertise in a specific subject. Although taking exams is an indicator of academic success during the student process at university, it can cause psychological stress for students. In this respect, exams activate the hypothalamus-pituitary-adrenal axis as a stressor factor and cause an increase in cortisol hormone level, also known as stress hormone. University students encounter numerous challenging conditions throughout their academic journey. During exam periods, students experience emotional distress due to an increase in stress hormones such as cortisol and adrenocorticotropic hormone, which also leads to an increase in their anxiety levels.[20] Exam anxiety is one of the main emotional stress factors contributing to increased smoking

among university students. Exam anxiety is a state of intense anxiety that prevents the effective use of previously learned information during the exam, resulting in a decrease in success. Smoking is an important public health problem that can lead to many chronic health problems, especially cancer, lung, and cardiovascular diseases, as well as being a lifelong harmful habit. The present study analyzed the relationships between smoking status before and after the exam and mean salivary cortisol hormone levels (Table 3). According to the obtained data, it was determined that the mean salivary cortisol difference between smoking and non-smoking students before and after the exam was statistically significantly different from each other ($p<0.05$). Salivary cortisol hormone levels in male and female smokers among the university students who participated in our study's exam period increased significantly compared to non-smoking groups ($p<0.05$, *Table 2*). As a result of the study, it is consistent with the results of the research reporting that salivary cortisol hormone levels increase in individuals due to exam stress.[21–24]

Gender is one of the physiological factors underlying the differences in the types and levels of stress experienced by individuals. Research indicates that female students tend to display irregular eating habits more frequently during exam periods, and a study involving both male and female students revealed a rise in food cravings and an increase in eating behavior symptoms.[25] Although this study yielded similar results to those in the literature, it did not find the changes in students' eating behaviors during the exam period to be statistically significant (*Table 2*). Similarly, in our study, when the exam anxiety of the participants was analyzed, it was found that the exam anxiety of female students (90%) was higher than that of male students (63.3%), and this difference between the anxiety of the students about the thought of having an exam according to gender was found to be statistically significant ($p<0.05$, *Table 2*).

The study's findings align with previous research indicating an increase in salivary cortisol hormone levels in female individuals during exam stress; however, they diverge from findings indicating a higher level of salivary cortisol hormone in men compared to women. [26-28] Hormones, a gender-specific factor, contribute significantly to the complex neuroendocrine response to stress, with women primarily releasing hormones from their ovaries.[29] As a justification for our current results, we think that women are exposed to more stress-inducing factors than men due to their physical (pregnancy, childbirth, child rearing, etc.) and mental burden (daily housework) during their lives, as well as the reasons stated in the literature, as well as the difference due to physiological structure such as gender-related endocrine system and hormonal differences.[30]

Nutrition is the biochemical and physiological process by which an organism uses food to support its life. One of the important factors affecting individuals' eating habits is stress.[31] Stress can lead to negative changes in nutritional behaviors, such as a preference for foods high in sugar and fat, which may not align with an individual's normal food preferences. Additionally, stress can cause changes in appetite, either increasing or decreasing. Exam stress can lead students to adopt unhealthy eating habits, leading to health issues like obesity.[32] Our current study determined that the exam period had no effect on the change in BMI values among smoking and non-smoking university students ($p> 0.05$). Although our study results show limitations, there is no research examining the effect of the exam period on the change in BMI values in smoking and non-smoking university students. However, while it is consistent with the results of research reporting that BMI has no effect on stress during the exam period, it differs from some research results showing that stress has a decreasing effect on BMI and increasing.[32,33-36] As a justification for this situation, we foresee that our study is due to the differences in the material method of the research reported in the literature.

Physical activity is any kind of movement or exercise that causes the body to expend energy for a healthy life. Long-term and intense stress is an important factor in the etiology of behavioral disorders such as

anxiety and depression. It is also an important tool in reducing the stress experienced by individuals as well as their healthy development.[37] According to our current study's results, there was no significant change in the physical activity status of smoking and non-smoking university students during the exam period ($p > 0.05$). While our current results align with research findings that suggest physical activity has no impact on stress during the exam period, they diverge from other findings that suggest physical activity can reduce stress. While our current results align with research findings that suggest physical activity has no impact on stress during the exam period, they diverge from other findings that suggest physical activity can reduce stress, they diverge from other findings that suggest physical activity can reduce stress.[38,39] As a justification for this situation, we foresee that it is due to the reasoning in the literature that university students are sedentary and do not engage in physical activity.[40–44]

To maintain the individual's state of health, multifaceted interventions such as gaining the right nutrition and physical activity habits, managing stress, and avoiding harmful habits are necessary. On the other hand, it could be beneficial to arrange trainings for university students to educate them on the benefits of physical activity in reducing stress, as well as nutrition trainings to help them manage any changes in their nutritional habits during the exam period. While our current findings indicate the impact of the exam period on physical activity, nutritional status, and salivary cortisol hormone levels among both smoking and non-smoking university students, longer-term, comprehensive studies are necessary to assess these effects. As a result, it is thought that examining the levels of the cortisol hormone, which is known as the stress hormone, will contribute to the strategies for preventing the negative effects of stress by determining the factors that trigger stress and the research to be carried out in this field.

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Ethical Approval

Bayburt University Ethics Committee approval (16.12.2022/Decision No. 332/13) and institutional permission were obtained before the study.

Author Contributions

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