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Relations of some corporeal properties with performances of volleyball players who participated in Japan world competitions

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ABSTRACT

The purpose of the present study was investigation of relations of some corporal properties with performances of world elite male volleyball players. Statistical sample of the study consisted of 164 players of participant national teams in world competitions (Japan 2011) with averages age of 26 years old, height of 196.71 cm, weight of 88.35 Kg and BMI of 22.84 (Kg/squared height). Corporal properties involved age, height, weight and BMI which received from official website of volleyball world federation. Performance properties included attack, block, serve, dig and libero and setter performances. Statistical analysis was performed in two parts of descriptive (average) and perceptive (Pierson (or Spearman) correlation test and independent one-way ANOVA test). Results of research showed a significant relation of height with attack performance, block and vertical jump (P<0.05). Though, there wasn't observed any significant relation among age and BMI with vertical jump (P>0.05). Serve, defense and libero performance didn't show any significant relation with none of individual characteristics, too (P>0.05). In contrast, setter performance significantly connected to age (P<0.05). The present founds could use in talents exploring process and selection of players. Nevertheless, one study couldn't be enough, and rather researches are required.

Keywords: Corporal Properties, Volleyball Players, Performance Properties, Body Mass Index (BMI), Talents Exploring

INTRODUCTION

Volleyball invented by William G. Morgan in 1895. This sport consists of aerobic and non-aerobic activities and needs muscular strength, power and agility, and also aerobic readiness and flexibility [1]. Volleyball is the fastest sport all around the world which requires high physical attempts during practice and match, in the shortest spans. So, concerning to characteristics of this sport, volleyball needs unique and different physical properties for its players, in comparison with other sports. Optimal and desirable execution of sport skill is a result of elaborate association of physiologic, anthropometric, psychological and bio-motive parameters with each other. Knowledge of anthropometric properties is a determining and effective factor on athletes' executions. Acquaintance with these properties has an important role in comparing athlete with himself/herself and others, and shortcomings detection, settlement and reformation. Substantial and correct designation of exercise schedules and talents exploring have

vital roles [2]. Several studies investigated relations anthropometric properties with various sports and think these properties affect on execution. So, anthropometric properties are utilized in selection of players [2, 3,4]. Identification of physical properties could play in athletes' successes of various sports. For example, importance of height condition in some teamwork sport, like volleyball and basketball, is accepted and obvious, and it has known body height has a positive influence on the whole duration of body execution and this issue consequently affects on athlete's performance [5]. In attention to the matter that having especial physical properties and physiologic capacities are the most important factors of winning in sport competitions, acquaintance with anthropometric aspects, like; height, weight and BMI, could open a new window for coaches about athletes' situations. Results of several researches about male and female volleyball players indicated agility, strength and vertical jump effect on volleyball execution. During a volleyball match with high intensity, players are jumping and descending, continually. These jumps could be with runabout (as attack jump) or without runabout (like block jump) [6]. About this issue, anthropometric indices have been called as very important parameters in volleyball, and are counted as noteworthy factors of determining suitable talents for volleyball playing [7]. There's an affirmative connection between volleyball skills and playing precedent (age), which means further experiences lead to raise execution success index. The indices of height, weight, muscular strength, agility and volleyball playing precedent are important to succeed in this sport, and in order to earn extreme success and better selection of players, attention to these parameters is necessary [8]. A research that was done on volleyball players of Brazil league one, indicated execution levels of Brazilian volleyball players weren't under influence of age. Results of that study showed experienced volleyball players hadn't superior performance than younger ones, necessarily, which means age hadn't any effect on execution of volleyball players [9]. Relations of some of corporal properties with vertical jump were investigated in a research, and was concluded height and age have positive influences on vertical jump but weight hasn't any effect on vertical jump. In the other hand, body fat percentage has a considerable contribute to vertical jump [7]. There're overly references, which indicate Body Mass Index (BMI) is a substantial scale in medical, sport and anthropometric studies. Healthy people with rather BMI need more reaction time than ones with minor BMI [10]. Many researchers found out anthropometric properties have noticeable effects on technical and tactical execution in volleyball, especially for attack and block [11]. Only weight and height were reported in some of researches and some others have described body composition indices, solely, and a few of these studies have described body structure variations, too. Therefore, researches which have identified these corporal relations are seldom, and negligible in volleyball, at least.

The purpose of the present study was determination of relations of some corporal properties with volleyball performance quality in male volleyball players, who participated in Japan 2011 world competitions.

MATERIALS AND METHODS

Subjects

Statistical sample of the present study involved 164 players of national teams, who participated in Japan 2011 volleyball world cup competitions and played in various posts. Research data was taken from Federation International Volleyball (FIVB) official website.

Corporal Properties Gathering Method

Players' common characteristics, including age, height and Body Mass Index (BMI), were gathered from volleyball world federation official website.

Performance Properties Collecting Method

Players' performance properties, involving attack, block, vertical jump, serve, dig, libero and setter performances were collected from volleyball international federation official website.

Statistical Method

At first, normality of data distribution was investigated by Kolmogorov-Smirnov test. When data distribution is abnormal logarithm of data will be used for statistical analysis, instead of data. Descriptive statistic was implemented to express and describe data in separation of each variable, and perceptive statistic was utilized to investigate founds of the study. Independent one-way variance analysis test was used to compare inter-group variations, and in order to find location of difference Toki post-hoc was utilized. Also, in order to investigate relations between variants, which were the most important aim of the present study, Pierson (or Spearman)

correlation coefficient was implemented. Level of significance considered as $P \leq 0.05$. All of statistical operations were done by SPSS v.15.

RESULTS

Subjects' Individual Properties

Individual properties of the subjects have briefed in table 1.

Variable	Number of Players	Aga (vaars ald)	Haight (am)	Weight (Kg)	DMI (K_{α}/m^2)
Country	Number of Flayers	Age (years old)	Height (Chi)	weight (Kg)	DMI (Kg/III)
Egypt	14	27.71	195.57	86.21	22.58
China	14	23.21	195.5	82.14	21.57
Japan	14	28.14	191.5	87.64	23.84
Iran	12	27	193.42	84.5	22.56
Serbia	14	24.71	200.07	88.5	22.11
Argentina	14	22.86	193.5	86.79	23.22
Unite States	14	29.57	200.07	95.14	23.78
Cuba	14	22.17	196	85.83	22.38
Italy	14	28.57	197.29	91.34	23.48
Brazil	14	30.36	198.29	88	22.34
Poland	14	26	197.5	86.07	22.1
Russia	14	27.71	201.21	97.07	24
Overall	164	26.55	196.71	88.35	22.84

The youngest average age concerns to players of Cuba (22.17 years old) whereas, Brazilian players have the oldest average age with 30.37 years old. Average age of Persian players is 27 years old. The highest players belong to Russia, with average height of 201.21 cm. Players of the Unite States and Serbia place in 2nd rank, with average height of 200.07 cm. Japanese players place in the last rank, with average height of 191.5 cm. Also, average height of players of Iran evaluated as 193.42 cm. Russian players with averages weight and BMI of 97.07 Kg and 24 Kg/m² (respectively) are in the first rank of this category in the other hand, the lowest averages of weight and BMI concern to Chinese players. Averages of weight and BMI respectively reported as 84.5 Kg and 22.56 Kg/m².

Subjects' Performance Properties

Performance properties of the subjects have briefed in table 2.

Table 2: Averages of performance properties of the subject (base on countries)

Variable Country	Attack	Block	Vertical Jump	Serve	Dig	Libero	Setter
Egypt	44.04	66.25	320.15	20	46.16	228	405.5
China	45.45	74.80	322.36	16	44.82	450	832
Japan	46.75	57.17	322.29	14	48.99	194.5	441
Iran	43.75	66.43	323.93	22	-	298	455.5
Serbia	44.97	67	323.93	20	52.14	380	497.5
Argentina	49.09	82.6	316.5	18	46.96	335	841
Unite States	47.87	63.86	326.29	25.8	45.92	286	421.5
Cuba	46.44	81.17	322.42	18.67	40.2	371	462
Italy	45.95	79.71	324.71	38.67	51.89	387	928
Brazil	48.01	68.14	318.43	19.5	53.44	424	443
Poland	46.45	87.17	322	17.25	53.93	429	491
Russia	48.06	70.38	330.5	25.5	-	195.5	398
Overall	46.55	71.92	323.48	21.58	48.46	312	506.29

Best performance of "attack" in the competitions, concern to "Russia" team (with 48.06 attacks per each game). Whereas, players of "Iran" have the lowest performance in attack (43.75 attacks per each game). Superior performance of "block" belongs to the "Polish" players (87.17 blocks per game). This number has reduced to the lowest extent for "Japan" team (57.17 blocks per game). Also, average of block performance of Iran team is 66.43 blocks per game. Players of "Cuba" allocated best performance of "vertical jump" to themselves (332.42 vertical jumps per game). In the other hand, the lowest performance of this index, concerns to players of "Argentina" (316.5 vertical jumps per game). Vertical jump performance of Iran team is 323.25 vertical jumps per game. Players of

"Italy" team have the best performance in "serve" (38.67 successful point serves per each game), and whereas serve performance of "Japanese" players is less than other teams (16 serves per game). Persian players with average "22 serves per game" have a superior serve performance than teams like "Serbia", "Argentina" and "Brazil". The "Polish" players have a better situation than other participant countries, in aspect of "dig" (53.93 digs per game). Dig performance of "Brazilian" players is in the 2nd rand of this category (53.44 digs per game). In the other hand, the lowest dig performance concerns to "Cuba" teams (40.2 digs per game). Best and worst "libero" performances belong to "China" and "Japan" teams with 450 (libero successful actions per each game) and 194.5 (libero acts per game), respectively. Average of libero performance for themselves (928 setter successful actions per each game). In contrast, lowest performance of this category belongs to "Russian" players (398 setter acts per game). Setter performance of Iran team has been evaluated as 455.5 (setter acts per game).

Correlation between Individual characteristics and Performance Properties Correlation matrices, between various individual and performance properties, have presented in tables 3 to 9.

Table 3: Correlation matrix between individual properties and attack (n=29)

Variables	1. Age	2. Height	3. Weight	4. BMI	5. Attack			
1. Age	1							
Height	-0.144*	1						
3. Weight	0.081	0.582**	1					
4. BMI	0.229**	0276**	0.619**	1				
5. Attack	-0.05	0.361*	0.146	-0.065	1			
* Significant at level of P≤0.05								
	** Significant at level of $P \leq 0.01$							

Table 4: Correlation matrix between individual properties and block (n=73)

Variables	1. Age	2. Height	3. Weight	4. BMI	5. Block			
1. Age	1							
2. Height	-0.144*	1						
3. Weight	0.081	0.582**	1					
4. BMI	0.229**	0276**	0.619**	1				
5. Block	-0.156	0.446*	0.143	-0.150	1			
* Significant at level of P≤0.05								
	** Significant at level of $P \leq 0.01$							

Table 5: Correlation matrix between individual properties and vertical jump (n=163)

Variables	1. Age	2. Height	3. Weight	4. BMI	5. Vertical Jump		
1. Age	1						
Height	-0.144*	1					
3. Weight	0.081	0.582**	1				
4. BMI	0.229**	0276**	0.619**	1			
5. Vertical Jump	-0.062	0.529**	0.203**	-0.297**	1		
* Significant at level of P≤0.05							
** Significant at level of P≤0.01							

Table 6: Correlation matrix between individual properties and serve (n=38)

Variables	1. Age	2. Height	3. Weight	4. BMI	5. Serve		
1. Age	1						
2. Height	-0.144*	1					
3. Weight	0.081	0.582**	1				
4. BMI	0.229**	0276**	0.619**	1			
5. Serve	0.011	0.006	0.250	0.257	1		
* Significant at level of P≤0.05							
** Significant at level of $P \leq 0.01$							

Variables	1. Age	Height	Weight	4. BMI	5. Dig			
1. Age	1							
2. Height	-0.144*	1						
3. Weight	0.081	0.582**	1					
4. BMI	0.229**	0276**	0.619**	1				
5. Dig	0.324	-0.064	0.109	0.149	1			
* Significant at level of P≤0.05								
	** Si	onificant at l	evel of P<0.0	1				

Table 7: Correlation matrix between individual properties and dig (n=18)

Table 8: Correlation matrix between individual properties and libero action (n=14)

Variables	1. Age	2. Height	3. Weight	4. BMI	5. Libero Act		
1. Age	1						
2. Height	-0.144*	1					
3. Weight	0.081	0.582**	1				
4. BMI	0.229**	0276**	0.619**	1			
5. Libero Act	0.022	-0.064	0.013	0.149	1		
* Significant at level of P≤0.05							
** Significant at level of P≤0.01							

Table 9: Correlation matrix between individual properties and setter action (n=21)

Variables	1. Age	2. Height	3. Weight	4. BMI	5. Libero Act		
1. Age	1						
2. Height	-0.144*	1					
3. Weight	0.081	0.582**	1				
4. BMI	0.229**	0276**	0.619**	1			
5. Libero Act	-0.381*	-0.240	0.107	-0.093	1		
* Significant at level of P≤0.05							
** Significant at level of P<0.01							

Relation of "attack" and individual properties of "height" is significant at the level of $0.05 \ (p^{=}0.05, r=0.361)$. Which means; attack status would improve with increment of players' heights. Whereas, there wasn't observed any significant relation among "age", "weight" and "BMI" with "attack".

Among individual properties, only "height" has an affirmative and significant (at level of 0.01) relation with "block" (p=0.01, r=0.446). That means; when players' "height" increase, their "block" performance would progress. Although, relations among "age", height" and "BMI" with "block" execution weren't significant.

There're positive and significant relations among "height" and "weight" with "vertical jump", at the level 0.01. Namely, "vertical jump" increases with increments of "height" and "weight". In contrast, relation between "BMI" and "vertical jump" is negative. Which means; players' "BMI" has a reductive role on amount of their "vertical jump". There wasn't observed any significant relation between "age" and "vertical jump". None of individual properties (age, height, weight and BMI), hasn't any significant relation (at the level of 0.05) with "serve" performance.

There wasn't any significant relation between individual properties (age, height, weight and BMI) with "dig" performance.

Also, no significant relation was observed between individual properties (age, height, weight and BMI) with "libero" performance.

Only "age" has a significant and negative relation with "setter" performance, among individual properties, at the level of 0.05 ($^{p=}0.05$, r=0.381). Namely, players' "setter" performance would reduce with increase in their "age". In the other hand, relations between "height", "weight" and "BMI" with "setter" performance weren't significant.

DISCUSSION AND CONCLUSION

The results of the present study indicated existence of a significant relation of attack with "age". Which means, whether a player is taller, he would have a better performance in attack. Whereas, there wasn't observed any significant connection of "age", "weight" and "BMI" with attack. The recent result is in contrariety to results of a research, which had reported affirmative relations between volleyball skills and age and stated success execution coefficient rises with age [7]. Next result of the present study showed there's a positive relation between "height" and block, namely when a player is taller, he would have a superior execution in block. While, there wasn't any significant connection among age, weight and BMI with block. This understanding is against found of a research, which presented block performance decreases with increment of BMI [12]. Another result of the present study indicated there're significant relations among "height" and "weight" with vertical jump. That means, vertical jump increases with increments of height and weight, whereas there isn't any significant difference between age and vertical jump, though there's a negative relation between BMI and vertical jump, namely vertical jump decreases with increment of BMI. Result of a research showed there isn't any significant difference in vertical jump, between youths and elders, which means age hasn't any effect on vertical jump [7]. These mentioned founds is in disagreement to understandings of the present study. In the other hand, in another research has been indicated presence of an affirmative relation between age and vertical jump, namely vertical jump increases with age [13]. Results of a research in this field showed whether BMI is rather, vertical jump would be weaker [14], which was in agreement with understandings of the present study. Results of the present study indicated serve hasn't any significant relation with none of individual properties (age, height, weight and BMI). In a research showed when a player is more experienced, he/she would have better serves [8]. Which, this result is in contrariety to founds of the present study. Results of another research showed there're affirmative significant relations between anthropometric properties (like; height, weight and trunk weight) and serve skill. That means, when a player is taller and has a larger BMI, his/her serve success percentage would be rather. Results of the present study indicated none of individual properties hasn't any significant connection with dig performance, namely dig performance isn't affected by age changes. Another result of the present study represented none of individual properties has any significant relation with performance of libero. It has been founded setter performance declined with player's age increase, which means whether age of player become rather; his setter performance would be weaker. In the other hand, there wasn't any significant relation among height, weight and BMI with setter performance.

In general, results of the present study about attack performance showed that "height" is an effective parameter on this parameter, namely when a player has a taller height he would be more successful in attack execution. So, to select an attacker for a team, a tall player should be chosen, preferably. "Height" has influence on blocker, which means whether a person is taller; he would be more successful in block execution. Hence, tall persons should be used in selection of blockers players. Also, it should be mentioned height, age, weight and BMI haven't any effect on performances of serve, dig and libero. Results of the present study indicated, in order to select player for each post, particular information could be represented to coaches. When a player person apply himself for membership in a volleyball team, at the first step, he/she could be guided to a proper post, by knowing his/her age and measuring his/her height, weight and BMI. In the other hand, results of the present study are indicators of importance of individual differences principle and essence of properties of exercise. In a manner that, training schedules could be prepared by an exacter programming, corresponding to players' properties and aim of team. However, an accurate conclusion couldn't be gained with only one study and rather researches should be carried out. Also, in order to represent a clear statement and an exact conclusion, rather variables measurements and more accurate control in further future studies are required. It's recommended, researchers should study relations of lengths of upper and lower limbs with players' performances. By collecting rather data like; ball speed at the moment of serve, ball speed at the moment of attack, metacarpus length, hand length, foot length of players and etc could obtain rather relations.

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