

# A Preliminary Cross-Sectional Study: Does Music Listening Have a Negative Impact on Eating Behavior?

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## Abstract

**Objective:** Cortical auditory and gustatory centers are considered to interact with each other. Studies have shown that music affects eating behavior. The present study aimed to investigate the effect of the time spent on engaging with music on eating behavior.

**Material and Method:** This is a randomized cross-sectional study. It included 40 volunteering undergraduates enrolled in the Department of Music, Fine Arts Faculty, Yuzuncu Yil University, Van, Turkey. All participants were administered a questionnaire to assess the time spent engaging with music, the Eating Attitudes Test (EAT-40), and the State-Trait Anxiety Inventory (STAI). The body mass index (BMI) was calculated for each participant.

**Results:** Eating behavior disorder (EBD) was detected in 11 (27.5%) participants. The EAT-40 scores established a positive correlation with the total time spent on music per week (Total-T) ( $r=0.413$ ,  $p<0.01$ ). The mean Total-T score was significantly higher in participants with EBD compared to those without EBD ( $16.45\pm15.896$  vs.  $6.24\pm6.418$  h/week) ( $p=0.006$ ). Furthermore, the mean score for the time spent playing a musical instrument per week (Inst-T) was significantly higher in participants with EBD compared to those without EBD ( $5.00\pm5.254$  vs.  $2.72\pm1.412$  h/week) ( $p=0.036$ ).

**Conclusion:** According to the data from this study, the time spent engaging with music increases eating behavior negatively.

**Keywords:** Eating behavior, Eating behavior disorder, Music, Musical instrument

## Özet

**Amaç:** Kortikal işitsel ve tatsal merkezlerin birbirleriyle etkileşim içinde olduğu düşünülmektedir. Yapılan çalışmalar müziğin yeme davranışı üzerinde etkili olduğunu göstermiştir. Bu çalışmanın amacı, müzikle geçirilen zamanın yeme davranışı üzerindeki etkisini araştırmaktır.

**Gereç ve Yöntem:** Çalışma, randomize kesitsel özelliklere sahiptir. Çalışmaya Van Yüzüncü Yıl Üniversitesi, Güzel Sanatlar Fakültesi, Müzik Bölümünde öğrenim gören 40 gönüllü lisans öğrencisi katılmıştır. Tüm katılımcılara bir anket (müzikle uğraşma süresini değerlendirmek için), Yeme Tutumları Testi (EAT-40) ve Durumluk-Sürekli Kaygı Envanteri (STAI) uygulanmıştır. Her katılımcı için beden kitle indeksi (BKİ) hesaplanmıştır.

**Bulgular:** Katılımcıların 11'inde (%27,5) yeme davranışı bozukluğu (YDB) tespit edilmiştir. EAT-40 puanları, haftalık müzik için harcanan toplam süre (Toplam-T) ile pozitif bir korelasyon göstermiştir ( $r= 0,413$ ,  $p<0,01$ ). Ortalama Toplam-T puanı, YDB olan katılımcılarda YDB olmayanlara kıyasla anlamlı derecede yüksek bulunmuştur ( $16,45\pm15,896$ 'ya  $6,24\pm6,418$  saat/hafta) ( $p=0,006$ ). Ayrıca, ortalama haftalık enstrüman çalma süresi (Inst-T) puanı YDB olan katılımcılarda YDB olmayanlara kıyasla anlamlı derecede yüksek bulunmuştur ( $5,00\pm5,254$ 'e  $2,72\pm1,412$  saat/hafta) ( $p=0,036$ ).

**Sonuç:** Bu çalışma verilerine göre, müzikle uğraşarak geçirilen zaman yemek yeme davranışını olumsuz yönde etkilemektedir.

**Anahtar Sözcükler:** Müzik, Müzikal enstrüman, Yeme davranışı, Yeme davranış bozukluğu

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## Introduction

Eating behavior and music engagement are organized by cortical brain centers. Eating behavior is controlled by the gustatory center and music engagement is controlled by the auditory center. Cortical auditory and gustatory centers are considered to interact with each other. Additionally, the emotion arising from a sensorial perception (e.g., music) is likely to affect the process of another sensorial perception (e.g., gustatory) (1). Listening to liked music stimulates positive emotions, while listening to disliked music suppresses striatal pathways to reward. The gustatory sensation of an individual changes when listening to liked or disliked music. In addition, individuals experience a sweet taste and positive emotions when listening to music they like or neutral music, whereas they experience a bitter taste and negative emotions when listening to music they do not like (2).

In previous studies, the effect of music on eating behavior was evaluated with background music. Eating material and background music were the main elements of the studies. The specified times included a single eating period. In addition, the researchers determined the type and other characteristics of the music used in these studies, which focused on the effect of background music on eating behavior (3).

Eating behavior and gustatory processes are known to induce emotional changes. One of the negative emotions that affect eating behavior is anxiety. There are studies on the coexistence of anxiety disorders in patients with eating disorders. Patients with anorexia nervosa (AN) are more prone to anxiety disorders and have higher anxiety levels than the general population (4). Additionally, patients with AN have relatively higher premeal anxiety levels (5). The neurobiological effects of restricted eating modulate anxiety levels in patients with AN. Bulimia nervosa (BN) is another common eating disorder commonly accompanied by anxiety (6). Furthermore, numerous studies have suggested a relationship between BN and anxiety sensitivity (4).

The present study aimed to investigate the effect of weekly time spent on music on eating behavior. We also evaluated the effect of anxiety level on this bilateral relationship (eating behavior/engaging with music) due to the significant coexistence of eating disorders and anxiety disorders. The differences between our study and other studies include the evaluation of the level of anxiety and the effect of long-term engaging with music (not only listening to music but also playing instruments) on eating behavior.

In our study, music students were selected as the participant group because their music engagement continued in a stable order and long hours. In addition, we allowed the participants to choose the type of music, such as music therapy practices. In this way, cross-sectional data of individuals were obtained objectively without interference.

In this study, we aimed to investigate the effect of engaging with music on eating behavior. Our hypothesis is that listening to music increases abnormal eating behavior in the long term. In addition, we assumed that playing music before the study might have a similar effect on eating behavior as listening to music. It is important to prove the effect of engaging with music time on eating behavior. The time spent on music can be adjusted by individuals easily. Additionally, the person can change the time spent on music (increasing or decreasing

as needed). Therefore, the results of our study can guide the methods in eating behavior disorders.

## Material and Method

Approval was obtained from the local ethics committee for this study on December 27, 2019 under the ethical decision number of 2019/18-03. The study was designed as a randomized cross-sectional study. It included 40 undergraduates aged 18-30 years who were enrolled in Yuzuncu Yil University Fine Arts Faculty Music Department. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

While determining exclusion and inclusion criteria, the participants' mental state, hearing problems, presence of illness, and/or drug use that indirectly affect appetite and eating behavior were taken into consideration. The inclusion criteria were as follows: being a student at Yuzuncu Yil University Fine Arts Faculty Music Department, volunteering to participate in the study and being over the age of 18. Exclusion criteria were: presence of active psychotic disorder, presence of disease related to the endocrine system (diabetes, Cushing syndrome, etc.), neurological disease (epilepsy, etc.) that could not be controlled by treatment, hearing loss, presence of psychotropic use, presence of any drug use affecting eating behavior (such as steroid hormone replacement).

Both verbal and written informed consent were obtained from all 40 participants who met the inclusion criteria. All participants were administered a questionnaire (formed by the researchers), the Eating Attitudes Test (EAT), and the State-Trait Anxiety Inventory (STAI).

### Questionnaire

The questionnaire collected information on the participants' sociodemographic features, body mass index (BMI), total time spent listening to music per week (List-T), total time spent playing a musical instrument per week (Inst-T) and the total time spent on music per week (Total-T).

### The Eating Attitudes Test (EAT-40)

The Eating Attitudes Test (EAT-40), developed by Garner et al. (7), is a self-rated scale assessing disordered eating behaviors such as AN and BN. The reliability and validity study of the Turkish version of the EAT-40 was conducted by Savasir et al. (8). The test consists of 40 items consisting of a 6-point Likert rating scale (from "1=never" to "6=always"). In this test, the cutoff score was set as 30 points. Elal et al. (9) devised four factors for the EAT factor structure, including "dieting", "bulimia and food preoccupation", "oral control", and "ambivalence about food".

### State-Trait Anxiety Inventory (STAI)

The State-Trait Anxiety Inventory (STAI), developed by Spielberger et al. (10), is a psychological inventory consisting of 40 items divided into two subscales with 20 items each. The State Anxiety (STAI-S) subscale is used to assess the severity of situational anxiety at a particular moment in time or under certain conditions. The trait anxiety (STAI-T) subscale is used to determine the severity of constant trait anxiety. The reliability and validity study of the Turkish version of the STAI was conducted by Oner et al. (11).

### Procedure

After obtaining ethics approval from Yuzuncu Yil University of Ethics Committee, a proclamation of the study was

first made to draw in potential participants in Yuzuncu Yil University Fine Arts Faculty Music Department. Then, the aim of the research was presented to the voluntary participants. Informed approval was obtained from all participants included in the study. They were asked to complete the questionnaire set prepared. Filling out the questionnaires took almost 20 minutes.

**Statistical Analysis**

Statistical analysis was performed using SPSS 22.0 (Statistical Package for Social Sciences, IBM Inc., Chicago, IL, USA). The consistency of continuous variables to a normal distribution was checked with the Shapiro-Wilks test. Descriptive statistics of continuous variables are expressed as mean±SD (standard deviation). The presence of a correlation between the groups was determined by the Pearson correlation test, chi-square test for parametric variables and Spearman correlation test for nonparametric variables. Additionally, in the comparison of binary groups, we used the t test. The level of significance was set at  $p < 0.05$  for all tests.

**Results**

The 40 undergraduates consisted of 21 males and 19 females. The BMI values of all participants were within normal ranges (range: 21.3-23.8 kg/m<sup>2</sup>). There was no significant difference between the sexes with regard to EAT-40 ( $r=0.148$ ), STAI-T ( $r=0.646$ ) and total STAI scores ( $r=0.079$ ) ( $p > 0.05$  for all). However, the STAI-S scores were significantly higher in females than in males ( $r=0.014$ ,  $p < 0.05$ ) (Table I).

**Table I.** Evaluation of the change in state anxiety, trait anxiety, Total STAI, and eating attitudes test scores by sex

		n	Mean±SD	Min.	Max.	*p value
STAI-S	M	21	37.81±10.38	26	73	0.014
	F	19	47.56±13.20	23	72	
	Total	40	42.31±12.61	23	73	
STAI-T	M	21	43.05±6.80	33	55	0.646
	F	19	44.56±12.99	13	68	
	Total	40	43.74±10.02	13	68	
Tot-STAI	M	21	81.33±14.41	64	127	0.079
	F	19	92.11±22.54	60	140	
	Total	40	86.31±19.14	60	140	
EAT-40	M	21	21.14±10.37	7	43	0.148
	F	19	26.37±12.01	8	54	
	Total	40	23.63±11.34	7	54	

\* t test; Values are given as mean and standard deviation; M=male; F=female; STAI-S=state anxiety; STAI-T=trait anxiety; Tot-STAI=Total STAI; EAT-40=eating attitudes Test; SD=standard deviation.

The STAI-S scores increased as the total time spent listening to music (List-T) increased ( $r=0.366$ ,  $p < 0.05$ ). The EAT-40 scores showed a positive correlation with the total time spent on music per week (Total-T) ( $r=0.413$ ,  $p < 0.01$ ) and the time spent playing a musical instrument per week (Inst-T) ( $r=0.35$ ,  $p < 0.05$ ). However, neither STAI-T nor STAI-S were affected by Inst-T and Total-T.

The EAT-40 scores indicated no significant correlation between age and List-T scores. Similarly, there was no

significant correlation between the EAT-40 scores and the situational and constant anxiety scores (STAI-S, STAI-T and Tot-STAI) (Table II).

**Table II.** Evaluation of the relationship between age, time spent listening to music, total time spent on music, time spent playing a musical instrument, state anxiety, trait anxiety, total STAI and eating attitudes test score

		Age	List-T	Total-T	Inst-T	STAI-S	STAI-T	Tot-STAI	EAT-40
Age	r	1							
List-T	r	0.123	1						
Total-T	r	0.287	0.954**	1					
Inst-T	r	0.412*	0.212	0.495**	1				
STAI-S	r	0.082	0.366*	0.159	-0.232	1			
STAI-T	r	0.202	0.210	0.237	0.073	0.461**	1		
Tot-STAI	r	0.160	0.326	0.225	-0.112	0.884**	0.815**	1	
EAT-40	r	-0.034	0.297	0.413**	0.359*	-0.111	0.089	-0.040	1

\*;  $p < 0.05$ , \*\*;  $p < 0.01$ , List-T=time spent listening to music (hours/week); Total-T=total time spent on music (hours/week); Inst-T=time spent playing a musical instrument (hours/week); STAI-S=state anxiety; STAI-T=trait anxiety; Tot-STAI=total STAI, EAT-40=eating attitudes test.

Participants with EAT-40 scores of 30 or greater were accepted as having an eating behavior disorder (EBD). EBD was present in 11 (27.5%) participants. There was no significant relationship between eating behavior and age ( $p=0.76$ ) or sex among these participants (chi-square: 1.584,  $p=0.208$ ) (Table III).

The mean Total-T score was significantly higher in participants with EBD compared to those without EBD (16.45±15.896 vs. 6.24±6.418 h/week) ( $p=0.006$ ). Furthermore, the mean Inst-T score was significantly higher in participants with EBD compared to those without EBD (5.00±5.254 vs. 2.72±1.412 h/week) ( $p=0.036$ ) (Table IV).

There was no significant difference between participants with and without EBD with regard to situational and constant anxiety scores (STAI-S, STAI-T and Tot-STAI).

**Table III.** Distribution of individuals with eating disorders by sex

			Sex		Total
			M	F	
EBD	No	n	17	12	29
		%	81.0	63.2	72.5
	Yes	n	4	7	11
		%	19.0	36.8	27.5
Total		n	21	19	40
		%	100.0	100.0	100.0
			Chi-square: 1.584		P=0.208

EBD=eating behavior disorder; M=male; F=female

**Table IV.** Comparison of age, time spent listening to music, total time spent on music, time spent playing a musical instrument, state anxiety, trait anxiety, total STAI and eating attitudes test scores of individuals with and without eating disorders

		n	Mean±SD	Min.	Max.	p value
Age	Non-EBD	26	22.69±2.36	18	27	0.760
	EBD	10	22.40±3.02	19	30	
	Total	36	22.61±2.52	18	30	
Total-T	Non-EBD	29	6.24±6.41	1	33	0.006
	EBD	11	16.45±15.89	2	44	
	Total	40	9.05±10.75	1	44	
List-T	Non-EBD	22	4.91±6.48	1	30	0.076
	EBD	10	11.90±15.27	1	40	
	Total	32	7.09±10.34	1	40	
Inst-T	Non-EBD	29	2.72±1.41	1	7	0.036
	EBD	11	5.00±5.2	1	20	
	Total	40	3.35±3.09	1	20	
STAI-S	Non-EBD	28	43.11±13.98	23	73	0.503
	EBD	10	39.90±8.69	28	57	
	Total	38	42.26±12.77	23	73	
STAI-T	Non-EBD	28	43.61±11.01	13	68	0.918
	EBD	10	44.00±7.76	33	58	
	Total	38	43.71±10.15	13	68	
Tot-STAI	Non-EBD	28	87.07±21.50	60	140	0.663
	EBD	10	83.90±12.26	69	108	
	Total	38	86.24±19.39	60	140	

\* t test; Values are given as the mean and standard deviation; EBD=eating behavior disorder; List-T=time spent listening to music (hours/week); Total-T=total time spent on music (hours/week); Inst-T=time spent playing a musical instrument (hours/week); STAI-S=State Anxiety; STAI-T=trait anxiety; Tot-STAI=Total STAI; SD=standard deviation.

## Discussion

Our hypothesis was that engaging with music affects abnormal eating behavior in a way leading to an increase it. In our study, the total time spent on music (i.e., time spent listening to music and playing a musical instrument) and the total time spent playing a musical instrument were significantly higher in participants with EBD compared to participants without EBD ( $p=0.006$ ,  $p=0.036$ , respectively). Furthermore, the EAT-40 scores (regardless of the presence of EBD) correlated with the total-T ( $r=0.413$ ,  $p<0.01$ ) and Inst-T scores ( $r=0.359$ ,  $p<0.05$ ).

Music can modulate basic taste perception features of food, such as sweetness and/or bitterness (12). Studies evaluating the impact of sound on eating behavior have shown that this can add significant value to people's experience of food and drink (13). Sounds that are unrelated to the food itself can affect flavor perception. Sound that changes the perception of flavor can be in the form of background music. It is believed that the positive emotions we associate with music can be transferred to the pleasure of food and beverages (14). Examples of this can be experienced in eating places such as restaurants, where sound can affect our perception of flavor (15).

Recent studies have identified a number of specific sonic and musical parameters that can be used to modify tasting experiences, thus adding notable pleasure to the consumer's overall eating experience (16,17). The assessment pleasantness of smells can rise in the presence of harmonic sounds (18). In particular, it is possible to compose soundscapes that systematically affect the perception of food flavor (19). Additionally, the more a person likes a sound, the more likely he/she is to perceive afterward-offer smell (20). This can be effective in eating behavior.

The data we obtained in our study suggest that the main parameter affecting eating behavior is not the time of listening to music but the duration of instrument playing. In music therapy, playing the musical instrument (such as discussing song lyrics or responding to music through art and song writing) is one of the parts of the therapy process. Music therapy is not a commonly used therapy for eating disorders (21). Studies evaluating the relationship between eating disorders and music therapy are generally case-level and limited in number (22). In addition, in the literature review, there was no study showing the effect of playing a musical instrument on eating behavior. Our study is unique exploring the effect of playing an instrument in isolation on eating behavior.

Studies have reported that music therapy has positive effects on anxiety. Music therapy was used as a treatment for anxiety in cancer patients, coronary artery disease (CAD) patients and patients requiring pain management (23-25). Another study indicated that listening to relaxing music reduced the physiological symptoms caused by stress and enhanced the participants' stress management skills (26).

In our study, we also evaluated the anxiety levels due to the common association between anxiety disorders and eating disorders. However, there was no significant correlation between the EAT-40 scores and the STAI-S or STAI-T. There was no significant difference between participants with and without EBD with regard to state and trait anxiety scores ( $p=0.503$ ;  $p=0.918$ ).

In our study, we evaluated the effect of eating behavior, engaging with music and anxiety levels on each other. The relationship between eating behavior/anxiety and music therapy/anxiety has also been evaluated in numerous studies. While anxiety is expected to increase in eating behavior disorders, the anxiety level of the individual is expected to decrease in therapeutic music applications. Our study found that the effect of anxiety on eating behavior was insignificant. We believe that this result may stem from the effect of engaging with music. To explain the effect of music on eating behavior, we believe that there is a need for additional long-term studies with a larger number of participants categorized by music genres.

## Conclusion

The data obtained in our study indicate that the time spent playing an instrument, one of the music engagements, increases negative eating behavior. The effect of anxiety on eating behavior in the participant group was found to be insignificant. Future research should examine the relationship between engaging with music and other eating disorders (such as binge eating disorder, food addiction) with larger populations.

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