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Physical Profile of Strongman and Strongwoman Athletes

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ABSTRACT

While strongmen and strongwomen are among the strongest athletes in all sports, limited literature is available pertaining to the physical and physiological characteristics of this population, including their vertical jump ability. Thus, the purpose of this study was to profile a cohort of strongman and strongwoman competitors at an international event and measure jump performance differences between novice strongman and strongwoman competitors. Twenty-three participants who attended an international event, sixteen were male (age: 27.4±5.9 years; body mass: 125.7±28.4kg), and seven were female (age: 28.4±6.1 years; body mass: 94.7±24.3 kg volunteered to participate in the present study. Body mass, hand length, hand grip strength, self-reported one repetition maximum for common powerlifting exercises, and specific countermovement vertical jump (CMJ) and squat jump (SJ) metrics were analyzed for between-sex differences within the sport. The present study's findings reveal that hand length, hand grip strength, and self-reported one repetition maximum for common powerlifting exercises were significantly higher for strongman competitors. For CMJ and SJ, both relative and absolute mean and peak force, power, and velocity in eccentric and concentric phases were significantly higher for strongman competitors. Contraction times were shorter for strongmen in both CMJ and SJ than strongwomen but were non-significant. Interestingly, the eccentric utilization ratio (EUR) and the stretch-shortening cycle percentage did not significantly differ between strongman and strongwoman competitors, however, the entire cohort's eccentric EUR was considerably less than 1.2, indicating higher overall strength than ballistic power. These findings are some of the first to examine neuromuscular power characteristics within an understudied population of athletes who are predominantly strength-based.

Keywords: force, power, strength, one repetition maximum, squat, bench, deadlift

INTRODUCTION

According to Kraemer et al. (2020), strongman and strongwoman events have a rich history dating back to the 1970s and were initially participated in by individuals from diverse backgrounds, including bodybuilders, powerlifters, professional football athletes, and many more. Strongman events vary, but usually feature events such as atlas stone lifting, overhead pressing, squats, vehicle pulling, tire flips, log lifts, farmer's walks, and various versions of carries (Strongman Corporation, nd.; Keogh et al., 2010a; Keogh et al., 2010b; McGill et al., 2009; Renals et al., 2018; Winwood et al., 2015). This competition has gained considerable popularity over the years, attracting amateur and professional competitors, where they are often challenged by strenuous activities through all common planes of motion in the human body.

These competition events (i.e., tire flips, atlas stones, log lifts, and farmers' walks) require competitors to produce high forces, often several times higher relative to their body mass (Winwood et al., 2012). Prior evidence suggested that this is necessary to endure the volume of spinal compression, shear force, and joint torque that these events elicit (McGill et al., 2009). Thus, a successful strongman or strongwoman athlete must be able to generate a high amount of muscular force and maintain this force production for a prolonged duration, sometimes spanning two to three minutes, depending on the events (Keogh et al., 2010a; Keogh et al., 2010b). A recent descriptive study revealed that elite strongman and strongwoman competitors are at the upper limits of reported body size and structure compared to other athletes (e.g., American football, basketball, soccer) and the general population (Chappell & Simper, 2020). These observations suggest that top-level strongmen possess an optimal physical profile to meet the demands of the competitions. However, further examination into muscular strength and power characteristics for strongman/strongwoman populations may provide insights to underlying contributors to performance.

Absolute strength is a critical component of success in strongman and strongwoman competitions, while hand grip strength is a common, simple, and reliable measure of absolute muscle strength (Cronin et al., 2017). Several studies have found differences in hand grip strength between elite and non-elite athletes in various sports settings, including but not limited to American football, field hockey, handball, bowling, volleyball, and combat sports (Wall et al., 2004; Shields et al., 1984; Sharma et al., 2012; Massuca et al., 2014; Razman et al., 2012; Pion et al., 2015; Grant et al., 2001; Hoffman et al., 2009). Normative grip strength data from the general populous are well reported, with males aged between 18 to 40 in the 90th quantile displaying 58-63 kg of force and females from the same age range and quantiles displaying 37-41 kg of force (McGrath et al., 2020). For strongmen specifically, only one prior study has investigated hand-grip strength within the population (Chappell & Simper, 2020). Specifically, the hand grip strength for the six elite-level strongmen ranged between 37-78 kg at baseline for each hand, while at 12 weeks and 24 weeks post-baseline, hand grip strength ranged between 45k g to 80 kg and 59 kg to 87 kg, respectively, for both hands. However, the relationship between hand-grip strength and overall strength, specifically for strongmen, has not been investigated. It may be hypothesized that there is a correlation between them due to the nature of the sport, which requires the competitors to carry heavy items for prolonged durations.

Like muscular strength, muscular power is also critical for success in strongman and strongwoman competitions. One of the most common assessments to evaluate athletes' muscular power is the countermovement vertical jump (CMJ), which also plays an important role in evaluating athletes' stretch-shortening cycle (SSC), which consists of eccentric, transition, amortization, and concentric phases (Laffaye et al., 2014). Haff et al. (2010) and Mcguigan et al. (2006) discussed the close relationship between sports performance and the SSC characteristics. The eccentric utilization ratio (EUR) compares the jump height of CMJ to a non-SSC-involved movement, such as squat jump (SJ) jump height, and is one of the more common ways to assess athletes' lower-body muscular power (Haff et al., 2010). When comparing research utilizing CMJ or SJ to assess athletes' lower-body muscular power development strategies, the jump strategy for each sport differs, with some favoring velocity-based output metrics while others favor force-based (e.g., driver) or duration-based (e.g., strategy) output metrics (Merrigan et al., 2022; Donahue et al., 2023). No previous research has investigated the jump performance characteristics of strongmen and strongwomen.

Understanding the characteristics of muscular strength and power in strongmen and strongwomen may be essential for developing and modifying training regimens. With the sport's growing popularity, such investigations could provide critical insights into this unique group of athletes, given the limited research available on them. Therefore, the purposes of this study are a) to profile the anthropometric, muscular strength, and lower-body muscular power characteristics of strongman and strongwoman athletes and b) to examine the differences in muscular strength and power between the two groups. Based on the sport's demands and the athletes' attributes, it is hypothesized that significant differences will be observed in handgrip strength, lower-body muscular power development, and jump performance characteristics between strongman and strongwoman athletes. Additionally, it is hypothesized that notable differences will be found in self-reported barbell back squats, barbell bench presses, and deadlifts one-repetition maximums (1-RM).

METHODS

Participants

Twenty-three participants (X±SD; age:27.7±5.9 years; body mass: 116.3±30.4 kg) who were actively competing in strongman and strongwoman competitions were included in the present study. All were attendees at an international strongman and strongwoman event. Sixteen were male (age: 27.4±5.9 years; body mass: 125.7±28.4kg), and seven were female (age: 28.4±6.1 years; body mass: 94.7±24.3 kg). The testing procedures performed in this study were approved by the university's Institutional Review Board. Participants were briefed on all procedures and provided informed consent before data collection.

Procedures

The handgrip and jumping testing procedures were conducted during an international strongman and strongwoman contest. After consenting, participants completed an introductory information report by self-reporting their current age and training status. The participants underwent a brief testing battery that assessed the individual's grip strength, CMJ, and SJ abilities. Grip strength was measured with a digital dynamometer (Baseline Evaluation Instruments, Fabrication Enterprises Inc., New York, USA) which displayed excellent agreement with a previously validated dynamometer (Rolsted et al., 2024). Hand lengths were measured from the styloid process of the ulna to the top of the middle finger via digital calipers (Neiko 01409A 12" Electronic Digital Caliper, China) (Rostamzadeh et al., 2021). The dynamometer's handle was adjusted according to the participants' hand length (Guy et al., 1996). The participants started each trial in a total shoulder abduction position, resulting in the hand being positioned overhead with a neutral hand position. While standing erect, on the researchers' command (e.g., 3-2-1-go), participants attempted to pull the handles together, yielding a maximal isometric effort, while simultaneously extending the shoulder in the sagittal plane and returning their elbow to 90 degrees of flexion such that the forearm was parallel with the floor at the end of each 3-second trial. Each hand was tested three times with a minimum of 15 seconds of rest between each trial. The best single trial, identified as the highest force measure, was used for statistical analysis from each participant's dominant hand while the first two repetitions of each hand were served as warm-up repetitions. The CMJ performance was measured using a dual force plate system sampling at 1,000 Hz (ForceDecks, VALD Performance, Brisbane, Australia). Participants were instructed to perform three maximum-effort repetitions of CMJs followed by SJs. All trials were performed with hands on the hip (no arm swing). On the researcher's verbal command (e.g., 3-2-1-go), the participant performed one maximum-effort repetition of a CMJ. A 15-20 second rest between each repetition was implemented to reduce the effect of fatigue. For SJs, the starting position was determined by each participant's parallel squat position, then the participant performed one maximum effort repetition of SJ. A 15-20 second rest between each repetition was implemented to reduce the effect of fatigue. A total of 3 repetitions were performed for both CMJ and SJ while only the best of trials determined by the peak concentric force were used for data analysis. Additionally, the first two CMJs and SJs served as warm-up repetitions, but these repetitions may also count as the best of trials if displayed higher peak concentric force than the last repetition. For the EUR calculations, we divided the CMJ jump height by the SJ jump height.

STATISTICAL ANALYSES

Each dependent variable's descriptive statistics (means and standard deviations) were calculated. Shapiro-Wilk's test corroborated that the normality assumption was not violated for any dependent variables examined in the present study. The Levene test corroborated that the homogeneity of variance assumption was not violated for any dependent variables examined in the present study except for grip strength. Independent sample t-tests were used to examine the muscular strength and SSC characteristic differences between strongman and strongwoman athletes. A Welch's t-test was performed to examine the difference between groups for grip strength. Due to the within-group sample size ($n < 20$), Hedges g was used to calculate the measure of effect size [i.e., $g = 0.2$ is a small effect, $g = 0.5$ is a moderate effect, and $g > 0.8$ is a large effect] (Hedges, 1981). Statistical significance was set α priori to $p < 0.05$. All statistical analyses were completed with SPSS (Version 29.0; IBM Corp., Armonk, NY, USA).

RESULTS

Descriptive statistics for basic anthropometric, hand grip strength and relative hand grip strength, self-reported one repetition max (1RM), and relative 1RM for squat, bench press, and deadlift were calculated and displayed in Table 1. As expected, strongman competitors' self-reported 1-RM from the squat, bench press, and deadlift were significantly higher than the strongwoman competitors. No significant differences were found in these 1-RM metrics when they were scaled by body mass. Differences in CMJ, SJ, and ratio metrics between strongman and strongwoman competitors were reported in Table 2. For the eccentric phase of CMJ metrics, all but braking phase duration and eccentric duration showed statistically significant differences between strongman and strongwoman competitors. For the concentric phase of CMJ metrics, all but countermovement depth and contraction time showed statistically significant differences between strongman and strongwoman competitors. For SJ metrics, concentric peak velocity, concentric mean force, relative concentric mean force, takeoff peak force, concentric mean power, relative concentric mean power, jump height, and modified RSI showed statistically significant differences between strongman and strongwoman competitors. Additionally, most effect sizes were moderate to large in magnitude for all jump performance metrics (g = 0.510–2.503). Eccentric duration (g = -0.214), eccentric utilization ratio (g = 0.14), and stretch shortening cycle percentage (g = 0.14) were the only jump metrics with small effect sizes.

DISCUSSION

The purpose of the present study was to profile the handgrip strength and jump performance of strongman and strongwoman competitors who attended an international strongman and strongwoman event and to examine potential sex differences between strongman and strongwoman event participants. While the strongman's absolute strength variables were significantly higher than the strongwoman's, no significant differences were found in relative strength variables. Compared to all male powerlifters competed in International Powerlifting Federation sanctioned powerlifting competitions between 1968 to 2022, the relative strength of strongman competitors was only ranked in the 10th percentile, while top performers squat ranked in the 80th percentile; while the relative strength of strongwoman competitors ranked between the 30th and 60th percentile compared to female powerlifters, while top performers were able to achieve above the 90th percentile for squat, bench press, and deadlift (van den Hoek et al., 2007). This is not surprising considering that the top performers were elite, championship caliber athletes. These findings indicate the importance of absolute strength in strongman and strongwoman populations. It is also interesting that relative strength was similar regardless of sex, which warrants further investigation.

Grip strength has been used as a field test to conveniently estimate an individual's strength, where several studies have investigated grip strength's correlation with an individual's absolute strength, which is tested using a standard maximum squat or bench press one can lift without failure (Schoffstall, 2010; Cronin et al., 2017; DeBeliso & Suazo, 2021). The correlation between grip strength and self-reported 1-RMs was very consistent if the lift performance was normalized to body mass,

Table 1. Descriptive statistics means and standard deviations (x̄ ± SD) of strongman and strongwoman competitors' physical characteristics, dominant hand grip strength, and self-reported one repetition max (1RM) of squat, bench press, and deadlift.

Variable (unit)	Strongman	Strongwoman	*p*	*t*	95% CI	*g*
General						
Age (years)	27.4±5.9	28.4±6.1	0.36	-0.37	[-6.6, 4.6]	-0.16
Body Mass (kg)	125.7±28.4*	94.7±24.3	0.01	2.50	[-7.0, 5.1]	1.09
Hand Length (mm)	185.1±14.1*	169.7±14.1*	0.01	2.42	[2.2, 28.8]	1.06
Years Competing (years)	2.1±1.7	2.9±2.7	0.22	-0.80	[-2.6, 1.2]	-0.35
Absolute Muscular Strength						
Hand Grip Strength (kg)	65.7±8.5*	45.0±3.9*	0.001	6.14	[13.7, 27.8]	2.68
Squat 1RM (kg)	229.9±51.0*	155.3±34.7*	0.002	3.28	[27.2, 122.0]	1.51
Bench Press 1RM (kg)	156.6±31.0*	92.3±18.6*	0.001	4.64	[34.8, 91.9]	2.15
Deadlift 1RM (kg)	251.0±40.6*	165.7±43.4	0.001	4.55	[46.3, 124.3]	1.99
Relative Muscular Strength						
Rel. Squat 1RM	1.87±0.78	1.73±0.68	0.27	0.62	[-0.3, 0.6]	0.30
Rel. Bench Press 1RM	1.27±0.28	1.02±0.36	0.05	1.71	[-0.1, 0.6]	0.79
Rel. Deadlift 1RM	2.05±0.39	1.87±0.78	0.23	0.75	[-0.3, 0.7]	0.33

*Note: * = significantly different when compared to strongwoman (p < 0.05); 95% CI = 95% confidence interval.*

Table 2. Descriptive statistics means and standard deviations (x̄ ± SD) of strongman and strongwoman competitors' countermovement jump, squat jump, and ratio metrics.

Variable (unit)	Strongman	Strongwoman	*p*	*t*	95% CI	*g*
CMJ Eccentric phase						
Braking phase duration [millisecond]	387.4±80.2	427.7±64.4	0.29	-1.09	[-103.4, 33.3]	-0.51
ECC braking impulse – A [Ns]	71.8±18.1*	41.3±18.7	0.002	3.99	[14.5, 50.9]	1.61
ECC duration [millisecond]	582.2±101.3	603.4±79.2	0.78	-0.28	[-95.3, 73.2]	-0.21
ECC peak velocity [m/s]	-1.18±0.22*	-0.90±0.24	0.02	-2.70	[-0.5, -0.05]	-1.15
ECC mean force – A [N]	1217.8±269.0*	930.4±238.7	0.02	2.68	[59.3, 550.0]	1.06
ECC peak force – A [N]	2630.3±528.3*	1655.7±395.3	0.001	5.01	[575.0, 1423.9]	1.90
ECC peak force – R [N/kg]	21.5±3.0*	17.6±2.0	0.002	3.58	[1.6, 6.2]	1.36
ECC mean power – A [W]	752.0±134.4*	475.1±184.6	0.004	3.83	[118.8, 468.0]	1.80
ECC mean power – R [W/kg]	6.2±1.1*	4.9±1.2	0.034	2.43	[0.1, 2.5]	1.08
ECC peak power – A [W]	1815.9±486.0*	977.6±385.2	0.001	4.69	[476.0, 1279.6]	1.76
ECC peak power – R [W/kg]	15.0±4.4*	10.2±2.9	0.006	3.16	[1.7, 8.3]	1.15
CMJ Concentric phase						
CON duration [millisecond]	294.0±48.1*	350.0±56.0	0.08	-1.99	[-101.0, 6.2]	-1.08
CON peak velocity [m/s]	2.60±0.28*	2.17±0.22	0.002	3.76	[0.2, 0.6]	1.55
CON mean force – A [N]	2251.2±448.6*	1471.0±293.8	0.001	4.80	[429.7, 1100.3]	1.82
CON mean force – R [N/kg]	18.4±2.1*	15.7±1.6	0.009	3.03	[0.7, 3.9]	1.31
CON peak force – A [N]	2783.6±522.1*	1816.9±302.9	0.001	5.38	[576.7, 1311.0]	1.97
CON peak force – R [N/kg]	22.6±2.9*	17.7±3.3	0.02	2.56	[0.4, 5.0]	1.15
CON mean power – A [W]	3065.5±612.9*	1636.3±322.8	0.001	7.51	[997.1, 1767.8]	2.50
CON mean power – R [W/kg]	25.3±5.2*	17.7±3.3	0.001	4.04	[3.3, 10.6]	1.56
CMJ Other						
Contraction time [millisecond]	876.3±139.4	953.6±125.7	0.37	-0.93	[-178.0, 72.1]	-0.55
Jump height [cm]	30.8±7.6*	20.5±4.8	0.002	3.70	[4.1, 15.1]	1.42
RSI-modified [ratio: jump height/ time to TO]	0.35±0.11*	0.23±0.09	0.01	2.77	[0.03, 0.2]	1.14
Countermovement depth [cm]	-35.9±6.6	-31.1±7.3	0.10	-1.79	[-12.8, 1.4]	-0.68
Squat Jump						
CON mean velocity [m/s]	1.07±0.14*	0.88±0.16	0.13	1.60	[-0.04, 0.3]	1.27
CON peak velocity [m/s]	2.61±0.25*	2.22±0.30	0.04	2.37	[0.02, 0.7]	1.48
CON mean force – A [N]	1730.1±312.1*	1208.7±241.7	0.001	5.03	[335.8, 826.0]	1.70
CON mean force – R [N/kg]	15.3±1.3*	13.7±0.9	0.02	2.58	[0.2, 2.4]	1.30
TO peak force – A [N]	2307.7±436.6*	1617.2±313.4	0.001	4.86	[441.4, 1121.8]	1.62
TO peak force – R [N/kg]	20.4±2.2*	18.3±1.6	0.04	2.12	[0.005, 3.7]	0.97
CON mean power – A [W]	1928.3±298.7*	1108.3±212.6	0.001	8.11	[607.9, 1031.8]	2.82
CON mean power – R [W/kg]	17.3±3.2*	12.8±2.6	0.03	2.42	[0.4, 6.7]	1.45
Contraction time [millisecond]	476.4±86.1	532.7±69.1	0.12	-1.67	[-128.8, 16.1]	-0.88
Jump height [cm]	30.9±6.8*	21.6±6.5	0.03	2.45	[0.8, 15.3]	1.36
RSI-modified [ratio]	0.70±0.22*	0.42±0.14	0.01	2.84	[0.06, 0.4]	1.37
Ratio						
Eccentric Utilization Ratio	1.03±0.08	1.03±0.24	1.0	0.00	[-0.2, 0.2]	0.14
Stretch Shortening Cycle %	3.03±8.18	1.30±18.61	0.19	1.41	[-0.05, 0.2]	0.14

*Note: * = significantly different when compared to strongwoman ($p < 0.05$); 95% CI =95% confidence interval; A - absolute; R - relative; ECC - eccentric; CON - concentric; TO - takeoff* with the associated Pearson correlation coefficient (r) ranging from 0.52 to 0.98 (Schoffstall, 2010; DeBeliso & Suazo, 2021). Grip strength tests have also been used to examine upper and lower-body muscular strength, where several studies reported significant correlations between upper-body and lower-body strength with grip strength (Milliken et al., 2008; Nara et al., 2022). However, the efficacy of using grip strength to estimate absolute strength in special populations, such as strongman and strongwoman participants, has remained largely unknown. There is some evidence suggesting that handgrip strength can correlate with 1RM strength test results in competitive powerlifting athletes (Travis et al., 2025). A cohort of strongman athletes reported between 45 kg-87 kg of grip strength in a span of 12 weeks (Chappell & Simper, 2020). In a study investigating the difference between the strongman training style and traditional training, Winwood et al. (2015) discovered that grip strength increased more with a strongman-style training program than a traditional resistance training program. Based on the observation of strongman events, speculations can be made that a strongman may need adequate grip strength to perform optimally.

Interestingly, our cohort of strongmen and strongwomen outperformed athletes in several sports (e.g., martial arts, rock climbing, basketball, volleyball, and handball) by about 20 kg (Iermakov et al., 2016; Assmann et al., 2020; Barut et al., 2008). Particularly for strongman, the observed mean handgrip strength of 64.5 kg positions this population towards the upper end of the top 10% of the general population (58-63 kg), as well as in athletic population, suggesting this population of competitive athletes likely possesses superior handgrip strength relative to normative data on the general population reported by others, with some competitors clearly surpassing these normative ranges and athletic population from multiple sports (McGrath, 2010; Massy-Westropp et al., 2011; Iermakov, 2016; Assmann et al., 2020; Barut et al., 2008). As for the strongwoman competitors, the observed mean handgrip strength of 45.0 kg was noticeably higher than the observed value for females in a 2011 study, which reported 30 kg for the same age group (Massy-Westropp et al., 2011). Just like their male counterpart, strongwoman competitors also seemed to possess superior handgrip strength. Compared to elite judo and handball female athletes, our cohort of strongwoman competitors displayed similar handgrip strength, where the judo and handball athletes were able to achieve a mean handgrip strength of 45.3kg (Leyk et al., 2007). Future investigations should examine the normative data range of hand grip strength for athletes who often exceed the normative range for the general population and examine if the relationship between hand grip strength and 1RM test exists in such a population.

Previous research has reported Wingate Anaerobic Test power output to quantify strongman's power output (Chappell & Simper, 2020). Strongmen produced less power than track and field athletes when both athletes' power outputs were scaled for body mass. However, a successful strongman depends primarily on absolute peak power output, rather than relative power output, which stands in contrast to track and field athletes, who demonstrate higher relative power in Wingate test results (Chappell & Simper, 2020). Force plates can also be utilized to measure muscular power output. Strongman competitors showed considerably higher absolute and relative force and power output in the eccentric phase of CMJ than strongwoman competitors, which may be likely explained by their higher body mass and the subsequent higher ground reactive forces. Strongman competitors also showed slightly less eccentric duration and braking phase duration which indicates that strongman and strongwoman competitors may utilize different mechanisms during the eccentric portion of the CMJ to produce force and power. The strongman competitors have significantly higher mRSI than strongwoman competitors, but both groups showed less noticeable mRSI than athletes from other sports such as basketball, American football, and soccer (Witte et al., 2024). Additionally, CMJ jump height was also significantly lower than other sports. For example, the strongman competitors' jump height was shorter than a cohort of American football athletes, even less than offensive and defensive linemen which are considered some of the largest athletes across sports (Johnson et al., 2025; Merrigan et al., 2023). However, this finding can be explained by the fact that strongmen tend to have larger body mass than average humans, even larger than American football linemen, limiting their ability to record higher CMJ jump height despite producing more force than the general population. By comparing phase durations, strongman competitors tend to spend less time in both the eccentric phase and the concentric phase than strongwoman competitors; this is not consistent with previous research as elite male athletes tend to spend longer in CMJ phases, particularly the eccentric deceleration phase (Philpott et al., 2020).

Strongman competitor's shorter time in CMJ phases can be explained by the fact that their training programs may not often include muscular power training such as Olympic weightlifting variations and plyometrics, which leads to inconsistent CMJ jumping performance compared to athletes in other sports. Compared with other sports, both CMJ and SJ's peak power showed similar pattern with American football linemen who are possibly some of the strongest athletes of all sport; the linemen recorded around 6000 watts for peak power during CMJ tasks(Merrigan et al., 2023). Our cohort of strongman competitors also had very similar peak CMJ jump power compared to both national and international caliber weightlifters as well as power lifters, while the male competitors had slightly higher peak CMJ jump power (5683W vs. 5437W) (Fry et al., 2003a; Fry et al., 2003b). While jump force and power analysis is rare for strongman and strongwoman competitors, it is a standard method to examine the neuromuscular characteristics of many other athletes. When compared to semiprofessional soccer athletes, both strongman and strongwoman competitors displayed considerably lower peak velocity, peak relative force and power in the concentric phase of the CMJ (Cabarkapa et al., 2024). For strongwoman competitors specifically, our cohort produced noticeably higher force and power in the eccentric phase of the CMJ than a group of professional female handball players, but force, power, and peak velocity were same of less compared to the same group of athletes during the concentric phase of the CMJ (Radovic et al., 2024). The discrepancies in CMJ force, power, and velocity can be explained by the difference in body mass between these two groups of athletes (94 kg for strongwoman competitors vs. 67kg for female handball players), and the inexperience in jumping for strongwoman competitors. Based on the CMJ and SJ analysis, although jumps are not common in strongman and strongwoman training, it may be beneficial for strongman and strongwoman athletes to incorporate muscular power training into their training plans, such as plyometric movements.

Both absolute and relative force and power from SJ were significantly higher in strongman competitors than in strongwoman competitors; the same rationale of performance differences between sex in CMJ performance can explain this. When exploring the differences in the ratio between CMJ and SJ, strongman competitors had a higher SSC percentage than strongwoman competitors indicating strongman competitors may have better utilization of the SSC than their female counterparts. However, the jump height for SJ in both strongman competitors and strongwoman competitors were higher than CMJ, indicating athletes in this sport have limited training in SSC which is expected as events in strongman and strongwoman competitions rarely requires the force production from the SSC. Existing literature has contributed the jump height differences between CMJ and SJ to the additional force produced by the countermovement which utilized the SSC to achieve such action (Bobbert et al., 1996; Bobbert & Casius, 2005). In contrast, no significant difference in eccentric utilization ratio (EUR) was found, and the EUR characteristic observed in our cohort may suggest that this cohort relied on absolute muscular force production over a longer duration of time instead of instantaneous or relative to time. This characteristic may partially explain why power output and the EUR did not differ significantly. The relative strength showed no significant difference between strongman competitors and strongwoman competitors, this agrees with previous research that showed strongman training programs are as effective as traditional resistance training programs in improving strength (Winwood et al., 2015). The EUR for the entire cohort was also averaged below 1.2 (Figure 1), which indicates higher overall strength than ballistic power (Mcguigan et al., 2006). Comparing the present study's data with previously reported values, the EUR is noticeably lower than that of several popular sports, especially with soccer athletes who achieved a EUR between 1.14 and 1.17 (Mcguigan et al., 2006). Mcguigan et al.. (2006) also reported that field hockey and male softball athletes had EURs similar to those of the participants in the present study. Athletes from Major League Baseball (MLB) and its minor league affiliates showed similar EURs compared to our data, especially the catchers, infielders, and outfielders from MLB (Amonette et al., 2023).

While the present study successfully profiled strongman and strongwoman athletes, there were several limitations. First, the participants' training background and basic anthropometric information were based on the survey; some participants may have been identified as the wrong group due to misinterpretation of the questions or the accuracy of responses. Additionally, due to the lack of reporting of deadlift styles and the use of lifting straps, the sex comparison of absolute and relative deadlift 1RM between the competitors may not be as precise as needed and may introduce bias in the comparison. Moreover, although all included participants indicated themselves as strongman and strongwoman competitors for the event, the performance level among the competitors was not equal. Some participants within the cohort may not have trained long enough for the events to retain performance characteristics of such population, which may mask more significant findings within the present investigation. Future research should focus on professional strongman participants within the exact scope of testing batteries.Overall, the present research adds more information to our limited understanding of the physical performance profiles of strongman and strongwoman competitors and can guide strength and conditioning program design in the future.

CONCLUSION

The present study explored common strength characteristics such as grip strength, 1RM of squat, deadlift, and bench press, as well as CMJ and SJ performance for a cohort of attendees at an international strongman event which consists of strongman and strongwoman athletes. Comparisons between the groups identifiedunique characteristics for a scarcely studied population of competitive athletes. The present study compared the population's grip strength, vertical jump ability, and lower-body muscular power performance. As expected, strongmen competitors had higher grip strength while showing significant differences in force and power production during the CMJ and SJ compared to strongwoman competitors. While the study's primary purpose was to profile the physical characteristics of strongmen and strongwomen populations, it is noteworthy that the training outcome of strongman training was similar compared to conventional training methods for the general population. Still, due to the complexity and intensity of the training approach, individuals should consult a strength and conditioning specialist before using such methods in a routine training program.

PRACTICAL APPLICATION

The current study's findings provided critical information on strongman and strongwoman athletes, who typically are larger in stature and need to produce greater absolute forces to be successful within competition. Strongman and strongwoman athletes' peak power production is among the highest compared to athletes from various sports. However, based on the findings of this investigation, and in order to perform optimally in strongman or strongwoman events, the authors suggest an emphasis on overall absolute strength development rather than ballistic power. However, developing lower-body muscular power may enhance an athlete's ability to generate and apply maximal or near-maximal forces within a given time frame, which is a key factor in most events within the sport. Additionally, strength and conditioning practitioners may consider incorporating some elements of strongman and strongwoman training into their programs for other sports, such as wrestling and American football, as a means to provide possible alternatives to supplement traditional training approaches at different phases of their respective seasons.

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CONFLICTS OF INTEREST

The author declare no conflicts of interest.

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ETHICAL APPROVAL

The testing procedures performed in this study were approved by the university's Institutional Review Board. Participants were briefed on all procedures and provided informed consent before data collection.

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REFERENCES

1. Amonette, W. E., Vazquez, J., & Coleman, A. E. (2023). Cross-Sectional Analysis of Ground Reaction Forces During Jumps in Professional Baseball Players. The Journal of Strength & Conditioning Research, 37(8), 1616-1622. https://doi.org/10.1519/jsc.0000000000004435
2. Assmann, M., Steinmetz, G., Schilling, A. F., & Saul, D. (2021). Comparison of Grip Strength in Recreational Climbers and Non-Climbing Athletes—A Cross-Sectional Study. International Journal of Environmental Research and Public Health, 18(1), 129. https://www.mdpi.com/1660-4601/18/1/129
3. Barut, Ç., Demirel, P., & Kıran, S. (2008). Evaluation of hand anthropometric measurements and grip strength in basketball, volleyball and handball players. Anatomy, 2(1), 55-59. https://doi.org/10.2399/ana.08.055
4. Bobbert, M. F., Gerritsen, K. G., Litjens, M. C., & Van Soest, A. J. (1996). Why is countermovement jump height greater than squat jump height?. Medicine and science in sports and exercise, 28(11), 1402–1412. https://doi.org/10.1097/00005768-199611000-00009
5. Bobbert, M. F., & Casius, L. J. (2005). Is the effect of a countermovement on jump height due to active state development?. Medicine and science in sports and exercise, 37(3), 440–446. https://doi.org/10.1249/01.mss.0000155389.34538.97
6. Cabarkapa, D., Cabarkapa, D. V., Fry, A. C., Song, Y., Gisladottir, T., & Petrovic, M. (2024). Comparison of Vertical Jump Force–Time Metrics Between ACL-Injured and Healthy Semi-Professional Male and Female Soccer Players. Sports, 12(12), 339. https://doi.org/10.3390/sports12120339
7. Chappell, A., & Simper, T. (2020). A Case Study Series of the Health Status and Key Anthropometry in Very Large Strength Athletes. International Journal of Strength and Conditioning, 1(1). 1-7. https://doi.org/10.47206/iuscaj.v1i1.2
8. Cronin, J., Lawton, T., Harris, N., Kilding, A., & McMaster, D. T. (2017). A Brief Review of Handgrip Strength and Sport Performance. The Journal of Strength & Conditioning Research, 31(11), 3187-3217. https://doi.org/10.1519/jsc.0000000000002149
9. Debeliso, M., & Suazo, N. (2021). The relationship between powerlifting performance and hand grip strength among female athletes. Turkish Journal of Kinesiology, 7(4), 112-122. https://doi.org/10.31459/turkjkin.1027695
10. Donahue, P. T., Peel, S. A., Rush, M., McInnis, A. K., Littlefield, T., Calci, C., & Brutofsky, T. (2023). Examining Countermovement Jump Strategies Between Women's NCAA Division I Sports. Journal of Strength and Conditioning Research, 37(10), 2052-2057. https://doi.org/10.1519/JSC.0000000000004505
11. Fry, A. C., Schilling, B. K., Staron, R. S., Hagerman, F. C., Hikida, R. S., & Thrush, J. T. (2003). Muscle Fiber Characteristics and Performance Correlates of Male Olympic-Style Weightlifters. The Journal of Strength & Conditioning Research, 17(4), 746-754. https://journals.lww.com/nsca-jscr/fulltext/2003/11000/muscle_fiber_characteristics_and_performance.20.aspx
12. Fry, A. C., Webber, J. M., Weiss, L. W., H Arber, M. P., Vaczi, M., & Pattison, N. A. (2003). Muscle Fiber Characteristics of Competitive Power Lifters. The Journal of Strength & Conditioning Research, 17(2), 402-410. https://doi.org/10.1519/1533-4287(2003)017<0402:mfcocp>2.0.co;2
13. Grant, S., Hasler, T., Davies, C., Aitchison, T. C., Wilson, J., & Whittaker, A. (2001). A comparison of the anthropometric, strength, endurance and flexibility characteristics of female elite and recreational climbers and non-climbers. Journal of Sports Sciences, 19(7), 499-505. https://doi.org/10.1080/026404101750238953
14. Guy M, Piatt C, Himmelberg L, Ballmann K, Mayhew JL. (1996). Isometric strength measurement as predictors of physical performance in college men. The Illinois Association for physical education, health recreation and dance Journal, 30,18-19.
15. Haff, G., Ruben, R., Molinari, M., Painter, K., Ramsey, M. W., Stone, M. E., & Stone, M. H. (2010). The Relationship Between The Eccentric Utilization Ratio, Reactive Strength, And Pre-Stretch Augmentation And Selected Dynamic And Isometric Muscle Actions. The Journal of Strength & Conditioning Research, 24, 1. https://doi.org/10.1097/01.Jsc.0000367120.66650.12
16. Hedges, L. V. (1981). Distribution theory for Glass's estimator of effect size and related estimators. Journal of Educational Statistics, 6(2), 107-128. https://doi.org/10.2307/1164588
17. Hoffman, J. R., Vazquez, J., Pichardo, N., & Tenenbaum, G. (2009). Anthropometric and Performance Comparisons in Professional Baseball Players. The Journal of Strength & Conditioning Research, 23(8), 2173-2178. https://doi.org/10.1519/JSC.0b013e3181bcd5fe
18. Iermakov, S.S., Podrigalo, L.V., & Jagiełło, W. (2016). Hand-grip strength as an indicator for predicting the success in martial arts athletes. Archives of Budo, 12. 179-186
19. Johnson, Q. R., Yang, Y., Cabarkapa, D., Stock, S., Gleason, D., Akehi, K., Sealey, D., Frels, C., Smith, D. B., & Fry, A. C. (2025). Key Performance Indicators for College American Football Starters: An Exploratory Study. Journal of Functional Morphology and Kinesiology, 10(1), 19. https://doi.org/10.3390/jfmk10010019
20. Keogh, J. W., Newlands, C., Blewett, S., Payne, A., & Chun-Er, L. (2010). A Kinematic Analysis of a Strongman-Type Event: The Heavy Sprint-Style Sled Pull. The Journal of Strength & Conditioning Research, 24(11), 3088-3097. https://doi.org/10.1519/JSC.0b013e3181b62c2f
21. Keogh, J. W. L., Payne, A. L., Anderson, B. B., & Atkins, P. J. (2010). A Brief Description of the Biomechanics and Physiology of a Strongman Event: The Tire Flip. The Journal of Strength & Conditioning Research, 24(5), 1223-1228. https://doi.org/10.1519/JSC.0b013e3181cc61cd
22. Kraemer, W. J., Caldwell, L. K., Post, E. M., DuPont, W. H., Martini, E. R., Ratamess, N. A., Szivak, T. K., Shurley, J. P., Beeler, M. K., Volek, J. S., Maresh, C. M., Todd, J. S., Walrod, B. J., Hyde, P. N., Fairman, C., & Best, T. M. (2020). Body Composition in Elite Strongman Competitors. The Journal of Strength & Conditioning Research, 34(12), 3326-3330. https://doi.org/10.1519/jsc.0000000000003763
23. Leyk, D., Gorges, W., Ridder, D., Wunderlich, M., Rüther, T., Sievert, A., & Essfeld, D. (2007). Hand-grip strength of young men, women and highly trained female athletes. European journal of applied physiology, 99(4), 415–421. https://doi.org/10.1007/s00421-006-0351-1
24. Laffaye, G., Wagner, P. P., & Tombleson, T. I. L. (2014). Countermovement Jump Height: Gender and Sport-Specific Differences in the Force-Time Variables. The Journal of Strength & Conditioning Research, 28(4), 1096-1105. https://doi.org/10.1519/JSC.0b013e3182a1db03
25. Massuça, L. M., Fragoso, I., & Teles, J. (2014). Attributes of top elite team-handball players. The Journal of Strength & Conditioning Research, 28(1), 178-186. https://doi.org/10.1519/JSC.0b013e318295d50e

26. Massy-Westropp, N. M., Gill, T. K., Taylor, A. W., Bohannon, R. W., & Hill, C. L. (2011). Hand Grip Strength: age and gender stratified normative data in a population-based study. BMC Research Notes, 4(1), 127. https://doi.org/10.1186/1756-0500-4-127
27. McGill, S. M., McDermott, A., & Fenwick, C. M. (2009). Comparison of Different Strongman Events: trunk muscle activation and lumbar spine motion, load, and stiffness. The Journal of Strength & Conditioning Research, 23(4), 1148-1161. https://doi.org/10.1519/JSC.0b013e318198f8f7
28. McGrath, R., Hackney, K. J., Ratamess, N. A., Vincent, B. M., Clark, B. C., & Kraemer, W. J. (2020). Absolute and Body Mass Index Normalized Handgrip Strength Percentiles by Gender, Ethnicity, and Hand Dominance in Americans. Advances in Geriatric Medicine and Research, 2(1), e200005, Article e200005. https://doi.org/10.20900/agmr20200005
29. Mcguigan, M. R., Doyle, T. L. A., Newton, M., Edwards, D. J., Nimphius, S., & Newton, R. U. (2006). Eccentric utilization ratio: effect of sport and phase of training. The Journal of Strength & Conditioning Research, 20(4), 992-995. https://journals.lww.com/nsca-jscr/fulltext/2006/11000/eccentric_utilization_ratio__effect_of_sport_and.42.aspx
30. Merrigan, J. J., Rentz, L. E., Hornsby, W. G., Wagle, J. P., Stone, J. D., Smith, H. T., Galster, S. M., Joseph, M., & Hagen, J. A. (2022). Comparisons of Countermovement Jump Force-Time Characteristics Among National Collegiate Athletic Association Division I American Football Athletes: Use of Principal Component Analysis. Journal of Strength and Conditioning Research, 36(2), 411-419. https://doi.org/10.1519/JSC.0000000000004173
31. Milliken, L. A., Faigenbaum, A. D., Loud, R. L., & Westcott, W. L. (2008). Correlates of Upper and Lower Body Muscular Strength in Children. The Journal of Strength & Conditioning Research, 22(4), 1339-1346. https://doi.org/10.1519/JSC.0b013e31817393b1
32. Nara, K., Kumar, P., Rathee, R., & Phogat, P. (2022). Predicting lower body explosive strength using hand grip dynamometer strength test. Kuldeep Nara, Parveen Kumar, Rohit Rathee & Shalini Singh. 9(4) 299-303. https://doi.org/10.22271/kheljournal.2022.v9.i4e.2610
33. Pion, J. A., Fransen, J., Deprez, D. N., Segers, V. I., Vaeyens, R., Philippaerts, R. M., & Lenoir, M. (2015). Stature and Jumping Height Are Required in Female Volleyball, but Motor Coordination Is a Key Factor for Future Elite Success. The Journal of Strength & Conditioning Research, 29(6), 1480-1485. https://doi.org/10.1519/jsc.0000000000000778
34. Philpott, L.K., Forrester, S.E., van Lopik, K., Hayward, S., Conway, P.P., & West, A.A. (2020). Countermovement jump performance in elite male and female sprinters and high jumpers. Proceedings of the Institution of Mechanical Engineers, Part P: Journal of Sports Engineering and Technology, 235, 131 - 138. https://doi.org/10.1177/1754337120971436
35. Radovic, K., Cabarkapa, D., Aleksic, J., Cabarkapa, D. V., Mirkov, D. M., Knezevic, O. M., & Fry, A. C. (2024). Vertical jump neuromuscular performance of professional female handball players-starters vs. non-starters comparison. Frontiers in sports and active living, 6, 1407601. https://doi.org/10.3389/fspor.2024.1407601
36. Razman, R., Cheong, J. P., Abas, W. W., & Osman, N. A. (2012). Anthropometric and strength characteristics of tenpin bowlers with different playing abilities. Biology of Sport, 29(1), 33-38. 10.5604/20831862.979853
37. Renals L, Lake J, Keogh J, Austin K. (2018). Strongman Log Push Press: The Effect Log Diameter has on Force-Time Characteristics. The Journal of Strength & Conditioning Research 32(10), 2693-2700. 10.1519/JSC.0000000000002764
38. Rolsted, S. K., Andersen, K. D., Dandanell, G., Dall, C. H., Zilmer, C. K., Bülow, K., & Kristensen, M. T. (2024). Comparison of two electronic dynamometers for measuring handgrip strength. Hand surgery & rehabilitation, 43(3), 101692. https://doi.org/10.1016/j.hansur.2024.101692
39. Rostamzadeh, S., Saremi, M., Vosoughi, S., Bradtmiller, B., Janani, L., Farshad, A. A., & Taheri, F. (2021). Analysis of hand-forearm anthropometric components in assessing handgrip and pinch strengths of school-aged children and adolescents: a partial least squares (PLS) approach. BMC Pediatrics, 21(1), 39. https://doi.org/10.1186/s12887-020-02468-0
40. Schoffstall, J., Morrison, S., Kozlik, B., & Boswell, B. (2010). Grip Strength and Powerlifting Performance. In Proceedings of the Southeastern Chapter of the American College of Sports Medicine Regional Conference.
41. Sharma, A., Tripathi, V., & Koley, S. (2012). Correlations of anthropometric characteristics with physical fitness tests in Indian professional hockey players. 7(3). 698-705. doi:10.4100/jhse.2012.73.09
42. Shields, C. L., Whitney, F. E., & Zomar, V. D. (1984). Exercise performance of professional football players. The American Journal of Sports Medicine, 12(6), 455-459. https://doi.org/10.1177/036354658401200610
43. Strongman Corporation (n.d.). https://strongmancorporation.com/
44. Travis, S. K., Schwarz, A. V., & Burke, B. I. (2025). Locked and Loaded: Divergent Handgrip Tests as Surrogate Measures for One-Repetition Maximal Strength. Biomechanics, 5(1), 16. https://doi.org/10.3390/biomechanics5010016
45. van den Hoek, D. J., Beaumont, P. L., van den Hoek, A. K., Owen, P. J., Garrett, J. M., Buhmann, R., & Latella, C. (2024). Normative data for the squat, bench press and deadlift exercises in powerlifting: Data from 809,986 competition entries. Journal of science and medicine in sport, 27(10), 734–742. https://doi.org/10.1016/j.jsams.2024.07.005
46. Wall, C. B., Starek, J. E., Fleck, S. J., & Byrnes, W. C. (2004). Prediction of Indoor Climbing Performance in Women Rock Climbers. The Journal of Strength & Conditioning Research, 18(1), 77-83. 10.1519/1533-4287(2004)018<0077:poicpi>2.0.co;2
47. Winwood, P. W., Cronin, J. B., Posthumus, L. R., Finlayson, S. J., Gill, N. D., & Keogh, J. W. L. (2015). Strongman vs. traditional resistance training effects on muscular function and performance. The Journal of Strength & Conditioning Research, 29(2), 429-439. https://doi.org/10.1519/jsc.0000000000000629
48. Winwood, P. W., Keogh, J. W., & Harris, N. K. (2012Interrelationships between strength, anthropometrics, and strongman performance in novice strongman athletes. The Journal of Strength & Conditioning Research, 26(2), 513-522. https://doi.org/10.1519/JSC.0b013e318220db1a
49. Witte, B. C., Schouten, T. C., Westphal, J. A., VanZile, A. W., Jones, D. D., Widenhoefer, T. L., Dobbs, W. C., Jagim, A. R., Luedke, J. A., & Almonroeder, T. G. (2024). The Modified Reactive Strength Index Is a Valid Measure of Lower-Body Explosiveness in Male and Female High School Athletes. Journal of strength and conditioning research, 38(8), 1428–1432. https://doi.org/10.1519/JSC.0000000000004806