

THE ROLE OF FOOD ADDICTION AND DEPRESSION IN DETERMINING EXECUTIVE FUNCTIONS AMONG ATHLETICALLY ACTIVE AND NON-ATHLETE VARSITY STUDENTS

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ABSTRACT

To examine the role of food addiction and depression in determining executive functions among athletically active and non-athlete varsity students was the central objective of this study. Data were collected at one point in time using a quantitative research design that was cross-sectional in nature. A total of 335 varsity students participated in the study. Among them, 165 students were athletically active, while 170 students were non-athletes. Participants belonged to the 18–25 years age range group. The mean age of athletically active students was 21.36 years (SD = 2.161). For non-athlete students, the mean age was 20.96 years (SD = 1.707). All participants were enrolled in different BS degree programs in various academic departments of their universities. Data were collected using a questionnaire method. The questionnaire included basic demographic information of the participants. Depression was measured using the PHQ-2 questionnaire. Whereas, food addiction was assessed through the YFA scale. Executive functioning was assessed using the Stroop Test. The collected data were analyzed using SPSS software (2022). Predictive relationships among the variables were examined using hierarchical regression techniques. The results showed that, among athletically active varsity students, depression and food addiction had a positive association with Stroop Test scores. Since higher Stroop scores indicate poorer performance, this finding suggests lower executive functioning among athletes with higher depression and food addiction levels. In contrast, depression did not show any significant relationship with executive functions among non-athlete varsity students. However, food addiction showed a negative association with Stroop Test scores in this group. This indicates that non-athlete students with higher food addiction scores performed better on the Stroop Test. These findings suggest that emotional and behavioral factors may influence executive functioning differently in athletic and non-athletic university students.

Keywords: executive function, depression, food addiction, varsity students, athletes and non-athletes

INTRODUCTION

Food addiction among university students has become an increasingly alarming concern, as many of the students might develop compulsive eating behaviors that are similar to those seen in substance-related disorders. (Romero-Blanco et al., 2021). Food addiction, however, is commonly recognized as the continued use of highly delicious meals despite adverse physical, psychological and scholastic repercussion (Florio et al., 2022). These manipulative eating behaviors have been found as a coping mechanism by some individuals, particularly those who were under academic and environmental stress. Overtime these practices may further affect cognitive processes and emotional stability of individuals (Hill et al., 2022). Long-term harm to mental health and general well-being in addition to interfering with daily functioning has also been associated with these habits (Magomedova & Fatima, 2025). Food addiction may be more prevalent in stressful situations where people constantly attempt to satisfy performance expectations at whatever cost (Bartone & Tripp, 2025).

Although, the frequency of food addiction might differ among university communities, but previous research has widely recognized it as an important public health issue. According to a previous study, 17% of South Asian college students fit the criteria for food addiction. Of these, female students reported somewhat higher rates of addiction of food than male students (Saha et al., 2022). Conversely, these addictive eating habits had detrimental effects, such as metabolic diseases, poor executive functioning and heightened vulnerability to psychiatric disorders like sadness and anxiety among them (Zavitsanou & Drigas, 2021). Furthermore, it has also been observed to impair students' cognitive performance and decision-making skills particularly those connected to academic and daily self-regulation (Yu et al., 2018). However, food addiction has previously been associated with increased psychological problems particularly depression.

Depression is a mental health problem where an individual experiences sadness for a prolonged time and loses interest in things they used to enjoy (Beisecker et al., 2024). It is typically associated with symptoms such as low mood, fatigue,

impaired concentration, negative self-perception, and difficulties in motivation and decision-making (Weber et al., 2023). When depressive feelings are mild, they may cause individuals to think more about their emotions and behavior (Tingaz et al., 2023). This can sometimes help people become more aware of their feelings and make careful decisions, which may support self-control. However, when depression becomes more severe, it often leads to problems with focus, slow thinking, difficulty adjusting thoughts, and weak impulse control (Woodson et al., 2025). These problems can harm both academic work and sports performance. For student athletes, such mental and emotional difficulties may affect their training and decision-making abilities during competition (Contreras-Osorio et al., 2022). Due to which, they may also lose their ability to handle stress and therefore showing a possible link between depression and executive functioning.

Executive functions refer to the mental abilities that help people plan their actions, stay focused, and control their behavior to reach goals (Nuño et al., 2021). It includes skills such as self-control, flexible thinking, memory, and decision-making, which are used in daily life (Ciuhan & Iliescu, 2021). For student athletes, executive functions play an important role because they must balance studies with training and competition (Symons et al., 2023). They also face pressure during performance and often need to make quick decisions. Strong executive skills help student athletes stay focused, manage their emotions, and handle challenges more effectively (Büning et al., 2021). When executive functions are well developed, athletes are better able to control their actions, make sensible choices, and remain calm under stress (Bryant et al., 2023). This supports both their sports performance and overall well-being.

In contrast, difficulties in executive functions may lead to impulsive actions, poor concentration, problems with planning, and reduced emotional control, all of which can interfere with training, competition, and academic responsibilities (Logan et al., 2023). These challenges may also make student athletes more vulnerable to unhealthy coping behaviors and psychological difficulties

(Yongtawee et al., 2022). For this reason, exploring how food addiction and depression relation to executive functions is essential for gaining a clearer understanding of cognitive and mental health risks among student athletes. In addition to guiding the development of therapies targeted at engaging cognitive functioning and emotional well-being, an understanding of these psychological pathways could assist in identifying potential risk and protective variables.

This study aims to examine the relationship between food addiction, depressive symptoms, and executive functioning in both athletically active and non-athlete varsity students. Specifically, it seeks to identify how variations in emotional and behavioral regulation, potentially influenced by dietary habits and mood, may affect cognitive performance in academic and athletic contexts. By comparing these two groups, the research intends to clarify whether engagement in regular physical activity moderates the impact of food-related and emotional factors on executive functioning. The results of this study may help in developing strategies to support students' mental well-being and enhance their thinking and decision-making skills. Furthermore, the results of this study may also encourage healthier habits, especially for those who are trying to manage both their studies and athletic activities.

Methods

Research Design

The quantitative cross-sectional survey was used in this study that enables data to be gathered from individuals at a specific point in time. This design was utilized to examine the role of food addiction and depression in determining executive functions among athletically active and non-athlete varsity students.

Population and sample size

For this novel study, data was gathered from distinct public and private universities of Lahore (one of the major cities of Pakistan). Initially the sample of this study consisted of 350 participants but the data of 15 participants was disturbing the normality of data during normality analysis. After deleting the data of 15 participants, the original study sample consisted of 335 varsity students of

which 165 were athletically active and 170 were non-athlete varsity students. They were aged between 18 to 25 years with average ages ($M = 21.36$, $SD = 2.161$) and ($M = 20.96$, $SD = 1.707$) respectively and were enrolled in BS programs across multiple academic departments. For this study, only those athletically active students were chosen, who competed at intervarsity, national and international level competitions. The relevant sports experience of athletes was above from five years ($M = 6.57$, $SD = 2.031$).

Instruments

The following tools were used to gather the data from intended participants:

Demographic Questionnaire

The demographic section consisted of five questions including age, gender, athletic status, level of playing, and experience of sports.

Patient Health Questionnaire – 2 (PHQ-2)

The PHQ-2 was used for measuring the symptoms of depression that was developed by Kroenke et al. (2003). The behavioral and psychological symptoms of individuals were measured from the 2-item PHQ scale. Earlier studies have showed relatively high reliability and validity of PHQ-2 due to a Cronbach alpha score ranging between 0.83-0.85 (Errazuriz et al., 2022; Scoppetta et al., 2021). Even for this study, the Cronbach's alpha score of this tool was reported to be 0.674 that demonstrates acceptable level of reliability and validity.

Yale Food Addiction Scale (YFAS)

Gearhardt et al. (2009) created the YFA scale that was used in this study to measure the food addiction among both student population types. The Cronbach's alpha score of YFAS in this study was 0.744, indicating that it possesses good validity and reliability. Earlier studies also revealed high Cronbach's alpha score of this tool ranging between 0.89 to 0.93 (Lima et al., 2024; Saffari et al., 2022).

Stroop Test

This study utilized Stroop Test to measure executive functioning of the participants. This test

was specially developed by Genetic Science Learning Center (2020). It is a widely and globally utilized technique to evaluate the major components of executive functioning. This test consisted of two segments, one with the conflicting words and the second with the non-conflicting words. The performance of the participants was evaluated based on the time taken to complete each task and the number of errors committed by them. Lastly, to ensure the accuracy of the responses, the standardized instructions (provided by the developers of the test) were taken into account. Due to which, any trial or response with more than three errors was discontinued and repeated.

Data Collection

All physical responses were anonymized and stored securely to ensure the confidentiality of the data. Additionally, only the researchers that were major part of the study throughout were given access to the data. An official permission letter from the department was presented to authorities at each university. In addition, the researchers coordinated with sports staff to assemble participants. The study's objectives and procedures were explained to the participants individually and they were assured about their voluntary participation with their information

being kept confidential. Participants could withdraw from this novel study at any time. They were given 25 - 30 minutes to complete the questionnaire, that was administered in-person by the researcher. Prior to data collection, consent to utilize the questionnaires was acquired via email from the relevant authors.

Data Analysis

The collected data was analyzed by employing SPSS v.25 to determine the relationship between depression, food addiction and executive functions of athletically active and non-athlete varsity students. The following statistical procedures were applied: 1) Firstly, we tested all the necessary assumptions likewise linearity, normality, multicollinearity, homoscedasticity, and independence error all were met; 2) Secondly, descriptive statistics to summarize demographic and psychometric data was applied; 3) Lastly, Multiple Linear Hierarchical Regression (MLHR) analysis was carried out to explore the predictive power of the depression and food addiction on executive functions of athletically active and non-athlete varsity students while controlling for demographic variables such as age and sports experiences. A value of significant was < 0.05 .

Results

Table 1: Demographic features of participants

Variables	Categories	Athletically Active		Non-athletes	
		<i>f</i>	%	<i>f</i>	%
Gender	Male	84	50.9	87	51.2
	Female	81	49.1	83	48.8
Playing level	Intervarsity	64	38.8	0	0
	National	77	46.7	0	0
	International	24	14.5	0	0
		M	SD	M	SD
Age		21.36	2.161	20.96	1.707
Playing experiences		6.57	2.031	.00	.000

The results of demographic table revealed that the athlete's group had 50.9% males and 49.1%

females, while the group of non-athletes included 51.2% males and 48.8% females. Among athletes'

group 38.8% competed at the varsity level, 46.7% at the national level, and 14.5% at the international level. The average age of athletes was 21.36 years (SD = 2.161) that was slightly higher than age of non-athletes. The average age of non-

athlete group was 20.96 years (SD = 1.71). Additionally, athletes reported an average of 6.57 years of playing experience (SD = 2.031) whereas, non-athletes had no playing experience.

Table 2: The ANOVA summary of hierarchical regression analysis for non-athlete varsity students

Model	Variables	Sum of square	df	Mean square	F	P
1	Regression	329.632	1	329.632	1.182	.279 ^b
	Residual	46864.021	168	278.953		
	Total	47193.653	169			
2	Regression	11089.786	3	3696.595	16.996	.000 ^c
	Residual	36103.867	166	217.493		
	Total	47193.653	169			

ANOVA summary of hierarchical regression analysis revealed that in Model 1, the controlled variable (age) was not statistically significant with dependent variables, $F = 1.182$, $P = .279$. However, when independent variables were included in model 2 with the controlled variable (age), the

model became statistically significant $F = 16.996$, $P = .000$. This showed that the combined predictors in model 2 explained a substantially greater proportion of the variance in the dependent variables compared to model 1.

Table 3: Hierarchical regression results for non-athlete varsity students

Model	Variables	B	Std. Error	β	t	P
1	Age	-0.818	0.752	-0.084	-1.087	0.279
2	Age	-1.083	0.670	-0.111	-1.617	0.108
	Depression	-1.478	0.809	-0.147	-1.826	0.070
	Food addiction	-1.712	0.355	-0.385	-4.817	0.000

In model 1, age failed to significantly predict executive functions ($\beta = -0.084$, $t = -1.087$, $p = .279$) among non-athlete varsity students. Whereas, in model 2, although age ($\beta = -0.111$, $p = .108$) and depression ($\beta = -0.147$, $p = .070$) remained non-significant predictors of executive function. However, food addiction ($\beta = -0.385$, t

$= -4.817$, $p < .001$) did demonstrate a statistically significant but negative association with executive functions among non-athlete varsity students. This indicated that non-athlete varsity participants with higher levels of food addiction were associated with improved levels of executive function.

Table 4: The ANOVA summary of hierarchical regression for athletically active varsity students

Model	Variables	Sum of square	df	Mean square	F	P
1	Regression	8726.586	2	4363.293	14.450	.000 ^d
	Residual	48616.651	161	301.967		
	Total	57343.238	163			
2	Regression	23794.721	4	5948.680	28.193	.000 ^e
	Residual	33548.517	159	210.997		
	Total	57343.238	163			

The ANOVA table of hierarchical regression for athletically active varsity students revealed that model 1 was statistically significant with $F = 14.450$ and $p = .000$. This suggested that the predictors in model 1 containing confounding factors explained a meaningful portion of the

variance on the dependent variable. Whereas, when the additional predictors i.e. independent variables were added in model 2 with confounding variables, the model while being significant, exhibited improved explanatory power $F = 28.193$, $P = .000$.

Table 5: Hierarchical regression for athletically active varsity students

Model	Variables	B	Std. Error	β	t	P
1	Age	-2.448	0.634	-0.282	-3.859	0.000
	Playing experiences	-2.229	0.672	-0.242	-3.317	0.001
2	Age	-1.353	0.546	-0.156	-2.476	0.014
	Playing experiences	-2.069	0.564	-0.225	-3.667	0.000
	Depression	3.519	0.816	0.280	4.314	0.000
	Food addiction	2.144	0.391	0.363	5.483	0.000

In model 1, both age ($\beta = -0.282$, $p = .000$) and playing experiences ($\beta = -0.242$, $p = .001$) were negative significant predictors of executive function. This indicated that increasing the age and playing experiences of athletically active varsity students might improve their executive function.

In model 2, age ($\beta = -0.156$, $p = .014$) and playing experience ($\beta = -0.225$, $p = .000$) did remain negative significant predictors of outcome variable. However, among the independent variables, depression ($\beta = 0.280$, $p = .000$) and food addiction ($\beta = 0.363$, $p = .000$) showed statistically positive relationship with executive functions athletically active varsity students. This proposed that those athletically active varsity students who tended to possess higher depression and food addiction levels might have decreased executive function. These findings ultimately suggested that high levels of both depression and food addiction might act as risk factors for executive functioning for athletically active varsity students.

Discussion

The central goal of this study was to assess the link between food addiction, depressive symptoms and executive functions in both athletically active and non-athlete varsity students. This study fills a notable gap in the literature, as no previous study

has explored this relationship among athletically active and non-athlete varsity students, rendering this investigation a valuable and original contribution. The findings revealed that among athletically active varsity students, both depression and food addiction showed statistically positive relationship with Stroop test scores. This proposed that those athletically active varsity students who tended to possess higher depression and food addiction levels might have decreased executive function. On the other hand, among non-athlete varsity students, depression failed to show any association with executive function. However, food addiction was negatively associated with Stroop test scores. This indicated that non-athlete varsity participants with higher levels of food addiction were associated with improved levels of executive function.

In the present study, food addiction showed a negative association with Stroop Test scores among non-athlete varsity students. This means that students who reported higher levels of food addiction tended to perform better on the Stroop test. As better performance on Stroop test has been associated to reduced errors, therefore, it can be proposed that these participants had improved or better executive functioning levels. This outcome was not expected during the initial stages of the study and required us to think carefully

during its interpretation. This is because past studies have reported contradictory findings to this. For instance, a study conducted on adolescents residing in Canada suggested that food addiction was directly negatively associated to executive functions among them (Rodrigue et al., 2019). Additionally, another study conducted on severely obese individuals also presented similar results. The study's findings proposed that those participants who reported elevated levels of food addiction were having low executive functioning levels (Rodrigue et al., 2018). Even a third study conducted in a similar context on American obese adolescents presented resembling outcomes. The study reported poor executive functioning among individuals with heightened food addiction levels (Vidmar et al., 2021). It may be that non-athlete students try harder when they are given a formal test. They may focus more because they know they are being evaluated. This extra effort can help them perform better on tasks that need attention and self-control. However, this short-term focus may hide problems linked to food addiction. Because of this, their executive functions may look better in a test setting than in everyday life.

Age and playing experience were also found to be negatively related to executive functions among athletically active varsity students. In practical terms, it was observed that those athletes that were older in age and those with more years of playing experience demonstrated lower mistakes on Stroop test. This suggested that higher the age and playing experience, greater is the executive functioning of the participants. This finding fits with the idea that long-term involvement in sports requires quick decisions, constant focus, and handling pressure. With time, these repeated demands may help improve how the brain controls attention and responses. It is also possible that as athletes grow older and gain experience, they become more comfortable in competitive situations. This familiarity may help them stay focused and ignore distractions more easily. Together, these factors may explain why more experienced athletes perform better on demanding cognitive tasks.

However, when comparing with non-athlete varsity students with respect to the role of food addiction and depression in determining

executive function, a different pattern emerged for athletically active participants. It was observed that athletically active students with higher levels of food addiction and depression demonstrated increased errors on Stroop test. This proposed that heightened depression and food addiction levels might be associated with poorer executive functioning among athletically active varsity students. Ciszewski et al. (2020) found that in non-clinical population disordered eating behaviors (common in athletes) were significantly predictive of executive dysfunction. Specifically, athletes and active students with higher eating disorder risk reported even lower executive functioning. Similarly, Sohail et al. (2023) found in a comparison of gymnastics athletes and non-athletes, researchers found an inverse relationship between junk food consumption and self-control which is a core component of executive function. Although, Harris et al. (2024) utilized the Executive Function Index (EFI) and found that individuals at risk for eating disorders showed significant deficits in the "Impulse Control" subscale of executive functioning. Another, Busch et al. (2021) Revealed that performance on general and food-specific EFs was unrelated to depression and overall eating disorder psychopathology, contrary to the previous finding that depression and food addiction are negatively associated with executive functioning. For student athletes, these problems may become stronger because they face pressure from training, competitions, and studies at the same time. This constant stress can reduce the mental energy needed to think clearly and stay focused. As a result, their ability to control thoughts and actions may suffer, especially during situations that demand high performance.

Directions for Future Research

Future study needs to search into longitudinal designs to elucidate causal pathways and investigate the underlying mechanisms such as stress, self-regulation or nutritional patterns that could explain these disparate impacts. Universities should also create focused interventions such as nutrition education, mental health support and sport specific cognitive training to improve executive functioning and lower the cognitive risks

connected to depression and food addiction especially in varsity athletes.

Conclusion:

This study examined how food addiction and depression might relate to executive functions in both athletically active and non-athlete varsity students. The findings showed that among athletically active students, higher levels of depression and food addiction were linked to poorer executive functioning, as reflected by higher Stroop test scores. In contrast, among non-athlete students, depression was not related to executive function, while higher food addiction was associated with better Stroop performance. These results suggested that psychological and eating-related factors may influence executive functions differently in athletes and non-athletes, highlighting the importance of considering activity level when studying cognitive functioning in university populations.

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