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Original Article

Evaluation of physical fitness in track and field throwing athletes across different competitive levels

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Abstract:
A comprehensive understanding of physical fitness across different competitive levels is essential in track and field athletics. Coaches of throwers typically develop training regimens tailored to either performance levels or the specific needs of individual athletes to maximize physical fitness and ultimately enhance competitive throwing performance. However, it remains uncertain whether the competitive level of athletes may require different training designs. Thus, this study aimed to assess and compare the physical fitness levels among throwers across varying competitive levels. Twenty-eight throwers (20 males, 8 females; age: 18.2 ± 2.7 years; body mass: 89.8 ± 15.1 kg; body height: 178.5 ± 9.9 cm) participated in the study. These athletes were categorized into three competitive experience groups: national level (n = 10), international level (n = 7), and international medallists (n = 11). During a summer training camp, comprehensive measurements were conducted, encompassing various aspects of physical fitness. These assessments comprised the following parameters: 20 m sprint time, countermovement jump (CMJ) height and power, standing long jump distance, handgrip isometric strength, and body composition analysis. Statistical analysis was performed utilizing one-way ANOVA. The results of the study revealed no significant differences for all variables between the three groups ($p > 0.05$). In addition, significant correlations were found between measures of physical fitness for both male and female athletes (i.e., body composition and physical fitness measurements). Therefore, in the early stage of throwers yearly preparation (i.e., summer training camp), physical fitness might be similar for throwers regardless of their competitive levels. From a practical perspective, coaches may design similar training programs for athletes especially in the beginning of the preparation phase in an attempt to enhance competitive performance among athletes with different competitive levels. Moreover, body composition may be a good predictor of physical fitness in both male and female thrower athletes.
Key Words: Track and field, athletic performance, skeletal muscle, shot put, hammer throw, javelin throw.

Introduction

Sport performance in track and field throwing events is influenced by several biomechanical (e.g., velocity, angle and height of release of the implement) and biological factors (e.g., lean mass, neural activation, muscle fibre type composition) (Bourdin et al., 2010; Brumitt et al., 2014; Leigh & Yu, 2007; Park et al., 2014; Zaras et al., 2021). Assessment of these factors may provide useful insights into the athletes training-induced adaptations and their preparedness for competitions (Zaras et al., 2016). Scientific literature emphasizes the significance of evaluating athletes' abilities at regular intervals since even the most experienced trainers may struggle to fully comprehend and quantify these variables (e.g., perceived effort, perceived fatigue, biochemical and hormonal analysis; diseases; injuries; technique and movement deviations; body composition; quality and duration of rest; psychology) that affect performance. Therefore, working with efficient and straightforward data is essential while maintaining scientific validity (Halson, 2014). Moreover, the availability of normative data

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(e.g., international athletes) of different physical fitness traits is essential for coaches and strength and conditioning professionals, as it can contribute to a better training program design while maintaining scientific validity (Halson, 2014).

Analysing athletes across different competitive levels can be essential for gaining a comprehensive understanding of the impact of the competitive level on physical fitness (Gabbett et al., 2007). By measuring throwers from different competitive levels, potential patterns, trends, or distinctions in the physical capabilities of the athletes can be identified. Moreover, such analysis also provides a normative data of the population which may further assist coaches and strength and conditioning professionals to design more effective training programs. Previous studies in throwers have only examined the differences between higher and lower performer's hammer throwers and shot-putters. The results from these studies showed that high performers hammer throwers were taller, heavier, had greater lean mass and body fat compared to lower performer's hammer throwers while higher performer's shot-putters had greater anthropometric measurements and somatotyping scores compared to lower performer's shot-putters (Singh et al.; Singh et al., 2011). However, whether throwers from a higher competitive level may have significant differences in physical fitness compared to throwers from a lower competitive level remains unclear.

Throwers usually tend to have higher body mass index compared to athletes in other athletic events (Dengel et al., 2019; Garcia-Carrillo, Yáñez-Sepúlveda, et al., 2023; Hirsch et al., 2016; Schmitt et al., 2005). In this context, body composition may also contribute to throwers performance. Among international young male throwing athletes, lean mass has been correlated with the rate of force development (RFD) at 0-250 ms ($r = 0.81$, $p = 0.016$) (Kavvoura et al., 2018) and countermovement jump (CMJ) peak force ($d = 0.59$, $p = 0.01$) (Bazyler et al., 2017). A higher percentage of lean mass was positively correlated with throwing distance ($r = 0.81$, $p < 0.05$) in experienced male hammer throwers (Terzis et al., 2010). In addition, a recent review showed that lean mass is linked with throwing distance and muscle power (Zaras et al., 2021). Moreover, shot-put distance and 20 m sprint time were correlated in highly competitive throwers ($r = -0.64$) (Morrow et al., 1982), although no correlation was found between 40 m sprint time and shot put distance in young throwers (Zaras et al., 2019) and well trained throwers (Zaras et al., 2016). However, sprinting may acutely increase throwing performance in well trained hammer throwers (Karampatsos et al., 2013). Consequently, sprinting, CMJ and muscle strength might be reliable tests and exercises to enhance throwing performance, although, it remains uncertain whether throwers from a higher competitive level may have a greater sprinting jumping and strength performance compared to their lower experienced counterparts. Analysing athletes of varying competitive levels can aid to understand the potential impact of competitive level on physical fitness (Gabbett et al., 2007; Garcia-Gil et al., 2018). However, there is a scarcity of studies investigating how the components of physical fitness—namely, body composition, linear sprint, jumping, and maximal voluntary isometric handgrip strength—may be different among track and field throwers across different competitive levels.

Therefore, the objective of this study was to investigate the physical fitness of track and field throwers in relation to their competitive level. It was hypothesized that throwers with a higher competitive level would exhibit higher physical fitness when compared to throwers from a lower competitive level.

Materials and methods

Participants

Twenty-eight throwers (age: 18.2 ± 2.7 years; male n=20; female n=8) were tested, all forming part of the Chilean National Team participating in a summer training camp. Athletes were divided into three groups according to their competitive experience: a) national level (NL, n=10, 35.7%), b) international level (IL, n=7, 25.0%) and c) international medallists (IM, n=11, 39.3%), including South American, Pan American, and World medallists. Details regarding their age, sex, and throwing event are provided in Table 1. All athletes were verbally and written informed regarding the experimental design, the objectives, and the associated rights, benefits, and risks, and they signed a consent form. At recruitment stage, athletes trained regularly, were free of injuries, and did not take any illegal substance. All experimental procedures were in accordance with the 1975 Declaration of Helsinki as revised in 2000 and were approved by the local University committee.

Table 1. Summary of throwers individual characteristics.

Athlete	Sex	Competitive level	Event	Age category	Implement weight
P1	Male	IM	Shot put	Adult	7.26 kg
P2	Male	NL	Shot put	Adult	7.26 kg
P3	Male	IM	Shot put	Adult	7.26 kg
P4	Male	NL	Shot put	Youth	6.0 kg
P5	Male	IM	Discus	Adult	2.0 kg
P6	Male	IL	Discus	Adult	2.0 kg
P7	Male	IM	Discus	Youth	1.75 kg
P8	Male	IL	Discus	Youth	1.75 kg
P9	Male	NL	Discus	Youth	1.75 kg

P10	Female	IM	Discus	Youth	1.0 kg
P11	Male	IL	Javelin	Adult	0.8 kg
P12	Male	IM	Javelin	Youth	0.8 kg
P13	Male	IL	Javelin	Youth	0.8 kg
P14	Male	NL	Javelin	Youth	0.8 kg
P15	Female	IM	Javelin	Adult	0.6 kg
P16	Female	IM	Javelin	Youth	0.6 kg
P17	Male	IM	Hammer	Adult	7.26 kg
P18	Male	IM	Hammer	Youth	6.0 kg
P19	Male	NL	Hammer	Youth	6.0 kg
P20	Male	IL	Hammer	Youth	6.0 kg
P21	Male	NL	Hammer	Youth	6.0 kg
P22	Male	NL	Hammer	Youth	6.0 kg
P23	Male	NL	Hammer	Youth	6.0 kg
P24	Female	IM	Hammer	Adult	4.0 kg
P25	Female	IL	Hammer	Youth	4.0 kg
P26	Female	IL	Hammer	Youth	4.0 kg
P27	Female	NL	Hammer	Youth	4.0 kg
P28	Female	NL	Hammer	Youth	4.0 kg

NL: national level; IL: international level; IM: international; medallist.

Study design

In a cross-sectional study design, measurements were carried out in two sessions during the same day. Body composition, linear sprint, and standing long jump were measured during morning hours whilst, handgrip strength and vertical jump tests were measured during afternoon hours. A general warm-up lasting approximately 10 minutes that included jogging and whole-body dynamic stretching was performed before each testing session (except before body composition analysis), with low-moderate intensity trials of each test performed prior to the test (e.g., moderate intensity sprints) (Andrade et al., 2015). For each performance test, three successful trials were conducted, with a 12-minute recovery period allowed between different tests to ensure maximal effort in each measurement.

Following the measurements, athletes were divided into three different groups according to their competitive experience: NL, IL and IM. Comparisons were performed between groups.

Body composition. To determine variables of body composition [i.e., minerals (kg), total body water (litres), percent of body fat (%), body fat mass (kg), body mass index (kg.m^{-2}), skeletal muscle mass (kg)], measurement was conducted using a segmental multi-frequency bioelectrical impedance body composition analyser (InBody120, model BPM040S12F07, Biospace, Inc., USA, to 0.1 kg). Athletes were instructed to follow specific guidelines for water consumption before testing, wear minimal clothing, and have an empty stomach before measurement. The measurement was performed with participants in an upright position and data collected through 8 electrodes located in their feet and hands to ensure accuracy and consistency.

\ ***Linear sprint.*** Following the body composition evaluation, athletes ate a breakfast rich in protein and carbohydrate and rested for approximately 2 hours before entering the performance tests. Speed performance was determined with a 20 m linear sprint test. Split times for distances of 5 m, 10 m, 15 m, and 20 m were also measured. More specific, participants started 0.5 m behind of the initial photocell, which was aligned with the start line. An electronic timing system (Brower Timing System, Salt Lake City, UT) was used to record the split times assessed to the nearest 0.01 sec. Each participant performed three trials of 20 m linear sprints with a rest period of six minutes between trials. The best time-trial was used for the statistical analysis.

Standing Long Jump. To determine the performance of the standing long jump (SLJ) test, a 5 metres metal metric strip was used (Stanley, USA). Long jump test was performed on an athletics sand pit. All athletes placed their toes at the edge of the running lane in front of the sand pit in an attempt to push with their feet and jump with arm swing as fast and long as possible (Zaras et al., 2019). The distance of the best jump was measured to the nearest centimetre from the take-off point to the nearest mark imprinted in the sand. Three maximum attempts were allowed with two minutes of rest, and the best was used for the statistical analysis. This test is among the most commonly utilized field tests for assessing the power capacity of leg muscles during dynamic actions (Horita et al., 1991; Izquierdo et al., 1999).

Vertical Jump. All CMJ with were performed with arms placed akimbo. Athletes had the instruction to jump as high as possible. More specific, athletes remained on a standing position and following the researcher's instruction they performed an individual self-selected semi squat, and then immediately jumped as high as possible. Peak vertical jump power was determined using the Sayer's equation: peak vertical jump power (W) = [51.9 • CMJ height (cm)] + [48.9 • body mass (kg)] – 2007 (Sayers et al., 1999). Athletes performed three maximum CMJs with two minutes of rest between attempts. The highest jump was used for the statistical analysis. Following the CMJ, athletes performed the drop jump (DJ) from a 40 cm drop height box. Athletes stepped on the box with arms akimbo and projected their lower limb of choice in front of them and outside the box. Then, they were instructed to let their body fall with both feet on the ground. Researchers also instructed athletes to minimize as much as possible the ground contact time and jump as high as possible. Researchers used verbal cues such as "floor is lava" to help athletes attain brief contact times. Athletes performed three maximum DJs with two minutes of rest between attempts. The DJ with the highest power output was used for the statistical analysis. In both standardized tests of CMJ and DJ, a contact platform was used (Ergotester, Globus, Codogne, Italy).

Maximal voluntary isometric handgrip strength. Handgrip strength was assessed using a handgrip dynamometer (Baseline®, Enterprises Inc., USA), with a sensibility of ± 1 kg, following the guidelines of the American Association of Hand Therapists (McArdle et al., 2006). The athletes performed three maximum attempts with a one-minute interval between each hand, maintaining a neutral position while seated on a chair (with the shoulder adducted and the hip, knee, and elbow joints flexed at 90°). Athletes had the instruction to apply their force as hard as possible and maintain their effort for 3-4 seconds. The highest force applied was used for the statistical analysis.

Statistical analysis

Data are presented as mean and standard deviations. The normality of the data was analysed by means of the Kolmogorov-Smirnov test. One-way ANOVA test was used to compare physical fitness between groups. Correlations between variables were performed with Pearson-r coefficient. Statistical significance was set at $p \leq 0.05$. All calculations were performed using IBM SPSS Statistics for Windows, version 20 (IBM Corp., Armonk, N. Y., USA).

Results

All athletes completed the measurements without injuries. No differences were found between the three experimental groups in any physical fitness variable (Table 2). Similarly, no significant differences were found for all body composition variables between groups (Table 3).

Table 2. Physical fitness of throwing athletes according to competitive level.

	National level	International level	International medallist	ANOVA test		Effect size
				F	p	Eta squared (η^2)
5-m sprint (s)	1.23±0.11	1.26±0.41	1.13±0.07	0.95	0.40	0.07
10-m sprint (s)	2.05±0.18	2.00±0.38	1.9±0.12	1.23	0.31	0.09
15-m sprint (s)	2.77±0.26	2.57±0.19	2.59±0.16	2.74	0.08	0.18
20-m sprint (s)	3.46±0.34	3.26±0.25	3.24±0.22	1.78	0.19	0.12
CMJH (cm)	0.38±0.09	0.39±0.12	0.40±0.09	0.13	0.88	0.01
CMJH L (cm)	0.20±0.05	0.19±0.06	0.21±0.07	0.13	0.88	0.01
CMJH R (cm)	0.18±0.05	0.20±0.08	0.21±0.06	0.70	0.51	0.05
CMJPVJP (W)	4422±912	4265±1158	4525±1316	0.11	0.89	0.009
DJH (cm)	0.35±0.10	0.37±0.11	0.37±0.08	0.25	0.78	0.02
DJP (W)	39.48±12.94	40.62±13.91	45.32±7.64	0.76	0.48	0.06
SLJ (m)	2.53±0.35	2.61±0.45	2.68±0.37	0.37	0.69	0.03
MVIHS L (kg)	52.28±14.57	55.9±12.76	51.45±14.68	0.22	0.80	0.02
MVIHS R (kg)	55.86±14.74	56.51±13.12	57.32±15.18	0.03	0.97	0.002

Values are presented as mean ± standard deviation; CMJH: Countermovement jump height; L and R: left and right leg (or arm), respectively; DJH: Drop jump height; DJP: Drop jump power; SLJ: Standing long jump; MVIHS: Maximal voluntary isometric handgrip strength; CMJPVJP: Countermovement jump peak vertical jump power.

Table 3. Body composition of throwing athletes according to competitive level.

	National level	International level	International medallist	ANOVA test		Effect size
				F	p	Eta squared (η2)
Minerals (kg)	4.90±0.86	4.93±1.04	5.02±1.14	0.03	0.97	0.003
Total body water (l)	51.64±9.79	52.53±11.38	53.66±12.54	0.08	0.92	0.007
Percent body fat (%)	22.47±9.31	17.71±7.89	19.35±6.86	0.79	0.47	0.06
Body fat mass (kg)	20.33±7.99	14.74±5.54	17.38±7.35	1.26	0.30	0.09
Body mass index ($kg.m^{-2}$)	28.17±3.80	27.04±3.00	28.67±4.22	0.40	0.68	0.03
Skeletal muscle mass (kg)	40.47±8.17	41.27±9.53	42.25±10.49	0.09	0.91	0.01

Values are presented as mean ± standard deviation.

Correlation analysis revealed significant correlations for both male and female athletes. More specific, skeletal muscle mass was significantly correlated with 20 m sprinting (r = -0.629, p = 0.003), CMJ power (r = 0.839, p = 0.001), horizontal jump (r = 0.717, p = 0.001) and total handgrip strength (r = 0.560, p = 0.010) in male throwers (Figure 1). In addition, skeletal muscle mass was significantly correlated with CMJ power (r = 0.831, p = 0.011) and horizontal jump (r = 0.736, p = 0.038) in female throwers. Moreover, percentage body fat was correlated with 20 m sprint (r = 0.475, p = 0.034), CMJ height (r = -0.492, p = 0.028) and horizontal jump (r = -0.560, p = 0.010) for male throwers. Similarly, percentage body fat was significantly correlated with 20 m sprint (r = 0.818, p = 0.013) and CMJ height (r = -0.727, p = 0.041) in female athletes.

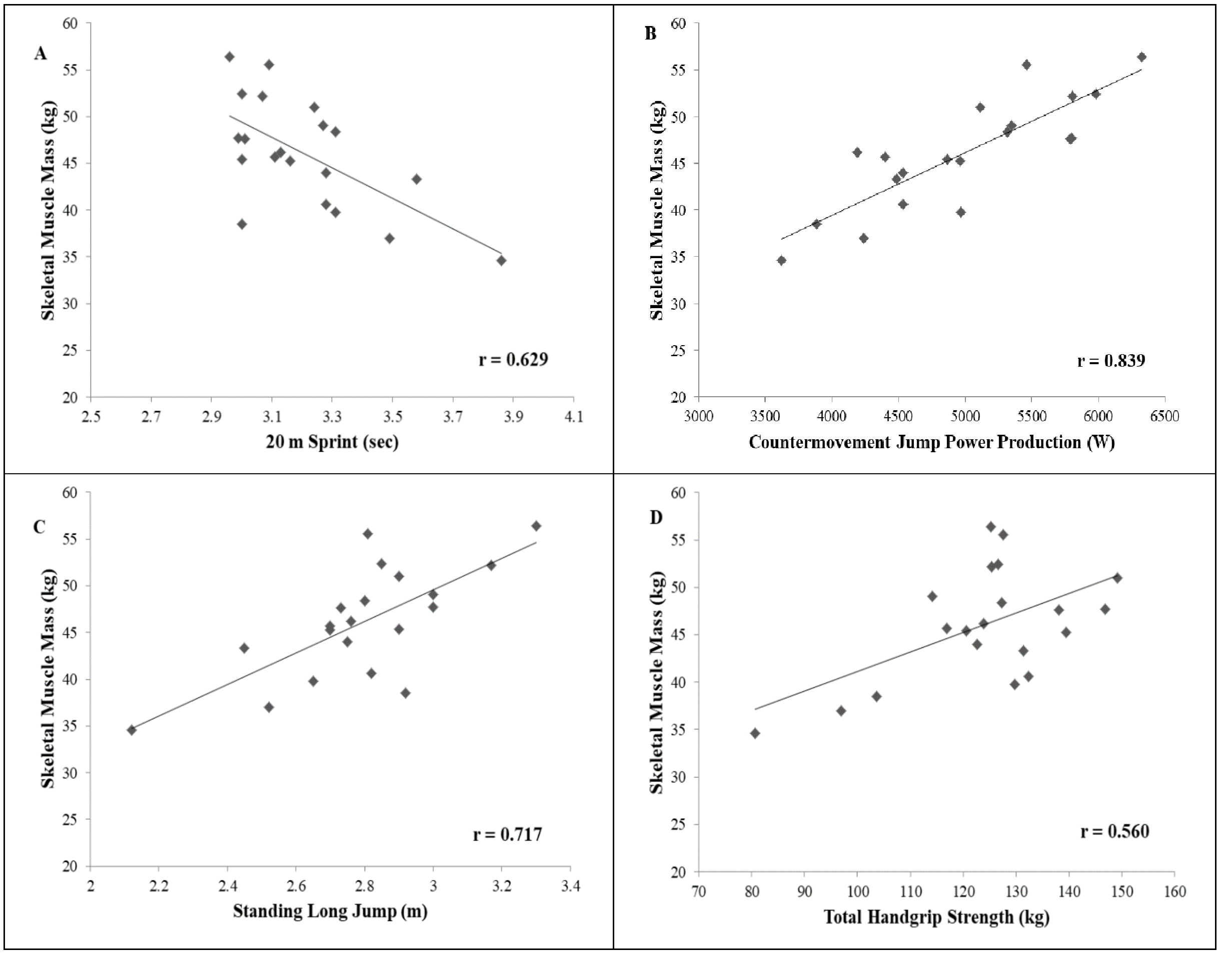

Figure 1. Correlations between skeletal muscle mass and A) 20 m sprint, B) countermovement jump power, C) horizontal jump and D) total handgrip strength. Only male throwers are included in the present correlations ($p < 0.05$).

Discussion

The aim of the study was to investigate the physical fitness of track and field throwers in relation to their competitive levels. The main finding of the study was that physical fitness was not different between throwers from different competitive level. One possible explanation for these findings is that all athletes were highly-trained throwers, ranging from elite to world-class athletes (McKay et al., 2022). Consequently, it might be difficult detecting differences in such high-level athletes. However, it is also important to note that all the athletes participated in the current study were attending a national training camp which was performed in the beginning of their preparation period. It can be hypothesized that athletes may not have acquired strong training adaptations so that significant differences may be detected. Consequently, the first hypothesis of the study is rejected. From a practical perspective, when coaches design the training programs for national and international throwing athletes, the competitive level might not be a restricted factor. A secondary finding of the study was that skeletal muscle mass, as measured in the current study, was significantly correlated with physical fitness performance in both male and female throwers, while percentage body fat was a restrictive factor for physical fitness. These results strengthen the connection between body composition and physical fitness in throwers. Therefore, coaches should aim to increase muscle mass while decreasing percentage body fat in an attempt to enhance physical fitness in throwers regardless of their competitive level.

In general, competitive experience is considered as a crucial factor for success in national and international competitions, with athletes needing to build on their self-esteem, reduce the competitive anxiety, and approach competition with a positive perspective (Hanton et al., 2008; Rocha & Osório, 2018). In the current study, no significant differences were observed between the three different groups of throwers, perhaps due to the training period where the study was performed (summer training camp). However, throwing performance during competitions is vastly different compared to training, mainly due to the presence of throwing rivals, judges, spectators and strict rules during the throw (i.e., foul throw). Although no significant differences were found between groups, it can be hypothesized that throwers from a greater competitive level may possess stronger psychological elements which in turn reinforce throwing performance during competition. A previous study has shown that athletes with a higher competitive experience had greater self-confidence before entering the competition while in the same time they had lower somatic anxiety and worry intensity compared to athletes with lower competitive experience (Hanton et al., 2008). In the same line with the above study, a recent systematic review showed that athletes with less experience tended to exhibit greater competition anxiety compared to those with more competitive experience (Rocha & Osório, 2018). Similarly, a study in Brazilian athletes showed that athletes with a higher competitive experience had higher levels of self-confidence during the competitions (Fernandes et al., 2013). Despite the fact that no significant differences were observed for physical fitness measurements between groups, it seems that throwers from a greater competitive level may have a higher performance under competition pressure due to their higher self-confidence and lower anxiety. Taking all together, for the current study this might be one possible explanation of the absence of significant differences between throwers from different competitive level. Although this explanation seems rational, still more research is required to reach certain conclusions regarding the effects of the competitive level and physical fitness ability of throwing athletes.

Another possible explanation of the non-significant difference between groups might be the ability of the international athletes to achieve a higher level of throwing technique. It is evident that athletes from a higher competitive and training level may have developed a better technique compare to athletes from a lower competitive level. However, biomechanical factors such as the velocity of release or the height of release were not measured in the study. Therefore, more studies are required to investigate the possible differences in technique between high and low experienced thrower athletes.

The physical capabilities demonstrated by the throwers are in line with the available evidences. For example, the acceleration speed (10 m sprint time) demonstrated by throwers at each competitive level was similar to athletes from other sports (e.g., handball [1.82 ± 0.07], soccer [1.82 ± 0.3]) (Ortega-Becerra et al., 2018; Wisløff et al., 2004). Similarly, maximal speed (i.e., 20 m sprint time) was also similar to elite athletes from other sports (e.g., handball [3.14 ± 0.10], soccer [3.0 ± 0.3]) (Ortega-Becerra et al., 2018; Wisløff et al., 2004). Although the small number of athletes, these results suggests that sprinting is a crucial exercise and performance test for all throwing athletes and should be included in all training programs. This is evident by a previous study which showed that 20 metres sprinting may acutely increase hammer throwing performance in well trained throwers (Karampatsos et al., 2013). These results show the importance of lower body power production on throwing performance as well as the role of lower body on transferring power to the upper body. Furthermore, the results from the sprinting, the CMJ and the long jump, all considered to be easy field measurements, and may be used as a reference index for South American throwers. In addition, skeletal muscle mass as measured here with the segmental multi-frequency bioelectrical impedance body composition analyser, highlighted its significant role in shaping the overall physical fitness of athletes across all throwing events. A recent review showed that lean mass is a significant predictor for competitive throwing performance (Zaras et al., 2021) while several studies have showed strong connections between lean mass and physical fitness (Bazyler et al., 2017; Kavvoura et al., 2018; Terzis et al., 2010). In line with these results, the findings of the current study showed that skeletal muscle mass was a significantly predictor for all physical fitness measurements in male athletes as well as for vertical and horizontal jumping performance in female throwers. In addition, the significant correlations between percentage body fat and physical fitness suggest that body fat has a restricted role in physical fitness. These findings are of particular interest since athletes were only in the beginning of their preparation phase following a summer training camp. It seems that muscle mass has a strong connection not only with throwing performance but with physical fitness, regardless of the training period. Coaches should regularly evaluate muscle mass in both male and female throwers in order to monitor the training-induced adaptations and predict physical fitness and throwing performance. In addition, throwers should aim to reduce percentage body fat through a properly designed diet, in an attempt to enhance physical fitness and competitive throwing performance. These results underscore the importance of skeletal muscle mass as a key factor contributing to the comprehensive physical capabilities of throwing athletes.

As mentioned before, muscle strength is a fundamental physical ability of throwing athletes. Several studies have showed that 1RM strength in multi-joint exercises (i.e., snatch, squat) was strongly correlated with throwing performance (Anousaki et al., 2021; Kyriazis et al., 2022; Zaras et al., 2016) in groups of throwers from all four throwing events. Moreover, upper-body power (i.e., med ball throws) has also demonstrated benefits in sport-specific throwing performance (Garcia-Carrillo, Ramirez-Campillo, et al., 2023). However, in the current study it was not possible to perform 1RM strength or upper-body power measurements due to the training phase and the athletic condition of the throwers (back from transition phase). Instead, the focus shifted to handgrip isometric strength, a metric that showed to be a positive predictor for Olympic weightlifting performance ($r = 0.606$) (Ince & Ulupinar, 2020). Notably, handgrip strength emerges as a valuable metric, offering insights into their physical fitness. However, according to the author's knowledge this is the first study to explore the handgrip strength in track and field throwing athletes. Although no difference was found between groups, handgrip strength was significantly correlated with skeletal muscle mass in male throwers but not in females, probably because of the small sample size. Coaches may consider this easy-to-use performance test to evaluate athlete's strength though maximum strength in resistance exercises should preferred.

This study has some limitations that should be acknowledged. Firstly, both male and female athletes from different age categories participated in the experimental groups. Consequently, results may be interpreted with caution. In addition, measurements were performed in the beginning of the annual training cycle, thus, athletes were not in their best athletic shape. However, it should also be noted that these athletes where the best across South America and represented a large part of throwers in the country. Nevertheless, more research is required in order to examine whether athletes from a greater competitive level may have different physical fitness compared to throwers from a lower competitive level.

Conclusions

Track and field throwers from higher and lower competitive levels may exhibit similar physical fitness performance during the beginning of the preparation phase. This might suggest that strength and conditioning preparation may share essential characteristics for throwers, irrespective of their competitive level, at least during the early stage of throwers yearly preparation. In addition, coaches may focus on enhancing the mental ability and throwing technique of throwers from a lower competitive level. This might ensure the higher performance during competitions and assist athletes elevating from national to international level. Moreover, the study showed that increases in muscle mass and reductions in percentage body fat should be the main goal for athletes in an attempt to enhance physical fitness and competitive throwing performance. Consequently, coaches should design more effective resistance training programs to increase muscle mass and strength, while athletes should regularly monitor their nutrition in order to reduce body fat and increase physical fitness performance.

Conflicts of interest
The authors have no competing interests to declare.

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