Chapter

Comparison of Anthropometric Profile and Cognitive Performance of Elite and Non-Elite Beach Volleyball Athletes

Danny Paollo Leite de Arruda, Alexandre Santos da Costa, Anderson Karlos de Luna Ramalho Santos, Carlos Renato Paz, Clizaldo Luiz Maroja Di Pace França, Eric de Lucena Barbosa, Lenilson Silva dos Santos, Marcos Antônio de Araujo Leite Filho, Marcos Antônio Camilo de Almeida, Natália Herculano Paz, Nilo Montenegro Netto Segundo, Pedro Augusto Mariz Dantas, Pedro Henrique Marques de Lucena, Ramon Cunha Montenegro, Renata Gouveia Nunes and Rossini Freire de Araújo

Abstract

To compare the anthropometric profile and cognitive performance of elite and non-elite beach volleyball athletes. Comparative and descriptive study. The sample was composed by 8 athletes, divided in 2 groups: elite (n = 4) and non-elite (n = 4). They were evaluated in anthropometric parameters age, weight and height, and the variables of the cognitive performance evaluated by the battery of computerized tests CogState® (Brief Battery): Detection (Simple Reaction Time); Identification (Choice Reaction Time); One Back Speed (Working Memory); One Back Acuracy (Short Term Memory). Data were classified as non-parametric with the dispersion curve analysis performed by the Shapiro Wilk test. Anthropometric profile and cognitive performance variables were compared with the *Mann Whitney* U test between the groups. The procedures were performed with a significance level of $p < 0.05$ *using* the Statistical Package for the Social Science - SPSS®, Version 25.0. It was observed that there was significant difference in the anthropometric profile in the variable age (sig = 0.029) and

in the cognitive performance significant differences occurred in the variables Detec (sig = 0.029) and Indent (sig = 0.029) of elite and not elite athletes of the beach volleyball modality. Elite and non-elite beach volleyball athletes present significant differences in the anthropometric variable (Age) and in the variables of cognitive performance (Detection and Identification) where elite athletes have a better cognitive performance than the non- elite athletes.

Keywords: cognitive performance, anthropometrics, CogState®, athletes elite and non-elite beach volleyball

1. Introduction

In the sportive competitions elite and not elite athletes have a demand for significant results. Therefore, the use of scientific methods is a current practice, in the sense of helping in the development of the sport performance and consequently in the sport results of these athletes. The characteristics that constitute the variables of the anthropometric profile of an athlete may be reflected in a way that he/she may play a determining role in his/her sporting potential within the chosen modality, which may lead to success [1]. Thus, the stature for athletes of the beach volleyball, can be important to contribute in the defensive and offensive actions of the modality, it is necessary, however a verification of the anthropometric profile to establish standards with relation to the modality [2]. We can affirm that the anthropometric profile of an athlete can influence in its more adequate sport performance for that modality [2]. However, anthropometric parameters are not the only determining variable in beach volleyball, as there are also cognitive factors in all its parameters, decision making, attention levels, working memory, which are fundamental in a sport with a great variability and impressibility [3–6]. The neurocognitive mechanisms in sport and the motor skills developed involve several neural processes, in addition to the learning of sport techniques. There are four elements that stand out with the development and neural adaptations of elite athletes [7]. (1) neural efficiency, which in turn is linked to a smaller amplitude in relation to the neuroelectric activity, causing a lower brain energy expenditure (2) referring to a larger cortical expansion, which is linked to motor and sensorial skills (3) specialized processing occurs in specific brain regions, which are developed through sports experiences lived by athletes, which induces the automation of neuroelectric connections (4) internal models, which cause the athlete to mentally simulate sports situations to which he/she will be submitted [7, 8]. These adaptations, for the most part, are considered to be motor areas, in brain regions that aid sport development, especially the cognitive engagement that is involved in sporting actions [9]. Cognitive processes trigger the so-called decision-making, being this decision-making composed of underlying elements such as attention, memory, perception and anticipation [6, 10] these cognitive factors are linked to sport. So the performance of the athlete to which he is dedicated will always depend on his physical and cognitive actions [11]. Elite athletes when compared to non-elite athletes, in several review studies demonstrate superior cognitive performance in specific situations of their sports [12]. Based on the perspective that these elements have repercussions on the performance of these individuals and on their sporting performance, the following objective of the study arises: to compare the variables of anthropometric profile and cognitive performance, between elite and non-elite athletes of the sport of beach volleyball?

2. Methods

This research had a descriptive characteristic [13] which verified the anthropometric profile and cognitive performance among elite and non-elite athletes of the beach volleyball modality. The universe of the study was constituted by athletes of the national circuit of beach volleyball/Banco do Brazil and the Cabo Branco Beach Volleyball Training Center/CT Cangaço. The sample was composed by 8 athletes, selected by non-probabilistic procedure, of the intentional type, with age bracket between 18 and 35 years old, being 04 elite athletes and 04 non-elite athletes. The participants received an informative document with all the procedures performed in the research. Afterwards, an informative document containing all the details regarding the date, time and place of research was delivered. Athletes who did not present the Free and Informed Consent Term - TCLE; did not agree with the terms of commitment, assumed with the researcher; were under medication treatment that influenced the execution of the tests; those who refused to participate in the study as volunteers, with no return or financial advantage, and those who did not show up on the day of data collection, were excluded from the process. The present study complied with the norms for research with human beings, resolution 466/12 of the National Health Council. CAAE: 26950119.0.0000.5176. One of the CogState® Computerized Cognitive Test Battery (Brief Battery) was used in the evaluation of cognitive performance, which is composed of four tests: Detection Test (cognitive domain measured: Psychomotor Function) **Figure 1**, Identification Test (cognitive domain measured: Attention) **Figure 2**, One Card Learning Test (cognitive domain measured: Visual Learning), One Back Speed Test (cognitive domain measured: Working Memory) in the study conducted used 4 tests from the (Brief Battery/ Brief Battery) being they Detection (Simple Reaction Time); Identification (Choice Reaction Time); One Back Speed (Working Memory); One Back Acuracy (Short Term Memory) which presented results in milliseconds (ms) and logarithmic values normalized to base 10, with validity from 0.76 to 0.89 [14, 15]. It was necessary to perform a demonstration of the protocol to facilitate the understanding and learning of the test. The analysis was done by the quantitative number of positive and negative answers divided by the total number of attempts executed.

Figure 1.
Detection test.

Figure 2.
Identification test.

Such results will be presented as percentage of correct answers. For weight evaluation a Tanita® Bc 601 bioimpedance scale was used, the individual barefoot with legs slightly apart with arms at the side of the body with the most erect body possible. For height assessment, a *Standard Sanny*® - ES 2030 stadiometer was used, with a range of use of 0.80 to 2.20 m, resolution in millimeters and a tolerance of +/− 2 mm at 2.20 m. The individual was barefoot, with heels together and arms relaxed. The data were classified as non-parametric with the analysis of the dispersion curve performed by the Shapiro Wilk test. The variables of anthropometric profile and cognitive performance were compared with the *Mann Whitney* U test between the two groups. The procedures were performed with a significance level of $p < 0.05$ *using* the Statistical Package for the Social Science - SPSS®, Version 25.0.

3. Results

In **Table 1** the anthropometric profile of elite and non-elite beach volleyball athletes were observed and it was verified that there was a significant difference in the variable age (sig = 0.029).

In **Table 2** the cognitive performance of elite and non-elite beach volleyball athletes was observed and it was verified that there were significant differences in

Profile	Veriables	Elite (n = 4)		Non-Elite (n = 4)		Comparison	
Anthropometric		**Med**	**Min_Max**	**Med**	**Min_Max**	**Mann–Whitney U**	**Sig.**
	Age	32,50	30,00_34,00	19,25	18,00_20,00		0.29
	Weight	94,46	85,00_102,85	88,50	78,00_110,00		0.114
	Height	1,98	1,85_2,10	1,89	1,79_1,93		0.200

Table 1.
Descriptive and comparative statistics of anthropometric data of elite and non-elite beach volleyball athletes - 2018 stage.

Performance	Variables	Elite (n = 4)		Non-Elite (n = 4)			Comparison
Cognitive		**Med**	**Min_Max**	**Med**	**Min_Max**	**Mann–Whitney U**	**Sig.**
	DETEC	114,5	113,00_116,00	102,5	89,00_110,00		0.29
	IDENT	115,5	114,00_117,00	106,5	99,00_111,00		0.29
	OBS	107,25	96,00_113,00	101,5	93,00_112,00		0.200
	OBA	96,25	85,00_102,00	91,75	70,00_102,00		

DETEC. = Detection; IDENT. = Identification; OBS. = One Back Speed; OBA. = One Back Acuracy.

Table 2.
Descriptive and comparative statistics of Cognitive Performance (CogState®) of elite and non-elite beach volleyball athletes - 2018 Stage.

the variables: Detec (0.029); Ident (0.029); evaluated by the CogState® computerized test battery (Brief Battery).

4. Discussion

The results presented in this study showed significant difference in the variable of anthropometric profile age (sing = 0.029), in elite and non-elite athletes of beach volleyball (**Table 1**). According Guedes [16] states that the chronological age and age defined by the birth of an individual that is determined by the civil calendar, thus the difference between the two groups is simply chronological. With the data of the above presented variables, there is a need that during a process for a selection of athletes for the Beach Volleyball modality, especially in relation to one of the variables the height, it can be observed a certain evolution, where it demonstrates that the stature inside of the anthropometric profile and a main measure for a selection process of this modality [17]. According to Gabbett, Georgieff and Domrow the anthropometric profile characteristic of the variable height is of fundamental importance for the performance of attack and blocking that occur during a beach volleyball game. In the variable of the anthropometric profile with relation to the weight of the elite athletes and not elite of the beach volleyball, with the variations, it can have or not a negative association for accomplishment of some tasks to be accomplished in the beach volleyball modality [1, 2]. When analyzing the cognitive performance of elite and non-elite beach volleyball athletes (**Table 2**) in the overall score in the variables where these results are given through the speed in milliseconds (ms) that are logarithmic values normalized to base 10, with validity from 0.76 to 0.89: Detection (Simple Reaction Time); Identification (Choice Reaction Time); One Back Speed (Working Memory); One Back Acuracy (Short Term Memory); evaluated by the CogState® computerized test battery (Brief Battery). It was verified in (**Table 2**) that significant differences occurred in the analyzed variables: Detection (Simple Reaction Time); Identification (Choice Reaction Time); evaluated by the CogState® computerized test battery (Brief Battery). When analyzing the variables: detec (sing = 0.029), ident (sing = 0.029), we can observe that elite athletes, have a better cognitive performance, in relation to non- elite athletes in these two variables, once, in the test results of these two variables, they are classified in a lower score as better performance. Where the variable (Detec) has its cognitive domain the (attention) and the variable (Ident) has its cognitive domain the (psychomotor function) since we analyzed the cognition of the greatest athletes of beach volleyball in Brazil and the world, being these world and Olympic champions of this category. According to Santos [18]. The processes of perception and attention depend on some factors, among them, the conscious ability to select the most essential sources of information and the quantity of stimuli. For SCHMIDT (1993) the concept of attention is related to the "information processing capabilities that put limits on the skillful human performance". Baddeley and Hitch in [19]. postulated a theory that supports the main current on (Working Memory) from an assumption that (Working Memory) has a command center, which is the Central Executive System (CES), responsible for integrating new information with data stored in long-term memory [20]. Several studies show that the (Working Memory) is one of the last cognitions to consolidate, but also one of the first to suffer degeneration in brain structures, being the frontal lobe the most affected bringing cognitive losses [21, 22]. In view of these facts, it is necessary to research about the importance of these variables to improve the performance of these athletes.

5. Conclusions

Analyzing the anthropometric parameters and the cognitive variables, it was observed that there was significant difference, in the anthropometric profile in the variable age (sig = 0.029) and in the cognitive performance, significant differences occurred in the variables Detec (sig = 0.029) and Indent (sig = 0.029) where in these two variables the elite athletes have a better cognitive performance than the athletes no elite.

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Conflict of interest

There is no conflict of interest between the authors.

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Author details

Danny Paollo Leite de Arruda[2,5*], Alexandre Santos da Costa[5], Anderson Karlos de Luna Ramalho Santos[5], Carlos Renato Paz[1], Clizaldo Luiz Maroja Di Pace França[7], Eric de Lucena Barbosa[5,7], Lenilson Silva dos Santos[5], Marcos Antônio de Araujo Leite Filho[3], Marcos Antônio Camilo de Almeida[5,6], Natália Herculano Paz[7], Nilo Montenegro Netto Segundo[5], Pedro Augusto Mariz Dantas[1], Pedro Henrique Marques de Lucena[7], Ramon Cunha Montenegro[1,6], Renata Gouveia Nunes[5,7] and Rossini Freire de Araújo[4]

1 Federal Institute of Education, Science and Technology of Paraíba—IFPB, Brazil

2 Federal University of Triângulo Mineiro—PPGCF/IFTM, Brazil

3 Mauritius of Nassau University Center/UNINASSAU, Brazil

4 National Volleyball Coach School, Brazil

5 Physical Evaluation Laboratory—LAF-UNIPÊ/SANNY, Brazil

6 Research Group on Science and Technology of Kinanthropometry of the IFPB-GPCTCine/IFPB, Brazil

7 University Center of João Pessoa—UNIPÊ, Brazil

*Address all correspondence to: dannypaollo@gmail.com

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