Relationship between anthropometric profiles and level of psychological resilience of elite Para-Badsites of sub-saharan Africa

Abstract

Background: Para-badminton is a crucial para-sport that improves the quality of life of people with disabilities by promoting their social integration and strengthening their physical and psychological capacities.

Objective: To analyze the relationships between the anthropometric profile, physical capacities, and the level of psychological resilience of elite para-badminton players in sub-Saharan Africa.

Methods: The study involved 20 para-badminton players (5 from Burkina Faso, 5 from Benin, and 10 from Togo), with an average age of 30. The CD-RISC-25 questionnaire was used as an assessment tool.

Results: Burkinabe para-badminton players show a tendency to be overweight, with a median BMI of 26.7 kg/m². Beninese players have a longer wingspan (1.75 m). In terms of psychological resilience, 55% of athletes have low resilience, although Togo has a notable proportion of athletes with high resilience. Furthermore, the correlation between wingspan and psychological resilience is moderately positive, indicating that athletes with greater wingspan tend to have greater psychological resilience.

Conclusion: Anthropometric profiles and psychological resilience among elite para-badminton players from sub-Saharan Africa reveal complex relationships, highlighting the importance of a longitudinal study.

Keywords: Anthropometric profiles; psychological resilience; elite para-badminton players.

Introduction

"Sport" refers to all forms of physical activity (PA), whether organized or not, that promote the expression or improvement of physical and mental fitness, the development of social relationships, and competition [1]. As such, it can have a positive impact on the lives of everyone, including people with disabilities [2], and is involved in the process of integration and social cohesion of people with disabilities, whether it takes place in a specific or mainstream environment[3].

Indeed, certain disciplines, so that they can be practiced by people with disabilities (PWD), have been modified and adapted to meet their specific needs [4]. This is the case of para badminton, which is a sport adapted from badminton; with events for each disability class (male and female), including Wheelchair 1 and 2 (WH1, WH2), Standing Lower 3 and 4 (SL3, SL4), Standing Upper 5 (SU5), and Standing Short 6 (SH6) [5].

The Paralympic movement has been considered a platform to showcase the capabilities and parameters of people with disabilities [6]. It is therefore important, on the one hand, to study the players' anthropometric parameters for potentially easier estimates of risk factors for metabolic diseases in the future [7]. On the other hand, these measurements are sought to identify a correlation between body structure, bone mass, physical characteristics, and performance abilities [8].

Furthermore, a study examined psychological resilience [9]. This concept is recognized as important in improving athletic performance and, consequently, acquiring valuable life skills [10]. It is defined as an individual's "capacity to adapt to stress" as well as the ability to "bounce back" in the face of adversity [11].Without positive adaptation to adversity in the sporting environment, young para-badminton players may experience adverse developmental consequences (poor relationships with coaches, negative peer influences, parental pressure, and the challenging psychological environment of competitive sport)[12–14]. Similarly, autonomous motivation is useful in predicting persistence and adherence, advantageous for effective performance, and reliably linked to psychological health [15].Also, Malais(2024)[16]investigated the relationship between autonomy, resilience, and life satisfaction in para-badminton athletes and the mediating role of resilience in the relationship between autonomy and life satisfaction. As such, fostering resilience in para-badminton players, in turn, allows them to achieve greater life satisfaction. Thus, given the unique opportunities that sport offers in terms of achieving goals and overcoming adversity on a frequent basis, it is essential that protective factors be identified, understood, and encouraged in young athletes [17].Furthermore, supportive sporting environments play a vital role in promoting and

maintaining resilience among para-badminton players in their daily interactions [17]. He development of psychological resilience in para-badminton is therefore a dynamic process that requires positive adaptation to stress. Therefore, a valid and standardized measure such as CD-RISC would be necessary for its assessment [16].

Anthropometric profile could be strongly correlated with the level of psychological resilience of some elite para-badminton players in sub-Saharan Africa. The aim was to analyze the relationships between anthropometric profile, physical abilities, level of psychological resilience, and quality of life in elite para-badminton players in sub-Saharan Africa

Material and methods

Type and Setting of the Study

This is a cross-sectional study conducted in the cities of Cotonou, Lomé, and Ouagadougou in Benin, Togo, and Burkina Faso.

Study Sample

The sample included 23 players: 10 from Togo, 5 from Burkina Faso, and 5 from Benin. Burkina Faso players comprised 3 paraplegics, 1 polio patient, and 1 with injection injury. In Benin: 1 upper limb deficiency, 1 paraplegic, and 3 lower limb deficiencies. In Togo: 1 lower limb deficiency, 1 foot amputation, 4 paraplegics, and 4 upper limb deficiencies. Inclusion criteria: elite wheelchair para-badminton players (WH1/WH2) or limb deficiency (SL3, SL4, SU5), participation in national/international competitions within 2 years, functional wheelchair, and written consent. Exclusion: damaged wheelchair, incomplete questionnaire, early withdrawal, or serious injury during the study.

Questionnaires

Assessment of the Level of Psychological Resilience [18]:The CD-RISC-25 was used to assess participants' adversity and positive adaptation, stress adaptation, and supportive sporting environments. It is divided into two main parts: the first part (general information) provides information on the respondent's name, age, gender, and classification, and the second part (questions related to various factors).

Experimental Design

It began with an awareness-raising exercise among para-badminton players and team leaders. An assessment was conducted to select the list of players who met the study criteria after obtaining written consent from participants through written informed consent and information

sheets. This first stage lasted one week. In the second week, we assessed the level of psychological resilience (adversity and positive adaptation, stress adaptation, supportive sporting environments) and collected anthropometric data (height, weight, span, and wingspan). Data collection was carried out after explanation and completion of the CD-RISC questionnaire on the participants' level of psychological resilience.

Variables studied

The variables on which the study depended were:

- anthropometric measurements: height, weight, wingspan, BMI
- level of psychological resilience: adversity and positive adaptation, stress adaptation capacity, and favorable sporting environments.

Ethical considerations

Ethical rules were respected throughout the study. Before the start of this study, authorization was obtained from the INJEPS sectoral scientific committee. For this purpose, written informed consent was obtained from the participants, confidentiality and personal data protection were guaranteed, and no participant was included in this study against their will or forced to continue the study if they wished to withdraw from the protocol.

Statistical analysis

After data collection, the analysis and centralization of the completed forms attest to the completeness and validity of the data. Statistical analyses were performed using SPSS software (version 27). Descriptive statistics were generated for the variables studied. Quantitative descriptive variables were expressed as mean and standard deviation, and qualitative variables as number and percentage. Kendall's Tau-B allowed us to see the correlation between psychological resilience factors and anthropometric profile.

Results

Overall, the average age is 30 years, the average BMI is 23.07 kg/m², and the average wingspan is 1.71 m. Para-badminton players from Benin have been practicing for longer than para-badminton players from Togo and Burkina Faso, i.e. 8 years, 3 years and 2 years respectively. The Beninese and Togolese had similar BMIs (21.94 kg/m² and 21.71 kg/m²) and lower BMIs than the para-badminton players from Burkina Faso (26.94 kg/m²), indicating a tendency towards overweight. The Beninese athletes have the largest wingspan (1.76 m), followed by the Togolese (1.72 m) and the Burkinabés (1.66 m). (**Table 1**)

Of the total sample, including all categories, regarding specific classes, the WH1 and SU5 categories show a high proportion of participants with low resilience. In contrast, the WH2 class stands out for a high number of participants displaying high resilience (25%). They have (Burkina Faso: 84 and Togo: 78.75). The SL3 and SU5 classes present worrying results, particularly with a low resilience score of 20% for SL3. The mean total score for the sample in this study is 73.83, with 11 (55%) having a low level of resilience and 9 (45%) having a high level of resilience. (**Table 2**).

The correlations between BMI and psychological resilience are negative. The correlation between wingspan and psychological resilience is moderately positive, indicating that athletes with a greater wingspan tend to have better psychological resilience. It should be noted, therefore, that anthropometric profile and level of psychological resilience are not significantly correlated. (**Table 3**).

Discussion

The average age of para-badminton players explains that the sample of this study is made up of adults and more specifically seniors in the world of sports. These results are similar to those of Oliveira et al., (2024) on "Physiological and metabolic responses of para badminton athletes to a simulated effort on the court", revealing that para-badminton players had an average age of 28.9 ± 10.8 years [19]. But they are lower than the data obtained by Fatih et al., (2018) in the investigations on the effects of badminton on the physical development of men with physical disabilities and the average age was 35 ± 4.9 years [20]. Seniority in practice is also an important factor, as a high seniority can be correlated with a better technical and psychological adaptation to the sport. The average BMI of the study is close to the median BMI of another study which is 22.9 kg/m^2 between 17.66-26.64 kg/m^2[21]. The same study states that a good BMI facilitates the recovery of players during physical exertion. In a study carried out on 16 wheelchair para-badge players, the mean value retained is 22.8 kg/m^2 with a standard deviation of 3.7 [22]corroborating the average BMI of the present one. A good BMI could be a result of better performance. Thus, the most physically performing athletes were significantly correlated with the body mass index and the fat mass index [21]. A study on the impact of physical factors on badminton performance: what performance assessment should be considered to ensure it is fair, taking into account the physical attributes of the students, revealed an average wingspan of 0.61 m with single-arm measurements[23].A large wingspan is a quality to have in para badminton since it could compensate for movements to quickly reach the shuttlecock, especially for people with limb disabilities or in wheelchairs.

Resilience is made up of resilience factors that enable an individual to overcome difficulties and bounce back after trauma [22]. Thus, the study on the relationship between self-perceived burden and post-traumatic growth in patients with colorectal cancer: the mediating effects of resilience shows a relatively low level of resilience in patients and which is similar to our study with a mean resilience score of 69.03 ± 19.06 with a range of 18 to 100 [12]. The present study explores the level of resilience similar to those explored by Tahernejad et al., (2024) on different resilience factors that are good, are led to a high level of resilience [24].The study by McManama et al., proposes three factors of psychological resilience namely: adversity and positive adaptation, stress coping skills and favorable sports environments [10]. In particular, adversity, a key element of psychological resilience, refers to negative experiences associated with poor adaptation. These challenges strengthen athletes' resilience by allowing them to overcome, learn, and grow. Positive adaptation to adversity, also in para badminton, improves their ability to respond to negative stimuli. Resilience is influenced by sport-specific stressors, such as competitive demands. Finally, favorable sport environments, including social and family support, enhance the development of para badminton players.

The correlation coefficient between BMI and the level of psychological resilience could indicate that a higher BMI is related to slightly lower resilience. The lack of significance could be explained by the small sample size (20 para-badminton players) or unmeasured variables. Furthermore, the link between BMI and resilience could be indirect, influenced by contextual factors such as personal experiences, coping strategies, or the athletes' specific conditions. In a study whose objective was to explore potential associations between resilience and the frequency of consumption of various food groups in middle-aged Europeans, resilience was measured using the validated Resilience Scale followed by a Pearson partial correlation analysis, which found no association between BMI and resilience but rather with food products. Improving psychological well-being can promote healthy eating habits and prevent obesity[25].The correlation coefficient between wingspan and psychological resilience ($r = 0.144$) shows a weak positive relationship, but again, it is not statistically significant. This could indicate that a larger wingspan may be slightly associated with a higher level of psychological resilience. However, since this correlation is very weak and insignificant, it is difficult to draw strong conclusions about the influence of wingspan on resilience. Overall, the results of this current study indicate that anthropometric profiles, such as BMI and wingspan, are not strongly related to the level of psychological resilience among the para-badminton players studied.

Conclusion

Anthropometric profile and psychological resilience are not significantly correlated. However, they are moderately correlated with quality of life and only significantly correlate with wingspan. This study highlights the existence of complex and multidimensional relationships between anthropometric profile and psychological resilience among elite para-badminton players in sub-Saharan Africa. A longitudinal study could explore the evolution of psychological resilience and physical abilities over several seasons to analyze their cumulative impact on athletes' quality of life.

Declarations

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Ethical Considerations

Ethical rules were respected throughout the study. Before the start of this study, authorization was obtained from the INJEPS sectoral scientific committee. For this purpose, written informed consent was obtained from the participants, confidentiality and personal data protection were guaranteed, and no participant was included in this study against their will or forced to continue the study if they wished to withdraw from the protocol.

AI Declaration

In preparing this work, the authors used ChatGPT to translate the content into English. After using this tool/service, the authors reviewed and edited the content as necessary and take full responsibility for the published material.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Author Contributions

ODA designed the study, organised the data, conducted the analyses, proposed the methodology, validated the data, and drafted the original manuscript.

AREdesigned the study, organised the data, conducted the analyses, proposed the methodology, validated the data, and reviewed and edited the manuscript.

MCG performed the analysis, conducted the survey, and revised the original manuscript.

JAAdesigned the study, organised the data, conducted the analyses, proposed the methodology, validated the data, and drafted the original manuscript.

BA supervised, revised, and approved the final version.

All authors have read and approved the final version of the manuscript, and agreed on the order of authorship.

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Data Availability Statement

The anonymised dataset generated and analysed during the study is available from the corresponding author upon reasonable request.

Disclaimer

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Table 1: General characteristics and anthropometric profile of the sample

		n	Age* (years)	Anteriority* (years)	Seniority* (years)	BMI* (Kg/m²)	Wingspan* (m)
Benin							
	WH1	00	NA	NA	NA	NA	NA
	WH2	00	NA	NA	NA	NA	NA
	SL3	01	20 ± NA	20 ± NA	5 ± NA	16.2 ± NA	1.70 ± NA
	SL4	03	23 ± 1	20.33 ± 5.5	6.33 ± 2.88	23.86 ± 2.8	1.77 ± 0.05
	SU5	01	24 ± NA	24 ± NA	8 ± NA	21.9 ± NA	1.80 ± NA
	Total	05	22.6 ± 1.67	21 ± 4.24	6.4 ± 2.3	21.94 ± 3.86	1.76 ± 0.05
Burkina-Faso							
	WH1	03	29 ± 14.93	27.33 ± 18.71	2 ± 0	26.53 ± 4.06	1.62 ± 0.02
	WH2	02	39 ± 1.41	35.5 ± 3.5	2 ± 0	27.55 ± 1.2	1.71 ± 0.09
	SL3	00	NA	NA	NA	NA	NA
	SL4	00	NA	NA	NA	NA	NA
	SU5	00	NA	NA	NA	NA	NA
	Total	05	33 ± 11.91	30.6 ± 14.08	2 ± 0	26.94 ± 2.99	1.66 ± 0.07
Togo							
	WH1	00	NA	NA	NA	NA	NA
	WH2	04	42.25 ± 8.99	40.7 ± 13.9	3.25 ± 0.5	18.87 ± 2.75	1.72 ± 0.09
	SL3	01	22 ± NA	19 ± NA	3 ± NA	30.7 ± NA	1.75 ± NA
	SL4	01	34 ± NA	23 ± NA	3 ± NA	30.1 ± NA	1.64 ± NA
	SU5	04	24.25 ± 8.46	24.2 ± 8.4	4.25 ± 2.5	20.2 ±1.48	1.74 ± 0.1
	Total	10	32.2 ± 11.65	29.9 ± 11.75	3.6 ± 1.57	21.71 ± 4.96	1.72 ± 0.08
Sample							
	WH1	03	29 ± 14.93	27.33 ± 18.71	2 ± 0	26.53 ± 4.06	1.62 ± 0.02
	WH2	06	41.17 ± 7.19	38.1 ± 3.67	2.83 ± 0.75	21.76 ± 4.99	1.72 ± 0.08
	SL3	02	21 ± 1.41	19.5 ± 0.7	4 ± 1.41	23.45 ± 1.25	1.72 ± 0.03
	SL4	04	25.75 ± 5.56	21 ± 4.69	4 ± 2.88	25.42 ± 3.86	1.74 ± 0.08
	SU5	05	24.2 ± 7.32	24.2 ± 7.32	5 ± 2.73	20.54 ± 1.49	1.65 ± 0.09
	Total	20	30 ± 10.68	26.68 ± 6.80	3.9 ± 2.22	23.07 ± 4.68	1.71 ± 0.08

:** *Mean ± SD* ***BMI:** *Body Mass Index* ***n:** *Frequency* ***m: meter ***WH 1:** *Wheelchair 1* ***WH 2:** *Wheelchair 2* ***SL 3:** *Standing Lower 3* ***SL 4:** *Standing Lower 4* ***SU 5:** *Standing Upper 5*

Table 2 :Resilience Level

		n	Resilience Level*		Total	Score Total**
			Low Resilience	High Resilience		
Benin						
	WH1	00	NA	NA	NA	NA
	WH2	00	NA	NA	NA	NA
	SL3	01	1(20)	0(00)	1(20)	67
	SL4	03	2(40)	1(20)	3(60)	74.33
	SU5	01	1(20)	0(00)	1(20)	68
	Total	05	4(80)	1(20)	5(100)	95.55
Burkina-Faso						
	WH1	03	2(40)	1(20)	3(60)	71.33
	WH2	02	0(00)	2(40)	2(40)	84
	SL3	00	NA	NA	NA	NA
	SL4	00	NA	NA	NA	NA
	SU5	00	NA	NA	NA	NA
	Total	05	2(40)	3(60)	5(100)	77.66
Togo						
	WH1	00	NA	NA	NA	NA
	WH2	04	1(10)	3(30)	4(40)	78.75
	SL3	01	1(10)	0(00)	1(10)	74
	SL4	01	0(00)	1(10)	1(10)	78
	SU5	04	3(30)	1(10)	4(40)	68
	Total	10	5(50)	5(50)	10(100)	74.66
Sample						
	WH1	03	2(10)	1(5)	3(15)	74.33
	WH2	06	1(5)	5(25)	6(30)	80.5
	SL3	02	2(10)	0(00)	2(10)	70.5
	SL4	04	2(10)	2(10)	4(20)	76.16
	SU5	05	4(20)	1(5)	5(25)	68
	Total	20	11(55)	9(45)	20(100)	73.89

:** *Frequency (Percentage)* ***n:** *Frequency* ***WH 1:** *Wheelchair 1* ***WH 2:** *Wheelchair 2* ***SL 3:** *Standing Lower 3* ***SL 4:** *Standing Lower 4* ***SU 5:** *Standing Upper 5* *:** *Moy* ***NA**: *Not Applicable*

314 **Table 3**:Correlation between anthropometric profile and level of psychological resilience

	Resilience Level
Body Mass Index	-0.249
Envergure	0.144

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