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Interplay Among Physical Characteristics Play Position and Shooting Accuracy of Elite-Female Basketballers

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Abstract

This study was conducted to examine effect of specialty and training frequency on physical fitness profile of Federal Capital Territory Abuja Karate Team. Descriptive correlational research design with stratified and purposive sampling was adopted to study 16 out of 30 karatekas (male, n = 9; female, n = 7); age, 28.4 ± 7.0 years. Data were collected using stopwatch, punch pad, kicking pad, karate belt, training bag and measuring tape after informed consent. SPSS 20.0 was used for data analysis with frequency, percentage, mean, t-test and multiple regression with 0.05 alpha level. No significant difference between the fitness profiles of kumite and kata and kata only group; t = .803, MD = 1.467, df = 14, p = .435 and 2 = 4% (0.04), and 95% CI = -5.38 to 2.44. Those who trained 3 days/wk. had higher fitness profile than those who trained daily, t = 2.32, MD = 3.37, df = 14, p = .039, 2 = 30% (0.30) and 95% CI = -6.54 to -0.19. Training frequency had greater influence on their fitness profile = .65, p =.01. Training frequency of 3-4 days/wk. and regular assessment of physical fitness using SKFT batteries was recommended.

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INTRODUCTION

Studies have documented that no any two individuals will shoot in exactly the same way because of each individual having unique structural body and way of displaying skills. The unique movement and stylistic interpretations of individual player, accounts for multiple patterns of movement and paths of projection that determine whether shooting is successful or not (Çetina, & Murat, 2014; Joseph , 2015). However, a good player is one who is both accurate and precise by shooting the same way each time and making it in the basket (Arcidiacono, P., Kinsler, J., & Price, J , 2017 ; Lab-Write, 2005).

Physical (height and weight), anthropometric (body lengths) and physiological differences, age and level of experience are identified factors predisposing to variability in performance whether of success or failure of athletes during competition (Er□ulj, F., & Štrumbelj, E., 2015 ; Apostolidis & Zacharakis, 2015). Tsarouchas et.al 'study in 1990, found some differences within good shooters in which some had 'low' elbow technique while others used a 'high' elbow technique in their shooting form and these have been found to depend on individual's unique structure and function, assets and liabilities. Studies by Padulo.,et all (2015), burns (1990) and Malone (1999) explained that skilled shooters are not born, but instead can develop with proper training using scientific approach as a necessity (Brancazio, 1984; Sekulic .et.all, 2017). The general observations of researchers are that one of the reasons for low performance in shooting is that most players do not learn the proper technique differentiating between strong and weak team (Shaoliang, Alberto, Miguel-Angel, Hongyou, Bruno, & Jaime, 2017). However, if the correct technique is consistently learnt and practiced overtime, accuracy and precision of shots become very high in performance.

The invention and development followed by the evolution of the rules and tactics of the basketball game resulted in the three basic playing positions designated as centre, forward, and guard (Miller & Bartlett, 1996, te Wierike, 2017) with the expected contribution to the team's scoring. Centres are mostly the tallest players (Dominic, 2005; Shaoliang, 2017) and normally playing close to the basket in order to utilize their heights to the greatest benefits of the team, whereas the major assignment Guards who are mostly the shortest players is to originate attacking patterns, a role which requires them to dribble the ball up the court (Krause, 1991; Miller & Bartlett, 1996; Abdelkrim . et .all , 2010) causing them to stay further away from the basket. The Forwards mostly are of medium stature, and their role incorporates aspects of those of both centres and guards. They are also expected to help guards in setting up attacking patterns and centres in defending opponents close to the basket. They also contest rebounds from missed shots, playing both the left and right hand side of the court between the zone and the side lines (Coleman, 1975; Miller & Bartlett, 1996, ; Abdelkrim . et .all , 2010). Players in all the three positions are expected to contribute to their team's scoring.

Height or stature and its reach play crucial role in sports, especially in basketball playing ability and scoring where height is also used as one of the indices for talent hunting. Oranugo's study, (1995) revealed that age, height, weight and body composition have significant relationship with winning in elite competitions. This has implication for training, tactical and strategic development for optimal performance. However, we investigated if these relationships or contributions could be significant in shooting performance.

Pojski□ ,. et all, (2011) reported findings which have shown that free throw percentage, field goals and three-point shots distinguish winning and losing of basketball teams (Trnini□ , et al, 2002; Pojski,. et al, 2009) while players who could score in all stages of the game under different conditions are essential for shooting accuracy and winning (Pojski, et al, 2011). The study was therefore undertaken to determine the interplay among physical characteristics, position played and shooting accuracy of Nigerian elite female basketball players.

METHODS

The research design was descriptive correlation using three by one by three factorial design (3x1x3) which permitted the categorization of players according to playing role/position (guards, forward, and centre) of three categories based on position played only and successful shots at three shooting distances which are the common shooting zones. Shooting at 2.74m, 4.67m and 6.40m distances represented at least the zone of each of the player during play (Miller & Bartlett, 1996).

The sample of the study comprised 14 of the 15 National champions for the Zenith Female Basketball league who completed the measurement and were in Camp preparing for an international club championship. The participants had played at national and international competitions

and had varying basketball experience and proficiency. All the players are right-handed, and their age ranged from 19 to 25 years which is comparative to previous studies (Eddings, 1996, Rojas. et.al, 2000). Informed consent and permission from team handlers were obtained before taking part in the study. The coaches objectively rated the players from 1-15 according to their shooting ability (CRSPA).

Bio-data included age, competition played and levels of play, years of experience, categories of exposure, training exposure. The height, weight were measured and BMI was calculated. For accuracy test, the method of Landin .,et all ,1993 ; Button, et al (2006) for accuracy test were adopted for the study. Before the measurement were collected, The measurement procedure included general and specific warm up, followed by shooting trials and a pre-test of 10 trials for each type of shot were conducted in order to classify the relative ability of each of the participant in comparison with the coach's rating. For the data collection, each participant was then video recorded taking 30 experimental trials, in three blocks of ten (14 participants x three blocks x ten shots per block) for each of the shooting perimeters, for the 3 shooting distances. The outcome of the scores of experimental shots was not video recorded, but were kept by the experimenter according to an objective rating system (Landin,. et all , 1993; Button, et al, 2006).

The researchers used the accuracy tests to measure and to compare players 'performances in shooting accuracy and also in relation to physical characteristics of height, weight and BMI. 5- Point scale was used as adapted from Landin,. et all (1993) and Button,. et al (2006) basketball free throw scoring system..

The weight was measured using bathroom scale calibrated in kilogramme. The height was obtained using two-calibrated metre-rulers stationed on the wall and both used for BMI determination. The descriptive statistics of percentage, ranking and mean were used to describe the data, Pearson's Product Moment correlation ('r') was used to test for significant relationships between the shooting accuracy at the different shooting distances and physical characteristics. For inter-individual data analysis, one way ANOVA was used to find significant variability between the group trials in shooting accuracy. The level of significance was set at 0.05.

RESULTS AND DISCUSSION

The range age of the players by play position were guards- 20-22years; forwards-21-24 year' and centre- 18-25years of age. The physical characteristics of the female elite basketballers showed weight range of the guards-60-68kg; for-

Table 1: Participants' Scores and Percentages of Shooting Accuracy at Three Shooting Distances

Position of Play	Participant	2.74m shot		4.67m shot		6.40m shots		CRPS	OPP-SA	ORP	YE
		Score	%	Score	%	Score	%	A	%	SA	
G1	Guard 1	124	82.67	135	90.0	115	76.67	4th	83.11	6th	5
G2	Guard 2	133	88.67	128	85.33	114	76.0	2nd	83.33	5th	8
G3	Guard 3	136	90.67	143	95.33	116	77.33	3rd	87.78	1st	8
G4	Guard 4	122	81.33	127	84.67	116	77.33	5th	81.11	9th	5
G5	Guard 5	122	81.33	131	87.33	109	72.67	10th	80.44	10th	9
F6	Forward 1	124	82.67	137	91.33	115	76.67	7th	83.56	4th	8
F7	Forward 2	110	73.67	120	80.0	109	72.67	12th	75.33	14th	9
F8	Forward 3	130	86.67	128	85.33	112	74.67	11th	82.22	7th	11
F9	Forward 4	132	88.0	121	80.67	113	75.33	9th	81.33	8th	8
F10	Forward 5	127	84.67	127	84.67	101	67.33	14th	78.89	12th	8
C11	Centre 1	128	85.33	139	92.67	120	80.0	1st	86.00	2nd	9
C12	Centre 2	126	84.0	136	90.67	117	78.0	6th	84.22	3rd	5
C13	Centre 3	118	84.0	133	88.67	110	73.67	8th	80.22	11th	5
C14	Centre 4	118	78.67	120	80.0	106	70.67	13th	76.44	13th	4

CRPSA: Coach's Ranking of Players shooting ability; **OPPS**- Overall Percentage of players shooting accuracy; **ORPSA**- Overall ranking of players shooting accuracy; **YE**=Years of experience

wards 67-85kg and centres 75-80kg. For height, guards were between 1.65-1.68m; forwards 1.75-1.88m and centre 1.88-1.93m. The BMI revealed range of 19.87-22.04kg/m2 for guards; 21.22-24.05kg/m2 for forwards; and 20.78-22.21 kg/m2 for centre players.

Research Question (RQ) 1: How accurate are the shots of female elite Nigerian basketball players?

Table 1 shows the score and percentage of accuracy shots of the participants at three distances with the subjective ranking by the coaches and objective ranking as determined by the accuracy testing. In 2.74m shooting performance, except forward 2(73.67%) who had 9 years' experience and centre 4 (78.67%) with only 4 years, all the participants scored above 80% and only C1 in 4.67m shot forward 5 who had 8years of experience scored the lowest (67.33%). Other participants' range fell between 70.67-78.0%. The result showed non- group domination in the shooting perimeters, as the ranking was shared between the guards, forwards and centre players (see table 1). Summarily, all the players have very 'good' score percentages in comparison with elite and international players.

Research Question (RQ) 2: Are there any relationships between physical characteristics and shooting accuracy of Nigerian female basketball players?

We further hypothesised that there is no significant relationship between physical characteristics (height, weight and BMI) and shooting accuracy of the female basketball players.

Table 2: Correlation Matrix of Physical Characteristics and Shooting Accuracy at Three Shooting Distances

Wt	Ht	BMI	2.74m	4.67m	6.40m	
Wt	1	0.857*	0.370	0.030	-0.181	-0.041
Ht	0.857*	1	-0.002	0.156	-0.026	.154
BMI	0.370	-0.002	1	-0.069	-0.188	-0.196
2.74m Shot	0.030	0.156	-0069	1	0.425	0.373
4.67m Shot	-0.181	-0.026	-0.188	0.425	1	0.595*
6.40m Shot	-0.041	0.154	-0.196	0.373	0.595*	1

*Correlation is significant at the 0.05 level (2-tailed) = p value >0.497

Table 2 indicates significant relationship between weight and height only, and independently both are insignificant with BMI establishing that neither height nor weight can predict BMI independently. No significant correlation was found between any physical characteristic and distance shooting but indicated between 4.67m and 6.40m shooting accuracy (p.val.> 0.497) demonstrated by both being distant shots from the basket. The insignificant correlation establishes height generally as factor of athletic ability, jump height, height release ratio but not paramount for accuracy of the shot.

RQ3: Does positional play (such as guard, forward, and centre) of the female basketball players differentiate their shooting accuracy at 2.74m, 4.67m and 6.40m distances?

We further hypothesized that: Position of play (guard, forward, centre) will not significantly d+ifferentiate shooting accuracy at the three shooting distances (2.74m, 4.67m and 6.40m).

Table 3: One-way ANOVA for position of play and shooting accuracy at the three shooting Distances

Shooting Accuracy	Sum of Squares	df	Mean Square	F-ratio	Prob	
2.74m	Between Groups	111.214	2	55.607	1.085	.372
	Within Groups	564.000	11	51.273		
	Total	675.214	13			
4.67m	Between Groups	54.600	2	27.300	.535	.600
	Within Groups	561.400	11	51.036		
	Total	616.000	13			
6.40m	Between Groups	44.464	2	22.232	.884	.441
	Within Groups	276.750	11	25.159		
	Total	**321.214**	**13**			

F(2,11) = 3.98>0.05 *Significant.

The result of the ANOVA (**table 2**) shows that position of play does not significantly differentiate between shooting performance of the categorised players at the three shooting distance perimeters.

DISCUSSION

Generally, all the participants' scores at 2.74m (73.67- 90.67%), 4.67m (80.0-95.33%), and 6.40m (67.33-80.0%) demonstrate elite and international level. The score levels of the players favourably compared with elite international free throw shooters (78 ± 8) who were studied by Hudson (1982) and also when compared with the three national players studied by Button et al. (2006) of which only the senior players scored 90% while the two remaining shooters scored 70% and 66% respectively. Similarly Button et al's participants on 5 points scale experiment score for 30 free throws

scored 114, 116 and 112 in order of performance; while the lowest score was 120 and the highest 143 for this study for the middle distance experimental shot. The above showed that the participants are highly skilled players in shooting. Apart from Hudson (1982) who studied female shooters in free throw in Elliot (1991), Eddings included only two females among his 22 participants,. the female compared favourably with other studies. Similarly, this study proved no gender differential when it comes to shooting accuracy and performance, implying that tactical and technicalities of skill difference might be only due to learning and integration processes involved in adaptation and training. Furthermore, other physiological factors could be determinant factor of differences found and not the technical aspect of shooting.

Tsarouchas,et al., (1990) used accuracy as a strategy to classify the elite players in their study. They espoused that the 'good' shooters were those who shot above 80% while 'poor' shooters were those whose ratings are below 65%. Comparing our participants' shooting accuracy to previous studies, they could be rated as highly skilled players. However, this study group performed well in the middle distance than the short distance and long distance shots. This might have occurred because most of the basketball players shoot consistently within this range for the uncontested shot (free throw) and mostly practiced it as penalty shot. Basketballers perform well in this shot than the jump shot because it is a closed skill that requires specific consistent segmental angular configuration, velocity and ball projection (All Africa Games [AAG], 2003). Furthermore, majority of the players could score 10 out of 10 in the middle distance shot. However, the performance of Guard 3 (1st) and 2 (2nd) was not expected in 2.75m shot because they tend to play more at the top of the key rather than at the perimeter zone which is a common area in which the forward and centre players predominantly operate and not the guards (see table 1). This enlightens more on the role and effect of practice and training rather than position of play zones on performance especially as it relates to shooting. This further has implication for strategies and conditioning of beginners and promising players by teachers and coaches when laying foundation for skill acquisition especially in relation to attacking the rim for making points and optimal performance. Though tactical and strategic patterns of training are essential for positional adaptation, but this should not be made rigid when it comes to offensive playing techniques especially with high level of shooting accuracy and performance being the goal of basketball as a sport. Coaching in this direction will prevent shooting potentials of players' being incapacitated.

The findings on the relationship between physical characteristics and shooting accuracy revealed that shooting accuracy does not depend solely on height and weight of the shooter though they are significant for general athletic prowess and playing ability especially when it comes to reach plays and take offs in basketball shooting. Furthermore, height and weight of the basketball players are of significant advantage for higher release height and release height ratio (Hudson, 1982; Eddings, 1996; Miller & Bartlett, 1993 and 1996) and essential for training, tactical and strategic development but not specific for prediction of shooting accuracy (Okuneye & Osman, 1996; Ackland, et.all., 1997; Dominic, 2006; Shahdadi, & Alisoufi, 2016) as established by this study. Hudson (1974) founded that velocity of wrist flexion just prior to release was one of the best predictors of shooting accuracy. By implication, physical characteristics might be of advantage in reducing the distance of projection of the ball to the basket but does not significantly contribute to the accuracy of the shot. It is deduced therefore, that there are general factors of performance of basketball as a sport and specific factors for specific skill and specific technique in each of the skill. This calls for specificity of training to optimise player's performance in specific shot and not by play position as observed in training programmes.

Differentiation was sought among the participants based on the position played on the court in order to discover if it might determine performance level at the three shooting distances using ANOVA (see table 3). The findings demonstrated that role differentiation is imperative to determine perimeter of play especially in defensive and strategic positioning for offensive plays and short skill, but not for accurascy at different distance. The guards were expected to perform poorly in the 2.74m shots and better in 6.40m shots but this was not found to be so confirming shooting accuracy not determined by their play position, rather by other factors relating to training and practice. Centre came 1st in the long distance shot (6.40) as against the general expectation from guards as based on play position while G3, G2 and F1 came first, 5th and fourth respectively in the short distance shot (4.67m) (see table 1). This therefore calls for understanding by teachers, coaches and sports scientists that shooting is a specialized skill which requires special consideration and technicalities for athletes, coaches and athletic trainers when it comes to conditioning for optimal performance.

CONCLUSION

We concluded that the female players are highly skilled in shooting accuracy performance and compared favourably with other elite and international players confirming good technique. Height, weight and BMI are insignificantly related to shooting accuracy at three predominant shooting distances in basketball. Play position does not determine shooting accuracy in relation to shooting distances. Since height and weight especially are not directly related to shooting accuracy, shooting accuracy performance at three distance zones should also be added to variables for talent hunting and team selection since optimal product in any basketball contest is the ability to outscore the opponents at the final whistle.

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