SITTING VOLLEYBALL PLAYERS: DIFFERENCES IN PHYSICAL AND PSYCHOLOGICAL CHARACTERISTICS BETWEEN NATIONAL AND LEAGUE TEAMS

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Abstract:

The aim of the present study was to describe and compare physical profiles and certain psychological aspects of sitting volleyball players in a national team and in a league team. Twenty-seven Brazilian sitting volleyball players (15 from the national team, 12 from the league team) took part in this study. They completed demographics, FANTASTIC, anthropometrics, handgrip, seated chest pass, modified agility T, modified speed and agility, and speed and endurance tests. Data were processed by $\chi 2$-test, Mann-Whitney U test, Pearson correlation, and a stepwise multiple linear regression analysis. The national team players had significantly more training time and better lifestyle ($p<.01$) than the league players. Significant regression equation results for predicting players' level included weekly training volume and hip circumference ($R2=.68$). In conclusion, national team and league players differed in just psychological aspects and magnitude of training time, which show the importance of psychological characteristics in elite sitting volleyball.

Key words: *performance tests, anthropometric, lifestyle, sitting volleyball*

Introduction

Starting point of sitting volleyball (SV) was in the Netherlands in 1956 and it was approved as an official Paralympic game in 1980. In Brazil, SV is a new sport and it was launched at the end of 2002 through a tournament organized by Ronaldo Gonçalves de Oliveira in the city of Mogi das Cruzes. Nowadays, male and female Brazilian SV teams are in the World ParaVolley Ranking on the second and third place, respectively (WorldParaVolley, 2018). Due to its simplicity, SV is a real example of adaptation and implementation of major team sports to participants with disabilities. Also, SV is well known as a rapid and unpredictable team sports that men and women can play together except at high level competitions (Vute, 2008). Accessibility, approachability and adaptability of the SV court (i.e. lower net, smaller size) allows individuals without or with physical disability to play together since they are all sitting on the floor; once they have entered the court, they are all in the same situation, regardless to age, gender or (dis)ability (De Haan, 1986).

One of the features of SV is that players "must", in the course of a game, sit on the ground or they "must" be with their gluteal body part in touch with the ground (Mahmutović, Delalić, Uslu, Ibrahimović, & Tabaković, 2015). Anthropometric characteristics of players have an important role in SV performance. Previous research have determined with a considerable certainty which athlete's anthropometric characteristics influence their levels of performance, at the same time helping to determine a suitable physique for a certain sport (Carter & Heath, 1990; Rienzi, Reilly, & Malkin, 1999). Also, player's anthropometric and physical characteristics may represent significant prerequisites for being successful in any sport (Gualdi-Russo & Zaccagni, 2001). Anthropometric characteristics of SV players and their physical fitness affect game performance and they could be helpful for coaches to make a strong team in terms of game effectiveness. As well as in non-disabled sports, especially in team ball sports, in disabled sports there is a necessity for searching relationships among numerous factors that influence sport results (Marszalek, et al., 2015).

Sitting volleyball is a high-level competitive game and requires players to move on the floor using hands as well as their fast reactions for getting into position early enough to play effectively (Yüksel & Sevindi, 2018). SV players are disabled in their lower bodies, therefore it is very important for them to have upper body physical fitness and core muscle strength, power, agility, stamina and other physical fitness factors (Jeoung, 2017; Lee & Kim, 2010; Vute, 1999). Similar to the Olympic Games, coaches and experts are continually seeking for ideal training methods for this Paralympic sport (Croft, Dybrus, Lenton, & Goosey-Tolfrey, 2010). They must be able to identify essential performance factors of elite sport in order to best recruit and train prospective athletes. One method of identifying important factors is examining differences in scores on performance tests (e.g., fitness, skills) among athletes (Barfield & Malone, 2012). For experts and coaches, it is important to use easy tests, which represent the anaerobic performance or physical fitness level and could simultaneously be applied on the court. Currently available physical fitness tests (fitness or non-laboratory field tests) could be used to assess SV players' fitness levels, but there have been few studies on the issue which on-court fitness characteristics affect SV skills and performance.

Participation in sports activities brings merits to the physical, psychological, and social health of disabled individuals (Rimmer, Ming, McCubbin, Drum, & Peterson, 2010; Tasiemski, Bergstrom, Savic, & Gardner, 2000; Tomasone, Wesch, Ginis, & Noreau, 2013). The participation in sports activities can improve the quality of life (QOL) of an individual with disabilities, especially in the social domains (Mockeviciene & Savenkoviene, 2012). A review study about QOL and physical activity in people with a spinal cord injury described that participating in sport activities was the increasing important factor in QOL of this population (Tomasone, et al., 2013). Tasiemski et al. (2000) found that the physically disabled people with sports participation had better levels of satisfaction with life with decreased levels of anxiety and depression. In another study (which seems to be a single study directly dealing with QOL in SV players) Akasaka et al. (2003) found almost all of the SV players had problems in physical functioning and physical role facets. Also, participating in SV may improve QOL of players. For most of the elite SV players, participation in sports activities is a lifelong orientation and remains significant even after the retirement from the national team. The sporting lifestyle has its roots in early childhood, where parents, friends, teachers, and later coaches create and direct it. Today it is a synonym for a healthy and sensible way of living (Bagarić, Tudor, & Ružić, 2016; Vute, & Krpač, 2000).

The purpose of this study was to describe physical profiles and certain psychological aspects of the Brazilian SV players and also to determine differences between players who played at the SV national team level and SV league players. There are not many studies in this area (Marszalek, et al., 2015) and to our knowledge and according to available studies, the present study is the first research in SV which compare the national team players to the league players.

Method

Participants

Twenty-seven SV players, out of whom 18.5 % were in the Minimally Disabled (MD) class and 81.5 % in the Disabled (D) class of the SV classification. They were either the Brazilian SV National Team (BSNT) players or Brazilian SV League (BSL) players. BSNT players included seven men and eight women (age= 31.5 ± 7.4 years; body mass= 81.7 ± 19.5 kg; body height = 1.73 ± .24 m), and BSL players were eight men and four women (age= 32.6 ± 11.0 years; body mass= 74.7 ± 12.6 kg; body height= 1.76 ± .07 m). All players were familiarized with the tests' protocols and had undergone performance tests at least once prior to the study. Participants were informed of the possible risks and benefits of the investigation before signing an informed consent form. The study protocol followed the declaration of Helsinki and was approved by the ethics committee of the University of Campinas, Brazil [2.623.954].

Procedure

Participants were informed about the questionnaires and anthropometric and performance tests procedures. Two questionnaires, anthropometric measurements and five test trials were conducted as randomized balance trials among the 27 players in two groups (Brazilian National Team group = 15 players and Brazilian League group = 12 players) in two sessions. All tests were completed within three days (day one: physical performance tests, day two: anthropometric tests and day three: questionnaires). All performance tests' trials were conducted at the same indoor location under same air temperature (24-25.5 ºC). Players performed physical tests one by one and were instructed to exert maximal effort during which they were verbally encouraged. Players wore same sport clothes for all their test trials. They had warm-up which was followed by 5 minutes of self-stretching focusing on the upper limb muscles.

Demographic questionnaire

The researchers created a brief demographic questionnaire to provide information regarding

the participants' background and socio-economic status, which provided the following variables: gender, age, living structure, educational level, employment status, financial satisfaction, disability classification, and weekly training time in the last six months (Table 1).

Lifestyle questionnaire

The research tool used to examine lifestyle of SV players was the FANTASTIC checklist by Wilson and Ciliska (1984). The Fantastic survey covers a wide range of issues which have a subtle but strong influence on health. The lifestyle survey supplements the assessment of health-related physical fitness and permits a more comprehensive view of the individual (CSEF, 2003). Cronbach's alpha coefficient measured the correlation between items and it was .69 (for the Brazilian Portuguese version), which is considered reasonable for an instrument designed to evaluate a latent variable (Añez, Reis, & Petroski, 2008). The acronym FANTASTIC represents first letters of nine domains (in English) across which 25 closed-end questions are distributed: F= Family and Friends; A= Activity (physical activity); N= Nutrition; T= Tobacco and Toxics; A= Alcohol Intake; S= Sleep, Seatbelts, Stress, and Safe sex; T= Type of behavior (type A or type B behavior pattern); I= Insight; C= Career (work, satisfaction with profession). Responses to questions of the questionnaire are rated on a 5-point Likert scale; 23 of them have multiple-choice questions (five answers) and two are dichotomous. Questions are coded as follows: zero point for the first column, 1 point for the second, 2 points for the third, 3 points for the fourth, and 4 points for the fifth column. For questions with two columns, the score is zero for the first column and four points for the next column. The summary of all points yields a total score that classifies individuals in five categories as follows: "Excellent" (85 to 100 points), "Very good" (70 to 84 points), "Good" (55 to 69 points), "Regular" (35 to 54 points), and "Needing improvement" (0 to 34 points). The lower score, the greater requirement for change.

Anthropometric measurements

The anthropometric measures (body mass, body height and circumferences of the forearm, arm, thigh, waist, shoulder, chest, and hip) were collected at the SESI academy located in Suzano city, SP, Brazil. The body mass (kg) was determined using a digital scale, model Balmak® electronic Classe III with an accuracy of 0.01 kg. For height, a SANNY® (Personal Caprice Portable, Brazil) stadiometer with 0.1 cm precision was used. Body mass index (BMI) was calculated by the ratio of body mass to the square of the body height. All the circumferences were measured by a SANNY® anthropometric scale with a precision of 0.1 cm.

Performance tests

Maximal strength was measured with a handgrip test (HG). Firstly, the way of holding a dynamometer in a sitting position was explained and demonstrated by the examiners. The elbow was bent (90°) and in touch with the trunk. Then, the players were asked to grip the dynamometer with their dominant hand and generate maximal handgrip strength until the examiner gave a vocal stop signal. A standardized instruction "pressing the dynamometer handle as hard as possible for three seconds" was given to all players (Fess, 1988). Players performed HG test in two attempts with a 2-5-second rest between the attempts (Jeoung, 2017; Körei, et al., 2017).

The seated chest pass test (SCP) is a non-laboratory field test assessing power of the upper body of sitting volleyball players and is maybe the most suitable test for coaches to use (Jeoung, 2017; Marszalek, et al., 2015; Molik, et al., 2013). The athletes seated on the floor in an extended-legs position (feet 60 cm apart) while their back was in touch with the wall. The medicine ball (4 kg for men and 2 kg for women) was held with both hands in front of the chest with the forearms parallel to the ground (Kim, Jongeun, & Kwangsun, 2018; Salonia, Chu, Cheifetz, & Freidhoff, 2004). While their back part was touching the wall, participants threw the medicine ball straight forward as strongly and as far as they could. Players did SCP in two attempts and the best distance thrown was recorded (Harris, et al., 2011).

Agility was determined as change of direction by the modified agility T-test (MAT). Based on the protocol outlined by Sassi et al., (2009), players were seated behind the start line A and as soon as the start sign was given, moved forward to cone B and touched the base of the cone with their right hand. Then they shuffled to the left to cone C and touched its base with the left hand. After that, the players shuffled to the right to cone D and touched the base with the right hand. Then, they shuffled back to the left to cone B and touched the cone base. Finally, the players moved backward as fast as possible and returned to line A. Recorded scores for MAT test was the best time out of two trials (Figure 1-I).

Modified speed and agility test (SAT) was used to determine agility and speed factors of SV players with change of direction based on the protocol outlined by Marszalek et al. (2015), which included forward sprinting and left and right shuffling of players seated behind the start line at cone A. After a vocal start sign has been given, players moved forward to cone B and touched the cone base, next shuffled to the right to cone C and touched it and then again returned to cone A. Then players moved forward from cone A to cone D and around it to cone B to touch its base; after that they shuffled to

the right to cone E to touch it too. Finally, players moved forward as quick as possible and returned to cone A and passed the start/finish line. Recorded score for the SAT test is the best time out of two trials (Figure 1-II) (Jeoung, 2017; Marszalek, et al., 2015).

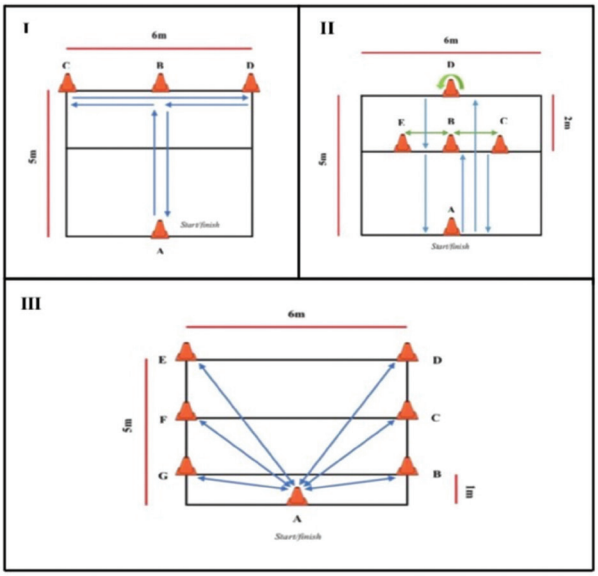

Figure 1. (I) MAT, (II) SAT, and (III) SET.

The speed and endurance test (SET) was used to assess endurance and speed abilities of players based on the protocol outlined by Marszalek et al. (2015). Players began from the seated position behind the starting line at cone A. After a start sign, each player shuffled, as fast as possible, forth and back from and to cone A to cones B, C, D, E, F, and G, respectively. Players had to touch base of all cones during the test. Recorded scores for the SET test is the best time out of two trials (Figure 1-III) (Jeoung, 2017; Marszalek, et al., 2015).

Statistical analysis

A cross-sectional comparative study design was adopted. Data were assessed for normality with the Shapiro-Wilk test (Heirani & Ahmadi, 2012; Shapiro & Wilk, 1965). The participants were divided into two groups: in the Brazilian SV National Team (BSNT) group there were 15 players and in the Brazilian SV League (BSL) group 12. Participants' sociodemographic and health-related characteristics were investigated using descriptive analyses. Variables were compared between the BSNT and BSL groups using χ^2-test for categorical variables and the *t*-test for continuous variables (age and weekly training time). Cohen's effect size was also used to compare characteristics of

Table 1. Characteristics of SV players (n = 27)

Variables		BSNT (n = 15)	BSL (n = 12)	P
		Mean ± SD or % (n)	Mean ± SD or % (n)	
Gender	Male	25.9 (7)	29.6 (8)	.29
	Female	29.6 (8)	14.8 (4)	
Age (years)		31.53 ± 7.43	32.58 ± 11.03	.82
Living structure				.63
	Alone	7.4 (2)	7.4 (2)	
	With parents	14.8 (4)	18.5 (5)	
	With partner	3.7 (1)	3.7 (1)	
	With partner and child(ren)	25.9 (7)	11.1 (3)	
	With child(ren)	3.7 (1)	3.7 (1)	
Educational level				.33
	High school	18.5 (5)	25.9 (7)	
	University	37 (10)	18.5 (5)	
Employment status				.056
	None/retired	0 (0)	14.8 (4)	
	Formal job	33.3 (9)	22.2 (6)	
	Informal job	22.2 (6)	7.4 (2)	
Financial satisfaction				.23
	Satisfied	25.9 (7)	7.4 (2)	
	Normal	25.9 (7)	29.6 (8)	
	Unsatisfied	3.7 (1)	7.4 (2)	
Classification				.82
	D	44.4 (12)	37 (10)	
	MD	11.1 (3)	7.4 (2)	
Weekly training (min)		508.67 ± 119.93	335.83 ± 92.97	.001*

Note. D – disabled; MD – minimally disabled. * p<.001.

participants. The Cohen's d estimates of 0.2, 0.5, and 0.8 for continuous variables indicated small, medium and large differences, respectively (Cohen, 2013). Anthropometric variables, physical performance tests' variables and lifestyle were compared between the two groups using the U Mann–Whitney test. The Pearson product moment correlation coefficient was used to determine the relationship among achievements in performance tests, anthropometric characteristics, psychology aspects and playing level. A stepwise multiple linear regression analysis was performed to determine which of the physical performance, anthropometric characteristics, and psychology variables could predict selection into the two groups. All statistical analysis was carried out with IBM SPSS Statistics 23.0. The alpha value was set at $p \leq .05$.

Results

A total of 27 SV elite players were recruited for the sample of participants that included 15 BSNT and 12 BSL players. The "Weekly training" time variable was in BSNT players (508.67±119.93 min) significantly greater ($p<.001$) than training time in BSL players (335.83±92.97 min). "Employment status" or career was also different but did not reach significance level ($p=.56$). Almost all the rest of variables were similar in both groups (Table 1).

The BSNT players scored higher in FANTASTIC lifestyle ($p=.01$), specifically in Family ($p=.001$), Activity ($p=.01$) and Career ($p=.01$) domains. There were no significant differences in anthropometric or physical performance test variables between the two groups (Tables 2 and 3).

Table 2. Differences in anthropometric and physical performance between the BSNT and BSL players

Variables		BSNT (n = 15)	BSL (n = 12)	Z	P	d
		M ± SD	M ± SD			
Anthropometrics	Body mass (kg)	81.71 ± 19.54	74.71 ± 12.63	-1.12	.26	.42
	Body height (m)	1.73 ± .24	1.76 ± .07	-.07	.94	.16
	BMI (kg/m2)	25.44 ± 3.87	23.94 ± 4.14	-.87	.38	.37
	Forearm (cm)	29.16 ± 3.35	27.84 ± 2.78	-1.07	.28	.42
	Arm (cm)	34.21 ± 4.91	31.71 ± 3.44	-1.31	.18	.58
	Thigh (cm)	61.84 ± 8.11	58.67 ± 6.45	-.95	.34	.43
	Waist (cm)	94.59 ± 12.33	89.62 ± 9.72	-1.22	.22	.44
	Shoulder (cm)	121.04 ± 13.31	117.20 ± 7.22	-.81	.42	.35
	Chest (cm)	103.04 ± 10.63	99.56 ± 6.34	-1.12	.26	.39
	Hip (cm)	105.22 ± 10.69	99.37 ± 7.09	-1.41	.15	.64
Physical performance	MAT (s)	11.63 ± 1.93	12.41 ± 2.34	-.97	.32	.36
	SAT (s)	11.21 ± 1.74	11.74 ± 1.77	-.83	.41	.3
	SET (s)	27.9 ± 4.39	28.61 ± 4.54	-.73	.46	.15
	HG (kgf)	46.67 ± 14.75	46.83 ± 9.28	-.12	.91	.01
	SCP (m)	4.91 ± .81	4.73 ± .58	-.51	.61	.25

Note. BMI – body mass index; MAT – modified agility T-test; SAT – speed agility test; SET – speed endurance test; HG – handgrip; SCP – seated chest pass. p<.05; p<.001

Table 3. Comparison of Lifestyle between the BSNT and BSL players

Variables		Domains	BSNT (n = 15)	BSL (n = 12)	Z	P	d
			M ± SD	M ± SD			
Lifestyle	FANTASTIC		81.8 ± 8.39	67.58 ± 14.87	-2.54	.01*	1.17
		Family	7.73 ± .59	5.17 ± 2.21	-3.26	.001**	1.58
		Activity	6.27 ± 1.1	4.92 ± 1.73	-2.49	.01*	.93
		Nutrition	7.67 ± 2.79	5.92 ± 1.16	-1.82	.06	.81
		Tobacco	13.73 ± 1.75	11.92 ± 3.37	-1.19	.23	.67
		Alcohol	10.33 ± 1.91	9.25 ± 2.49	-1.09	.27	.48
		Sleep	17.27 ± 2.21	15 ± 3.88	-1.43	.15	.71
		Type of personality	5.27 ± 1.83	4.50 ± 1.44	-1.31	.18	.46
		Insight	9.8 ± 1.65	8 ± 2.45	-1.94	.052	.86
		Career	3.73 ± .59	2.92 ± .9	-2.52	.01*	1.06

Note. * p<.05; ** p<.001

Table 4. Relationship between performance tests, anthropometric characteristics, psychological aspects and playing level in SV players

Variables		Playing level
Anthropometrics	Height	-.08
	Weight	.21
	BMI	.19
	Forearm	.21
	Arm	.28
	Thigh	.21
	Waist	.22
	Shoulder	.17
	Chest	.19
	Hip	.31
Physical performance	MAT	-.18
	SAT	-.15
	SET	-.08
	CPS	.12
	HG	.007
Lifestyle	FANTASTIC	.53*
Weekly training time		.63*

Note. BMI: body mass index; MAT: modified agility T-test; SAT: speed agility test; SET: speed endurance test; HG: handgrip; SCP: seated chest pass. * p<.001

Discussion and conclusions

The present study is the first to investigate the physical profile and psychology aspects (Lifestyle) of BSNT and BSL players. The results of this study demonstrate that no substantial differences were found in the anthropometric measures and performance tests variables between the two groups, but the variable Lifestyle was significantly different between them. Previous studies have reported a strong relationship between physical fitness, anthropometrics and the playing level attained, with the level of fitness and anthropometrics of volleyball players typically increasing as the playing level is increased (Gabbett, & Georgieff, 2007; Smith, Roberts & Watson, 1992; Thissen-Milder, & Mayhew, 1991). Unlike our results, some studies showed that the international elite players presented generally better physical performance compared to the league players. This indicates that international games are more intense than domestic games (Andersson, Randers, Heiner-Møller, Krustrup & Mohr, 2010; Mohr, Krustrup, Andersson, Kirkendal, & Bangsbo, 2008). On the other hand, Ross, Gill, and Cronin (2015) observed that there were no differences between the international and provincial rugby players in power output and strength.

Table 5. Multiple linear regression analysis for associations of being BSNT player with measures of weekly training time and hip circumference

Variable	Model 1			Model 2		
	B	SE *B*	*β*	*B*	SE *B*	*β*
Weekly training time	-.002	.001	-.634**	-.002	.000	-.551**
Hip circumference				-.015	.006	-.286*
R^2			.402			.680
Adjusted R^2			.378			.639
F			16.79			16.32

Note. * p<.05. ** p<.01.

The correlations between performance tests' scores, anthropometric characteristics, psychological aspects, and playing level are shown in Table 4. Training time and lifestyle (FANTASTIC) were positively associated (p<.001) with playing level in players.

Table 5 shows the stepwise linear regression analysis that was performed to determine which of the physical performance, anthropometric and psychological variables could predict selection in the two playing levels. A significant regression equation was found [model 1] (F (1,25)= 16.79, p<.000), with an R^2 of .402; [model 2] (F (3,23)= 16.32, p<.000), with an R^2 of .680. Players predicted being the BSNT players is equal to 5.04 - .002 (weekly training) - .015 (hip circumference), where weekly training time was measured in minutes and hip circumference was measured in centimeters.

Training time variable was in the BSNT players significantly greater than in the BSL players. Whereas employment status or career was insignificantly different, the BSNT players scored higher in FANTASTIC lifestyle, specifically in the Family, Activity and Career domains. Interestingly, two groups of players did not differ in anthropometric or physical performance tests variables. The present study found a significant relationship between playing level (national team and league) and training time and lifestyle (FANTASTIC) with both variables being positively associated with a higher level of play. These findings indicate the contributing factors to success and discriminate between playing levels among the Brazilian SV players. Alternatively, the finding of a significant

relationship between lifestyle with playing level may indicate that the psychological aspects among elite SV players is more important than their physical performance.

Training time and hip circumference were the variables that contributed significantly to the multiple linear regression equation of predicting playing level. These findings indicate that odds of being a BSNT player increase by more training time and more hip circumference centimeters. It is interesting that the hip circumference of SV players will affect their playing level. According to clinical examinations and in some studies, muscle strength has often been assessed by measuring circumference and there is correlation between circumference and strength in limbs (Damholt & Termans, 1978). From a study by Nadollek, Brauer, and Isles (2002), it became clearl that strong hip muscles were correlated with increased weight-bearing, faster velocity, and balance on the amputated limb.

Edwards, Ngcobo, Edwards, and Palavar (2005) found in their study by comparisons between elite and amateur players revealed that the elites had higher scores on the mental health than the amateurs. According to the study by Eilat, Hazor, and Carmeli (2015), the reason for different mental health of BSNT and BSL players was maybe their training time factor. They found that when professional factors among wheelchair basketball players from several national teams were compared, the most significant factor appeared to be the number of hours spent training each week. Furthermore, they mentioned that psychological aspects and team achievement are influenced by hours of practice, which were related to physical ability requirements for athletic performance (Eilat, et al., 2015).

While the results of the current study clearly demonstrate differences in FANTASTIC and weekly training time of the Brazilian SV players between playing levels, these findings provide no information on their responsiveness to training. The ability to perform sport skills successfully is constrained by physiological limitations (Starkes & Ericsson, 2003) and the level of motor fitness of SV players (Jadczak, Kosmol, Wieczorek, & Śliwowski, 2010) but no information was collected on the skill levels of the SV players and their ability to play the game. Obviously, the development of a standardized skill testing battery for SV players is warranted. A standardized skill assessment, which would test the core sport skills of SV (i.e., serving, receiving, spiking, setting, blocking, and passing), thus allowing the identification of specific strengths and weaknesses, thus also enabling the individualization of coaching programs, would be a helpful tool to supplement the physical performance tests commonly used to monitor the development of these players.

In conclusion, the current study investigated physical performance, anthropometric and psychological (lifestyle) characteristics of the Brazilian SV players competing at the international and national levels. The results of this study demonstrated signifi. cant differences in the training time and psychological aspects but no significant differences in physical performance and anthropometric characteristics of Brazilian SV players who competed at different playing levels. These findings provide normative data and performance standards for the Brazilian SV players who compete at the international and national levels.

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