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Anthropometric and Somatotype Characteristics of Top Elite Turkish National Jumpers

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Resumen

Introducción: Este estudio tiene como objetivo investigar exhaustivamente las características antropométricas y somatotípicas de los saltadores nacionales turcos de élite especializados en las disciplinas de salto de altura, salto de longitud, salto con pértiga y salto triple. Al reconocer la importancia fundamental de la composición corporal y el somatotipo en el rendimiento deportivo, la investigación profundiza en la intrincada interacción entre estos atributos y los logros competitivos. **Métodos:** Aprovechando una cohorte de 13 atletas nacionales, compuesta por seis mujeres y siete hombres, la metodología implica la aplicación de mediciones antropométricas estandarizadas y el método Heath-Carter para la evaluación del somatotipo. **Resultados**: Los resultados iluminan distintos perfiles, que presentan porcentajes de grasa corporal más bajos en saltadores de élite turcos en comparación con los estudios existentes. Además, el estudio revela variaciones específicas de género en la masa muscular y distingue patrones de somatotipo únicos dentro de la cohorte. Significativamente, las puntuaciones de somatotipo se alinean con las tendencias globales observadas en los atletas de salto de altura de élite, enfatizando los patrones universales entre los deportistas de alto nivel. Los análisis comparativos con estudios internacionales subrayan aún más los puntos en común en los componentes del somatotipo entre los atletas de élite. Además, se discernió que los mejores saltadores de ambos sexos exhibían una altura y un peso corporal más bajos en comparación con sus homólogos de élite de salto de altura. Esta investigación contribuye a una comprensión refinada de las complejidades morfológicas asociadas con el dominio de estas disciplinas, ofreciendo información valiosa para optimizar los regímenes de entrenamiento. **Conclusión:** En resumen, el estudio subraya el papel fundamental que desempeñan las características antropométricas y somatotípicas en la configuración del éxito de los saltadores nacionales turcos de élite.

Palabras Clave: Índice de masa corporal, Características morfológicas, Atletismo, Composición corporal

Abstract

Introduction: This study aims to comprehensively investigate the anthropometric and somatotype characteristics of elite Turkish national jumpers specializing in high jump, long jump, pole vault, and triple jump disciplines. Recognizing the fundamental significance of body composition and somatotype in athletic performance, the research delves into the intricate interplay between these attributes, and competitive accomplishments. **Methods:** Leveraging a cohort of 13 national athletes, comprising six females and seven males, the methodology involves the application of standardized anthropometric measurements and the Heath-Carter method for somatotype assessment. **Results:** The outcomes illuminate distinct profiles, featuring lower body fat percentages in Turkish elite jumpers when compared to existing studies. Additionally, the study reveals gender-specific variations in muscle mass and discerns unique somatotype patterns within the cohort. Significantly, somatotype scores align with global trends observed in elite high jump athletes, emphasizing universal patterns among top-level performers. Comparative analyses with international studies further underscore commonalities in somatotype components among elite athletes. Furthermore, it was discerned that the top jumpers in both genders exhibited lower body height and body weight in comparison to their elite high-jumping counterparts. This research contributes to a refined understanding of the morphological intricacies associated with proficiency in these disciplines, offering valuable insights for optimizing training regimens. **Conclusion:** In summary, the study underscores the pivotal role played by anthropometric and somatotype characteristics in shaping the success of top elite Turkish national jumpers.

Keywords: Body mass index, Morphological Characteristics, Track and Field, Body Composition

Introduction

The body composition and somatotype of athletes play a substantial role in sports performance, complementing other influential factors such as physiological capacity, physical fitness, psychological considerations, and skill proficiency (Shahidi, Al-Gburı, Karakas, & Taşkıran, 2023). Numerous studies have provided corroborative evidence for the assertion that optimal athletic performance is contingent upon the possession of a specific physique tailored to the demands of the respective sport (Shahidi, Carlberg, & Kingsley, 2023; Shahidi, Yilmaz, & Esformes, 2023). The attainment of success in various competitions is contingent upon the meticulous consideration of morphological characteristics, a pivotal factor that is intrinsically tied to the specificities of each competition or event (Anup, Nahida, Nazrul Islam, & Kitab, 2014). It is imperative to recognize that these morphological attributes play a crucial role in influencing outcomes, thereby underscoring their significance within competitive endeavors (Singh, Singh, & Singh, 2010). The attainment of success in specific sporting events necessitates the possession of distinctive anthropometric characteristics (Abraham, 2010). It is crucial to recognize that variations exist in the body structure and composition of individuals engaged in individual sports as opposed to team sports (Peeri, Shahidi, & Azarbayjani, 2014; Shahidi, Kingsley, Svensson, TAŞKIRAN, & Hassani, 2021). The nature of tasks inherent to certain events, exemplified by disciplines such as shot put or high jump, is highly specific, contributing to the emergence of diverse and event-specific physiques conducive to success (Langer). This phenomenon, wherein the physical requirements of a sport drive the selection of optimal body types tailored to that sport, is academically denoted as "morphological optimization"(Mande, 2016). Examinations of somatotypes among athletes, encompassing both elite and Olympic-caliber performers, have consistently revealed discernible patterns (Yadav & Sardar, 2016). Athletes reliant on strength and speed have exhibited a predominant mesomorphic constitution, characterized by a well-developed musculature (Singh & Kumar, 2018). In contrast, those engaged in endurance-centric disciplines have demonstrated a predilection towards ectomorphy, typified by a leaner physique with a reduced degree of mesomorphic muscularity (J. L. Carter & Heath, 1990). These findings contribute to a nuanced understanding of the relationship between somatotype and athletic specialization, providing valuable insights into the morphological distinctions associated with varying athletic demands (Adhikari & McNeely, 2015). Langer (2007) conducted a comprehensive investigation into the somatotypes of high jump athletes (Langer). Across a majority of measured parameters, discernible trends were observed indicating an inclination for an increase in specific somatotype components. The average somatotype for high jumpers was identified as 3.4–3.7–4.2. Noteworthy among the prevalent somatotypes were endomorphic mesomorphs (16.7%), mesomorphic ectomorphs (15.2%), and ectomorphic mesomorphs (13.5%). In the female high jumpers under scrutiny, the most frequently occurring somatotypes included endomorphic ectomorphs (43.8%), mesomorphic ectomorphs, ectomorphic endomorphs (each at 16.3%), and ectomorphic mesomorphs (15.2%) (Langer). These findings contribute to a nuanced understanding of the somatotypic profiles characterizing high jump athletes, thereby enhancing our comprehension of the morphological nuances associated with proficiency in this specific athletic discipline. Athletics specifically centered on jump disciplines like long jump, high jump, and triple jump, constitutes a captivating domain within sports science. Athletes engaged in these events exhibit unique skill sets and physiological adaptations crucial for high-performance execution (Asfaw & Pallavi, 2018). In-depth exploration of these disciplines involves delving into the anthropometric characteristics of jumpers, encompassing factors such as body composition, limb length ratios, and muscle distribution (Asfaw & Pallavi, 2018; KaurTiwana, 2013; Langer). Understanding the intricate interplay between anthropometric features and athletic success is paramount in this realm of study, providing valuable insights into the mechanics and physiological adaptations necessary for achieving exceptional performance in jumping disciplines. Therefore, the primary objective of the current investigation was to assess the anthropometric characteristics of the Turkish elite national athletic squad and ascertain the significance of these anthropometric attributes in relation to performance levels. This study sought to elucidate the interplay between anthropometric variables and athletic performance within the context of the national athletic team.

Methods

The current study encompassed a cohort comprising 6 female and 7 male athletes (N=13, mean age: 24.4, weight: 67.9, height: 177.1 ± 8.4) specializing in high jump, long jump, pole vault, and triple jump, all of whom were members of the Turkish senior national team (Figure 1). The research methodology involved the acquisition of primary data through standardized anthropometric measurements. Additionally, secondary data were obtained, specifically pertaining to the athletes' best performance results achieved in competitive settings. The most notable performance outcomes of athletes were discovered on the European Athletics websites (https://www.european-athletics.com/) has shown in table 1. It is essential to note that all aspects of this research adhered to the principles outlined in the Declaration of Helsinki and were granted approval by the Institutional Review Board of Istanbul Gedik University.

Table 1. Encapsulates the culmination of optimal performance records attained by individual athletes throughout the competition.

Name-Surname	Gender	Branch	Best Result (Cm)	Country
A... A..	M	HIGH JUMP	230 CM	Cluj-Napoca (ROU)
G... A..	F	TRIPLE JUMP	1385 CM	Seha Aksoy Atletizm Pisti, Izmir (TUR)
A... E... Ü...	M	HIGH JUMP	223 CM	Doug Shaw Memorial Stadium, Myrtle Beach, SC (USA)
B... S...	F	HIGH JUMP	189 CM	Atletski Stadion, Kraljevo (SRB)
I... A..	M	POLE VAULT	520 CM	Ust-Kamenogorsk (KAZ)
T... D...	F	TRIPLE JUMP	1431 CM	Shuangliu Sports Centre, Chengdu (CHN)
N... E...	M	TRIPLE JUMP	1737 CM	Gunder Hägg Stadion, Gävle (SWE)
K... A..	F	HIGH JUMP	186 CM	Istanbul (TUR)
D... P...	F	POLE VAULT	433 CM	Istanbul (TUR)
B... A...	M	HIGH JUMP	205 CM	Istanbul (TUR)
M... B...	M	TRIPLE JUMP	1578 CM	Atıcılar Atletizm Sahası, Bursa (TUR)
I... M... M...	F	LONG JUMP	546 CM	Seha Aksoy Atletizm Pisti, Izmir (TUR)
Y... E... G...	M	LONG JUMP	751 CM	Erzurum (TUR)

Anthropometric

Anthropometric variables were assessed following the International Society for the Advancement of Kinanthropo metry (ISAK) protocol guidelines (Shahidi, Al-Gburı, et al., 2023).

Figure 1. Presents anthropometric characteristics of athletes

The anthropometric measures assessed were weight, stature, sitting height, arm span, segment lengths, bone breadths, muscle girths, and skinfolds. Body composition was determined using the five-way fractionation model, which partitions the body into distinct anatomical components: adipose, muscle, bone, residual, and skin tissue masse (Norton et al., 1996; Kerr, 1988). The proportionality of body mass fractionation was assessed using the Phantom Z-score stratagem (Ross & Marfell-Jones, 1991). Additionally, the following anthropometric indices were calculated: body mass index (BMI; body mass in kg/height in m²), the sum of four, six, and eight skinfolds, and muscle-to-bone ratio as kg muscle · kg bone-1.

Somatotype

The Heath-Carter method was employed to assess somatotype in the present study (J. Carter, 2002). The calculation of somatotype was performed utilizing the following equations as prescribed by Heath and Carter.

Endomorphy = ─ 0.7182 + 0.1451 × ∑SF ─ 0.00068 × ∑SF2 + 0.0000014 × ∑SF3 where ∑SF = (sum of triceps, subscapular and supraspinale skinfolds) multiplied by (170.18/height in cm). This is called height-corrected endomorphy and is the preferred method for calculating endomorphy).

Mesomorphy = 0.858 × humerus breadth + 0.601 × femur breadth + 0.188 × corrected arm girth + 0.161 × corrected calf girth ─ height × 0.131 +4.5

Three different equations are used to calculate ectomorphy according to the height-weight ratio (HWR): If HWR is greater than or equal to 40.75, Ectomorphy = 0.732 × HWR ─ 28.58. If HWR is less than 40.75 and greater than 38.25 then, Ectomorphy = 0.463 × HWR ─ 17.63. If HWR is equal to or less than 38.25 then, Ectomorphy = 0.1

Statistical analysis

Statistical analyses were conducted using SPSS 26.0 (Statistical Package for the Social Sciences). Descriptive and inferential statistical procedures, including the computation of means and standard deviations, were employed to analyze the data comprehensively, addressing the research questions posed in this study.

Results

Table 1 and Table 2 comprehensively describe the anthropometric characteristics observed among elite jumper athletes, categorized by gender.

Table 2. The anthropometric characteristic of athletes by gender

Total (N=13)	Mean ± SD	Female (n=6)	Mean ± SD	Male (n=7)	Mean ± SD
Age (y)	24.4 ± 3.2	Age (y)	25.1 ± 2	Age (y)	23.7 ± 3.9
Weight (kg)	67.9 ± 11.1	Weight (kg)	60.5 ± 11.2	Weight (kg)	74.2 ± 6.6
Height (cm)	177.1 ± 8.4	Height (cm)	171.8 ± 8.9	Hight (cm)	181.7 ± 4.9
Sitting height (cm)	91.8 ± 3.5	Sitting height (cm)	89.2 ± 2.1	Sitting height (cm)	94 ± 2.8
Arm Span (cm)	177.8 ± 11.2	Arm Span (cm)	169.5 ± 10.1	Arm Span (cm)	185 ± 6.2
Adipose Mass (kg)	15.7 ± 3.5	Adipose Mass (kg)	16.7 ± 5.1	Adipose Mass (kg)	14.8 ± 1.2
Muscle Mass (kg)	30.3 ± 7.2	Muscle Mass (kg)	24.3 ± 3.6	Muscle Mass (kg)	35.5 ± 5.1
Residual Mass (kg)	10.6 ± 1.7	Residual Mass (kg)	9.2 ± 1.5	Residual Mass (kg)	11.8 ± 0.6
Bone Mass (kg)	7.3 ± 1.3	Bone Mass (kg)	6.3 ± 1	Bone Mass (kg)	8.2 ± 0.9
Skin Mass (kg)	3.7 ± 0.7	Skin Mass (kg)	3.7 ± 1.1	Skin Mass (kg)	3.7 ± 0.1
Body fat %	9.2 ± 1.5	Body fat %	10.3 ± 0.7	Body fat %	8.3 ± 1.4
BMR (Kcal/day)	1643.3 ± 234.9	BMR (Kcal/day)	1429.6 ± 125.8	BMR (Kcal/day)	1826.4 ± 111.6

TEE (Kcal)	3836.1 ± 684.4	TEE (Kcal)	3197.6 ± 360	TEE (Kcal)	4383.4 ± 268
WHR	0.7 ± 0.0	WHR	0.7 ± 0	WHR	0.8 ± 0
Sum of 3 skinfolds (mm)	23.3 ± 3.8	Sum of 3 skinfolds (mm)	23.1 ± 2.4	Sum of 3 skinfolds (mm)	23.5 ± 4.9
Sum of 6 skinfolds (mm)	49.6 ± 8.7	Sum of 6 skinfolds (mm)	55.6 ± 4.2	Sum of 6 skinfolds (mm)	44.4 ± 8.3
Sum of 8 skinfolds (mm)	61.6 ± 10	Sum of 8 skinfolds (mm)	68.1 ± 4.2	Sum of 8 skinfolds (mm)	56.1 ± 10.3
Muscle/bone index	4.1 ± 0.6	Muscle/bone index	3.8 ± 0.7	Muscle/bone index	4.3 ± 0.5
Body mass index (kg/m2)	21.4 ± 1.7	Body mass index (kg/m2)	20.3 ± 1.6	Body mass index (kg/m2)	22.4 ± 1.2
Crural index	1.1 ± 0	Crural index:	1.1 ± 0	Crural index:	1.1 ± 0
Sitting ht. Index (%)	51.8 ± 1.3	Sitting ht. Index (%)	52.0 ± 1.8	Sitting ht. Index (%)	51.7 ± 0.7
Braquial index	0.7 ± 0	Braquial index:	0.7 ± 0	Braquial index:	0.7 ± 0
Biacromial/Biiliocristal	1.3 ± 0.1	Biacromial/Biiliocristal:	1.3 ± 0.1	Biacromial/Biiliocristal:	1.4 ± 0
ENDO	2.2 ± 0.5	ENDO	2.5 ± 0.2	ENDO	1.9 ± 0.5
MESO	4 ± 1.2	MESO	3.15 ± 1.1	MESO	4.7 ± 0.6
ECTO	3.2 ± 0.5	ECTO	3.5 ± 0.5	ECTO	3.1 ± 0.5
Best Record (cm)	724.3 ± 590.5	Best Record(cm)	695.1 ± 569.8	Best Record(cm)	749.2 ± 652.2

Table 3. The anthropometric characteristic based on gender and branch

Variables	**Female High Jump (n=2)**	**Male High Jump (n=3)**	**Female Long Jump (n=1)**	**Male Long Jump (n=1)**
	Mean ± SD	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**
Age (y)	26.1 ± 2.5	22.2 ± 2.6	25.47	22.52
Weight (kg)	67.7 ± 21.6	72 ± 10.7	57	73.9
Height (cm)	177 ± 16.9	182.8 ± 8	169.9	178.5
Sitting height (cm)	90.1 ± 4.1	94.2 ± 4.6	89.9	94
Arm Span (cm)	174.5 ± 19	185.4 ± 4	165	174
Adipose Mass (kg)	20.7 ± 8.8	14.9 ± 1.9	17	14.8
Muscle Mass (kg)	24.8 ± 6.2	33 ± 7.5	20	35.1
Residual Mass (kg)	10.2 ± 2.8	11.8 ± 1	9.3	12
Bone Mass (kg)	7.2 ± 1.5	8.4 ± 1.5	7	8.2
Skin Mass (kg)	4.5 ± 2	3.667	3.7	3.8
Body fat %	10.7 ± 0.7	8.2 ± 2.2	11.1	8.8
BMR (Kcal/day)	1460.5 ± 217	1816.3 ± 185.1	1371	1811
TEE (Kcal)	3213 ± 478	4359 ± 444.4	3017	4348
WHR	0.75 ± 0	0.8 ± 0	0.7	0.8

Sum of 3 skinfolds (mm)	22.5 ± 4.9	23.6 ± 7.5	24	21
Sum of 6 skinfolds (mm)	58 ± 4.2	43.3 ± 13.2	60	47
Sum of 8 skinfolds (mm)	69 ± 4.2	56.3 ± 16.7	73	56
Muscle/bone index	3.4 ± 0	3.9 ± 0.2	2.85	4.3
Body mass index (kg/m2)	21.2 ± 2.8	21.4 ± 1.4	19.7	23.2
Crural index:	1 ± 0	1.1 ± 0	1.11	1.11
Sitting ht. Index (%)	51 ± 2.5	51.5 ± 0.5	52.9	52.7
Braquial index:	0.7 ± 0	0.7 ± 0	0.78	0.75
Biacromial/Biiliocristal:	1.2 ± 0.1	1.3 ± 0.0	1.3	1.5
ENDO	2.6 ± 0.3	1.9 ± 0.8	2.4	1.8
MESO	3.6 ± 0.2	4.3 ± 0.7	2.8	5.2
ECTO	3.3 ± 0.4	3.6 ± 0.3	3.7	2.6
Variables	**Female Pole Vault (n=1)**	**Male Pole Vault (n=1)**	**Female Triple Jump (n=2)**	**Male Triple Jump (n=2)**
	Mean ± SD	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**
Age (y)	26.95	25.3	23.1 ± 1	25.8 ± 7.8
Weight (kg)	57	76.7	56.8 ± 2.6	76.4 ± 2
Height (cm)	164.5	182.8	171.2 ± 0.4	181.2 ± 0.3
Sitting height (cm)	90	95	87.7 ± 0.2	93.2 ± 1.7
Arm Span (cm)	161	183	171 ± 1.4	191 ± 1.4
Adipose Mass (kg)	13.2	13.5	14.4 ± 0	15.3 ± 0
Muscle Mass (kg)	26.4	40.1	24.9 ± 1.5	37 ± 1.4
Residual Mass (kg)	8.4	12.1	8.7 ± 1	11.7 ± 0
Bone Mass (kg)	6	7.3	5.4 ± 0	8.5 ± 0.5
Skin Mass (kg)	3.1	3.7	3.35	3.8 ± 0
Body fat %	10.6	7.3	9.5 ± 0	8.9 ± 0.3
BMR (Kcal/day)	1355	1859	1465.5 ± 136.4	1833 ± 67.8
TEE (Kcal)	2981	4461	3381 ± 521.8	4399 ± 162.6
WHR	0.7	0.9	0.7 ± 0	0.8 ± 0
Sum of 3 skinfolds (mm)	23	21	23.5 ± 2.1	26 ± 2.8
Sum of 6 skinfolds (mm)	56	39	51 ± 0	47.5 ± 2.1
Sum of 8 skinfolds (mm)	70	49	64 ± 2.8	59.5 ± 3.5

Muscle/bone index	4.43	5.47	4.6 ± 0.3	4.3 ± 0.1
Body mass index (kg/m2)	21.1	23	19.4 ± 0.9	23.2 ± 0.4
Crural index:	1.12	1.15	1.12 ± 0	1.1 ± 0
Sitting ht. Index (%)	54.7	52	51.2 ± 0	51.4 ± 1
Braquial index:	0.7	0.77	0.7 ± 0	0.7 ± 0
Biacromial/Biiliocristal:	1.3	1.5	1.4 ± 0	1.4 ± 0
ENDO	2.7	1.6	2.4 ± 0	2.1 ± 0.3
MESO	4.9	5.5	2 ± 0.1	4.8 ± 0.7
ECTO	2.7	2.9	4 ± 0.5	2.6 ± 0.2

The total mean age (24.4 ± 3.2), height cm (177.1 ± 8.4), and weight kg (67.9 ± 11.1) were for both genders. The mean of Adipose Mass (kg), Muscle Mass (kg), Residual Mass (kg), Bone Mass (kg), Skin Mass (kg), and Body fat percentage has shown in Figure 1.

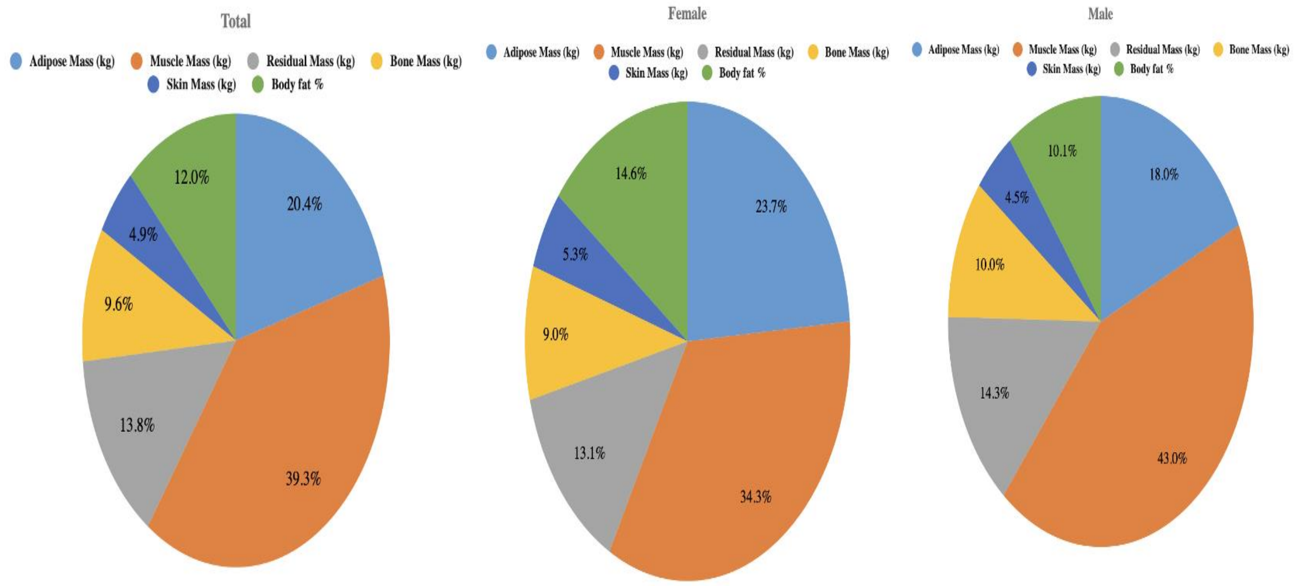
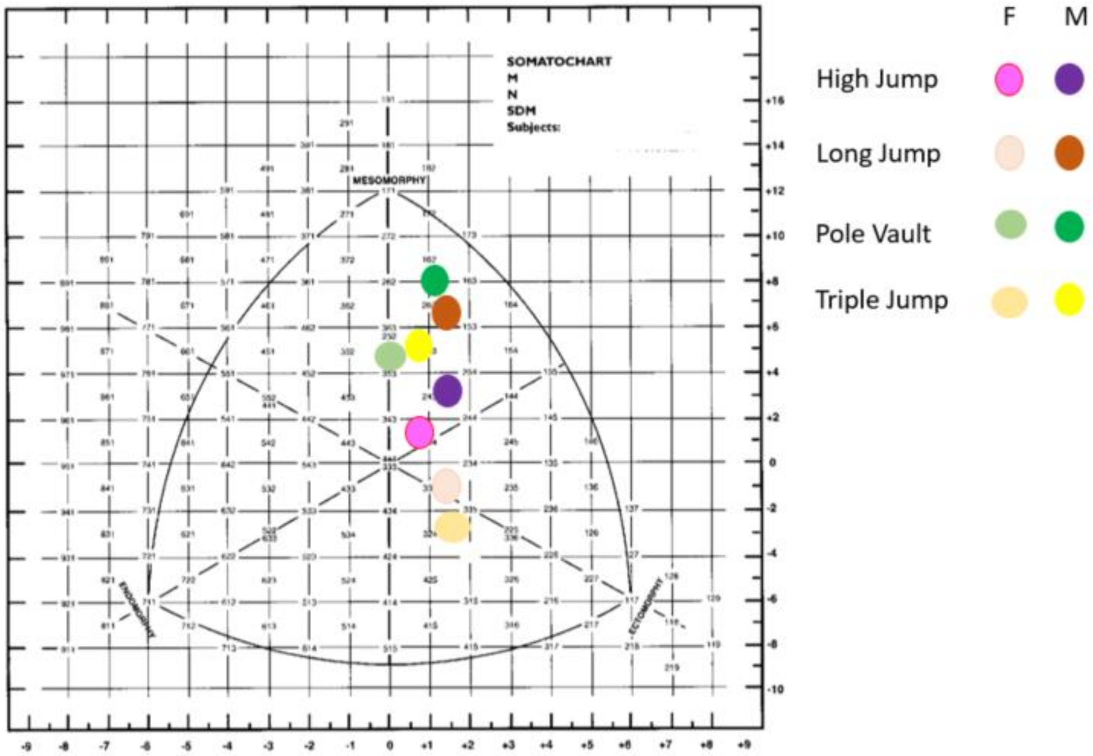


Figure 2. Illustrates the structural body shape differences among athletes, categorized based on gender

The total basal metabolic rate and total energy expenditure are (1643.3 ± 234.9 Kcal/day; 3836.1 ± 684.4 Kcal) respectively. The total somatotype was ectomorphic mesomorph 2.2 - 4 - 3.2 (SD: 0.5 - 1.2 - 0.5) endo-meso-ecto. The female athletes were balanced mesomorphs 2.5 - 3.15 - 3.5 on average whereas the male athletes were ectomorphic mesomorphs on average 1.9 - 4.7 - 3.1 (As shown in figure 2).

In general, males exhibit lower body fat, a sum of 8 skinfolds, and a higher muscle-to-bone ratio, with values of 8.3%, 56.1 mm, and 4.3 index, respectively. When comparing branches within the male category, pole vault athletes demonstrate lower body fat (7.3%), a sum of 8 skinfolds (49 mm), higher muscle mass (40.1 kg), and a greater muscle-to-bone ratio (5.47 index) (Figure 4). Conversely, in the female category, triple jump athletes display lower body fat (9.5%), a sum of 8 skinfolds (64 mm), and a higher muscle-to-bone ratio 4.6.



Note: F: female and M: male

Figure 3. Somatographs of the best male and female jumpers

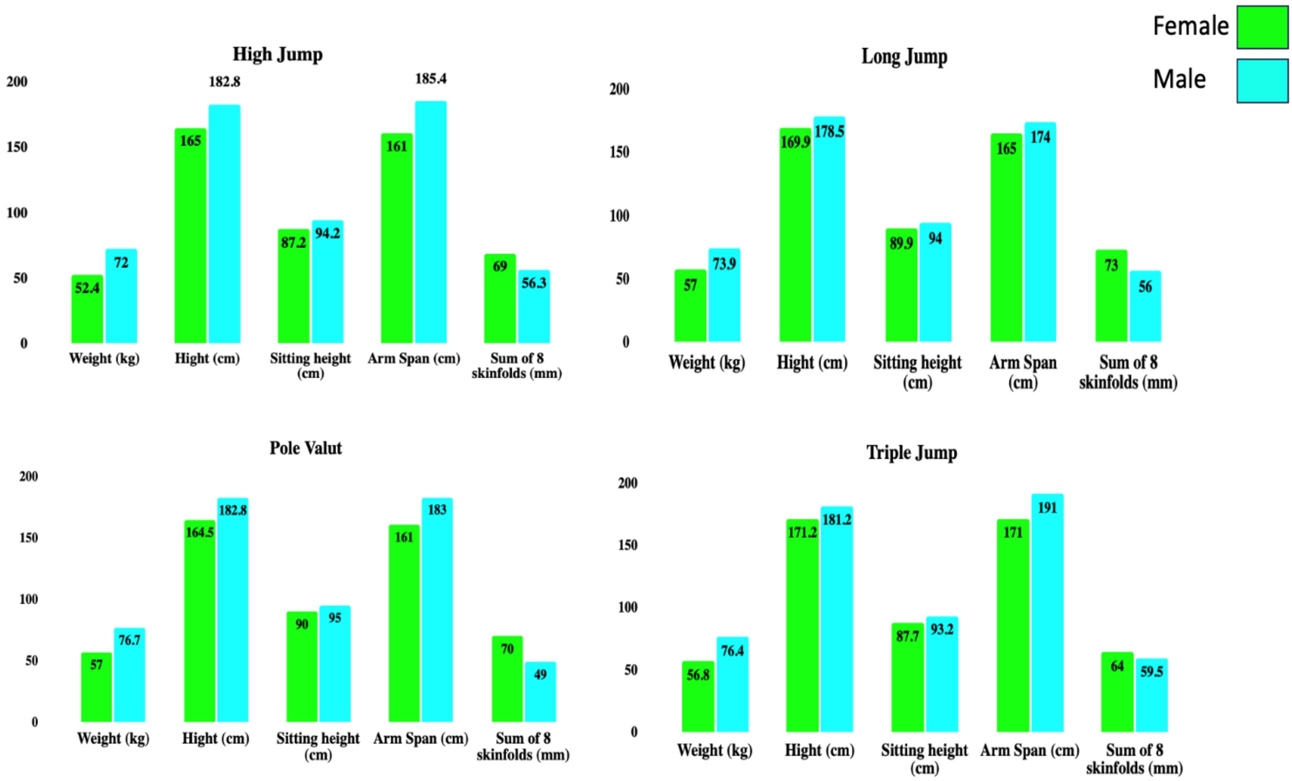


Figure 4. Illustrates the comparison of anthropometric characteristics within the same branches categorized by gender

Discussion

The outcomes of the present investigation lead us to assert that the notable associations observed among various anthropometric variables in jumpers serve as decisive determinants of performance. This substantiates the assertion that competitive sports necessitate a physique tailored to the demands of specific events. Athletes excelling in various branches of jumping exhibit a requirement for distinct body size, shape, and proportionality to attain the highest level of proficiency. This underscores the significance of recognizing the event-specific physical structures contributing to the success of top-level jumpers across different disciplines. Within the female category, high jump athletes exhibited both greater body weight and height (67 kg, 177 cm) compared to their counterparts in long jump (57 kg, 169 cm), pole vault (57 kg, 164 cm), and triple jump (56 kg, 171 cm). Additionally, the pole vault athlete demonstrated a notable increase in muscle mass, registering at 26.4 kg. In the male category, pole vault athletes showcased higher body weight and height (76.7 kg, 182.8 cm) when contrasted with participants in high jump (72 kg, 182 cm), long jump (73.9 kg, 178.5 cm), and triple jump (76.4 kg, 181.2 cm). Furthermore, the male pole vault athlete displayed a superior muscle mass, recording 40.1 kg. In the female category, the higher body weight and height in high jump athletes may enhance force application during takeoff. Conversely, the lighter, shorter stature of long jump and triple jump athletes emphasizes agility and speed. Pole vault athletes exhibit a balanced physique with higher muscle mass, aligning with the explosive and technical nature of pole vaulting. Among males, elevated body weight and height in pole vault participants contribute to generating momentum, emphasizing the biomechanical demands of this event. The higher muscle mass in male pole vault athletes underscores the importance of strength. Lower body weight in long jump participants emphasizes speed and agility. Similar body weight and height in male high jump and triple jump athletes suggest shared biomechanical demands. Upon comparing the outcomes of this study with respect to age, body weight, and body height, it was discerned that the top jumpers in both genders exhibited lower body height and body weight in comparison to their elite high-jumping counterparts (Langer). This observation suggests a distinctive physiological profile among the highest-performing jumpers, emphasizing the nuanced interplay of anthropometric factors in achieving excellence in jumping disciplines. The identification of such divergences contributes valuable insights into the nuanced physical requirements that differentiate top jumpers from elite high jumpers, thereby enhancing our understanding of the multifaceted nature of athletic performance. Conversely, the findings of the present study reveal that Turkish elite jump athletes exhibited a lower body fat percentage in contrast to findings reported in another study (Singh et al., 2010). This discrepancy in body composition underscores the variability among elite jumpers from different populations and emphasizes the need for context-specific analyses when evaluating athletic performance. The observed divergence in body fat percentages prompts further inquiry into the potential influence of cultural, genetic, or training regimen factors that contribute to these distinctive physiological profiles among elite jump athletes in the Turkish context. Such nuanced insights contribute to the broader discourse on the multifactorial determinants of athletic excellence within specific demographic cohorts.

In examining the somatotype scores of elite Turkish male and female jumpers, noteworthy patterns emerge. In the context of female athletes participating in high jump, long jump, pole vault, and triple jump, distinct somatotype categories emerge, characterized by central, central, balanced mesomorph, and balanced ectomorph body types, respectively (2.6 – 3.6 – 3.6 * 2.4 – 3.8 – 3.7 * 2.7 – 4.9 – 2.7 * 2.4 – 2 – 2 - 4). For their male counterparts engaging in the same disciplines, the somatotype delineation reveals an ectomorphic mesomorph, ectomorphic mesomorph, balanced mesomorph, and balanced mesomorph configuration for high jump, long jump, pole vault, and triple jump, respectively (1.9 – 4.3 – 3.6 * 1.8 – 5.2 – 2.6 * 1.6 – 5.5 – 2.9 * 2.1 – 4.8 – 2.6). In the female category, the prevalence of central somatotype for high jump and long jump suggests a balanced distribution of body mass, which could contribute to optimal force application during takeoff and landing phases. The emphasis on balance mesomorph for pole vault implies a combination of muscularity and leanness, potentially advantageous for the explosive demands of pole vaulting. On the other hand, the balance ectomorph somatotype associated with triple jump indicates a balance between slender build and athleticism, which may be conducive to efficient horizontal and vertical movements in this event. For male athletes, the ectomorphic mesomorph somatotype identified for high jump and long jump implies a lean and muscular physique, potentially contributing to the power-to-weight ratio essential for effective jumping performance. The balance mesomorph somatotype associated with pole vault suggests a well-rounded combination of muscle mass and leanness, aligning with the multifaceted requirements of pole vaulting. In the case of triple jump, the balance mesomorph somatotype in males indicates a harmonious blend of muscularity and leanness, potentially supporting the demands of the event that involve both horizontal and vertical components.

Comparative analysis with findings from other study involving high jumpers reveals intriguing parallels (Asfaw & Pallavi, 2018; Langer). Male jumpers in those studies demonstrate dominant ectomorphic mesomorph profiles, with scores ranging from 2.4 to 3.2 for endomorphy, 3.2 to 4.0 for mesomorphy, and 3.5 to 5.1 for ectomorphy. These consistent trends underscore a prevalent physiological emphasis on ectomorphic mesomorphy among elite male high jumpers, transcending regional and cultural differences. Similarly, female high jumpers in prior research exhibit a distinctive somatotype composition, characterized by ectomorphic endomorphy. The somatotype scores in these studies range from 3.6 for endomorphy, 2.0 for mesomorphy, to 5.1 for ectomorphy. Notably, the Turkish female jumpers' somatotype scores align with this observed pattern.

However, akin to the outcomes of the current study, Anup and colleagues (2014) reported that Bangladeshi male athletes exhibited an average ectomorphic-mesomorphic somatotype with endo-meso-ecto components of 1.5-4.1-3.0. Similarly, the female athletes in their study manifested a balanced mesomorphic somatotype, with endo-meso-ecto components of 2.7-3.4-2.7, aligning with the findings of the present investigation (Anup et al., 2014). In addition, the Turkish elite jumpers demonstrated distinctive muscle mass characteristics, with values of 35.5 kg for males and 24.3 kg for females. Additionally, the muscle-to-bone ratio was approximately 4.3% for males and 3.8% for females. These specific findings contribute to the comprehensive understanding of the physiological attributes inherent in elite jumping athletes, emphasizing the importance of muscle composition and distribution in the pursuit of optimal performance. The delineation of gender-specific differences in muscle mass and the muscle-to-bone ratio provides valuable insights into the nuanced physiological adaptations associated with elite jumping athleticism, further enriching the discourse on the intricate interplay between musculoskeletal factors and athletic excellence.

Conclusion

The outcomes of this investigation offer valuable insights into the anthropometric features, body composition, and somatotype of high jump athletes, contributing to the practical domain in several key ways. Primarily, this study enhances comprehension of the intricate anthropometric characteristics and somatotypes inherent in high jumpers. By discerning the nuanced interplay between physique and performance, coaches, sports scientists, and researchers gain a deeper understanding of the unique physiological attributes associated with elite high jump athletes. Secondly, the precise data on body composition derived from this study holds significant implications for coaches in tailoring training programs for high jumpers. With a nuanced understanding of the athletes' somatotypes and body composition, coaches can optimize training regimens to capitalize on individual strengths and address specific physiological considerations, thereby enhancing the overall effectiveness of training interventions. Furthermore, the comprehensive dataset generated in this study serves as a valuable reference for physical education teachers and coaches. Aspiring to identify and nurture talent in young athletes, educators can draw upon this repository of information to inform the selection process. The reference data aids in the nuanced evaluation of young athletes, facilitating the identification of individuals with predispositions aligning with the physiological profiles observed in successful high jumpers. In summary, the practical applications of this study extend beyond the immediate context, offering a nuanced understanding of anthropometric and somatotypic considerations in high jump performance. This knowledge, in turn, informs targeted training strategies, contributes to talent identification processes, and serves as a valuable reference for those involved in the development and coaching of high jump athletes.

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Full access to data on request (Houtan.shahidi@gedik.edu.tr / Hootan.shahidi@yahoo.com).

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