RESEARCH ARTICLE

INTERNATIONAL JOURNAL OF KINANTHROPOMETRY

DOI: 10.34256/ijk2517

Analysis of Anthropometric Measurements and Somatotype Profile in Apprentice Jockeys

Muttalip Ayar [1,*], Yasemin Tuğba Öğünç [2], Ezgi Akdağ [3], Şirin Ece Alagöz [3], Fatih Ozbey [2]

[1] Istanbul Beykent University, Faculty of Health Science, Department of Nutrition and Dietetics, 34500, Istanbul, Türkiye
[2] University of Health Sciences Türkiye, Faculty of Hamidiye Health Sciences, Department of Nutrition and Dietetics, 34668, Istanbul, Türkiye
[3] University of Demiroglu Bilim, Institute of Health Sciences, Department of Nutrition and Dietetics, 34394, Istanbul, Türkiye
* Corresponding author email: mttlp_ayr@hotmail.com
DOI: https://doi.org/10.34256/ijk2517
Received: 03-01-2025; Revised: 11-03-2025, Accepted: 29-03-2025; Published: 13-04-2025

Abstract

Introduction: Body composition and somatotype characteristics are among the factors affecting performance in apprentice jockeys. This study aimed to determine the differences between apprentice jockeys with different anthropometric measurements and somatotype profiles. **Methods:** Male apprentice jockeys (n=46) from the Jockey Club of Turkey who were being trained at Ekrem Kurt Apprentice Training Centre were included in the study. The mean age of the study group was 16.39 ± 1.07 years, and the students were evaluated in two groups: 1st-grade and 2nd-grade students. Anthropometric measurements were taken, body composition was determined, and somatotype profiles were calculated by the Heath-Carter method. Pairwise comparisons of non-normally distributed quantitative data were performed using the Mann-Whitney U test. Statistical significance was set at $p < 0.05$. In addition, effect sizes were analyzed using Cohen's d effect size (ES) classification for pairwise comparisons. **Results:** The study determined the endomorphic component of apprentice jockeys as 2.32 ± 1.55, the mesomorphic component as 3.54 ± 1.00, and the ectomorphic component as 4.45 ± 1.05. In addition, no significant difference was found between the endomorphic, ectomorphic, and mesomorphic components in the comparison between the groups ($p>0.05$). In addition, according to the results of body composition measurements, the body lean mass (kg) of 2nd-grade students was higher ($p=0.001$). **Conclusions:** Apprentice jockeys are lean and thin in terms of body type, which explains the predominance of the ectomorphy component, which is characterized by low fat and moderate muscularity. Somatotypes, considered among the important components of performance in athletes, are frequently used in talent selection, especially in children and adolescent athletes. More studies are needed to determine the physical suitability of adolescent athletes for the jockeying profession.

Keywords: Anthropometers, Apprentice Jockeys, Body Composition, Somatotype

Resumen

Introducción: La composición corporal y las características somatotípicas se encuentran entre los factores que afectan el rendimiento en jinetes aprendices. Este estudio tuvo como objetivo determinar las diferencias entre jinetes aprendices con diferentes medidas antropométricas y perfiles somatotípicos**. Métodos:** Se incluyeron en el estudio 46 jinetes aprendices varones del Jockey Club de Turquía, quienes se formaban en el Centro de Formación de Aprendices Ekrem Kurt. La edad media del grupo de estudio fue de 16,39 ± 1,07 años, y los estudiantes fueron evaluados en dos grupos: estudiantes de 1.er y 2.º grado. Se tomaron medidas antropométricas, se determinó la composición corporal y se calcularon los perfiles somatotípicos mediante el método de Heath-Carter. Se realizaron comparaciones pareadas de datos cuantitativos con distribución no normal mediante la prueba U de Mann-Whitney. La significación estadística se estableció en $p < 0,05$. Además, se analizaron los tamaños del efecto utilizando la clasificación del tamaño del efecto (ES) de la d de Cohen para las comparaciones pareadas. **Resultados:** El estudio determinó el componente endomórfico de los jinetes aprendices como 2,32 ± 1,55, el componente mesomórfico como 3,54 ± 1,00 y el componente ectomórfico como 4,45 ± 1,05. Además, no se encontró diferencia significativa entre los componentes endomórfico, ectomórfico y mesomórfico en la comparación entre los grupos ($p>0,05$). Además, de acuerdo con los resultados de las mediciones de la composición corporal, la masa magra corporal (kg) de los estudiantes de 2º grado fue mayor ($p=0,001$).

Conclusiones: Los jinetes aprendices son delgados y esbeltos en términos de tipo de cuerpo, lo que explica el predominio del componente ectomorfico, que se caracteriza por baja grasa y musculatura moderada. Los somatotipos, considerados entre los componentes importantes del rendimiento en los atletas, se utilizan con frecuencia en la selección de talentos, especialmente en niños y adolescentes atletas. Se necesitan más estudios para determinar la idoneidad física de los atletas adolescentes para la profesión de jockey.

Palabras Clave: Antropómetros, Aprendices de jinete, Composición corporal, Somatotipo

Introduction

Horse racing is among the most popular and interesting sports branches worldwide. Jockeys differ from other athletes because they spend a long racing season with strict weight management, long working hours, and limited rest time to fulfill the competition conditions (Ryan et al., 2020). Jockeys have to meet the physiological demands of the sport and have optimal cardiovascular fitness and a particular muscular strength, as they have to control horses that weigh about 10 times their weight, in addition to the requirement to be light in weight (Kiely et al., 2018). From the past to the present, it is observed that jockeys have a relatively thin body structure, low body weight, and short stature. It is stated that this type of body provides an advantage in races by balancing power and body mass in the best way (O'connor et al., 2018). Although it varies according to the racing rules, strict weight limits in the range of 49.9-63.5 kg in flat races and 57.0-75.5 kg in jumping races are applied for jockeys in order to increase competitiveness (Wilson et al., 2014).

It is well known that athletic success is affected by various factors ranging from morphological and body composition characteristics to sport-specific skills (Cavedon et al., 2022). Anthropometric measurements are an important health and performance practice used to monitor the effectiveness of nutrition programs and training, especially in athletes (Campa et al., 2020). Body composition determined by using anthropometric characteristics are determined for which branch in sports and athletes suitable for these profiles are selected in the talent identification process in young athletes (Roelofs et al., 2017). Determination of somatotype profiles of athletes is instrumental in sports where body form may affect performance (Gutnik et al., 2015).

Carter and Heath developed a three-dimensional, formula-based concept for the detailed classification of body structure. Body types are based on three morphological components: endomorph (relative fatness), mesomorph (relative musculoskeletal development), and ectomorph (relative linearity), which are obtained by anthropometric measurements (Campa et al., 2020).

While mesomorphy is associated with individual sports requiring muscular strength, such as ball games and martial arts, ectomorphy is predominant in runners, especially long-distance runners, and endomorphy is predominant in athletes requiring high amounts of body fat, such as sumo wrestlers (Gutnik et al., 2015).

Among children and young athletes, the somatotype profiles of those who are successful in their branches are similar to those of adult athletes in the related branches. For these reasons, somatotypes play an important role in sport selection at an early age. Based on the individual's body structure, it is possible to predict physical abilities, reveal the physical structure suitable for a particular sports branch, and determine the effect of training on body structure. In addition, body types can help to understand which body structure is characterized by physical performance, which is an important factor in success (Yaşar et al., 2019).

This study aimed to determine and compare the body composition and somatotype profiles of apprentice jockeys in the adolescent age group during the training phase. It is important because it is the first scientific study to analyze the somatotype characteristics of apprentice jockeys.

Methods

This descriptive study was conducted between January and June 2023, with the participation of 46 male apprentice jockeys between the ages of 13 and 18 who were affiliated with the Turkish Jockey Club. Before the study, the athletes and their families were asked to approve the informed consent form. The ethics committee permission for the study was obtained from the Health Sciences University Hamidiye Scientific Research Ethics Committee (Decision no: 22/198).

Anthropometric measurements of the athletes were taken and recorded after an overnight fast between 06:00 and 08:00. Under normal conditions, anthropometric measurements followed the standard techniques adopted by the International Society for the Advancement of Kinanthropometry (ISAK). Thus, conditions that affect the thickness and compressibility of skinfold measurements, such as exercise, bathing, sauna use, or dehydration

Table 1. Anthropometric measurements and comparisons by classes

the day before, were avoided. Participants were measured barefoot and wearing only shorts (Sanchez Munoz et al., 2020). Measurements were repeated 3 times, so a new set of measurements was started after one set of measurements was completed.

Body Composition Measurements

Some anthropometric measurements were made to determine the body composition of apprentice jockeys. These measurements included weight, height, skinfold thickness, circumference, and bone diameter.

Several anthropometric measurements were taken to determine the body composition of the apprentice jockeys. These measurements included weight, height, skinfold thickness, circumference, and bone diameter.

Body weight was measured using a weighing scale (Tanita BC730) measuring to the nearest 0.1 kg. Height was measured with a stadiometer (SECA 213) at 0.1 cm intervals. Skinfold thickness was measured using a skinfold caliper (Holtain) with an accuracy of 0.1 mm. Body circumference was measured using a 7 mm wide, rigid steel tape, and bone diameter was measured using a bicondylar caliper (Holtain). Body fat percentage was calculated from skinfold thickness measurements. Body density was calculated using the Lohman formula, and body fat percentage was calculated using the Brozek equation (Ayar et al., 2023).

Somatotype

According to Carter and Heath, somatotypes and height-to-weight ratio (HWR) were calculated using anthropometric measurements, including height, weight, six skinfold thicknesses (triceps, biceps, subscapular, supraspinal, abdominal, and calf), two bicondylar widths (humerus and femur), and two arm circumferences (upper arm and calf) (Nobari et al., 2021; Carter, 2002).

Heath-Carter Somatotype Formula

- Endomorphism = - 0.7182 + 0.1451 * x - 0.00068 * x 2 + 0.0000014 * x 3 (x = ‘Triceps’ + ‘Suprailiac’ + ‘Subscapula’) Height Correction Formula = x * 170.18 / height (cm)
- Mesomorphy = [0.858 + 0.601 * elbow width - ‘bicondylar humerus’ (cm) + 0.601 * knee width - ‘bicondylar femur’ (cm) + 0.188 * arm circumference (cm) + 0.161 * calf circumference (cm)] - [height (m) * 0.131] + 4.50
- Ectomorphy = (Height-to-weight ratio) * 0.732 - 28.58 (Height-to-weight ratio = Height / 3 √ Weight)

It is expressed as three numbered values, always in the same order, representing the components of endomorphism, mesomorphism, and ectomorphism, respectively (Carter, 2002).

Statistical Analysis

Statistical analysis of the data collected in the study was carried out using SPSS 25.0 (IBM SPSS Statistics for Windows). The data were analyzed using descriptive statistical methods (mean, standard deviation, median, frequency, ratio, minimum, and maximum), and the normality of the distribution was tested using the Kolmogrov-Smirnov test. Pairwise comparisons of non-normally distributed quantitative data were performed using the Mann-Whitney U test. Statistical significance was set at $p < 0.05$. In addition, effect sizes were analyzed using Cohen's d effect size (ES) classification for pairwise comparisons. ES sizes were classified according to the Hopkins scale: 0.0-0.2 = trivial; 0.2-0.6 = small; 0.6-1.2 = moderate; 1.2-2.0 = large; 2.0-4.0 = very large; >4.0 = almost perfect (Bernards et al., 2017).

Results

The body weight (kg), height (cm), body circumference (cm), and diameter (cm) of the apprentice jockeys participating in the study were measured. The mean age of the participants was 16.39±1.07 years, the mean height was 163.05±5.87 cm, and the mean body weight was 47.41±5.07 kg. When comparing the classes, it was found that the mean age of the 2nd-grade students was higher than that of the st-grade students, and their height and body weight were also higher ($p<0.05$) (Table 1)

	Total (n=46)	1st-grade (n=15)	2nd-grade (n=31)	p	Effect Size
Age (years)	16.39±1.07 (13.88-18.13)	15.18±0.79 (13.88-16.18)	16.98±0.57 (16.25-18.13)	**0.000***	.975
Body Height (cm)	163.05±5.87 (150.10-174.30)	159.09±5.10 (150.10-169.50)	164.96±5.29 (155.10-174.30)	**0.002***	.786
Body Weight (kg)	47.41±5.07 (37.30-57.80)	43.95±4.53 (37.30-52.00)	49.08±4.48 (39.90-57.80)	**0.002***	.790
BMI (kg/m^2)	17.82±1.58 (14.80-22.21)	17.33±1.22 (14.80-19.49)	18.05±1.70 (15.85-22.21)	**0.331**	.628
Calf circumference (cm)	30.36±1.70 (27.30-34.00)	29.68±1.43 (28.00-33.00)	30.70±1.74 (27.30-34.00)	**0.074**	.619
Flexed arm (cm)	26.61±4.21 (2.30-32.00)	24.64±6.39 (2.30-29.70)	27.56±2.16 (23.50-32.00)	**0.024***	.726
Extended Arm (cm)	25.51±2.05 (21.50-30.00)	24.48±1.83 (21.50-27.20)	26.01±1.99 (22.00-30.00)	**0.030***	.788
Humerus Bicondyle (cm)	6.46±0.32 (5.80-7.20)	6.31±0.32 (5.80-7.00)	6.53±0.30 (5.90-7.20)	**0.023***	.694
Femur Bicondyle (cm)	9.01±0.75 (5.20-10.60)	8.72±1.07 (5.20-9.60)	9.15±0.51 (8.20-10.60)	**0.264**	.616

Abbreviation: BMI, Body Mass Index, Values are presented as Mean ± SD (min-max), *p < 0.05; **p < 0.01.

Mann Whitney U test was performed to compare baseline differences between groups.

Table 2. Skinfold thickness measurements and body fat percentage averages by class

	Total (n=46)	1st-grade (n=15)	2nd-grade (n=31)	p	Effect Size
Age (years)	16.39±1.07 (13.88-18.13)	15.18±0.79 (13.88-16.18)	16.98±0.57 (16.25-18.13)	**0.000***	.975
Body Height (cm)	163.05±5.87 (150.10-174.30)	159.09±5.10 (150.10-169.50)	164.96±5.29 (155.10-174.30)	**0.002***	.786
Body Weight (kg)	47.41±5.07 (37.30-57.80)	43.95±4.53 (37.30-52.00)	49.08±4.48 (39.90-57.80)	**0.002***	.790
BMI (kg/m^2)	17.82±1.58 (14.80-22.21)	17.33±1.22 (14.80-19.49)	18.05±1.70 (15.85-22.21)	**0.331**	.628
Calf circumference (cm)	30.36±1.70 (27.30-34.00)	29.68±1.43 (28.00-33.00)	30.70±1.74 (27.30-34.00)	**0.074**	.619
Flexed arm (cm)	26.61±4.21 (2.30-32.00)	24.64±6.39 (2.30-29.70)	27.56±2.16 (23.50-32.00)	**0.024***	.726
Extended Arm (cm)	25.51±2.05 (21.50-30.00)	24.48±1.83 (21.50-27.20)	26.01±1.99 (22.00-30.00)	**0.030***	.788
Humerus Bicondyle (cm)	6.46±0.32 (5.80-7.20)	6.31±0.32 (5.80-7.00)	6.53±0.30 (5.90-7.20)	**0.023***	.694
Femur Bicondyle (cm)	9.01±0.75 (5.20-10.60)	8.72±1.07 (5.20-9.60)	9.15±0.51 (8.20-10.60)	**0.264**	.616

Abbreviation: BMI, Body Mass Index, Values are presented as Mean ± SD (min-max), *p < 0.05; **p < 0.01.

Mann Whitney U test was performed to compare baseline differences between groups.

As part of the study, skinfold thickness measurements were taken to determine body composition and somatotypes. Among the skinfold thickness measurements, subscapular (mm) measurements were statistically higher in 2nd-grade students than in 1st-grade students (p=0.009). The mean body fat percentage was similar in both groups (p>0.05) (Table 2).

The somatotype values of the apprentice jockeys who participated in the study are shown in Table 3. The somatotype values of the athletes were calculated as 2.32, 3.54, and 4.45. It was found that the ectomorphic character of the athletes was higher than that of the others. It should be noted that there was no statistically significant difference between the groups (p<0.05).

Table 3. Body type classification

	Total (n=46)	1st-grade (n=15)	2nd-grade (n=31)	p	Effect Size
Endomorphy	2.32 ±1.55 (1.19-11.24)	2.50±2.46 (1.19-11.24)	2.23±0.88 (1.21-4.58)	**0.439**	.549
Mesomorphy	3.54± 1.00 (1.09-6.76)	3.43±0. 89 (1.09-4.71)	3.59±1.07 (1.78-6.76)	**0.935**	.544
Ectomorphy	4.45±1.05 (1.69-6.27)	4.46±0. 81 (3.27-6.27)	4.45±1.17 (1.69-6.15)	**0.824**	.503

Values are presented as Mean ± SD (min-max), *p < 0.05; **p < 0.01.

Mann Whitney U test was performed to compare baseline differences between groups.

The apprentice jockeys' somatotypes were assessed in 13 categories (Table 4). The distributions of the somatotypes of the 1st-grade students (Figure 1) and the 2nd-grade students (Figure 2) are shown.

Table 4. Somatotype categories of apprentice jockeys according to their classes

Categories	1st-grade	2nd-grade
Endomorphic Ectomorph	-	-
Ectomorphic Endomorph	-	-
Balanced Endomorph	-	-
Mesomorphic Endomorph	-	-
Mesomorph - Endomorph	1	-
Endomorphic Mesomorph	-	1
Balanced Mesomorph	-	5
Ectomorphic Mesomorph	2	3
Mesomorph - Ectomorph	5	4
Mesomorphic Ectomorph	4	15
Balanced Ectomorph	3	2
Endomorphic Ectomorph	-	-
Central	-	1
Total	15	31

Discussion

Body composition plays a fundamental role in jockey performance and in determining the abilities of young athletes (Malina & Geithner, 2011). This study aimed to determine the anthropometric characteristics and somatotype profiles of apprentice jockeys and compare them with those of other sports in the literature.

Jockeys are generally athletes with a lean body type and have been reported to have BMI values as low as approximately 20 kg/m^2 (Wilson et al., 2014). Body composition is one of the many determinants of sports performance, but it is prioritized in performance assessment, especially in young athletes (Malina & Geithner, 2011).

DOI: 10.34256/ijk2517

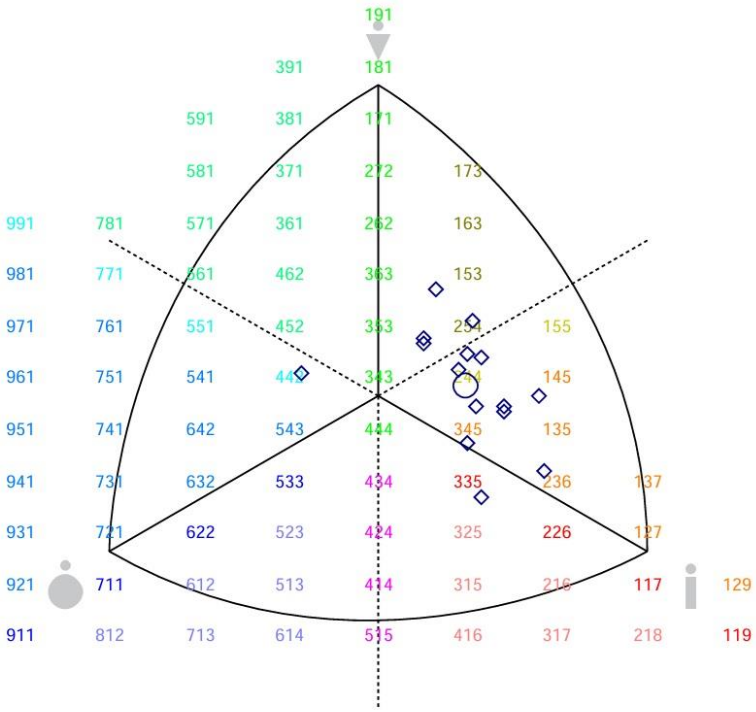

Figure 1. The distributions of the somatotypes of the 1st-grade students. Mean profile of Document: ○

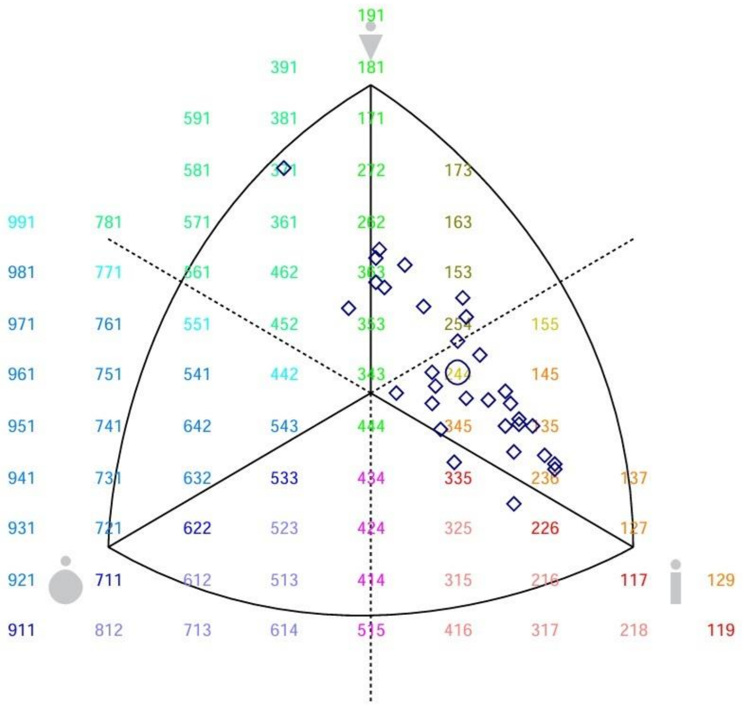

Figure 2. The distributions of the somatotypes of the 2nd-grade students. Mean profile of Document: ○

In ‘weight-sensitive’ sports such as horse racing, low body mass and leanness are targeted to support performance (Mathisen et al., 2023). Excessive body fat percentage can have a negative impact on sports performance and is often recognized as a significant limiting factor in athletic achievement (Santos et al., 2014). A study conducted by Cullen et al. (2015) found that male apprentice jockeys with an average age of 19 years had significantly lower BMI and body mass than their physically active peers. In another study (n=32) evaluating the body composition of apprentice jockeys of the same age group, it was shown that the average body weight of the jockeys was 56 kg, and their total fat mass was 7.2 kg (Wilson et al., 2020). In this study, it was concluded that the mean body weight of the participants was 44 kg, and the total fat mass was 4.2 kg. The total body weight and fat mass were lower than the studies in the literature because the study sample consisted of younger age group apprentice jockeys.

The average BMI of the apprentice jockeys participating in the study was 17.5 kg/m^2. According to the BMI percentile curve for age, the average BMI of the participating apprentice jockeys was below the 5th percentile curve, and they were in the underweight category. A study of male apprentice jockeys in Australia reported that they were in the lowest 5th percentile of international weight-for-age standards (Silk et al., 2015). Whilst a higher body fat percentage in sports can be detrimental to endurance performance, it has been reported that increased muscle mass can benefit performance in various sports (Mathisen et al., 2023). However, the fact that BMI does not distinguish between lean and fat mass makes it inadequate to assess body composition's effect on performance (Andrade et al., 2023).

The mean somatotype of the apprentice jockeys in the study was ectomorphic (2.32; 3.54; 4.45). Ectomorphy dominates the ectomorphic somatotype, while endomorphy and mesomorphy are less than half a unit (Carter, 2002). Although thinness and leanness are prominent in the ectomorphic body type profile, it has been reported that body composition is associated with leanness (Tóth et al., 2014) and that children with low body weight tend to have an ectomorphic somatotype (Andrade et al., 2023). These characteristics support the need for minimal body weight, improved balance, and high muscular endurance during races (Wilson et al., 2020).

It has been reported that somatotype is positively associated with ectomorphy value and negatively associated with the endomorphy value in sports where leg pushing is dominant, and performance is based on factors such as leg strength; however, low ectomorphy scores may be advantageous in power movements where short arms are preferred (Ryan-Stewart et al., 2018). In horse races, jockeys use their arms and hands only for directional control and pushing the horse forward, which is associated with lower upper arm muscle activity in apprentices (Legg et al., 2022). On the other hand, in rowing, where the legs are a strong determinant of performance, it has been shown that the somatotype of male rowers is ecto-mesomorphic. In contrast, the somatotype of female rowers is balanced mesomorphic (Penichet-Tomas et al., 2021).

Studies of somatotypes in elite sports have shown that the ideal somatotype varies from sport to sport. Although mesomorphism is often associated with athletic success, its dominance is not evident in every sport. It has been reported that skiers' somatotypes are predominantly endomorphic, basketball players are predominantly endomorphic, and football players are predominantly ectomorphic (Gutnik et al., 2015). In water sports, cycling, and combat sports, the central mesomorphic somatotype, which tends towards endomorphism, is more common (Baranauskas et al., 2024).

Various environmental factors such as diet, physical activity, and other lifestyle changes have been shown to influence somatotype (Ventrella et al., 2008). It has been reported that in males who are physically inactive during adolescence and before, the endorphic component is significantly higher in those who are physically active. In contrast, the ectomorphic component is significantly higher in those who are physically active (Longkumer, 2014).

The relationship between body composition and performance is complex and sport-specific (Lukaski & Raymond-Pope, 2021). Specific body composition profiles are required for successful performance in different sports (González Macías & Flores, 2024). Somatotypes are relatively stable during growth, and all three somatotype components are highly related to genetic background (Ventrella et al., 2008). It has been noted that somatotype methods using anthropometric measurements of body shape and composition are instrumental in sports where the biomechanics of body movements and, thus, the resulting performance have a direct effect (Gutnik et al., 2015; Ryan-Stewart et al., 2018). In this way, it is understood that it can be used as a marker to evaluate young athletes to achieve sports success.

This study is important because it is the first to determine somatotype characteristics in apprentice jockeys. It can be a reference source when guiding young athletes into the horseracing field. However, due to the small sample size, the results should be interpreted on an individual level and with caution.

Conclusion

Apprentice jockeys are lean and thin in terms of body type, which explains the predominance of the ectomorphy component, which is characterized by low fat and moderate muscularity. The physical requirements for success in each sport are different. Somatotype profiling can be an important tool in assessing jockeys' athletic performance. Therefore, somatotype profiles can be used to optimize training and racing results for apprentice jockeys. More studies are needed to determine the physical suitability of adolescent athletes for the jockeying profession.

References

Andrade, L. D., Vilca, N. G., Figueroa, M. I., Martínez, J. I., Alfaro Gómez, E. L., Dipierri, J. E. (2023). Somatotype Altitudinal Variation and Its Relationship with the Nutritional Status of Children in the Jujuy Province, Argentina. *American Journal of Human Biology*, 35(9): E23910. https://doi.org/10.1002/ajhb.23910

Ayar, M., Kucuk Yetgin, M., Agopyan, A., Elmacioglu, F. (2023). The Effect Of A Nutrition Program For Weight Loss During The Pre-Competition Period On The Body Composition, Hydration, And Mood Profile Of Elite Greco–Roman Wrestlers. *Sport Sciences for Health*, 19(4): 1245-1256. https://doi.org/10.1007/s11332-023-01059-7

Baranauskas, M., Kupčiūnaitė, I., Lieponienė, J., Stukas, R. (2024). Dominant Somatotype Development In Relation To Body Composition and Dietary Macronutrient Intake among High-Performance Athletes in Water, Cycling and Combat Sports. *Nutrients*, *16*(10): 1493. https://doi.org/10.3390/nu16101493

Bernards, J. R., Sato, K., Haff, G. G., Bazyler, C. D. (2017). Current Research and Statistical Practices in Sport Science and a Need for Change. *Sports*, *5*(4): 87. https://doi.org/10.3390/sports5040087

Campa, F., Silva, A. M., Talluri, J., Matias, C. N., Badicu, G., Toselli, S. (2020). Somatotype and Bioimpedance Vector Analysis: A New Target Zone for Male Athletes. *Sustainability*, *12*(11): 4365. https://doi.org/10.3390/su12114365

Carter, J. E. L. (2002). Part 1: The Heath-Carter Anthropometric Somatotype-Instruction Manual. *Department Of Exercise and Nutritional Sciences San Diego State University*.

Cavedon, V., Milanese, C., Sacristani, F., Zancanaro, C. (2022). Body Composition in Karate: A Dual-Energy X-Ray Absorptiometry Study. *Applied Sciences*, 13(1): 559. https://doi.org/10.3390/app13010559

Cullen, S., Dolan, E., Mcgoldrick, A., Brien, K. O., Carson, B. P., Warrington, G. (2015). The Impact of Making-Weight on Cognitive Performance in Apprentice Jockeys. *Journal of Sports Sciences*, 33(15): 1589-1595. https://doi.org/10.1080/02640414.2014.1002104

González Macías, M. E., Flores, J. (2024). Somatotype, Anthropometric Characteristics, Body Composition, and Global Flexibility Range in Artistic Gymnasts and Sport Hoop Athletes. *Plos One*, *19*(10): E0312555. https://doi.org/10.1371/journal.pone.0312555

Gutnik, B., Zuoza, A., Zuozienė, I., Alekrinskis, A., Nash, D., Scherbina, S. (2015). Body Physique and Dominant Somatotype in Elite and Low-Profile Athletes with Different Specializations. *Medicina*, 51(4): 247-252. https://doi.org/10.1016/j.medici.2015.07.003

Kiely, M. A., Warrington, G. D., Mcgoldrick, A., O'loughlin, G., Cullen, S. (2018). Physiological Demands of Daily Riding Gaits in Jockeys. *The Journal of Sports Medicine and Physical Fitness*, 59(3): 394-398. https://doi.org/10.23736/S0022-4707.18.08196-3

Legg, K., Cochrane, D., Gee, E., Macdermid, P., Rogers, C. (2022). Physiological Demands and Muscle Activity of Jockeys in Trial and Race Riding. *Animals*, 12(18): 2351. https://doi.org/10.3390/ani12182351

Longkumer, T. (2014). Physical Activity and Somatotypes among Ao Naga Boys. *The Anthropologist*, *17*(2): 669-675. https://doi.org/10.1080/09720073.2014.11891476

Lukaski, H., Raymond-Pope, C. J. (2021). New Frontiers of Body Composition in Sport. *International Journal of Sports Medicine*, *42*(07): 588-601. https://doi.org/10.1055/a-1373-5881

Malina, R. M., Geithner, C. A. (2011). Body Composition of Young Athletes. *American Journal of Lifestyle Medicine*, *5*(3): 262-278. https://doi.org/10.1177/1559827610392493

Mathisen, T. F., Ackland, T., Burke, L. M., Constantini, N., Haudum, J., Macnaughton, L. S., ... & Sundgot-Borgen, J. (2023). Best practice recommendations for body composition considerations in sport to reduce health and performance risks: a critical review, original survey and expert opinion by a subgroup of the IOC consensus on Relative Energy Deficiency in Sport (REDs). British Journal of Sports Medicine, 57(17), 1148-1160.Nobari, H., Oliveira, R., Clemente, F. M., Pérez-Gómez, J., Pardos-Mainer, E., Ardigò, L. P. (2021). Somatotype, Accumulated Workload, and Fitness Parameters in Elite Youth Players: Associations with Playing Position. *Children*, *8*(5): 375.

Nobari, H., Oliveira, R., Clemente, F. M., Pérez-Gómez, J., Pardos-Mainer, E., Ardigò, L. P. (2021). Somatotype, Accumulated Workload, and Fitness Parameters in Elite Youth Players: Associations with Playing Position. *Children*, *8*(5): 375.

O'connor, S., Warrington, G., Mb, A. M., Cullen, S. (2018). A 9-Year Epidemiologic Study (2007–2015) On Race-Day Jockey Fall and Injury Incidence in Amateur Irish Horse Racing. *Journal of Athletic Training*, *53*(10): 950-955. https://doi.org/10.4085/1062-6050-339-17

Penichet-Tomas, A., Pueo, B., Selles-Perez, S., Jimenez-Olmedo, J. M. (2021). Analysis of Anthropometric and Body Composition Profile In Male and Female Traditional Rowers. *International Journal of Environmental Research and Public Health*, *18*(15): 7826. https://doi.org/10.3390/ijerph18157826

Roelofs, E. J., Smith-Ryan, A. E., Trexler, E. T., Hirsch, K. R. (2017). Seasonal Effects on Body Composition, Muscle Characteristics, and Performance of Collegiate Swimmers and Divers. *Journal of Athletic Training*, *52*(1): 45-50. https://doi.org/10.4085/1062-6050-51.12.26

Ryan, K. D., Brodine, J., Pothast, J., McGoldrick, A. (2020). Medicine in the Sport of Horse Racing. *Current Sports Medicine Reports*, *19*(9): 373-379. https://doi.org/10.1249/JSR.0000000000000750

Ryan-Stewart, H., Faulkner, J., Jobson, S. (2018). The Influence of Somatotype on Anaerobic Performance. *Plos One*, *13*(5): E0197761. https://doi.org/10.1371/journal.pone.0197761

Sanchez Munoz, C., Muros, J. J., Lopez Belmonte, O., Zabala, M. (2020). Anthropometric Characteristics, Body Composition and Somatotype of Elite Male Young Runners. *International Journal of Environmental Research and Public Health*, 17(2): 674. https://doi.org/10.3390/ijerph17020674

Santos, D. A., Dawson, J. A., Matias, C. N., Rocha, P. M., Minderico, C. S., Allison, D. B., Sardinha, L.B., Silva, A.M. (2014). Reference Values for Body Composition and Anthropometric Measurements in Athletes. *Plos One*, *9*(5): E97846. https://doi.org/10.1371/journal.pone.0097846

Silk, L. N., Greene, D. A., Baker, M. K., Jander, C. B. (2015). Tibial Bone Responses to 6-Month Calcium And Vitamin D Supplementation In Young Male Jockeys: A Randomised Controlled Trial. *Bone*, *81*: 554-561. https://doi.org/10.1016/j.bone.2015.09.004

Tóth, T., Michalíková, M., Bednarčíková, L., Živčák, J., Kneppo, P. (2014). Somatotypes in Sport. *Acta Mechanica et Automatica*, *8*(1): 27-32. https://doi.org/10.2478/ama-2014-0005

Ventrella, A. R., Semproli, S., Jürimäe, J., Toselli, S., Claessens, A. L., Jürimäe, T., Brasili, P. (2008). Somatotype in 6–11-Year-Old Italian and Estonian Schoolchildren. *Homo*, *59*(5): 383-396. https://doi.org/10.1016/j.jchb.2007.07.001

Wilson, G., Drust, B., Morton, J. P., Close, G. L. (2014). Weight-Making Strategies in Professional Jockeys: Implications for Physical and Mental Health and Well-Being. *Sports Medicine*, *44*: 785-796. https://doi.org/10.1007/s40279-014-0169-7

Wilson, G., Hill, J., Martin, D., Morton, J. P., Close, G. L. (2020). Gb Apprentice Jockeys Do Not Have The Body Composition To Make Current Minimum Race Weights: Is It Time To Change The Weights Or Change The Jockeys? *International Journal of Sport Nutrition and Exercise Metabolism*, *30*(2): 101-104. https://doi.org/10.1123/ijsnem.2019-0288

Yaşar, B., Özder, A., Önal, S., Özdemir, A., Yavuz, C. M., Sağır, M., Özer, B. K. (2019). Farkli Kategorilerdeki Futbolcularin Somatotip, *Spormetre Beden Eğitimi Ve Spor Bilimle,* 17(4):143-157. https://doi.org/10.33689/spormetre.566493

Acknowledgments

The researchers would like to thank the students and their parents who volunteered to participate in the study. We would also like to thank the Turkish Jockey Club officials who provided the necessary permissions for the fieldwork and implementation.

Funding

There is no external funding to declare

DOI: 10.34256/ijk2517

Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Informed Consent Statement

All the athletes included in the study provided written informed consent.

About the License