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Research Article

A Comparative Analysis of the Anthropometric and Biomotor Characteristics of Male and Female Korfball Athletes Preparing for the West Java PORPROV

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Abstract:

Background: Korfball is a mixed-gender sport in which body size and physical capacities may influence match performance, but data on the physical profiles of Indonesian korfball athletes are scarce.
Aims: This study compared the anthropometric characteristics and biomotor components of male and female korfball athletes preparing for the 2026 West Java Provincial Sports Week (PORPROV).
Methods: This descriptive comparative, cross-sectional study included all 12 athletes of the Bandung City team (6 male, 6 female; total sampling). Height, body weight, BMI, and 12 biomotor tests (sit-and-reach, trunk lift, stork stand, 20-m sprint, side step, medicine ball throw, vertical jump, relative leg power, 1-minute push-up, wall sit, core stability, and VO_2max estimated from the 20-m multistage fitness test) were measured. Normality was assessed with the Shapiro–Wilk test; groups were compared with Welch's t-test or the Mann–Whitney U test. Effect sizes (Hedges' g, r) with 95% confidence intervals are reported, and p-values were Holm-adjusted within the anthropometric (k = 3) and biomotor (k = 12) domains.
Result: Male athletes were taller, heavier, and had a higher BMI (g = 1.32–2.20), ran 20 m faster (g = −4.52), and had greater medicine ball throw distance (g = 2.96) and vertical jump height (g = 2.09); all remained significant after adjustment. Female athletes performed more push-ups in one minute (g = −2.74), a result that requires verification of the test protocol. No significant differences were detected for flexibility, balance, agility, relative leg power, core stability, wall sit, and estimated VO_2max; however, with six athletes per group only very large effects (d ≈ 1.8) could be detected, so these findings are inconclusive.
Conclusion: Within this small squad, sex differences were clearest in body size, sprint speed, and upper- and lower-body power. The findings are exploratory and provide a baseline profile for coaches; they should be confirmed in larger samples with standardized test protocols.

Keywords: Anthropometry; Biomotor Components; Korfball; Thematic Evolution

1. INTRODUCTION

Korfball is a mixed gender team sport played on a rectangular field, in which players use their hands to throw the ball into the opponent's basket (Korf) (Syaputra et al., 2025). Korfball is a sport with a unique feature that sets it apart from other team a team sport that requires both men and women to be on the same team. Korfball is played by four men and four women on the same team sports: while most team sports typically have separate categories for men and women, korfball is, with two women and two men each assigned to offensive and defensive positions (Aydın et al., 2025).

A game with minimal physical contact and rapid transitions between offense and defense demands that athletes be in peak physical condition. Throughout a korfball game, athletes are required to repeatedly perform high intensity movements such as sprinting, changing direction, jumping, passing, shooting, aerial rebounding, and transitioning between offense and defense. These conditions require korfball athletes to possess optimal biomotor capacity to maintain performance throughout the game. A systematic review of futsal (Spyrou et al., 2020) indicates that high-intensity team sports require (Spyrou et al., 2020) well-balanced neuromuscular, anaerobic, and aerobic capabilities to perform repetitive movements. In the world of sports coaching,

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biomotor capacity serves as the foundation for developing an athlete's performance. Biomotor components such as strength, power, speed, agility, endurance, flexibility, balance, and aerobic capacity interact with one another to support the execution of skills and optimal performance.

This aligns with the explanation by (Bompa & Buzzichelli, 2019) that an athlete's quality is determined by systematic training, which is the result of a combination of strength, endurance, speed, flexibility, coordination, and power. In team sports, these elements do not operate in isolation but work synergistically to support one another in achieving optimal performance. This is consistent with recent systematic reviews explaining that the combination of these biomotor components such as sprint speed, jump ability, and muscular strength enables athletes to maintain the rhythm of the game, move and change direction quickly, execute explosive jumps, and maintain technical quality throughout the match (Altavilla, 2025; Horníková & Zemková, 2021).

The contribution of biomotor components in team sports such as korfball varies. Rapid changes of position and high acceleration require speed, the ability to maintain the quality of shots and long passes during a match is supported by upper extremity power (shoulders, chest, upper and lower arms, and hands), jump height, leg power, and balance all of which support rebounding and aerial duels. Aerobic capacity (VO_2max) enables athletes to maintain the intensity of play throughout the game (Haff & Triplett, 2016).

In addition to biomotor capacity, one of the other indicators for assessing an athlete's performance is anthropometry. Anthropometric characteristics including body weight, height, body composition, body segment proportions, and Body Mass Index (BMI) are correlated with movement efficiency, explosiveness, and aerobic activity (Lukaski & Raymond-Pope, 2021). An ideal body composition allows athletes to have a better physical advantage, as they are able to move more effectively and generate maximum power. Therefore, evaluating body composition is crucial, particularly for monitoring physical condition, designing training programs, and preventing injuries in athletes (Spyrouet al., 2020).

Ahead of the 2026 West Java Provincial Sports Week (PORPROV) this coming November-December, competition among regional contingents is expected to be intense. The Bandung City Korfball Team therefore needs an evidence-based training program. Physical condition contributes to maintaining the quality of technical and tactical skills as well as game efficiency when the intensity of play on the field increases and fatigue sets in (Mandorino et al., 2025). Inadequate biomotor capacity can lead to a decline in technical performance and increase the risk of injury on the field (Joyokusumo et al., 2025; Suchomel et al., 2016).

Various studies on team sports have shown differences in anthropometric characteristics and biomotor abilities between male and female athletes. In terms of physical performance, male athletes generally have larger body size, greater muscle mass, faster sprint speed, and neuromuscular characteristics that favor explosive power compared to female athletes (Handelsman et al., 2018; Hunter et al., 2023), whereas differences in flexibility and balance are smaller or inconsistent across studies (Aedo-Muñoz et al., 2019; Pontaga et al., 2024). (Bompa & Buzzichelli, 2019; Suchomel et al., 2016) While there are many scientific studies and reviews discussing biomotor capacity and body composition in Indonesia (Fauzi & Sapulete, 2024; Kardiyanto & Wijanarko, 2021; Misfajar, 2019; Taqy et al., 2024), research specifically on the sport of korfball in Indonesia remains scarce. Existing korfball related studies in Indonesia still tend to address skill assessment instruments, athlete motivation, or program development separately (Aryanto et al., 2020; Lestari et al., 2024; Dony et al., 2025) rather than examining anthropometric, body composition, and physical condition profiles in an integrated manner, and research attention remains concentrated on more popular sports such as basketball, soccer, volleyball, and handball.

A previous study by (Godinho et al., 1996) examined high-level Dutch korfball players and found that its anthropometric characteristics differed from those of athletes in other team sports. The study explained that korfball athletes are smaller and lighter than basketball and volleyball players but heavier and taller than players in other team sports, and it highlighted morphological differences between male and female athletes. Meanwhile, research examining anthropometric measurements in conjunction with various dominant biomotor components as a basis for evaluating athletes' physical condition remains very limited. Furthermore, understanding the specific differences between male and female athletes on a single korfball team is crucial for

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coaches in determining training volume and intensity for both genders when preparing for regional level competitions such as PORPROV. Additionally, most korfball research we identified originates from European countries, whose populations may differ from Indonesian athletes in anthropometric characteristics, body composition, and training methods. Based on the literature reviewed above, there appears to be a research gap: to our knowledge, no study has jointly described the anthropometric profiles and biomotor capacities of Indonesian korfball athletes by sex using a broad set of physical tests.

Therefore, this study aimed to compare the anthropometric characteristics (height, body weight, and BMI) and the biomotor components of male and female korfball athletes of the Bandung City team preparing for the 2026 West Java PORPROV. Given the small size of the squad, the analysis is exploratory and describes this specific team. We expected male athletes to show larger body dimensions and higher speed and power, whereas differences in flexibility, balance, and endurance were expected to be smaller.

2. MATERIAL AND METHOD

2.1 Research Design

This study employed a descriptive comparative design with a cross-sectional approach. All measurements were obtained in a single testing session at the Faculty of Sport and Health Education (FPOK), Universitas Pendidikan Indonesia (UPI), Bandung, during the general preparation phase of the training camp for the 2026 West Java Provincial Sports Week (PORPROV). All 12 korfball athletes of the Bandung City team who attended the training camp were included by total sampling (6 male and 6 female athletes). Athletes are eligible if (a) they are members of the Bandung City korfball team prepared for PORPROV 2026, (b) participate in regular training. Athletes with medical conditions that are contraindications to the test are excluded. All 12 eligible athletes are tested; one male athlete with a shoulder injury is still included but cannot take the medicine ball throw test. Because the entire team was tested, the sample is the team itself rather than a random sample of a larger population. Inferential statistics are therefore used to judge the size and consistency of between-sex differences within this team, and the findings should not be generalized to other korfball athletes.

2.2 Data Collection Procedures

Anthropometric variables include height, weight, and body mass index (BMI = weight/height², kg/m²). All measurements were taken at the Sport Science Laboratory, Faculty of Sports and Health Education, Universitas Pendidikan Indonesia, using a stadiometer and a digital scale belonging to the laboratory. BMI was calculated from the results of the two measurements. The biomotor tests were chosen to represent the physical demands of korfball: flexibility (sit-and-reach; trunk lift), balance (stork stand), speed (20-m sprint), agility (side step test), explosive power (medicine ball push-chest throw; vertical jump; relative leg power), and muscular and aerobic endurance (1-minute push-up; wall sit; core stability; and VO_2max estimated from the 20m multistage fitness test) (Bompa & Buzzichelli, 2019). Relative leg power (W/kg) was estimated from vertical jump height and body mass with the Sayers et al. (1999) equation [peak power (W) = 60.7 x jump height (cm) + 45.3 x body mass (kg) - 2055, divided by body mass].

2.3 Eligibility Criteria

Data were analyzed using SPSS Statistics version 27. Descriptive statistics are presented as mean ± SD (and range), and as median [interquartile range] for variables analyzed with non-parametric tests. The distribution of each variable within each sex was examined with the Shapiro–Wilk test. Because this test has low power with six athletes per group, its results were interpreted together with the data range and the presence of outliers rather than as proof of normality. Between-sex differences in normally distributed variables were tested with Welch's t-test, which does not assume equal variances and performs well with small and unbalanced groups (Delacre et al., 2017). Variables that were not normally distributed in at least one group (trunk lift, wall sit, core stability, and estimated VO_2max) were tested with the Mann–Whitney U test (exact p-values, which handle tied values; Z with tie correction). For the medicine ball throw, one male athlete could not complete the test because of a shoulder injury; this variable was analyzed using the available data (male n = 5, female n = 6) without imputation.

Effect sizes are reported as Hedges' g (the bias-corrected standardized mean difference based on the pooled SD, calculated as male minus female) with 95% confidence intervals from the noncentral t distribution for Welch tests, and as $r = Z/\sqrt{N}$ for

Mann–Whitney tests. Values of 0.2, 0.5, and 0.8 (Cohen, 1988) were used as rough descriptive benchmarks, recognizing that such default thresholds are not universally appropriate (Caldwell & Vigotsky, 2020). Fifteen between-sex comparisons were made (3 anthropometric and 12 biomotor). To limit false-positive findings, p-values were adjusted with the Holm method within each domain (anthropometric, k = 3; biomotor, k = 12). Both unadjusted and Holm-adjusted p-values are reported, and differences were considered statistically significant when the adjusted p-value was below 0.05. A sensitivity analysis (two-sided independent-samples t-test, $\alpha = 0.05$, power = 0.80, n = 6 per group) showed that only very large effects ($d \approx 1.8$) could be detected reliably. Non-significant results are therefore interpreted as inconclusive rather than as evidence of no difference.

3. RESULTS AND DISCUSSION

3.1 Results

Descriptive statistics for the whole sample (N = 12; 6 male and 6 female athletes of the Bandung City korfball team) are shown in Tables 1 and 3. The medicine ball throw was available for 11 athletes (male n = 5, female n = 6).

Table 1. Anthropometric characteristics of the athletes (N = 12)

No	Anthropometry	N	Overall (mean ± SD)	Range (min–max)	Male (n = 6) mean ± SD	Female (n = 6) mean ± SD
1	Weight (kg)	12	64.55±12.47	51.40–91.30	73.73±10.83	55.37±4.75
2	Height (cm)	12	168.41±9.75	158.00–187.00	175.82±8.16	161.00±3.29
3	BMI (kg/m²)	12	22.55±2.08	19.87–26.11	23.78±2.20	21.32±1.03

Table 1 presents the anthropometric characteristics. The mean body weight of the 12 athletes was 64.55 kg (range 51.40–91.30 kg); male athletes (73.73 ± 10.83 kg) were heavier than female athletes (55.37 ± 4.75 kg) and showed greater variability. Mean height was 168.41 cm (range 158.00–187.00 cm), with male athletes (175.82 ± 8.16 cm) taller than female athletes (161.00 ± 3.29 cm). Mean BMI was higher in male (23.78 ± 2.20 kg/m²) than in female athletes (21.32 ± 1.03 kg/m²). BMI values were classified using the WHO Asia-Pacific criteria (Lim et al., 2017).

Table 2. Body mass index (BMI) categories of the athletes by sex (WHO Asia-Pacific criteria)

BMI category	Range (kg/m²)	Male (n = 6) f	Male %	Female (n = 6) f	Female %	Total (N = 12) f	Total %
Underweight	<18.5	0	0.0%	0	0.0%	0	0.0%
Normal	18.5–22.9	1	16.7%	6	100.0%	7	58.3%
Overweight	23.0–24.9	3	50.0%	0	0.0%	3	25.0%
Obese	≥25.0	2	33.3%	0	0.0%	2	16.7%
Total		6	100.0%	6	100.0%	12	100.0%

Table 2 shows that all six female athletes were in the normal BMI category, whereas among the male athletes one (16.7%) was normal, three (50.0%) were overweight, and two (33.3%) were obese. In muscular athletes, BMI-based "overweight" or "obese" labels may reflect lean mass rather than excess fat and should not be interpreted as a nutritional problem without body-composition data.

On average, male athletes had higher values for all three anthropometric variables (height, body weight, and BMI). Whether these differences are statistically significant is tested in Table 5.

Table 3. Biomotor test results of the athletes (N = 12)

No	Biomotor component	Test	N	Overall (mean ± SD)	Range (min–max)	Male (n = 6) mean ± SD	Female (n = 6) mean ± SD
1	Flexibility	Sit-and-reach (cm)	12	15.09±6.28	4.60–25.40	14.97±6.78	15.22±6.38
		Trunk lift (cm)	12	42.00±5.48	37.00–56.50	41.75±3.70	42.25±7.23
2	Balance	Stork stand (s)	12	29.42±17.28	2.50–57.50	25.33±19.51	33.50±15.37
3	Speed	Sprint 20 m (s)	12	3.46±0.29	3.08–3.87	3.20±0.12	3.72±0.09
4	Agility	Side step test	12	37.50±7.78	31.00–57.00	41.17±9.70	33.83±2.56

5	Explosive Power	Medicine ball throw (m)*	11	3.36±0.63	2.70–4.30	3.94±0.44	2.88±0.19
		Vertical jump height (cm)	12	50.08±8.39	40.00–69.00	56.33±6.98	43.83±3.54
		Relative leg power (W/kg)	12	60.16±6.15	52.05–72.30	63.92±5.40	56.40±4.48
6	Muscle & Aerobic Endurance	Push-up 1 min (reps)	12	36.58±16.04	13.00–61.00	23.50±10.09	49.67±7.31
		Wall sit (s)**	12	200.83±63.28	125.00–300.00	221.67±88.13	180.00±0.00
		Core stability (level)	12	9.17±3.04	5.00–12.00	10.00±3.16	8.33±2.94
		Estimated VO_2max (ml/kg/min)	12	38.56±5.95	33.00–50.30	41.10±6.90	36.02±3.84

**Medicine ball throw: n = 11 (male n = 5, female n = 6) because one male athlete had a shoulder injury. **All female athletes recorded 180 s.*

Table 3 presents the biomotor results. Only 11 athletes completed the medicine ball push-chest throw: one male athlete could not perform the test because of a shoulder injury; descriptive and inferential statistics for this variable are therefore based on the available data (male n = 5, female n = 6). Normality was then examined with the Shapiro–Wilk test (Table 4) to decide between parametric and non-parametric tests.

Table 4. Shapiro–Wilk normality test by sex

Variable	W (male)	p	Status	W (female)	p	Status
Height	0.954	0.774	Normal	0.814	0.078	Normal
Weight	0.930	0.583	Normal	0.859	0.187	Normal
BMI	0.912	0.447	Normal	0.918	0.494	Normal
Sit & Reach	0.966	0.864	Normal	0.956	0.790	Normal
Trunk Lift	0.950	0.738	Normal	0.733	0.014	Non-normal
Stork Stand Test	0.963	0.844	Normal	0.955	0.780	Normal
Sprint 20 m	0.876	0.251	Normal	0.941	0.669	Normal
Side Step Test	0.912	0.452	Normal	0.843	0.138	Normal
Medicine ball throw*	0.836	0.155	Normal	0.912	0.452	Normal
Vertical Jump	0.890	0.316	Normal	0.931	0.586	Normal
Leg Power	0.957	0.797	Normal	0.857	0.180	Normal
Push-Up 1 Minute	0.918	0.491	Normal	0.960	0.819	Normal
Wall sit**	0.764	0.027	Non-normal	-	-	Constant (SD = 0)
Core Stability	0.697	0.006	Non-normal	0.755	0.022	Non-normal
Estimated VO_2max	0.892	0.327	Normal	0.739	0.016	Non-normal

**Medicine ball throw: male n = 5, female n = 6.*
***Wall sit: all female athletes recorded the same value (180 s; SD = 0), so normality could not be tested.*

Table 4 shows that most variables were normally distributed in both sexes ($p > 0.05$). Wall sit (male), trunk lift (female), core stability (male and female), and estimated VO_2max (female) departed significantly from normality ($p < 0.05$), and the female wall-sit values were constant (all 180 s). Given the small groups, the Shapiro–Wilk test has limited power, and a non-significant result should not be taken as proof of normality. Variables that were non-normal in at least one group were analyzed with the Mann–Whitney U test (Table 6); all others were analyzed with Welch's t-test (Table 5).

Table 5. Between-sex comparisons of anthropometric and biomotor variables (Welch's t-test)

No	Variable	Male (mean ± SD)	Female (mean ± SD)	t (Welch)	*df*	p (unadj.)	p (Holm)	Hedges' g [95% CI]
1	Height (cm)	175.82±8.16	161.00±3.29	4.127	6.58	0.005	0.015	2.20 [0.76, 3.58]
	Weight (kg)	73.73±10.83	55.37±4.75	3.803	6.85	0.007	0.015	2.03 [0.63, 3.36]
	BMI (kg/m²)	23.78±2.20	21.32±1.03	2.473	7.09	0.042	0.042	1.32 [0.10, 2.48]
2	Sit-and-reach (cm)	14.97±6.78	15.22±6.38	−0.066	9.96	0.949	1.000	−0.04 [−1.08, 1.01]

3	Stork stand (s)	25.33±19.51	33.50±15.37	−0.805	9.48	0.440	1.000	−0.43 [−1.48, 0.64]
4	Sprint 20 m (s)	3.20±0.12	3.72±0.09	−8.479	9.28	<0.001	<0.001	−4.52 [−6.71, −2.28]
5	Side step test	41.17±9.70	33.83±2.56	1.790	5.69	0.126	0.884	0.95 [−0.19, 2.06]
6	Medicine ball throw (m)*	3.94±0.44	2.88±0.19	4.988	5.29	0.004	0.035	2.96 [1.20, 4.65]
	Vertical jump height (cm)	56.33±6.98	43.83±3.54	3.913	7.42	0.005	0.047	2.09 [0.68, 3.44]
	Relative leg power (W/kg)	63.92±5.40	56.40±4.48	2.626	9.67	0.026	0.208	1.40 [0.17, 2.58]
	Push-up 1 min (reps)	23.50±10.09	49.67±7.31	−5.142	9.11	<0.001	0.006	−2.74 [−4.29, −1.13]

*p (Holm): Holm-adjusted p within each domain (anthropometric k = 3; biomotor k = 12, including the four Mann–Whitney comparisons in Table 6). Hedges' g = male minus female (positive = higher in males; for sprint time, negative = faster in males; for push-ups, negative = more repetitions in females); CI from the noncentral t distribution. *Male n = 5, female n = 6.*

Male athletes were taller, heavier, and had a higher BMI than female athletes (Table 5). All three differences remained significant after Holm adjustment (height: adjusted p = 0.015; weight: adjusted p = 0.015; BMI: adjusted p = 0.042), with large standardized effects (Hedges' g = 2.20 [95% CI 0.76, 3.58], 2.03 [0.63, 3.36], and 1.32 [0.10, 2.48], respectively). The wide confidence intervals reflect the small sample (n = 6 per group), so these magnitudes are imprecise estimates.

Among the biomotor variables, the largest between-sex difference was in 20-m sprint time: male athletes were faster (3.20 ± 0.12 s vs 3.72 ± 0.09 s; adjusted p < 0.001; g = −4.52 [−6.71, −2.28]). Male athletes also threw the medicine ball farther (3.94 ± 0.44 m vs 2.88 ± 0.19 m; adjusted p = 0.035; g = 2.96 [1.20, 4.65]) and jumped higher (56.33 ± 6.98 cm vs 43.83 ± 3.54 cm; adjusted p = 0.047; g = 2.09 [0.68, 3.44]). Relative leg power was higher in male athletes (63.92 ± 5.40 vs 56.40 ± 4.48 W/kg; unadjusted p = 0.026), but this difference did not remain significant after adjustment (adjusted p = 0.208; g = 1.40 [0.17, 2.58]). Female athletes performed more push-ups in one minute (49.67 ± 7.31 vs 23.50 ± 10.09 repetitions; adjusted p = 0.006; g = −2.74 [−4.29, −1.13]); because this result is opposite to most published data, it should be interpreted with caution (see Discussion).

No significant between-sex differences were detected for sit-and-reach (unadjusted p = 0.949; g = −0.04), stork stand (female 33.50 ± 15.37 s vs male 25.33 ± 19.51 s; unadjusted p = 0.440; g = −0.43), or the side step test (male 41.17 ± 9.70 vs female 33.83 ± 2.56; unadjusted p = 0.126; adjusted p = 0.884). The side step comparison had a large point estimate (g = 0.95, 95% CI −0.19 to 2.06) and very unequal variability between sexes (SD 9.70 vs 2.56), which is more consistent with limited statistical power than with equal performance.

Four variables (trunk lift, wall sit, core stability, and estimated VO_2max) were not normally distributed in at least one group and were compared with the Mann–Whitney U test (Table 6)..

Table 6. Between-sex comparisons of non-normally distributed variables (Mann–Whitney U test)

Variable	Male median [IQR]	Female median [IQR]	U	Z	p (unadj.)	r (magnitude)	p (Holm)	Result
Trunk lift (cm)	42.25 [39.38–42.88]	40.25 [38.12–41.62]	14.0	−0.643	0.55	0.186 (small)	1.000	Not Significant.
Wall sit (s)**	240.00 [138.75–300.00]	180.00 [180.00–180.00]	15.0	−0.542	0.41	0.156 (small)	1.000	Not Significant.
Core stability (level)	12.00 [8.25–12.00]	7.00 [6.00–11.00]	13.0	−0.862	0.47	0.249 (small)	1.000	Not Significant
Estimated VO_2max (ml/kg/min)	39.60 [35.70–46.50]	34.05 [33.20–39.40]	10.0	−1.286	0.22	0.371 (medium)	1.000	Not Significant.

*IQR = interquartile range; n.s. = not significant. r = Z/√N (0.1 small, 0.3 medium, 0.5 large). p = exact two-sided p; Z with tie correction. p (Holm): adjusted within the biomotor domain (k = 12). **All female athletes recorded 180 s.*

None of the four variables differed significantly between male and female athletes (exact unadjusted p = 0.22–0.55; Holm-adjusted p = 1.000). Effect sizes were small to medium (r =

0.16–0.37); the largest was for estimated VO_2max (male median 39.60 vs female 34.05 ml/kg/min; r = 0.37), so a moderate difference cannot be ruled out with six athletes per group. All female athletes recorded the same wall-sit time (180 s), so this test could not discriminate between female athletes.

3.2 Discussions

This study aims to compare the anthropometric and biomotor characteristics of male and female korfball athletes from Bandung who will compete in the 2026 West Java PORPROV. The results of this study show that male athletes have significantly higher anthropometric characteristics (height, weight, and BMI) compared to female athletes. The effect sizes (Hedges' g = 1.32–2.20) were large, although the wide confidence intervals show that their magnitude is imprecisely estimated with six athletes per group. Several studies on team sports have revealed that male athletes generally have larger body sizes and dimensions compared to female athletes due to the influence of increased endogenous testosterone in males during puberty, which enhances longitudinal bone growth (Handelsman et al., 2018; Hunter et al., 2023; Joyner et al., 2025). On average, adult men are 7–8% taller, with longer, denser, and stronger bones (Handelsman et al., 2018). Men's taller stature and the mechanical structure of their long bones enable a greater hand reach while optimizing the function of the arm lever. This provides advantages in rebounding, shooting and passing effectiveness, as well as blocking (Albaladejo-Saura et al., 2023; Handelsman et al., 2018; Ojeda-Aravena et al., 2025; Toro-Román et al., 2023). In korfball, greater height is likely to be advantageous in overhead shooting, aerial duels, and rebounding.

The 20-m sprint showed the largest between-sex difference in this study. Male athletes recorded faster average times than female athletes. In general, in team sports, men have a physical advantage because they are stronger, faster, and more powerful than women (Hunter et al., 2023; Hunter & Senefeld, 2024). These findings are consistent with a study (Haugen et al., 2020) conducted on soccer players, which showed that men's superior acceleration is not only reflected in total sprint time but is also supported by differences in force profiles, speed, and power. Furthermore, a study (Samozino et al., 2022) biomechanically demonstrated that sprinting speed over distances under 30 meters depends on maximum power (PH max) as well as an optimal force-velocity profile for that distance. This pattern is also consistent with findings in racket sports, where male padel athletes consistently show better reaction speed and lateral speed than female athletes, although these differences do not always reach statistical significance at the professional level with a limited number of samples (Pradas et al., 2025). The combination of anthropometric characteristics, sprinting ability, and short distance acceleration in the modern sport of korfball plays a crucial role in offensive to defensive transitions and vice versa, as well as in creating or closing space.

Another finding of this study was a difference in explosive muscle power, as reflected in the results of the Medicine Ball Throw, Vertical Jump, and Leg Power tests, in which male athletes scored higher. The differences in the medicine ball throw and vertical jump remained significant after Holm adjustment, whereas the difference in relative leg power did not (adjusted p = 0.208). Relative leg power is usually derived from jump performance and body mass, so it is not independent of the vertical jump result. Long range shooting ability, quick passes, jumps during rebounds, changes of direction after a rebound, and the technical and tactical demands of korfball may depend on upper and lower body strength and power, as well as the ability to generate rapid, synergistic force (Comfort et al., 2024; Shalom et al., 2024).

This is supported by findings from various studies revealing that male athletes possess higher power than female athletes across various team sports (Toro-Román et al., 2023). Additionally, the finding that female athletes completed more push-ups in one minute deserves careful attention. The test results showed that the average number of push-ups in 1 minute for female athletes was higher than that of male athletes, even though, in general, much of the literature using a standardized (non-modified) push-up protocol for both sexes indicates that men significantly exceed women in push up repetitions (Alizadeh et al., 2020; Augustsson et al., 2009). Because these results contradict most of the published data, differences in test protocols are considered first. However, male and female athletes perform push-up tests with the same protocol (same body position, count criteria, and test duration), so these differences are less likely due to differences in protocols. Cadence alone has been shown to alter push-up performance and force distribution differently in men and women (Rozenek et al., 2022).

The male athlete with a shoulder injury recorded the lowest push-up count (13 repetitions); excluding him did not change the conclusion (Welch t-test, p = 0.002). If the protocol was identical, the physiological explanations below remain speculative. In the literature on exercise physiology, the superiority of female athletes in terms of muscle endurance can emerge in specific contexts. Women generally tend to have higher resistance to fatigue during slow-motion activities and sustained contractions at the same intensity (Hunter & Senefeld, 2024) such as during push-ups. When performing push-ups, the upper extremity muscles (triceps brachii, pectoralis major, and anterior deltoid) are primarily engaged (Alizadeh et al., 2020). Because push ups represent an exercise load relative to body mass, and women generally exhibit a lower glycolytic-based anaerobic capacity than men (De Poli et al., 2019) and reach their lactate thresholds at a higher relative exercise intensity (Benítez-Muñoz et al., 2025), this may, in principle, contribute to a slower onset of fatigue in female athletes; however, fatigue and lactate were not measured in the present study. During repeated and prolonged submaximal work, such as 1 minute push up, Type I (slow-twitch) muscle fibers in women have been shown to be more resistant to metabolic fatigue (Hunter & Senefeld, 2024). A study conducted by Rozenek et al. (2022) also demonstrated that cadence has a significant impact on push up performance and the distribution of force between men and women.

No statistically significant between-sex differences were detected for flexibility (sit-and-reach, trunk lift), balance (stork stand), agility (side step), core stability, wall sit, and estimated VO_2max. A lack of statistical significance is not evidence of equivalence: with six athletes per group, the study could reliably detect only very large effects (d ≈ 1.8), and several of these comparisons had medium-to-large point estimates (side step g = 0.95; estimated VO_2max r = 0.37; core stability r = 0.25) with wide confidence intervals. These results are therefore treated as inconclusive. The literature is discussed below for context, not as confirmation of similarity between the sexes.

The absence of a significant difference in sit-and-reach flexibility contrasts with the general literature, which suggests that girls have higher sit-and-reach flexibility than boys, with the difference increasing during puberty (Nuzzo, 2026). The female flexibility advantage has been attributed to a wider pelvic structure accompanied by greater anterior tilt ability, as well as joint laxity affected by the hormone estrogen. However, some studies in the athlete population suggest that this difference may be narrowed or even lost when both groups come from the same team sport and undergo a relatively homogeneous exercise load, as exercise-induced neuromuscular adaptations tend to uniformize the range of motion of the major joints, especially the hamstrings and lower back, in both sexes (Aedo-Muñoz et al., 2019).

In terms of balance, the literature on the influence of gender on static and dynamic balance in team sports athletes still shows conflicting results. A study in football, basketball, and volleyball athletes reported that although men showed higher static balance values in general, the results of the normalized Y-balance test for leg length did not differ significantly between male and female athletes in the same team sports group (Pontaga et al., 2024). These findings are compatible with the present stork stand result, but this study cannot determine whether balance depends more on sport-specific training experience than on sex. Regarding core stability, a study comparing (Pontaga et al., 2024) the effects of core stabilization training programs on men and women showed that there was no significant difference in the results of core muscle strength tests between the two sexes, although there were differences in static and dynamic balance responses after the exercise program (Akyüz et al., 2025). This suggests that core muscle strength may respond similarly in men and women given the same exercise stimulus; note that this was an intervention study in healthy adults, not athletes, and the present cross-sectional data cannot confirm this.

The lack of a significant difference in the side step test should be interpreted cautiously. The male mean was higher by 7.34 (g = 0.95, 95% CI −0.19 to 2.06) and male performance was far more variable (SD 9.70 vs 2.56), so the result is more compatible with low statistical power than with equal agility. Agility depends not only on strength and linear speed but also on cognitive-perceptual abilities, neuromuscular coordination, and reaction to stimuli. A study of team-sport athletes (football, handball, basketball, and volleyball) found that speed and power were the main predictors of agility in women, whereas balance was the main predictor in men. That study was correlational and does not show that both sexes reach equal agility through different routes; it suggests, however, that the determinants of agility may differ between sexes, which merits investigation in korfball with sport-specific agility tests.

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No significant difference was detected for estimated VO_2max or the wall sit. A possible explanation, which the present data cannot test, is that aerobic and muscular endurance at the regional competitive level depend strongly on training volume and intensity and not only on innate physiological differences. Men generally have higher absolute and relative VO_2max because of larger heart size, hemoglobin mass, and oxygen delivery capacity (Santisteban et al., 2022), and in this sample the male estimated VO_2max was numerically higher (41.10 ± 6.90 vs 36.02 ± 3.84 ml/kg/min; r = 0.37, a medium effect), so a true difference cannot be excluded. Women may show greater resistance to fatigue during prolonged submaximal contractions (Hunter & Senefeld, 2024), which could contribute to similar wall-sit durations, but all female athletes recorded exactly 180 s, indicating a ceiling or cut-off effect that limits the interpretation of this test. In addition, VO_2max was estimated from the multistage fitness test, which is influenced by running economy and anaerobic capacity, and was not measured directly. A comparative study of university-level athletes in korfball and volleyball showed similar results for flexibility, anaerobic and aerobic capacity, handgrip strength, and periodic performance, with no significant differences observed (Aydınet al., 2025).

Research on korfball and its comparison with other team sports regarding flexibility often shows nearly identical results, while balance, agility, and VO_2Max may be similar or differ depending on the sport, the testing methods used, and the characteristics of the sample groups (Aydın et al., 2025; Ezgin et al., 2025). A study Reza et al., 2024) noted no differences in abdominal muscle strength across several team sports. A study involving an 8-week korfball training intervention revealed no significant differences in flexibility and agility components between groups, while there were notable differences in the results of the 20-meter sprint, vertical jump, and plank tests (Ezgin et al., 2025). Note that these studies compared sports rather than sexes, so they provide only indirect context for the present findings (Aydın et al., 2025).

Because training load and training history were not recorded, it cannot be inferred whether the absence of significant differences reflects similar training stimuli for male and female athletes; this should be examined in future studies that record training exposure.

3.2.1 Implications

The findings are consistent with the well-documented sexual dimorphism in body size, sprint speed, and explosive power, and show that these differences are already evident within a single regional korfball squad. For flexibility, balance, agility, core stability, and endurance the present data are inconclusive and do not demonstrate that korfball produces equivalent adaptations in men and women. The results can serve as a baseline profile for the Bandung City Team, for example to plan individualized conditioning and to monitor change over the preparation period.

3.2.2 Research contribution

This study provides descriptive baseline data on the anthropometric and biomotor profiles of a regional-level Indonesian korfball Team, for which, to our knowledge, data are scarce.

3.2.3 Limitations

The sample was small (6 male and 6 female athletes; 5 male athletes for the medicine ball throw) because it comprised the entire PORPROV 2026 squad, so statistical power was low (only effects of d ≈ 1.8 or larger could be detected reliably), confidence intervals are wide, and the results cannot be generalized to other korfball populations. The analysis involved 15 comparisons and is exploratory; Holm adjustment was applied within domains, and with a single adjustment across all 15 tests the height, weight, and vertical jump differences would have adjusted p-values of about 0.06–0.07. Normality tests have low power with six athletes per group. Body composition was not measured directly (BMI only), VO_2max was estimated from a field test, and some tests had protocol issues (push-up protocol, wall-sit ceiling at 180 s in females). Age, maturation, playing position, and training load were not controlled. Finally, this study recorded physical condition at a single time point (a one-shot measurement) during the general preparation phase, so it could not capture changes across the training macrocycle.

3.2.4 Suggestions

Future studies should include several korfball teams (regional or national level) with sample sizes based on an a priori power analysis, measure body composition directly (skinfolds, bioelectrical impedance, or DXA), standardize and report test protocols (especially the push-up and wall-sit tests), record training load and playing position,

and use equivalence tests if the aim is to show that the sexes perform similarly.

4. CONCLUSION

In this exploratory comparison of the Bandung City korfball squad, male athletes were taller, heavier, and had a higher BMI, faster 20-m sprint times, and better medicine ball throw and vertical jump performance than female athletes; these differences remained significant after Holm adjustment. Female athletes completed more push-ups in one minute, a result that requires verification of the test protocol. No significant differences were detected for flexibility, balance, agility, relative leg power, core stability, wall sit, and estimated VO_2max, but with six athletes per group these findings are inconclusive rather than evidence of similarity. Because sex differences in speed and power largely reflect biological differences, coaches should monitor athletes against sex-specific reference values and their own progress, and use these data as a baseline profile for designing training programs and monitoring athletes in preparation for the PORPROV in November–December 2026. The findings should be confirmed in larger samples with standardized test protocols.

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6. AUTHOR CONTRIBUTION STATEMENT

This research is the result of the collaboration and cooperation of all the authors involved. All authors were equally involved in accordance with their respective roles throughout the process, from the research phase to the writing of the article manuscript.

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REFERENCES

Aedo-Muñoz, E., Araya-Ibacache, M., Miarka, B., Moya-Jofre, C., Cancino-Lopez, J., Mozer, R. L., & Brito, C. J. (2019). Effect of sex differences in sports groups on hamstring flexibility based on the sit-reach test: New parameters for Chilean athletes. Journal of Physical Education and Sport, 19(4), 2374–2378. https://doi.org/10.7752/jpes.2019.04359

Akyüz, Ö., Kirantay, Ş. R., & Günendi, G. (2025). Comparison of the effects of core stabilization exercises on muscle strength and balance in women and men. SPORT TK-EuroAmerican Journal of Sport Sciences, 14, Article 165. https://doi.org/10.6018/sportk.695751

Albaladejo-Saura, M., Vaquero-Cristóbal, R., García-Roca, J. A., & Esparza-Ros, F. (2023). What Variables Allow the Differentiation between More and Less Successful Adolescent Volleyball Players? Journal of Human Kinetics, 88, 229–242. https://doi.org/10.5114/jhk/166107

Alizadeh, S., Rayner, M., Mahmoud, M. M. I., & Behm, D. G. (2020). Push-ups vs. bench press differences in repetitions and muscle activation between sexes. Journal of Sports Science and Medicine, 19(2), 289–297. https://www.jssm.org/jssm-19-289.xml-abst

Altavilla, G. (2025). The influence of performance factors in team sports and methodological indications in relation to the performance model: A systematic review. Physical Education Theory and Methodology, 25(2). https://doi.org/10.17309/tmfv.2025.2.27

Aryanto, B., Sukoco, P., & Lumintuarso, R. (2020). The Validity of Construct Analysis on Assessment Instrument of Basketball Skill forSenior High School in Yogyakarta City. International Journal of Human Movement and Sports Sciences, 8(5): 193-198, 2020. https://doi.org/10.13189/saj.2020.080506

Augustsson, S. R., Bersås, E., Thomas, E. M., Sahlberg,

M., Augustsson, J., & Svantesson, U. (2009). Gender differences and reliability of selected physical performance tests in young women and men. Advances in Physiotherapy, 11(2), 64–70. https://doi.org/10.1080/14038190801999679

Aydın, G., Atıcı, E., & Saldıran, T. Ç. (2025). Physical Performance Parameters of Korfball and Volleyball Athletes: A Cross-Sectional Study in Türkiye. Balıkesır Health Sciences Journal, 14(1), 220–228. https://doi.org/10.53424/balikesirsbd.1603172

Benítez-Muñoz, J. A., Rojo-Tirado, M. Á., Benito Peinado, P. J., Murias, J. M., González-Lamuño, D., & Cupeiro, R. (2025). Greater relative first and second lactate thresholds in females compared with males: Consideration for exercise prescription. International Journal of Sports Physiology and Performance, 20(1), 30–36. https://doi.org/10.1123/ijspp.2024-0079

Bompa, T. O., & Buzzichelli, C. A. (2019). Periodization: Theory and methodology of training (6th ed.). Human Kinetics.

Caldwell, A. R., & Vigotsky, A. D. (2020). A case against default effect sizes in sport and exercise science. PeerJ, 8, e10314. https://doi.org/10.7717/peerj.10314

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Lawrence Erlbaum Associates.

Comfort, P., McMahon, J. J., Lake, J. P., Ripley, N. J., Triplett, N. T., & Haff, G. G. (2024). Relative strength explains the differences in multi-joint rapid force production between sexes. PLoS ONE, 19(2 February). https://doi.org/10.1371/journal.pone.0296877

Delacre, M., Lakens, D., & Leys, C. (2017). Why psychologists should by default use Welch's t-test instead of Student's t-test. International Review of Social Psychology, 30(1), 92–101. https://doi.org/10.5334/irsp.82

De Poli, R. A. B., Gonzalez, J. A. M., Fonsati, N., & Zagatto, A. M. (2019). Differences between genders in anaerobic capacity during a supramaximal effort. Motriz: Revista de Educação Física, 25(3). https://doi.org/10.1590/s1980-6574201900030018

Dony, G.W., Mikdar, U,Z., Ulfa, Z.D.,Tanasale, I., & Rifani, M. (2025). Perkembangan Olahraga Korfball di Provinsi Kalimatan Tengah. Journal Sport Science Indonesia (JASSI). Vol 4 No 3, 2025: 2721-0693. https://garuda.kemdiktisaintek.go.id/documents/detail/5382089

Ezgin, A., Bilgiç, M., & Bilgiç, F. B. (2025). Effect of Korfball-Based Movement Training on Selected Motoric Characteristics. Herkes Için Spor ve Rekreasyon Dergisi, (Advanced Online Publication), 710–721. https://doi.org/10.56639/jsar.1771219

Fauzi, M, S., & Saputele, J.J. (2024). Korelasi Antropometri Dan Kondisi Fisik Terhadap Keterampilan Bermain Bola Voli. Jurnal Penjakora Volume 11 Nomor 1, April 2024. ISSN 2356-3397 (Print) | ISSN 2597-4505 (Online). https://ejournal.undiksha.ac.id/index.php/PENJAKORA/article/view/76572/30457

Godinho, M., Fragoso, I., & Vieira, F. (1996). Morphologic and anthropometric characteristics of high level Dutch korfball players. Perceptual and Motor Skills, 82(1), 35–42. https://doi.org/10.2466/pms.1996.82.1.35

Haff, G. G., & Triplett, N. T. (Eds.). (2016). Essentials of strength training and conditioning (4th ed.). Human Kinetics.

Handelsman, D. J., Hirschberg, A. L., & Bermon, S. (2018). Circulating testosterone as the hormonal basis of sex differences in athletic performance. In Endocrine Reviews (Vol. 39, Number 5, pp. 803–829). Oxford University Press. https://doi.org/10.1210/er.2018-00020

Haugen, T. A., Breitschädel, F., & Seiler, S. (2020). Sprint mechanical properties in soccer players according to playing standard, position, age and sex. Journal of Sports Sciences, 38(9), 1070–1076. https://doi.org/10.1080/02640414.2020.1741955

Hunter, S. K., Angadi, S. S., Bhargava, A., Harper, J., Hirschberg, A. L., Levine, B. D., Moreau, K. L., Nokoff, N. J., Stachenfeld, N. S., & Bermon, S. (2023). The Biological Basis of Sex Differences in Athletic Performance: Consensus Statement for the American College of Sports Medicine. In Translational Journal of the American College of Sports Medicine (Vol. 8, Number 4, pp. 1–33). Lippincott Williams and Wilkins. https://doi.org/10.1249/TJX.0000000000000236

Hunter, S. K., & Senefeld, J. W. (2024). Sex differences in human performance. The Journal of Physiology, 602, 4129–4156. https://doi.org/10.1113/JP284198

Horníková, H., & Zemková, E. (2021). Relationship between physical factors and change of direction speed in team sports. Applied Sciences, 11(2), 655. https://doi.org/10.3390/app11020655

Joyner, M. J., Hunter, S. K., & Senefeld, J. W. (2025). Evidence on sex differences in sports performance. In Journal of Applied Physiology (Vol. 138, Number 1, pp. 274–281). American Physiological Society. https://doi.org/10.1152/japplphysiol.00615.2024

Joyokusumo, N. A. N., Sulistyarto, S., Sudijadonko, A., & Kumaat, N. A. (2025). Studi literatur analisis

komponen biomotor utama permainan bolavoli indoor. Jurnal Ilmiah dan Karya Mahasiswa, 3(1), 117–128. https://doi.org/10.54066/jikma.v3i1.2963

Kardiyanto, D.W., & Wijanarko, B. (2021). Kardiyanto, D.W., & Wijanarko, B. (2021). Antropometri Dan Biomotorik Atlet Bolavoli Duduk Paralympic Indonesia Ditinjau Dari Karakteristik Cidera Dan Kualitas Kondisi Fisik. Gelanggang Olahraga: Jurnal Pendidikan Jasmani dan Olahraga 5(1) 136-145. https://doi.org/0.31539/jpjo.v5i1.2840

Lim, J.U.,Lee, J.H. Kim, J.S., Hwang Y.I., Kim,T.H., Lim,S.Y., Yoo, K.H., Jung,K.S., Kim, Y. K., Rhee, C.K. Comparison of World Health Organization and Asia-Pacific body mass index classifications in COPD patients. (2017). International Journal of COPD 2017:12 2465–2475. https://doi.org/10.2147/COPD.S141295

Lestari, B., Fajar, M.K., Yuhantini, E.F., Nurpratiwi, R., Rusdiawan, A., Sidik, R.M., Wiriawan, O., Aryanto, B. (2024). Korfball Coach Training in Klaten Regency, Central Java. GANDRUNG: Jurnal Pengabdian Kepada Masyarakat. Volume 5, Number 1, Februari 2024. https://doi.org/10.36526/gandrung.v5i1.3238

Lestari, B., Samudra, F.A., Nurpratiwi, R., Triardhana, Y.A., Rusdiawan, A, Sidik, M.A., Fajar, M. K. (2025). Transformasi Kesiapan Atlet Korfball Kabupaten Bantul melalui Pendampingan Program Latihan Fisik Menuju PORPROV DIY 2024. Laksana Olahraga Jurnal Pengabdian kepada Masyarakat Vol. 03, No. 01, Februari, 2025, pp 001-011. https://doi.org/10.26740/laksanaolahraga.v3i01.64516

Lukaski, H., & Raymond-Pope, C. J. (2021). New Frontiers of Body Composition in Sport. In International Journal of Sports Medicine (Vol. 42, Number 7, pp. 588–601). Georg Thieme Verlag. https://doi.org/10.1055/a-1373-5881

Mandorino, M., Gabbett, T. J., Tessitore, A., Leduc, C., Persichetti, V., & Lacome, M. (2025). The Interaction of Fitness and Fatigue on Physical and Tactical Performance in Football. Applied Sciences (Switzerland), 15(7). https://doi.org/10.3390/app15073574

Misfajar, M., & Sulistyorini. (2019). Analisis Antropometri Dan Kondisi Fisik Pemain Bolabasket Putra. Indonesia Performance Journal. IPJ (3) (2019). http://journal2.um.ac.id/index.php/jko

Nur, L., & Malik, A. A. (2021). Basketball Skill Achievements: Comparison between Technical Approach and Tactical Approach based on Physical Fitness Level. Jurnal Pendidikan Jasmani Dan Olahraga, 6(1), 51–58. https://doi.org/10.17509/jpjo.v6i1.31610

Nuzzo, J. L. (2026). Sex differences in sit-and-reach flexibility in children and adolescents: A meta-analysis. Journal of Bodywork and Movement Therapies, 47, 608–619. https://doi.org/10.1016/j.jbmt.2026.05.012

Ojeda-Aravena, A., Camacho-Villa, M. A., Millan-Domingo, F., Quintero-Bernal, R., Merchán, J. A., Villafrades, F., & De la Rosa, A. (2025). Sex-Specific Morphological and Neuromuscular Profiles of U-15 Colombian Basketball Players. Journal of Functional Morphology and Kinesiology, 10(4). https://doi.org/10.3390/jfmk10040422

Pontaga, I., Vilks, S., & Abolins, V. (2024). Assessment of static and dynamic balance performance in team sports athletes. Journal of Physical Education and Sport, 24(1), 123–132. https://doi.org/10.7752/jpes.2024.01016

Pradas, F., Muñoz, D., Garcia-Gimenez, A., Moreno-Azze, A., Sánchez-Alcaraz, B. J., & Sánchez-Pay, A. (2025). Physical fitness in professional padel: Performance differences according to players' gender and playing side position. Biology of Sport, 42(4), 231–239. https://doi.org/10.5114/biolsport.2025.151647

Reza, M. N., Rahman, M. H., Islam, M. S., Mola, D. W., & Andrabi, S. M. H. (2024). Assessment of Motor Fitness Metrics among Athletes in Different Sports: An Original Research. Physical Education Theory and Methodology. 24(1), 47–55. https://doi.org/10.17309/tmfv.2024.1.06

Rozenek, R., Byrne, J. J., Crussemeyer, J., & Garhammer, J. (2022). Male-Female Differences in Push-up Test Performance at Various Cadences. Journal of Strength and Conditioning Research, 36, 3324 - 3329. https://doi.org/10.1519/jsc.0000000000004091

Samozino, P., Peyrot, N., Edouard, P., Nagahara, R., Jimenez-Reyes, P., Vanwanseele, B., & Morin, J. B. (2022). Optimal mechanical force-velocity profile for sprint acceleration performance. Scandinavian Journal of Medicine and Science in Sports, 32(3), 559–575. https://doi.org/10.1111/sms.14097

Santisteban, K. J., Lovering, A. T., Halliwill, J. R., & Minson, C. T. (2022). Sex differences in VO2max and the impact on endurance-exercise performance. International Journal of Environmental Research and Public Health, 19(9), 4946. https://doi.org/10.3390/ijerph19094946

Shalom, A., Gottlieb, R., Alcaraz, P. E., & Calleja-Gonzalez, J. (2024). Unique Specific Jumping Test for Measuring Explosive Power in Young Basketball Players: Differences by Gender, Age, and Playing Positions. Sports, 12(5). https://doi.org/10.3390/sports12050118

Spyrou, K., Freitas, T. T., Marín-Cascales, E., & Alcaraz, P. E. (2020). Physical and Physiological Match-Play Demands and Player Characteristics

in Futsal: A Systematic Review. In Frontiers in Psychology (Vol. 11). Frontiers Media S.A. https://doi.org/10.3389/fpsyg.2020.569897

Suchomel, T. J., Nimphius, S., & Stone, M. H. (2016). The Importance of Muscular Strength in Athletic Performance. In Sports Medicine (Vol. 46, Number 10, pp. 1419–1449). Springer International Publishing. https://doi.org/10.1007/s40279-016-0486-0

Syaputra, R. H., Risjanna, M. R., & Rismayadi, A. (2025). Utilizing GPAI for Korfball Game Analysis. Jendela Olahraga, 10(1), 61–70. https://doi.org/10.26877/jo.v10i1.21111

Taqy, A., Nurrochmah, S., & Pratama, R. (2024). Analisis Antropometri Dan Kondisi Fisik Pemain Bolabasket Porprov 2022 Kota Batu Dan Kabupaten Malang. Jurnal Kejaora: Jurnal Kesehatan Jasmani dan Olah Raga. Volume 9 Nomor 1, Edisi April 2024. https://doi.org/10.36526/kejaora.v9i1.3457

Toro-Román, V., Grijota, F. J., Muñoz, D., Maynar-Mariño, M., Clemente-Gil, S., & Robles-Gil, M. C. (2023). Anthropometry, Body Composition, and Physical Fitness in Semi-Professional Soccer Players: Differences between Sexes and Playing Position. Applied Sciences (Switzerland), 13(3). https://doi.org/10.3390/app13031249