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Profile of Anthropometric and Physical Ability Differences Between Men's and Women's Volleyball Players 11-16 Years

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ABSTRACT: The purpose of this study was to form a profile of men's volleyball players which includes anthropometric characteristics, and Physical Fitness. This research method is descriptive quantitative. The subjects of this study we tested one hundred and twenty-seven men's volleyball players, who are members of the volleyball team as far as UNY, Indonesia. Men's volleyball athletes (11 to 16 years old) undergo body composition evaluation, flexibility test, vertical jump height test, speed test, arm power test, agility test, and endurance test. Average result of height 163.8 ± 11.8 cm, weight 55.6 ± 14.3 kg, sitting height 83.9 ± 6.4 cm, arm span 167.5 ± 13.5 cm, flexibility 35.5 ± 6.2 cm, limb power 51.1 ± 11.2 cm, speed 6.6 ± 0.8 sec, agility 20.9 ± 1.95 sec, arm power 6.2 ± 1.6 m, endurance 30.7 ± 6.4. The conclusion of the study may represent a step in shaping the profile of a 11-16 year old men's volleyball player in terms of anthropometric characteristics, body composition and physical performance parameters. Anthropometric measurements and biomotor test results of volleyball athletes aged 11-16 years are very important because they provide data that can be used in the selection of players for sports, Scientists, and coaches.

Keywords: Volleyball, Anthropometric, Physical Ability

I. INTRODUCTION

Volleyball is a team sport that requires stamina, coordination, strength, mobility, and flexibility (Charlton et al., 2017). Volleyball players are required to perform high physical and technical activities as well as motor jumping movements (blocking and spiking), explosive movements, sprints, and high-intensity movements that occur repeatedly during the game (Barajas-Pineda et al., 2021; Milić et al., 2017; Mtsweni et al., 2017). Players who have a composition of physical conditions including power, speed, coordination, and endurance can improve competing techniques such as spikes and serves because they are strong predictors in the results of volleyball matches (Challoumas & Artemiou, 2018; Hnatchuk et al., 2018). In volleyball today, the use of jumps and speed is an important aspect due to the greater demands on physical strength and 80% points of the speed of technical movement of attack and block, the goal is to maximize the chances of victory in the match such as quickly setting the position and maximizing the techniques used when attacking or defending (Alminni et al., 2019).

In decades many special training methods were developed for the improvement of effective techniques. (Krakan et al., 2020) With the combined training method of sprints and springboards found significant results on jump performance. During the training period will effectively increase muscle activity and increase muscle ratio, this effect is not only significant on jumps, but on the coordination of athletes due to stimulation of the muscles of the lower limbs (Alp & Mansuroglu, 2021). While Endurance is the determinant of an athlete's performance because of the repetitive activity and pressure that occurs (Bridel & Denison, 2016). Vo2Max volleyball athletes are trained based on typical endurance according to the game (spiking, jumping, power hit, blocking setting), so that aerobic capacity can be optimal (Lleshi, 2021). Elements of biomotor complexity and variety of physical training are required in volleyball, according to the characteristics of the game running at a fast tempo.

To deal with the high demands of the game, the players must be well prepared, not only technically and tactically but also physically. Why is the need for physical exercise so important? because a good physique helps athletes to achieve top-level performance, because the physical, technical, moral and intellectual athletes are inseparable from the participation of physical exercise (Sabillah et al., 2022; Singh & Kachhawa, 2020). Moreover (Sabillah et al., 2022) In achievement sports, the physical condition of athletes greatly affects the performance, function and organization of the body. The performance of volleyball players can be influenced by several factors, such as anthropometric characteristics, physical fitness, reaction time and muscle strength for both male and female players (Malikov et al., 2020). To improve on these factors, coaches need information

regarding the physical and functional abilities of athletes to set appropriate training goals. It is designed to bring players closer to the existing international standards for the game of professional volleyball. The anthropometric characteristics of athletes become one of the important factors that affect the level of performance (Toselli & Campa, 2018).

In the game of volleyball, anthropometric characteristics and technical ability determine 83% of the player's jumping range, and physical capacity determines 17%, the anthropometric characteristics of the player are an important aspect of peak performance due to the obstacles that players must overcome: a net of 2.43 m for men and 2.24 m for women, this means that there is a difference between the male and female sexes in particular (Masanovic, 2018). Dominant anthropometric characteristics are genetically determined compared to the progress of the training period (Albaladejo-Saura et al., 2022). The need for knowledge of anthropometric distinctions between gender and age is interesting to know more deeply. To determine the stage of early development to the elite level of the athlete, it is necessary to have an awareness of growth, maturation, as an act of training (DiCesare et al., 2019; Malisoux et al., 2013). In other studies it was said, anthropometric and physical data as determinants of the role of athletes to be starters vs non-starters.or selection and qualification (Milić et al., 2017).

Interest in the anthropometric characteristics, body composition, and somatotypes of various competitive sports has increased over the past few decades. Many literature reviews conclude that anthropometry correlates with the skill abilities and performance of volleyball players. Collection of anthropometric data of athletes (body mass, standing, and sitting height) is important throughout the specialization period to improve data accuracy and development of performance potential (Moeskops et al., 2022). It has been well explained that there are certain physical characteristics in many sports, such as anthropometric profiles, that indicate whether players would be suitable to compete at the highest level in a particular sport.1–8 Quantification of the morphological characteristics of elite athletes can be a key point in linking body structure to sports performance. This is justified by the clear distinction that distinguishes the male and female phenotypes in strength, acceleration and speed due to the greater muscle mass of men (Toselli & Campa, 2018), height , etc. However, There is currently little data on the physical characteristics as well as anthropometry of young people 41–4.

Anthropometric measurements include height, weight, fat percentage, thickness measurements and various indices, e.g. body mass index (BMI), brachial and crural indices, and others (Lloyd & Oliver, 2019). In volleyball, there have been many studies that address this issue (Mala et al., 2015) Especially female athletes of volleyball, while scientific data on male players is still scant. In female athletes, the acceleration of puberty is 10 years of age and adult height is reached 14-15 years. As the findings in the study conducted by (Tsoukos et al., 2019) height, range height, jump height and vertical achievement there are differences between selected junior women's volleyball athletes and non-qualified for the national team there are significant differences with high predictive accuracy (78,1%). Meanwhile, for men's volleyball anthropometry is more specific to a standing height that is more than lean muscle mass, a low sitting height, longer hands, thinner hips and ankles, thicker shins (Lan et al., 2017).

Therefore that anthropometry and proper body composition are essential to the successful performance of volleyball. Why this research is important, based on the research conducted, and the importance of anthropometric and physical fitness measurement tests, it was found that in Yogyakarta there have been no anthropometric and physical fitness measurement tests carried out. Yogyakarta is characterized by a lack of strong scientific research. The level of anthropometry and basic physical freshness of men's volleyball athletes aged 11-16 years in Yogyakarta is still unknown. If there is no more research related to anthropometric tests and physical fitness of athletes, there is no hope of achieving high achievements. This research will help researchers to find out the current status of men's volleyball athletes aged 11-16 years in Yogyakarta. The results of this study will help physical education, and the coach coach to find out the advantages and disadvantages of his athletes.

The player's participation in the change of spikes and blocks in relation to the role of the player, since the player has different actions and responsibilities with respect to his position (Table 1). For example, middle blockers are the players who execute the most blocks, so, in theory, they must have sufficient anthropometric and/or physical characteristics to fulfill this role. On the other hand, setters and liberos don't need to be tall or strong (Charlton et al., 2017), But they need more experience to read the game correctly and for decision-making and more agility.

Vertical jump (VJ) performance is an essential element for successful volleyball practice. The objectives of this study were (a) to explore the anthropometry and performance of the overall physical condition of volleyball players of both sexes, (b) to explore differences in anthropometry and biomotor performance between sex and age group, and (c) to evaluate sex. We assessed the VJ capacity on 253 volleyball players (113 boys and 140 girls).

II. MATERIAL AND METHODS

This research method is descriptive quantitative. We tested one hundred and twenty-seven men's volleyball players, and one hundred and one women's volleyball players who were members of the Selabora UNY volleyball team. The athletes (11 to 16 years old), .the players have at least participated for two years of training experience and participated at least twice in the national or regional level volleyball Championships. The inclusion criteria considered, for young volleyball players, are two years of training experience and an average of 4 months of training sessions; While the exclusion criterion is that there is no history of injury in the past year (i.e. muscles, tendons, bones). The players undergo anthropometric evaluation and physical fitness measurements. Data collection, players are advised to use sportswear or volleyball clothing (volleyball shoes and game clothes). All measurements and tests of volleyball players belonging to the experimental group were carried out in Yogyakarta (Indonesia).

1.Data Retrieval Technique Procedures

The sequence of data retrieval procedures is: Anthropometric evaluation, flexibility test, limb power test, speed test, coordination test, agility test, power test, and endurance test. The four player anthropometric variables measured include height, weight, sitting height, and arm span. Height and Weight: Height and height sitting measurements with a centimeter score, weight measurements are carried out with digital scales with a sensitivity level of 0.01 kg (Casadei & Kiel, 2019).

Seven variables of the player's physical ability are carried out using the following measuring instruments: Sit and reach tests are used for the assessment of flexibility, especially lower back and hamstring muscle flexibility (De Nardi et al., 2015). Vertical jump test to measure limb power, 40m running test to measure speed, tennis ball throw test to measure coordination (Yu & Smith, 2017), The T-test measures the player's speed ability to run forward and backward and accurately change direction laterally. Four cones were set in the starting position, after 10 yards (9.14 m) of distance and after 5 yards (4.57 m) to the right and left, each forming a 90° angle, a basketball throw test to measure arm power, and a multistage test to measure endurance.

2.Data Analysis Techniques

Data analysis in this study using the SPSS 25.0 program, Anthropometric data is presented as minimum, maximum, average, and standard deviation values are calculated for all variables. Shapiro Wilks and Kolmogorov-Smirnov were used to assess the normality of the data. No violation of the normality distribution ($p>0.05$) was found. After that test the differences in anthropometry and physical abilities of men's and women's volleyball players using an independent t-test.

III. RESULTS AND DISCUSSION

Result

Anthropometric characteristics and physical abilities of men's and women's volleyball players are presented in Table1. Statistically significant differences were found between SP and NSP male players in stature (p=.042), arm span (p=.031), ball speed (p=.001), standing long jump (p=.016), 30- m sprint (p=.034) and in VO2max estimates(p=.018), and between SP and NSP female players in ball speed (p=.009) and standing long jump (p=.045) (Table2). No significant differences were found in weight, armspan/height ratio, hand length and span, and flexibility of sitting and reaching. Considering the different playing positions, significant differences were found between SP and NSP men's backs in height (p=.008), hand spread (p=.042), arm span (p=.019) and ball speed (p=.005). For the female sample on the other hand in stature (p=.041) and arm span (p=.046) (Table 3). For the wings, significant differences were found in ball speed (p=.007), 30 m sprint (p=.039) and VO2max estimates(p=.002) between SP and NSP male players and in VO2maks(p=.019) estimates between SP and NSP female players (Table4). For pivots, significant differences are found only in spherical velocity (p=.001) between SP and NSP females (Table 5). Finally, no significant differences were found statistically between SP and NSP male and female goalkeepers (Table6).

Table 1. Anthropometric results of U11-16 men's and women's volleyball athletes

Variable	MEN (n=127)			WOMEN (n=101)			p
	Min	Max	Mean & S.D	Min	Max	Mean & S.D	
Height (cm)	129.7	192.5	163.8 ± 11.8	123	170.8	152.13±9.1	0.000
Body Mass (kg)	25.2	103.5	55.6 ± 14.3	21.2	82	46.6±12.01	0.000
Sitting Height	67.5	99	83.9 ± 6.4	67	87.5	78.6±4.8	0.000
Arm Span (cm)	126	189	167.5 ± 13.5	124	177	156.66±10.7	0.000
Flexibility	13	47.5	35.5 ± 6.2	21.5	45	33.8±4.8	0.28

Leg Power	22	71	51.1 ± 11.2	22	54	36.5±6.2	0.000
Speed (sec)	9.8	5.2	6.6 ± 0.8	5.91	10.77	7.5±0.7	0.000
Coordination	0	20	9.6 ± 4.7	0	14	4.72±3.71	0.000
Agility (sec)	30.9	17.04	20.9 ± 1.95	19.72	30.32	22.8±1.8	0.000
Arm Power (m)	2.2	9.6	6.2 ± 1.6	1.3	6.4	4.27±0.9	0.000
Vo2max	12.2	47.1	30.7 ± 6.4	19.1	35.1	26.01±3.43	0.000

Table 2. Results of the analysis of anthropometric differences and physical abilities of U11-13 and U14-16 men's and women's volleyball players

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Height (cm)	Equal variances assumed	4.384	.037	8.160	226	.000	11.63169	1.42549	8.82275	14.44063
	Equal variances not assumed			8.397	225.851	.000	11.63169	1.38515	8.90222	14.36117
Body Mass (kg)	Equal variances assumed	1.633	.203	4.878	226	.000	8.68817	1.78095	5.17879	12.19756
	Equal variances not assumed			4.977	225.354	.000	8.68817	1.74567	5.24824	12.12811
Sitting Height	Equal variances assumed	6.796	.010	6.878	226	.000	5.30686	.77155	3.78650	6.82722
	Equal variances not assumed			7.094	225.533	.000	5.30686	.74811	3.83268	6.78104
Arm Span (cm)	Equal variances assumed	5.206	.023	6.550	226	.000	10.75863	1.64256	7.52194	13.99533
	Equal variances not assumed			6.723	226.000	.000	10.75863	1.60032	7.60518	13.91209
Flexibility	Equal variances assumed	8.151	.005	2.210	226	.028	1.65156	.74744	.17872	3.12441
	Equal variances not assumed			2.276	225.764	.024	1.65156	.72577	.22142	3.08170
Leg Power	Equal variances assumed	9.100	.003	7.827	226	.000	16.31777	2.08491	12.20941	20.42612

	Equal variances not assumed			8.608	154.700	.000	16.31777	1.89562	12.57313	20.06240
Speed (sec)	Equal variances assumed	1.749	.187	-8.938	226	.000	-.89463	.10009	-1.09186	-.69740
	Equal variances not assumed			-9.046	222.520	.000	-.89463	.09889	-1.08952	-.69974
Coordination	Equal variances assumed	4.213	.041	8.591	226	.000	4.90715	.57117	3.78166	6.03264
	Equal variances not assumed			8.818	226.000	.000	4.90715	.55649	3.81057	6.00373
Agility (sec)	Equal variances assumed	.044	.834	-7.486	226	.000	-1.89945	.25373	-2.39943	-1.39947
	Equal variances not assumed			-7.541	219.853	.000	-1.89945	.25190	-2.39589	-1.40301
Arm Power (m)	Equal variances assumed	31.730	.000	0.614	226	.000	1.90122	.17913	1.54824	2.25420
	Equal variances not assumed			11.229	208.764	.000	1.90122	.16931	1.56745	2.23499
Vo2max	Equal variances assumed	32.535	.000	6.685	226	.000	4.72924	.70740	3.33530	6.12318
	Equal variances not assumed			7.124	200.497	.000	4.72924	.66388	3.42016	6.03833

DISCUSSION

This study was conducted to determine the anthropometric and fitness profile of male volleyball players 11-16 years old. The initial value data obtained in the study is included in the literature, this aims to serve as a reference for coaches for sports guidelines and scientists to be the reference for subsequent research. In the context of previous studies, no research has been found regarding the anthropometric and biomotor determination of male volleyball players 11-16 years old. Therefore, the findings of this study will be useful and can be assessed for volleyball and other sports. In the context of research, some anthropometric tests and measurements are determined by height, weight, sitting height, and upper body length. While physical fitness is determined by the ability to test flexibility, limb power, speed, coordination, agility, power, and endurance.

In a study conducted to determine the anthropometric profile of men's volleyball players, the average height of junior Serbian volleyball players was 194.28 (Masanovic et al., 2019), In our study the average height of athletes was 163.8 ± 11.8. Body mass research already done for Australian junior volleyball athletes is 71.1 (Gabbett & Georgieff, 2007) . In this study, the body mass of athletes averaged 55.6 ± 14.3. Arm Span that has been done averages 187.99 (Manjunantha & Longitude, 2016). In this study, the average arm span was 167.5 ± 13.5and the average Sitting Height was 83.9 ± 6.4. It can be observed that the height and arm span values have lower differences in values in this study. In research (Manjunatha & Bujurke, 2020) states that arm span has little effect on playing performance. (Pocek et al., 2021) states that players who have a lower height can compensate for their shortcomings with the ability to jump above average for a particular targeted position. Generally speaking,

talented and non-talented junior volleyball players are based on the assessment of skill aspects, tactical understanding of the game (Belem et al., 2014), game intelligence (Smilios et al., 2017), Perception-cognitive skills (Alves et al., 2013) motor abilities, and anthropometric and physical characteristics (Marcelino et al., 2014). Nonetheless, height is considered the main criterion in the process of assessing young players (Carvalho et al., 2020). Upper extremities and height are very important, especially in attacking and blocking positions, and it is an important criterion in the selection of the players (Mahmutović et al., 2015; Marszalek et al., 2015).

The success of the performance of volleyball athletes in performing movements depends on anthropometric aspects as well as the supporting physical aspects, the hallmarks of the game of volleyball that combines sprints, jumps, and high intensity are in dire need of a good physical aspect. In this study, the average flexibility value result was 35.5 ± 6.2, the average leg power result using the vertical jump test got a result of 51.1 ± 11.2, the speed result got an average value of 6.6 ± 0.8, the agility result got an average value of 20.9 ± 1.95, the arm power result got an average value of 6.2 ± 1.6, endurance results got an average value of 30.7 ± 6.4.

Flexibility is needed by football players because in doing spikes and service movements performed by the joints of the body including the shoulders, elbows, wrists, hips, knees, ankles, and a number of large muscles (Manshouri et al., 2014). Research (Manshouri et al., 2014) states that specially designed Pilates training consisting of three training sessions per week plus one general weekly session of volleyball practice can increase flexibility. The sit-and-reach test is used by (Greco et al., 2019) which suggests that flexibility is enhanced after 5 weeks of pilates exercises.

In this case, the vertical jump ability is very important in volleyball regardless of the player's position, while the vertical jump value can distinguish the player not only in terms of the player's position and the level of playing performance ability (Pocek et al., 2021). In particular, volleyball performance has been shown to be associated with high jumps (Skazalski et al., 2018). Research results (Kozina et al., 2018) Men's volleyball players have an average vertical jump of 68 cm, this proves the vertical jump results of 11-16 year old volleyball players in this study are lower. The results of the study (gulati 2021) average vertical jump is 50.94, this result proves that the research conducted has a higher value. In connection with that, improving vertical jump capability in bolavoli can be trained with a pliometric exercise program (Silva et al., 2019). In addition, eight-week plyometric interventions in male and female volleyball players showed an increase in vertical jump (6%) after training (Behrens et al., 2014).

Agility and speed are important aspects of almost every defensive and offensive maneuver performed by a volleyball player (Silva et al., 2019), agility and speed training can improve their defensive and off-season abilities and performance in volleyball games (Wang et al., 2020). Research results (Chuang et al., 2022) states a 6-week suttle run exercise with a distance of 2m is the most effective exercise to improve agility. Some studies have shown that exercise agility and speed can provide performance gains for athletes in a sprint performance of 10 m, 20 m (Padrón-Cabo et al., 2020).

Arm power is an important aspect of volleyball because doing spikes or smashes, blocks, and serves requires a large muscle explosive power (Gulati et al., 2021). Research (Arte et al., 2019) states that a combined plyometric and throwing ball for eight weeks can significantly increase arm power. As reported (Mannan et al., 2015) The plyometric exercise program, which has been modified specifically for volleyball for 12 weeks with a frequency of three times a week, can increase arm power by 13.51%.

In addition, the endurance component is important in the game of volleyball because elite volleyball athletes experience significant physical and psychological demands during the competition season. Athletes participate in workouts and matches with a duration of 90+ minutes, and often use explosive movements (Mendes et al., 2018). Research (Aschendorf et al., 2019) stated 5 weeks of HIIT training with a duration of 2 hours, session A high-intensity intervals of 4 × 4 minutes with 3 minutes of recovery, performed seven times during the intervention period. Session B consists of two sets of 15 × 30-second high-intensity intervals with 15-second recovery between repetitions and 3-minute recovery between sets (Buchheit & Laursen, 2013), can increase aerobic endurance capacity.

Anthropometry and exercise performance in certain physiological tests, such as jumping ability, running speed, agility, upper body muscle strength, flexibility, and torso strength can contribute to the selection of talented athletes and the long-term program of athletes in achieving optimal results (Papadopoulou et al., 2019; Tsoukos et al., 2019). This information is important for coaches to design training programs for young footballers taking into account the individual needs of each player and a long-term training system that matches the appropriate training adaptation and individual abilities of the athlete's biological status

IV. CONCLUSION

The conclusions of this study may represent a step in shaping the profile of 11-16 year old men's volleyball players in terms of anthropometric characteristics, body composition and physical performance parameters. Furthermore, researchers hope these data will contribute to the professional selection of men's volleyball. Anthropometric measurements and biomotor test results of 11-16 year old volleyball athletes are very important because they provide data that can be used in the selection of players for sports, Scientists, and coaches.

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