

The role of anthropometry, physical, psychological and personality for elite athletes in competitive sports

Tri Setyo Guntoro^{1ABCDE}, Sutoro^{1ABCD}, Miftah Fariz Prima Putra^{1ABCDE}, Kurdi^{1ABD}, Zsolt Németh^{2BDE}, Edi Setiawan^{3ACD}

¹Faculty of Sport Sciences, Universitas Cenderawasih, Indonesia

²Department of Theory and Practice of Sport Games, University of Pécs, Hungary

³Faculty of Teacher Training and Education, Universitas Suryakencana, Indonesia

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Abstract

Background and Study Aim This study aims to describe and explore the anthropometric, physical, psychological, and personality traits of elite Papuan Indonesian athletes in seven different sports, namely weightlifting, rowing, cricket, futsal gateball, sailing, and hang-glider.

Material and Methods A total of 118 athletes (80 men, 38 women with a mean age of 25.05±6.9) from these seven categories were selected. Furthermore, the anthropometric measurement consists of height, weight, and body mass index. At the same time, physical ability is made up of five components, namely flexibility, arm muscle strength, abdominal muscle strength, leg muscle power, and aerobic endurance. The psychological ability and personality characteristics were also measured using the Psychological Skill Inventory for Sport (PSIS) and the Athlete's Personality Inventory (IKA).

Results There were significant differences in the six variables ($p < 0.01$), but no significant difference in the other variables ($p > 0.05$). The six variables include height, BMI, arm and abdominal muscle strength, leg muscle power, and aerobic endurance with F and p-values of 3.052 and 0.008 ($p < 0.01$), 3.497 and 0.003 ($p < 0.01$), 9.822 and 0.001 ($p < 0.01$), 11.855 and .001 ($p < 0.01$), 52.747 and 0.001 ($p < 0.01$), and 11.298 and 0.001 ($p < 0.01$). The other four variables include weight, flexibility, psychological abilities, and personality traits, showed no significant difference ($p > 0.05$). Aerobic endurance variables, in general, had a significant relationship with anthropometric variables and other physical aspects. However, psychological variables and personality characteristics did not significantly correlate with other variables.

Conclusions The anthropometric and physical aspects of athletes tended to have differences based on sports. However, psychological variables and personality characteristics had no relationship with physical and anthropometric aspects.

Keywords: anthropometric, physical abilities, psychological skills, personality, elite athletes

Introduction

The performance level of athlete is based on multifactorial influences such as anthropometric and physical abilities [1, 2, 3], psychological, mental, personality [4, 5, 6], coaches [7, 8], and the environment [9, 10]. These factors are interrelated and influence the performance of athletes on the field [11, 12, 13]. Data from previous studies reported that anthropometric factors [14, 15], physical abilities, psychological [16], are very important for an athlete to be successful professionally at the competitive sports level in the future. There are at least three primary factors that influence the performance of athletes in the field, namely anthropometrics, physical, and psychological abilities [17,18]. The anthropometric aspect deals with body measurements such as height, weight, arm length, with various urgency levels within

sports [19]. While the physiological traits are related to motoric potential and abilities [20], such as speed, strength, agility, and endurance, and are greatly influenced by a person's physiological condition. However, the psychological aspect is related to mental readiness and the ability to practice and compete for achievement [21]. Many studies have conducted an anthropometric analysis because they believe it perfectly describes the performance and achievements of athletes [17, 22, 23]. Furthermore, each sport has different anthropometric needs that support specific skills. For example, goalkeepers in futsal require higher height characteristics compared to weightlifting. In contrast, body weight tends to be more needed in weight lifting to support athletes in lifting relatively heavy weights.

Physical ability is commonly referred to as physiological, which is an important aspect of competitive sports [24, 25, 26]. Excellent physical could assist athletes play optimally, which supports them to obtain higher achievements [27]. In several

game sports such as futsal, cricket, and football, a physical condition such as aerobic endurance plays a major factor since the game lasts for a long period [28]. Therefore, these athletes need to have a higher VO_{2max} than other athletes in hang-gliding, sailing, and weightlifting. However, arm muscle strength is more required in weightlifting and rowing than futsal and gate ball.

The psychological aspect of athletes is part of the dimensions that greatly determine a competition's outcome [16, 29, 30]. In the event that an athlete feels anxious or unconfident, their skills and good physical condition become ineffectual [31]. According to Lange-Smith, Cabot, Coffee, Gunnell & Tod [32], the key factor to be able to have high performance and compete and be successful in competitive sports is managing the psychological aspect as well as possible. Unfortunately, the psychological aspect is often overlooked because most trainers or coaches focus on building the physical features. Therefore, this psychological aspect often becomes a "scapegoat" for failing to achieve the laid down goals and unsatisfactory performance.

Previous studies have shown that personality characteristic is one of the many factors contributing to an individual's success, especially in sports [33, 34, 35]. Basically personality is closely related to the behavior or actions of athletes when training or when competing. For example, athletes with good personality will have respect for friends, coaches or opponents. Conversely, a bad personality will make the athlete never achieve high success [36]. Data from previous studies reported that personality has a positive relationship with performance in sports [37].

Comprehensively studying the anthropometric, physical, psychological, and personality aspects of athletes from various sports provided more beneficial information. This means it had limitations in the previous studies, which only partially examined every element related to athletes. Researchers had not found any studies that comprehensively investigated athletes' anthropometric aspects, physical fitness, personality characteristics, and psychology. These were essential aspects to enhance performance among athletes. Based on the above description, this study aims to describe and explore in the anthropometric, physical, psychological, and personality traits of elite Papuan Indonesian athletes in seven different sports

Materials and Methods

Participants

This study used subjects that included elite athletes from Papua Indonesia who was undergoing training to prepare for Indonesia's biggest national sports event, called the XXth National Sports Week

(PON). Furthermore, a total of 118 athletes (mean age: 25.05 ± 6.9 years) from seven different sports were involved in this study, namely 18 in Weight lifting (10 males, 9 females), 15 in Cricket (9 males, 6 females), 30 in Rowing (18 males, 12 females), 10 in Futsal (10 males), 15 in Gateball (13 males, 2 females), 19 in Sailing (12 males, 7 females) and 11 in Hang-gliding (8 males, 3 females).

Research Design

Anthropometric characteristics were determined based on height, weight, and Body Mass Index (BMI). The height was measured using a stadiometer (Seca 213; Seca, Japan) nearest 0.1 cm. While the bodyweight was measured using a digital weight scale (HBF-214; Omron, Japan) to the nearest 0.1 kg, and the BMI was calculated based on body weight and height (BW/H^2).

Furthermore, the physical ability (physiological) was measured using five components: flexibility, arm and abdominal muscle strength, leg muscle power, and aerobic endurance. Flexibility was estimated using a vertical trunk flexion meter (TKK 5403; Takei, Japan) to the nearest 0.1 cm. At the same time, the Abdominal and arm muscle strength was measured by doing sit-ups and push-ups for 60 seconds (TKK 5505; Takei, Japan) [38]. The Leg muscle power was measured three times using the vertical jump test [39], and the best results were recorded to the nearest of 0.1 cm. In addition, the aerobic endurance was measured using a multi-stage run 20m test [40].

The psychological ability was determined using the Psychological Skill Inventory for Sport (PSIS) [41] and has been adapted in Indonesian by Dimiyati, Herwin, & Hastuti [42], with a validity and reliability value between 0.54 to 0.89 and 0.8 to 0.92. Furthermore, the personality characteristics were found using the Athlete Personality Inventory (IKA) [43].

Statistical Analysis

Data were analyzed using descriptive techniques such as mean \pm Standard Deviation (SD) using the minimum and maximum values. While further statistical analysis was carried out using the one-way analysis of variance (One-way ANOVA) and to determine the relationships between the variables, Pearson's product-moment correlation analysis was employed. The accepted level of statistical significance was $p < 0.05$, and all data analyses were performed with the assistance of the IBM SPSS version 26 program (Armonk, NY, USA: IBM Corp).

Results

The first analysis results were presented descriptively using the minimum, maximum, average, and standard deviation values (Table 1). The results show that the age of elite athletes undergoing training was between the ages of 17 to 48, with an

average value of 25.05±6.9. In the anthropometric aspect, the athlete's height and body weight was between 138 to 183cm and 43.5 to 120.6kg with an average value of 163.39±8.01, and 67.5±13.49, while BMI was between 17.39 to 43.4 kg/m² with a mean value of 25.27±4.58. Furthermore, for physical and flexibility aspects, arm and abdominal muscle strength, leg muscle power, aerobic endurance, arm muscle strength, abdominal muscle strength had values between 1.5 to 27 cm, 11 to 56, 11-68, 9.7-144 cm, 20.4-54.1 ml/kg/min with an average value of 11.94±5.53, 38.98±9.12 and 20.4-54.1 ml/kg/min. The psychological ability dimension had a value in the range of 68 to 174, with an average value of 131.86±17.78. In addition, the personality characteristics scored 144 to 240 with an average value of 205.5±18.29.

The height, IMT, arm and abdominal muscle strength, leg muscle power, and aerobic endurance variables showed a statistically significant difference with a F and Sig. values of 3.052 and 0.008 (p<0.01), 3.497 and 0.003 (p<0.01), 9.822 and 0.001 (p<0.01), 11.855 and 0.001 (p<0.01), and 52.747 and 0.001 (p<0.01). However, the variables of psychological ability, weight, flexibility and

personality characteristics had no statistically significant difference with an F and Sig. values of 0.568 and 0.755 (p>0.05), 1.096 and 0.370 (p>0.05), 0.865 and 0.523 (p>0.05) (Table 2).

The summary of the relationship analysis among the variables is presented in Table 3. Based on the analysis results, several variables had a significant relationship, but the others did not have relationship. Endurance variables, in general, had a significant relationship with anthropometric variables and other physical aspects. Psychological variables and personality characteristics did not significantly correlate with other variables.

Discussion

Statistically, the result found significant differences in six categories and no difference in the other four categories. First, there were significant differences in height since each sport has different requirements (anthropometrics) [15]. Therefore, it was one of the criteria assessed by the coach in the selection process for elite athletes in Indonesia. The determination of the height criteria between coaches of one sport and another was certainly different due to their requirements and the characteristics

Table 1. Descriptive statistics (N=118; Male=80, Females=38)

Variable	Weightlifting (M±SD)	Cricket (M±SD)	Rowing (M±SD)	Futsal (M±SD)	Gateball (M±SD)	Sailing (M±SD)	Hang-Gliding (M±SD)
Age (year)	31.22±5.1	23.80±5.13	20.27±2.8	19.90±.876	32.40±8.05	24.50±3.85	25.91±4.13
Height (cm)	157.79±8.26	161.86±10.92	166.37±6.89	165.18±6.08	163.59±8.84	162.72±6.77	166.84±7.47
Wight (kg)	70.48±5.81	63.23±11.52	65.04±9.92	65.44±11.36	67.62±12.14	72.78±16.92	68.14±9.61
BMI (kg/m ²)	28.13±18.93	24.17±3.93	23.41±2.63	23.95±3.76	25.26±3.97	27.60±5.32	24.52±3.45
Flexibility (cm)	13.45±6.28	10.40±7.37	12.65±4.86	11.00±5.63	10.17±6.03	11.89±4.42	13.00±5.85
Arm muscle strength (kg)	34.50±5.35	35.87±7.31	42.87±8.08	44.50±5.87	28.53±7.23	43.74±8.64	41.00±6.40
Abdominal muscle strength (s)	42.61±7.34	31.60±6.63	41.10±10.44	26.60±6.78	21.27±5.72	31.42±7.80	38.82±10.98
Leg muscle power (cm)	52.94±12.84	47.00±7.82	47.66±9.12	52.60±5.92	40.28±13.32	105.47±20.32	48.82±11.75
Aerobic endurance (ml/kg/min)	26.50±15.55	32.03±5.13	39.25±7.89	45.28±6.91	30.31±7.54	37.62±8.33	40.23±9.71
Psychological abilities (points)	133.11±5.71	131.87±16.54	134.13±20.45	137.10±12.76	127.13±17.05	127.84±13.65	132.18±22.41
Personality characteristics (points)	205.44±18.78	196.73±16.59	207.40±16.21	206.30±14.91	207.00±15.42	207.16±18.25	206.91±23.24

Table 2. The test result of anthropometric, physical capacity, psychological abilities, and personality

Variable	Mean ± S.D	F	Sig.
Height (cm)	163.4 ± 8.01	3.052	0.008*
Wight (kg)	67.54 ± 13.49	1.096	0.370 ^{n_s}
BMI (kg/m ²)	25.28 ± 4.58	3.497	0.003*
Flexibility (cm)	11.94 ± 5.53	0.865	0.001*
Arm muscle strength (kg)	38.98 ± 9.12	9.822	0.001*
Abdominal muscle strength (s)	34.60 ± 11.7	11.855	0.001*
Leg muscle power (cm)	57.28 ± 25.01	52.747	0.001*
Aerobic endurance (ml/kg/min)	35.59 ± 9.1	11.298	0.001*
Psychological abilities (points)	131.86 ± 17.78	0.568	0.672 ^{n_s}
Personality characteristics (points)	205.52 ± 18.2	0.673	0.755 ^{n_s}

Notes: *p < .01; ^{n_s}: Non-significant

Table 3. Correlation test results between variables

Variable	1	2	3	4	5	6	7	8	9	10
1. Height (cm)	-									
2. Wight (kg)	0.413**	-								
3. BMI (kg/m ²)	-0.093	0.866**	-							
4. Flexibility (cm)	-0.059	-0.024	0.001	-						
5. Arm muscle strength (kg)	0.266**	0.029	-0.115	-0.067	-					
6. Abdominal muscle strength (s)	-0.090	-0.128	-0.092	0.136	0.381**	-				
7. Leg muscle power (cm)	0.048	0.090	0.073	0.003	0.389**	0.038	-			
8. Aerobic endurance (ml/kg/min)	0.356**	-0.165	-0.367**	-0.022	0.652**	0.227*	0.310**	-		
9. Psychological abilities (points)	0.171	0.088	-0.006	0.019	-0.040	0.039	-0.143	0.102	-	
10. Personality characteristics (points)	0.143	0.068	-0.010	0.087	0.141	0.135	0.082	0.138	0.064	-

Note: **Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed)

of the sports. Reilly et al. [44] also mentioned that each sport's anthropometric characteristics (height) were diverse; for example, the average height of elite rugby and soccer athletes was 1.79±0.06 and 1.77±0.06. Itoh & Hirose [45] studied athletes' anthropometrics and found significant differences in the height category. In certain sports, such as football, the height between the goalkeepers, attackers, and midfielders were mostly different [44]. This means that the height requirements of athletes in each sport, including playing position, were also different [45].

The results also showed that there was no significant differences in body weight since elite Indonesian Papuan athletes were not amateurs. They had been trained for a long time at their respective clubs; therefore, their weights were well preserved, and no one was obese or very thin. These results align with the research conducted by Kovacevic [46], whereby there was no difference in body weight in the athletes. This result contradicted with the research conducted by Gall et al. [47], who

mentioned that there was a significant difference in the bodyweight category between professional and international athletes. It is also in line with the study conducted by Canhadadas et al. [48], however, the difference with this present study was the comparison of subjects based on the age group.

Furthermore, the results also showed a significant difference in BMI. This is supported by the study conducted by Putra and Ita [49], who compared the BMI of athletes in three different sports. The difference in the criteria for ideal body weight in each sport was believed as a factor that contributed to those results. For example, weightlifting requires a relatively heavier body weight than other sports like gliding and sailing. Weightlifters weigh more than any other athletes and even weigh up to 120.60 kg. In contrast with the BMI results, no significant difference was found in the flexibility variable. This is due to the long training process that had been conducted by athletes before entering the camp. They all trained individually and at their respective clubs. Furthermore, these results were

supported by the studies of Itoh & Hirose [45], who found no significant difference in flexibility. A significant difference was found in the arm muscle strength variable due to differences in the physical ability requirements in each sport. For example, weightlifting, rowing, and cricket require greater arm muscle strength than futsal, hang-gliding, and sailing [50]. Under these conditions, athletes must train rigorously to increase their arm muscle strength. Conversely, futsal athletes would also focus more on the physical aspects such as aerobic endurance, speed, agility, and leg muscle power since these physical dimensions are required.

The research data shows that the results of rowing, weightlifting, and cricket athletes were higher than other athletes. However, the results of this study are different from previous study which was conducted by Putra and Ita [49]; there was no significant difference in the arm muscle strength of the athletes in three different sports. Their research reported that data collection was carried out when the athletes had just begun their training concentration programs. This means they had not received any intensive program from the coach concerning physical exercise. However, this study was carried out when the athletes underwent an intensive training program. The research subjects involved were also from different sports. Therefore, it was natural to find different results between the two studies. The study conducted by Vukasevic et al. [51] found no significant difference in the arm muscle strength (push-ups) category. However, there were subject differences between Vukasevic et al and this study, and this is because they compared athletes in the same sport.

There was a significant difference in the abdominal muscle strength variable due to the characteristics of the sport. This is supported by the research data, which shows that the mean value of rowing and weightlifting athletes ($M=41.85\pm 11.6$) was higher than the average score ($M=34.6\pm 11.6$). Previous studies have shown that the strength of the abdominal muscles greatly enhances the performance of rowing athletes and weightlifters. However, these results differ from Vukasevic et al [51], whereby there was no statistical difference in the abdominal muscle strength variable. In addition, the difference between the two research results could not be separated from the differences in the subjects studied.

There was a significant difference in the leg muscle power variable. This is supported by the research conducted by Kobal et al. [52], in four different sports and is also in line with Gall et al. (2010). The reason behind these results was that the seven sports sampled in the study had different game characteristics and physical needs, which affected the physical capacity of the athletes [47]. For example, futsal athletes need leg power muscle

strength to improve their performance on the field, especially when performing kicks and running. However, this is different for the hang-gliding and sailing athletes in which do not require leg muscle power. However, the results of these studies differ from that of Vukasevic et al. [51], whereby there was no significant difference in the leg muscle power of the athletes. Furthermore, the difference in research results was due to the number of sports studied. Significant differences are mostly found in studies that involve several sports [52], compared to those involving one sport.

There was a significant difference in the aerobic endurance variable due to the characteristics of the sport under study. Weightlifting, cricket, rowing, futsal, gateball, sailing, and hang-gliding have different playing methods and require different aerobic endurance. For example, futsal, rowing, cricket, and gateball require a higher physical capacity (aerobic endurance) than hang-gliding, sailing, and weightlifting. These results are supported by previous research conducted on athletes from Papua, Indonesia, which showed significant differences in the aerobic endurance variable [49]. However, a different result was found in Lopez-Plaza et al. [53], whereby they investigated rowing athletes and found no differences in aerobic endurance. The study only compared the numbers in rowing and not between sports. Therefore, there was a tendency to have the same physical capacity (aerobic endurance).

This study found no difference in the psychological abilities of athletes because Indonesian National Sports Committee made a policy or program called "Character Building and Achievement Motivation Training" (CB-AMT) by involving experts in the field of sports psychology. Furthermore, the program's main objective was to form a winning mentality for Papuan athletes [54]. All those undergoing training were required to participate in the CB-AMT. The program was acknowledged as a factor that causes elite Papuan athletes to be at a relatively similar psychological level. However, this study did not analyze and reveal its role in the psychological condition of the athletes [51].

The next results of this study found no differences in the personality characteristics in elite athletes from Papua, Indonesia. The "elite" status indicates that the athletes studied were a set of selected individuals, and not all of them could enter this level because they had to compete among themselves. Furthermore, those involved were psychologically strong and were tested, and there was no difference when measured using the Athlete's Personality Inventory (IKA). This result is in line with the study conducted by Guntoro et al. [55], whereby there were no differences in athletes' personality characteristics in four different sports. It was due to the similarity level in terms of mentality. However,

the results would differ if the research subjects were compared between several groups, such as elite and non-elite athletes and non-athletes.

The result of the correlation analysis among variables shows that, in general, the aspect of endurance had a significant relationship with anthropometric variables (BMI) and other physical capacities. This strengthened the previous evidence that endurance capacity was a key and supporting aspect of several other physical components [28, 24, 27]. Different results were found on psychological and personality variables. The two variables did not have a significant relationship with other variables. Previous study found that psychological and personality dimensions have a relationship with the physical capacity of athletes [56]. However, that study were conducted on one sport and involving only 12 athletes. This was very different from the current research which involved various sports and a lot of athletes.

A number of important limitations need to be considered. First, the tests or measurements were only carried out once. Therefore, further research needs to be conducted by performing several tests or measurements. For example, in four weeks, the same retest was conducted to evaluate the changes that had been occurred, both physically and psychologically, since they were dynamic. Secondly, the characteristics of the sports did not represent the other four type of sports, namely martial arts, games, accuracy, and measurability. Therefore, further studies need to involve more sports and athletes to obtain more comprehensive information. Finally,

coaches, sports administrators, and athletes can use this result to improve less than ideal conditions. This is very important because anthropometric aspects, physical, psychological, and personality capacities affect an athlete's performance in the field.

Conclusions

There were significant differences in the six variables, but the others was not different. The six variables include height, BMI, arm and abdominal muscle strength, leg muscle power, and aerobic endurance. The other four variables which include weight, flexibility, psychological abilities, and personality traits, showed no significant difference. Endurance variables, in general, have a significant relationship with anthropometric variables and other physical aspects. However, psychological variables and personality characteristics do not significantly correlate with other variables. Thus, the anthropometric and physical aspects of athletes tend to have differences based on sports. However, psychological variables and personality characteristics did not have relationship with physical and anthropometric aspects.

Acknowledgement

We would like to express our gratitude to the Research and Development from University of Cenderawasih

Conflict of interest

No conflict of interest in this research.

References

1. Radu L-E, Hazar F, Puni A-R. Anthropometric and Physical Fitness Characteristics of University Students. *Procedia - Soc Behav Sci.* 2014;149:798–802. <https://doi.org/10.1016/j.sbspro.2014.08.315>
2. Cui Y, Liu F, Bao D, Liu H, Zhang S, Gómez MÁ. Key anthropometric and physical determinants for different playing positions during national basketball association draft combine test. *Front Psychol.* 2019;10:1–9. <https://doi.org/10.3389/fpsyg.2019.02359>
3. Kammoun MM, Trabelsi O, Gharbi A, Masmoudi L, Ghorbel S, Tabka Z, et al. Anthropometric and physical fitness profiles of tunisian female soccer players: Associations with field position. *Acta Gymnica.* 2020;50(3):130–7. <https://doi.org/10.5507/ag.2020.013>
4. Purcell R, Gwyther K, Rice SM. Mental Health In Elite Athletes: Increased Awareness Requires An Early Intervention Framework to Respond to Athlete Needs. *Sport Med - Open.* 2019;5(1):1–8. <https://doi.org/10.1186/s40798-019-0220-1>
5. di Fronso S, Budnik-Przybylska D. Special Issue: Sport Psychology Interventions for Athletes' Performance and Well-Being. *Int J Environ Res Public Health.* 2023;20(4):3712. <https://doi.org/10.3390/ijerph20043712>
6. Park I, Jeon J. Psychological Skills Training for Athletes in Sports: Web of Science Bibliometric Analysis. *Healthc.* 2023;11(2):259. <https://doi.org/10.3390/healthcare11020259>
7. Nicholls AR, Earle K, Earle F, Madigan DJ. Perceptions of the coach-athlete relationship predict the attainment of mastery achievement goals six months later: A two-wave longitudinal study among F. A. Premier League Academy Soccer players. *Front Psychol.* 2017;8:684. <https://doi.org/10.3389/fpsyg.2017.00684>
8. Foulds SJ, Hoffmann SM, Hinck K, Carson F. The coach-athlete relationship in strength and conditioning: High performance athletes' perceptions. *Sports.* 2019;7(12):1–11. <https://doi.org/10.3390/sports7120244>
9. Donnelly AA, MacIntyre TE, O'Sullivan N, Warrington G, Harrison AJ, Igou ER, et al. Environmental influences on elite sport athletes well being: From gold, silver, and bronze to blue green and gold. *Front Psychol.* 2016;7:1–6. <https://doi.org/10.3389/fpsyg.2016.01167>

10. Rogerson M. Commentary: Environmental influences on elite sport athletes well being: From gold, silver, and bronze to blue, green and gold. *Front Psychol.* 2017;8:3389–91. <https://doi.org/10.3389/fpsyg.2017.00078>
11. Lau JS, Ghafar R, Hashim HA, Zulkifli EZ. Anthropometric and Physical Fitness Components Comparison between High- and Low-Performance Archers. *Ann Appl Sport Sci.* 2020;8(2):1–8. <https://doi.org/10.29252/aassjournal.897>
12. Villaseca-Vicuña R, Molina-Sotomayor E, Zabaloy S, Gonzalez-Jurado JA. Anthropometric profile and physical fitness performance comparison by game position in the Chile women's senior national football team. *Appl Sci.* 2021;11(5):1–16. <https://doi.org/10.3390/app11052004>
13. Pedro ZV, Rodrigo VV, Jair B. Anthropometric profile and physical fitness performance comparison by game position and connections with performance parameters in official matches of Chilean men rugby players. *J Phys Educ Sport.* 2022;22(10):2454–64.
14. Haksever B, Soylu C, Micoogullari M, Baltaci G. The physical characteristics and performance profiles of female handball players: Influence of playing position. *Eur J Hum Mov.* 2021;46:37–49. <https://doi.org/10.21134/eurjhm.2021.46.602>
15. Doyle B, Browne D, Horan D. Differences in anthropometric and physical performance characteristics between U17, U19, and Senior Irish female international football players. *Int J Sport Sci Coach.* 2021;16(2):352–9. <https://doi.org/10.1177/1747954120968191>
16. Lochbaum M, Stoner E, Hefner T, Cooper S, Lane AM, Terry PC. Sport psychology and performance meta-analyses: A systematic review of the literature. *PLoS One.* 2022;17:1–22. <https://doi.org/10.1371/journal.pone.0263408>
17. Brocherie F, Girard O, Forchino F, Al Haddad H, Dos Santos GA, Millet GP. Relationships between anthropometric measures and athletic performance, with special reference to repeated-sprint ability, in the Qatar national soccer team. *J Sports Sci.* 2014;32(13):1243–54. <https://doi.org/10.1080/02640414.2013.862840>
18. Csáki I, Szakály Z, Fózer-Selmec B, Kiss SZ, Bognár J. Psychological and anthropometric characteristics of a Hungarian Elite Football academy's players. *Phys Cult Sport Stud Res.* 2017;73(1):15–26. <https://doi.org/10.1515/pcssr-2017-0002>
19. Ghosh K, Bera SJ, Ghosh S, Singha P, Jana A, Mahapatra M, et al. Effects of short-term training on anthropometric, physical fitness and physiological variables of football players. *J Hum Sport Exerc.* 2023;1–13.
20. Jeoung B. Correlation of physical fitness with psychological well-being, stress, and depression in Korean adults. *J Exerc Rehabil.* 2020;16(4):351–5. <https://doi.org/10.12965/jer.2040454.227>
21. Sobhani V, Rostamizadeh M, Hosseini SM, Hashemi SE, Román IR, Mon-López D. Anthropometric, Physiological and Psychological Variables That Determine the Elite Pistol Performance of Women. *Int J Environ Res Public Health.* 2022;19(3):1102. <https://doi.org/10.3390/ijerph19031102>
22. Zaccagni AL, Lunghi B, Barbieri D, Rinaldo N, Šarac T, Šarac J, et al. Performance prediction models based on anthropometric, genetic and psychological traits of Croatian sprinters. *Biol Sport.* 2019;36(1):17–23. <https://doi.org/10.5114/biolSport.2018.78901>
23. Martínez-Rodríguez A, Peñaranda-Moraga M, Vicente-Martínez M, Martínez-Moreno M, Cuestas-Calero BJ, Soler-Durá J, et al. Relationship between Anthropometric Measures and Anxiety Perception in Soccer Players. *Int J Environ Res Public Health.* 2022;19(15):8898. <https://doi.org/10.3390/ijerph19158898>
24. Sporiš G, Vuleta D, Milanović D. Fitness profiling in handball: Physical and physiological characteristics of elite players. *Coll Antropol.* 2010;34(3):1009–14.
25. Ibáñez SJ, Piñar MI, García D, Mancha-Triguero D. Physical Fitness as a Predictor of Performance during Competition in Professional Women's Basketball Players. *Int J Environ Res Public Health.* 2023;20(2):988. <https://doi.org/10.3390/ijerph20020988>
26. Liu R, He L. The relationship between physical fitness and competitive performance of Taekwondo athletes. *PLoS One.* 2022;17:1–14. <https://doi.org/10.1371/journal.pone.0267711>
27. Barley OR, Chapman DW, Guppy SN, Abbiss CR. Considerations when assessing endurance in combat sport athletes. *Front Physiol.* 2019;10:1–9. <https://doi.org/10.3389/fphys.2019.00205>
28. Ranković G, Mutavdžić V, Toskić D, Preljević A, Kocić M, Nedin-Ranković G, et al. Aerobic capacity as an indicator in different kinds of sports. *Bosn J Basic Med Sci.* 2010;10(1):44–8.
29. Uroh CC, Adewunmi CM. Psychological Impact of the COVID-19 Pandemic on Athletes. *Front Sport Act Living.* 2021;3:1–7. <https://doi.org/10.3389/fspor.2021.603415>
30. Reyes-Bossio M, Corcuera-Bustamante S, Veliz-Salinas G, Villas Boas Junior M, Delgado-Campusano M, Brocca-Alvarado P, et al. Effects of psychological interventions on high sports performance: A systematic review. *Front Psychol.* 2022;13:1068376. <https://doi.org/10.3389/fpsyg.2022.1068376>
31. Putra MFP, Guntoro TS, Wandik Y, Ita S, Sinaga E, Hidayat RR, et al. Psychometric properties at Indonesian version of the sport anxiety scale-2: Testing on elite athletes of Papua, Indonesian. *Int J Hum Mov Sport Sci.* 2021;9(6):1477–85. <https://doi.org/10.13189/saj.2021.090645>
32. Lange-Smith S, Cabot J, Coffee P, Gunnell K, Tod D. The efficacy of psychological skills training for enhancing performance in sport: a review of reviews. *Int J Sport Exerc Psychol.* 2023; 0:1–18. <https://doi.org/10.1080/1612197X.2023.2168725>
33. Piepiora P. Assessment of Personality Traits Influencing the Performance of Men in Team Sports in Terms of the Big Five. *Front Psychol.* 2021;12:679724. <https://doi.org/10.3389/fpsyg.2021.679724>
34. Waleriańczyk W, Stolarski M. Personality and sport performance: The role of perfectionism, Big Five

- traits, and anticipated performance in predicting the results of distance running competitions. *Pers Individ Dif.* 2021;169:109993. <https://doi.org/10.1016/j.paid.2020.109993>
35. Stoyanova S, Tomova D, Petrova K. Personality peculiarities that differentiate elite and sub-elite athletes. *J Phys Educ Sport.* 2017;17(4):2105–9.
 36. Patsiaouras A, Chatzidimitriou M, Charitonidis K, Giota A, Kokaridas D. The Relationship of personality and trait anxiety between male and female volleyball players. *Ann Appl Sport Sci.* 2017;5(3):39–47. <https://doi.org/10.29252/acadpub.aassjournal.5.3.39>
 37. Zar A, Reza SH, Ahmadi F, Nikolaidis PT, Safari MA, Keshazarz MH, et al. Investigating the Relationship between Big Five Personality Traits and Sports Performance among Disabled Athletes. *Biomed Res Int.* 2022;2022. <https://doi.org/10.1155/2022/8072824>
 38. Patah IA, Jumareng H, Setiawan E, Aryani M, Gani RA. The importance of physical fitness for pencak silat athletes : Home-based weight training tabata and circuit can it work ? *J Sport Area.* 2021;6(1):86–97. [https://doi.org/10.25299/sportarea.2021.vol6\(1\).6172](https://doi.org/10.25299/sportarea.2021.vol6(1).6172)
 39. Peterson MD. *Power.* Human Kinetics; 2012.
 40. Magee MK, White JB, Merrigan JJ, Jones MT. Does the multistage 20-m shuttle run test accurately predict vo₂max in ncaa division i women collegiate field hockey athletes? *Sports.* 2021;9(6):75. <https://doi.org/10.3390/sports9060075>
 41. Milavic B, Padulo J, Grgantov Z, Milić M, Mannarini S, Manzoni GM, et al. Development and factorial validity of the Psychological Skills Inventory for Sports, Youth Version – Short Form: Assessment of the psychometric properties. *PLoS One,* 2019;14(8):1–17. <https://doi.org/10.1371/journal.pone.0220930>
 42. Dimiyanti, Herwin, Hastuti TA. Karakteristik-psikologis-atlet-di-pusat [Psychological-characteristics-of-athletes-at-center]. *Psikologi.* 2013;40(2):143–58.
 43. Maksun A, Negeri U. Kualitas Pribadi Atlet: Kunci Keberhasilan Meraih Prestasi Tinggi [Personal Qualities of Athletes: The Key to Success in Reaching High Achievements]. *Anima, Indonesian Psychological Journal,* 2016;22:1–8.
 44. Reilly T, Bangsbo J, Franks A. Anthropometric and physiological predispositions for elite soccer. *J Sports Sci.* 2000;18(9):669–83. <https://doi.org/10.1080/02640410050120050>
 45. Itoh R, Hirose N. Relationship Among Biological Maturation, Physical Characteristics, and Motor Abilities in Youth Elite Soccer Players. *J Strength Cond Res.* 2020;34(2):382–8. <https://doi.org/10.1519/JSC.0000000000003346>
 46. Kovacevic N, Mihanovic F, Hrbic K, Mirovic M, Galic T. Anthropometric Characteristics and Specific Functional Swimming Capacities in Youth U12 Water Polo Players. *Montenegrin J Sport Sci Med.* 2023;19(1). <https://doi.org/10.26773/mjssm.230304>
 47. le Gall F, Carling C, Williams M, Reilly T. Anthropometric and fitness characteristics of international, professional and amateur male graduate soccer players from an elite youth academy. *J Sci Med Sport.* 2010;13(1):90–5. <https://doi.org/10.1016/j.jsams.2008.07.004>
 48. Canhadadas IDL, Silva RP, Chaves CR, Portes LA. Anthropometric and physical fitness characteristics of young male soccer players. *Rev Bras Cineantropometria e Desempenho Hum.* 2011;12(4):239–45. <https://doi.org/10.5007/1980-0037.2010v12n4p239>
 49. Putra MFP, Ita S. Gambaran kapasitas fisik atlet Papua: Kajian menuju PON XX Papua [Description of the physical capacity of Papuan athletes: Study towards the XX Papua PON]. *J Keolahragaan.* 2019;7(2):135–45. <https://doi.org/10.21831/jk.v7i2.26967>
 50. November RVC, Leach LL. Relationship between shoulder complex strength and throwing velocity in club cricketers. *J Hum Sport Exerc.* 2020;15(1):67–78. <https://doi.org/10.14198/jhse.2020.151.07>
 51. Vukasevic V, Mitrovic M, Masanovic B. A comparative study of motor ability between elite basketball players from different regions. *Sport Mont.* 2020;18(1):3–7. <https://doi.org/10.26773/smj.200201>
 52. Kobal R, Nakamura FY, Kitamura K, Cal Abad CC, Pereira LA, Loturco I. Vertical and depth jumping performance in elite athletes from different sports specialties. *Sci Sport.* 2017;32(5):e191–6. <https://doi.org/10.1016/j.scispo.2017.01.007>
 53. Lopez-Plaza D, Alacid F, Rubio-Arias J, Lopez-Minarro PA, Muyor JM, Manonelles P. Morphological and Physical Fitness Profile Of Young Female Sprint Kayakers. *J Strength Cond Res.* 2019;33(7):1963–70. <https://doi.org/10.1519/JSC.0000000000002511>
 54. Mangolo EM, Guntoro TS, Kurdi, Putra MFP. The differences in Papuan elite athletes in the anxiety perspective. *J Sport Area.* 2021;6(3):296–303. [https://doi.org/10.25299/sportarea.2021.vol6\(3\).6569](https://doi.org/10.25299/sportarea.2021.vol6(3).6569)
 55. Guntoro TS, Kurdi K, Putra MFP. Karakter kepribadian atlet Papua: kajian menuju POPNAS ke-XV [Personality characteristics of Papuan athletes: a study towards the XVth POPNAS]. *Jurnal SPORTIF : Jurnal Penelitian Pembelajaran,* 2020;6(1): 40–58. https://doi.org/10.29407/js_unpgri.v6i1.13638
 56. Ciorbea I, Pasarica F. The Study of the Relationship between Personality and Academic Performance. *Procedia - Soc Behav Sci,* 2013;78:400–4. <https://doi.org/10.1016/j.sbspro.2013.04.319>

Information about the authors:

Tri Setyo Guntoro; <https://orcid.org/0000-0002-8093-5564>; tsguntoro09@gmail.com; Faculty of Sport Sciences, Universitas Cenderawasih; Indonesia.

Sutoro; <https://orcid.org/0000-0003-0674-6340>; prof.sutoro@gmail.com; Faculty of Sport Sciences, Universitas Cenderawasih; Indonesia.

Miftah Fariz Prima Putra; <https://orcid.org/0000-0002-0484-5460>; mifpputra@gmail.com; Faculty of Sport Sciences, Universitas Cenderawasih; Indonesia.

Kurdi; (Corresponding Author); <https://orcid.org/0009-0002-2114-1737>; kurdimr18@gmail.com; Faculty of Sport Sciences, Universitas Cenderawasih; Indonesia.

Zsolt Németh; <https://orcid.org/0000-0003-4656-2618>; zsolt.nemeth@gamma.ttk.pte.hu; Department of Theory and Practice of Sport Games, University of Pécs; Hungary.

Edi Setiawan; <http://orcid.org/0000-0001-7711-002X>; edi_setiawan@unsur.ac.id; Faculty of Teacher Training and Education, Universitas Suryakencana; Indonesia.

Cite this article as:

Guntoro TS, Sutoro, Putra MFP, Kurdi, Németh Z, Setiawan E. The role of anthropometry, physical, psychological and personality for elite athletes in competitive sports. *Pedagogy of Physical Culture and Sports*, 2023;27(4):331–339.

<https://doi.org/10.15561/26649837.2023.0409>

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (<http://creativecommons.org/licenses/by/4.0/deed.en>).

Received: 15.06.2023

Accepted: 25.07.2023; Published: 30.08.2023