

## RESEARCH • ARAŞTIRMA

## Do Locus of Control Affect Anthropometric Measurements, Food Intake and Diet Quality in Adolescent Soccer Players?

### *Adölesan Futbolcularda Denetim Odağı Antropometrik Ölçümleri, Besin Alımını ve Diyet Kalitesini Etkiler mi?*

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#### ABSTRACT

**Aim:** This study was conducted to examine the effect of locus of control on anthropometric measurements, nutritional status, and diet quality in adolescent soccer players.

**Subjects and Method:** The study involved 72 male soccer players between the ages of 14 and 18. The researcher utilized the Rotter Locus of Control Scale face-to-face to the athletes to ascertain their locus of control. The 3-day food consumption records of athletes were gathered in order to assess their nutritional state. The Healthy Eating Index-2015 was used to assess the athletes' dietary quality.

**Results:** The average score of the athletes on Rotter's Locus of Control Scale was determined as  $10.28 \pm 3.15$ . The athletes' ages, total weights, skeletal muscle weights, and body mass index values were found to have a positive and statistically significant weak connection with the players' scores on the "Locus of Control" ( $r: 0.268$ ;  $p = 0.023$ ;  $p < 0.05$ ). The Total Healthy Eating Index (HEI) score was  $37.16 \pm 10.14$  on average, 90.3% ( $n=65$ ) of the athletes had a "poor" diet, and 9.7% ( $n=7$ ) had a diet quality that needed improvement. There was no statistically significant relationship between the athletes' total HEI score and Rotter's Locus of Control Scale score ( $p > 0.05$ ). Regression analysis reveals that it is connected to skeletal muscle weight as a factor in determining the degree of the locus of control ( $F = 5.756$ ;  $p = 0.019$ ;  $p < 0.05$ ).

**Conclusion:** Findings related to locus of control of athletes are interesting, however, there is a need for more comprehensive studies that can determine the relationship of locus of control with anthropometric measurements and food intake.

**Keywords:** Adolescent, anthropometry, diet quality, locus of control, soccer

#### ÖZET

**Amaç:** Bu çalışma, adölesan futbolcularda denetim odağının antropometrik ölçümler, beslenme durumu ve diyet kalitesi üzerindeki etkisini incelemek amacıyla yapılmıştır.

**Bireyler ve Yöntem:** Çalışmaya 14-18 yaş arası 72 erkek futbolcu dahil edilmiştir. Sporcuların denetim odaklarını belirlemek için Rotter Denetim Odağı Ölçeği (RDOÖ) araştırmacı tarafından yüz yüze uygulanmıştır. Sporcuların beslenme durumlarını değerlendirmek için 3 günlük besin tüketim kayıtları toplanmıştır. Sporcuların diyet kalitesini değerlendirmek için Sağlıklı Yeme İndeksi-2015(SYİ-2015) kullanılmıştır.

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**Bulgular:** Sporcuların RDOÖ puan ortalaması  $10.28 \pm 3.15$  olarak belirlenmiştir. Sporcuların yaşları, toplam ağırlıkları, iskelet kası ağırlıkları ve beden kütle indeksi değerleri ile sporcuların “Denetim Odağı” puanları arasında pozitif ve istatistiksel olarak anlamlı zayıf bir ilişki olduğu saptanmıştır ( $r: 0.268$ ;  $p = 0.023$ ;  $p < 0.05$ ). Toplam SYİ-2015 puanı ortalama  $37,16 \pm 10,14$  olup, sporcuların %90,3’ünün ( $n=65$ ) diyet kalitesi “kötü”, %9,7’sinin ( $n=7$ ) ise diyet kalitesi iyileştirilmesi gereken düzeydedir. Sporcuların toplam SYİ puanı ile RDOÖ puanı arasında istatistiksel olarak anlamlı bir ilişki bulunmamıştır ( $p > 0.05$ ). Regresyon analizi, denetim odağının derecesini belirlemede bir faktör olarak iskelet kası ağırlığına bağlı olduğunu ortaya koymaktadır ( $F = 5.756$ ;  $p = 0.019$ ;  $p < 0.05$ ).

**Sonuç:** Sporcuların denetim odağına ilişkin bulgular ilgi çekicidir ancak denetim odağının antropometrik ölçümler ve besin alımı ile ilişkisini belirleyebilecek daha kapsamlı çalışmalara ihtiyaç bulunmaktadır.

**Anahtar kelimeler:** *Adölesan, antropometri, denetim odağı, diyet kalitesi, futbol*

## INTRODUCTION

The adolescent period is the developmental period that begins in puberty and ends in adulthood. In 2016, The Lancet Commission on Child Health defines the adolescence period as the age range of 10 to 19, and the youth period as the age range of 15 to 24; in this definition, young people cover the entire age group between the ages of 10 and 24 (1). Since it is a fast-growing period, it is very important to provide adequate and balanced nutrition in order to reach full growth potential, and failure to provide optimal nutrition can lead to delayed and/or insufficient growth-development (2).

The existence of adequate and balanced nutrition in the adolescent period, together with the intake of sufficient energy and nutrients, ensures that the individual is in the same growth-development phase as his peers (3).

Adequate and balanced nutrition is important in preventing injuries, initiating and maintaining recovery processes, and achieving optimal performance, as well as maintaining growth-development and general health in adolescent athletes. Therefore, it is important to evaluate the nutritional status of adolescent athletes as in all other risk groups (4).

Although the parents, teachers, and trainers have a large share in athletes’ eating attitudes and food consumption preferences, the preferences of athletes may vary due to psychological, behavioral, and

emotional reasons (5). “Locus of control,” which is a concept that can affect all attitudes and behaviors, including nutrition, is the tendency of the individual to perceive the events affecting him, whether good or bad, as the results of his own abilities, characteristics, and behaviors or as the effect of forces other than himself, such as luck, fate, fortune and other powers (6).

There has been some evidence in the literature that there is a connection between locus of control and overall wellbeing (7), despite the fact that no study has looked specifically at the association between locus of control and anthropometric measurements. In addition, it was discovered that athletes’ self-efficacy and internal locus of control were better than those of other groups and positively reflected on body image in a study looking at the effects of self-efficacy and locus of control on body image in fashion models, students, and athletes (8).

This study aims to examine the relationship between internal and external locus of control and anthropometric measurements, nutritional status, and diet quality in adolescent athletes aged between 14 and 18 years old.

The hypotheses on which the research is based are as follows:

- H0: Locus of control has no effect on anthropometric measurements in adolescent soccer players.

- H1: Locus of control has an effect on anthropometric measurements in adolescent soccer players.
- H2: Locus of control has no effect on food intake in adolescent soccer players.
- H3: Locus of control has an effect on food intake in adolescent soccer players.
- H4: Locus of control has no effect on diet quality in adolescent soccer players.
- H5: Locus of control has an effect on diet quality in adolescent soccer players

## SUBJECTS AND METHODS

### Study Population and Design

While calculating the sample, the correlation test was chosen in the exact test group in the G-power program, and the correlation coefficient of 0.30 p was calculated as 67 with a margin of error of 0.05 with a power of 80% and a minimum sample size of 67. Estimating a 10% loss, the study was initiated with 74 soccer players who agreed to voluntarily participate in the study after reading the voluntary consent form. A signed voluntary consent form was also obtained from the parents of the athletes. However, the soccer players who could not keep their 3-day food consumption records regularly and/or gave incomplete information in the records were excluded from the study and the study was completed with 72 soccer players. While the inclusion criteria were to be between the ages of 14-18, to have been playing soccer for at least 2 years and to participate voluntarily; the exclusion criteria is having any disease.

In the first stage of data collection, the questionnaire including demographic questions and the questions related to soccer (the weekly training times, and the content of the training) was applied face-to-face by the researcher. In the second stage, the “Rotter Locus of Control Scale”, developed by Rotter (6) in 1966 and validated and reliable in Turkish by Dağ (9) in 1991, was applied face-to-face by the researcher to

determine the locus of control of the athletes. In the third stage, body weight (kg) and height (cm) were measured and then skeletal muscle weight, body fat weight and body fat ratio were determined with the help of Bioelectrical Impedance Analysis (BIA) using the Inbody 230 device. Height measurement; feet side by side and head in Frankfurt plane with the help of a stadiometer leaning against the wall in accordance with the standards (10). Body weight and BIA measurements were made simultaneously and the necessary conditions were complied with before the measurement. Individuals were asked to come without breakfast (10-12 hours of fasting), not to consume too much liquid (water, tea, coffee) before the test (at least 4 hours), and not to do heavy physical activity. Before the measurement was made, the subjects were asked to remove the metals that touched their skin. Care was taken to keep the person in the appropriate position on the measuring device (10). The body mass index (BMI) was calculated by dividing the body weight (kg) by the square of the height (m). In the 4th stage of the research, 3-day food consumption, consisting of two week days and one weekend day, was taken from the athletes using the “Food Consumption Record Form” to be used in the calculation of the Healthy Eating Index-2015 at the last stage of the study. The HEI-2015 is a widely used index to measure the quality of the diet according to the recommendations in the American dietary guidelines. It is updated every 5 years by the United States Departments of Agriculture (USDA) of Health and Human Services. In this research, the average of 3-day food consumption records was used to calculate diet quality with HEI-2015. 3-day food consumption records were analyzed with BeBIS (Nutrition Information System) 7.2 version program.

The protocol of the study was approved by the Ethical Committee of the Acibadem Mehmet Aydinlar University with the number of 2020-01/3.

### Data Evaluation

The total score of Rotter Locus of Control Scale can range from 0 to 23, and the higher the score, the higher the external locus of control belief, and it represents the

increase in internal locus of control as the total score decreases (9). The 3-day food consumption records taken from the athletes to be used in the calculation of HEI were analyzed with BeBIS (Nutrition Information System) 7.2 version program. According to the results, the adequacy of the daily consumption of energy and nutrients is assessed by Nutrition Guide reference to Turkey (11). In line with the results, the percentages of meeting the energy and nutritional requirements determined for the 14-18 year old male in TUBER were calculated based on the median values (11). HEI-2015 consists of a total of 13 components, 9 of which are sufficient and 4 of which must be consumed in a limited manner. Qualification components are: "total fruit", "whole fruit", "total vegetables", "dark green leafy vegetables and legumes", "whole grains", "milk and dairy products", "total protein foods", "seafood and vegetable proteins". The increase in the consumption of qualification components also increases the total HEI score. The components that should be consumed in a limited way are "fatty acids", "refined foods", "sodium", "added sugar" and "saturated fat", and the decrease in the consumption of these components increases the total HEI score. The HEI score, which is evaluated out of 100 points in total, is categorized as "bad" when it is 50 or below, "need to be improved" when it is 51-80, and "good" if it is above 80 (12).

NCSS (Number Cruncher Statistical System) 2007 (Kaysville, Utah, USA) program was used for statistical analysis. Descriptive statistical methods (mean, standard deviation, median, frequency, ratio, minimum, maximum) were used while evaluating the study data. The conformity of the quantitative data to the normal distribution was tested with the Kolmogorov-Smirnov, Shapiro-Wilk test and graphical evaluations. The Mann-Whitney U test was used in the comparison of two groups of data that did not show normal distribution. Kruskal Wallis test was used in the comparisons of groups of three or more that did not show normal distribution. Spearman's Correlation Analysis was used to evaluate the relationships between variables. Significance was evaluated at least at the  $p < 0.05$  level.

## RESULTS

Table 1 summarizes the demographic characteristics and anthropometric properties of the individuals participating in the research. The study was carried out with a total of 72 cases, The ages of the cases ranged between 14 and 18, with an average of  $15.56 \pm 1.51$  years.

**Table 1.** Distribution of demographic features and anthropometric properties

	Lower-Upper (Median)	Mean±SD
Age (years)	14-18 (15)	15.56±1.51
Starting time for soccer (years)	1-10 (6)	5.77±1.91
Weekly training time (hours)	3-9 (5.5)	5.93±1.58
	<b>n</b>	<b>%</b>
<b>Educational status</b>		
Not going to school	9	12.5
Going to school	63	87.5
<b>Position</b>		
Goalkeeper	5	6.9
Striker	26	36.1
Defense	26	36.1
Midfield	15	20.8
	<b>Lower-Upper (Median)</b>	<b>Mean±SD</b>
Height (cm)	145-183 (172)	169.17±10.11
Body weight (kg)	30-80.7 (57.1)	56.46±10.96
Skeletal muscle weight (kg)	13.7-40.5 (28)	27.47±5.75
Body fat weight (kg)	1.9-16.4 (6.6)	6.98±2.91
BMI (kg/m <sup>2</sup> )	14.1-24.9 (19.3)	19.53±2.19
Body fat ratio (%)	6-25.8 (11.8)	12.24±4.00
Height (cm)	145-183 (172)	169.17±10.11
	<b>n</b>	<b>%</b>
<b>Height (cm)</b>		
<50p.	27	37.5
50-85p.	39	54.1
> 85p.	5	6.9
<b>BMI (kg/m<sup>2</sup>)</b>		
<50p.	6	8.3
50-85p.	11	15.2
> 85p.	55	76.3

SD: Standard Deviation, BMI: Body Mass Index

The height of participants varies between 145 and 183 cm, with an average of  $169.17 \pm 10.11$  cm; their weight ranges from 30 to 80.7 kg, with an average of  $56.46 \pm 10.96$  kg, and their BMI ranges between 14.1 and 24.9 kg/m<sup>2</sup>, with an average of  $19.53 \pm 2.19$  kg/m<sup>2</sup>.

Table 2 shows the intake of energy and macro nutrients and the distribution of HEI scores. The daily total energy intake of participants is on average  $2141.14 \pm 798.61$ , and the rate of coverage according to TUBER is  $64.75\% \pm 23.59$  on average. Their daily protein intake is on average  $81.62 \pm 28.38$  g, and the coverage rate according to TUBER is on average  $131.48\% \pm 45.50$ . The total HEI score is  $37.16 \pm 10.14$  on average, and the HEI score of 90.3% (n = 65) of participants is at a poor level, while 9.7% (n = 7) is at the required level, which must be developed.

Table 3 describes the correlations between the scores of the Rotter’s Locus of Control Scale and other variables. A positively weak and statistically significant correlation was found between skeletal muscle weights and the scores of Rotter’s Locus of Control Scale scores (r: 0.274; p = 0.020; p <0.05) and between the BMI values and the scores of Rotter’s Locus of Control Scale (r: 0.244; p = 0.039; p <0.05).

There was no statistically significant relationship between the total energy (kcal), protein (g), fat (g), and carbohydrate (g) levels of participants and the scores of the Rotter’s Locus of Control Scale, and between the total HEI scores and the scores of the Rotter’s Locus of Control Scale. (p> 0.05).

Table 4 shows the effect of descriptive characteristics and total HEI score on the Rotter’s Locus of Control Scale. As a result of the regression analysis, the effect of skeletal muscle weight on the Rotter’s Locus of Control Scale was found to be significant (p=0.018).

### DISCUSSION

In the adolescence period, which the growth and development make their peak, the need for energy and nutrients for the construction of new tissues increases. It is important to use anthropometric measurements in monitoring and evaluating growth and development and ensuring that adolescents can meet their needs during this period with an adequate and balanced diet. To our knowledge, this study provides the first investigation examining the relationship between anthropometric measurements and locus of control. In this study, a statistically

**Table 2.** Intake of energy and macro nutrients and the distribution of HEI scores

	Intake		Covered (%)	
	Lower-Upper (Median)	Mean±SD	Lower-Upper (Median)	Mean±SD
Total energy (kcal)	717-5821.3 (2009.3)	2141.14±798.61	20.1-159.8 (62.9)	64.75±23.59
Total energy (kcal/kg)	8.91-91.96 (37.17)	39.28±15.30	-	-
Protein (g)	26-181.4 (76.2)	81.62±28.38	37.4-273.2 (127.3)	131.48±45.50
Protein (g/kg)	0.32-2.87 (1.38)	1.48±0.52	-	-
Carbohydrate (g)	46.7-701.7 (242.1)	248.75±110.21	35.9-539.8 (186.2)	191.35±84.78
Carbohydrate (g/kg)	0.66-11.09 (4.51)	4.57±2.08	-	-
Fat (g)	35.8-233.6 (79.8)	86.81±33.33	-	-
Fat (g/kg)	0.51-3.69 (1.48)	1.59±0.64	-	-
	<b>Lower-Upper (Median)</b>		<b>Mean±SD</b>	
Total Healthy Eating Index Score	18-69 (36)		37.16±10.14	
Distribution of Healthy Eating Index Scores	<b>n</b>		<b>%</b>	
“Bad”	65		90.3	
“Need to be improved”	7		9.7	

SD: Standard Deviation, HEI: Healthy Eating Index

**Table 3.** Correlations between the scores of the Rotter's Locus of Control Scale and other variables

	Rotter's Locus of Control Scale Score	
	r	p
Age (years)	0.268	<b>0.023*</b>
Starting time for soccer (years)	0.180	<b>0.129</b>
Skeletal Muscle Weight	0.274	<b>0.020*</b>
Body Fat Weight	0.143	<b>0.231</b>
BMI (kg/m <sup>2</sup> )	0.244	<b>0.039*</b>
Total Healthy Eating Index Score	-0.135	<b>0.258</b>
Total energy (kcal/kg)	0.041	<b>0.731</b>
Protein (g/kg)	0.062	<b>0.604</b>
Carbohydrate (g/kg)	0.028	<b>0.816</b>
Fat (g/kg)	0.079	<b>0.508</b>

BMI: Body Mass Index, r: Spearman's Correlation Coefficient. \* $p < 0.05$

**Table 4.** The effect of descriptive characteristics and total Healthy Eating Index Score on the Rotter's Locus of Control Scale

The dependent variable	The independent variable	B	t	p	F	Model (p)	R <sup>2</sup>
Rotter's Locus of Control Scale	Constant	6.127	3.467	0.001**	5.756	<b>0.018</b>	0.11
	Age	-0.116	-0.299	0.766			
	Skeletal muscle weight	0.122	2.399	0.019*			
	BMI	0.022	0.082	0.935			
	School (+)	2.099	1.593	0.116			
	Total healthy eating index score	-0.054	-1.494	0.140			

\* $p < 0.05$

significant weak correlation was found between the skeletal muscle weights of participants and Rotter's Locus of Control Scale Scores (r: 0.274;  $p = 0.020$ ;  $p < 0.05$ ). A statistically significant weak correlation (r: 0.244;  $p = 0.039$ ;  $p < 0.05$ ) was found between the BMI values of participants and the Rotter's Locus of Control Scale scores (r: 0.244;  $p = 0.039$ ;  $p < 0.05$ ). As a result of the linear regression analysis, the effect of skeletal muscle weight on Rotter's Locus of Control Scale was significant.

Adequate and balanced nutrition for adolescent athletes plays an important role in achieving optimal growth and maintaining optimal sports performance (13,14). The locus of control that we examined in our study may also affect nutritional status and diet quality. Although there are no studies examining the relationship between HEI and locus of control in the literature, several studies have examined the relationship between nutritional status and locus

of control. In a study conducted with 943 pregnant women, it was found that pregnant women with a more internal locus of control had healthier eating habits. It has been concluded that pregnant women with a dominant internal locus of control consume more fruits, vegetables, whole grain products, dairy products, and vegetable protein sources, and less red meat than pregnant women with a dominant external locus of control (15). In a study conducted with university students in Germany, it was found that individuals with a dominant internal locus of control are more interested in healthy eating and do more physical activity (16). In a review published in 2014 examining the effects of cognitive factors on health-related behaviours in adolescents, it was shown that, although no direct relationship was established with nutrition, adolescents with a more dominant external locus of control were associated with disregarding health and narcotic substance use.

Finally, in a study conducted with 651 students, which expressed the opposite opinion, it was thought that external motivation could be related to healthy eating behaviours to both improve health and increase athletic performance, while internal motivation may be related to training-oriented healthy behaviours. However, it has been emphasized that nutrition is not involved in these behaviours (17). In our study, it was found that there was no statistically significant relationship between the macronutrient intake and Rotter's Locus of Control Scale score ( $p > 0.05$ ). While 90.3% ( $n = 65$ ) of the participants in the study had a bad HEI score, 9.7% ( $n = 7$ ) had the score that should be improved; The fact that no "good" HEI score was found in the sample can be associated with the fact that the athletes are amateur youth soccer players. Having no nutrition education because there are no any dietitians in the club due to the limited budgets of amateur clubs, the presence of socioeconomic problems, low awareness of their families and themselves about sports nutrition and the limited and/or wrong knowledge of the trainers about sports nutrition. No statistically significant relationship was found between any of the HEI components and Rotter's Locus of Control Scale scores ( $p > 0.05$ ). Likewise, there was no statistically significant relationship found between the total HEI score and Rotter's Locus of Control Scale score ( $p > 0.05$ ).

There are a few studies in the literature that examine the relationship between athletes' ages and locus of control. In a study conducted with the participation of soccer players, no relationship was found between the locus of control of participants and their ages (18). Similarly, Hasırcı (19) found that age is not an important factor in team sports, and Baştürk (20) did not find a significant relationship between age and locus of control in male soccer players aged 14-16. On the other hand, in Knoop's research on locus of control and age, it is seen that participants under the age of 20 and over 60 are predominantly externally controlled, while participants aged 20-60 are predominantly internally controlled (21). In our study, a positively weak and statistically significant relationship was

found between the ages of the participants and the Rotter's Locus of Control Scale score ( $r: 0.268$ ;  $p = 0.023$ ;  $p < 0.05$ ). When the studies in the literature and our study are evaluated within a framework, the data on locus of control and age does not seem consistent. In order to reach a general comment about this relationship, it may be appropriate to work with more samples from different age groups.

The relationship between the time when participants started to play soccer and the locus of control, there are a few studies in the literature that examine this relationship. In the study conducted by Koca, no relationship was found between sports experience and locus of control score (22). Similarly, in another study, it was shown that there was no relationship between the time when participants started playing soccer and their locus of control (18). Differently, Bozyiğit emphasized in his study that as the sports experience of volleyball players increased, they became more internally controlled (23), while in the Hasırcı study, soccer players showed that as their sports experience increased, they became more externally controlled (19). In this study, a statistically significant relationship was not found between the results of Rotter's Locus of Control Scale and their time to start soccer.

In the light of all these scientific data and in line with the result of our study, no clear relationship was found between locus of control and anthropometric measurements, food intake, or diet quality. In this study, a significant statistical relationship was found only between locus of control and body mass index and skeletal muscle weight. In contrast, in multiple regression analysis, only the effect of skeletal muscle weight on Rotter's Locus of Control Scale was found to be significant. However, the narrow age group range, the fact that only the male soccer player group was studied, and this group was selected only from the amateur club may have limited the results of the study. Therefore, it is necessary to carry out advanced and more comprehensive studies by choosing from different sports branches of female and male athletes belonging to different age groups. Based on the significant relationships found in other studies

on locus of control and nutritional habits, this study leads the literature in examining this relationship in athletes as well.

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**Ethics approval • Etik Kurul Onayı:** *The protocol of the study was approved by the Ethical Committee of the Acibadem Mehmet Aydınlar University with the number of 2020-01/3. • Çalışmanın protokolü Acibadem Mehmet Aydınlar Üniversitesi Etik Kurulu tarafından 2020-01/3 numarası ile onaylanmıştır.*

**Conflict of interest • Çıkar çatışması:** *Yazarlar çıkar çatışması olmadığını beyan ederler. • The authors declare that they have no conflict of interest.*

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