Relation between In-Game Role and Service Characteristics in Elite Women's Volleyball

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Abstract

Quiroga, ME, García-Manso, JM, Rodríguez-ruiz, D, Sarmiento, S, de Saa, Y, and Moreno, MP. Relation between in-game role and service characteristics in elite women's volleyball. *J Strength Cond Res* 24(9): 2316–2321, 2010—The aim of this study was to determine whether the in-game role of players (setter, outside, middle, or opposite player) in elite women's volleyball is significantly related to the characteristics of their service. The sample consisted of 1,300 service deliveries (total serves for all matches) made by players in the 8 teams participating in 2 Final 4 stages of the Indesit European Champions League. The variables recorded were in-game role of the server, service type, speed of delivery, service area, target zone, and effectiveness of delivery. Results showed a significant relation between the server's in-game role and service type ($p \leq 0.01$), service speed ($p \leq 0.01$), service area ($p \leq 0.01$), and effectiveness of delivery ($p \leq 0.001$). The most significant relation observed was with the service area, primarily because of the server having to make a quick transition to the defense zone. Setters and opposite players most commonly served from behind zone 1 (100 and 80% of serves, respectively), which they defended after serving. Similarly, middle players served most frequently from behind zone 5 (47% of serves), the zone they subsequently defended.

Key Words female player, service type, speed, zone, effectiveness

Introduction

The serve (K-0) (24) is a fundamental aspect of modern elite volleyball. It is the first play through which a point can be scored (24), preceding all other point-scoring plays such as spiking or blocking (9). Palao (26) and Valadés (35) reported the percentage of points obtained by type of play at the Sydney 2000 and Athens 2004 Olympics: service 4.4–8.1%, spiking 76.8–80%, and blocking 14.5–15.6%. Marcelino and Mesquita (22) recorded the mean number of points won and lost by type of play in the 2003 World League: spiking, 17.51–45.46%, blocking 10.01–18.72%, and service 4.98–16.68%. Fröhner and Murphy (14) and Fröhner (13) indicated that the higher the level of play is, the less chance there will be of making a direct score from the service. Moreover, at higher levels, the benefits derived from serving lie not only in immediate scoring but also in the way the serve influences subsequent play. In women's volleyball (33), the service affects the opposing team's ability to implement complex 1 (K-1) (reception, set, attack, and cover) (8,26,28), and the subsequent defense mounted by the serving team.

The service is regarded as the first means of attack in the arsenal of elite teams (19) and has a clearly offensive purpose (21). Despite recent rule changes, such as the new Rally Point System and the introduction of a defense specialist (libero), and the changes in play they have led to, there remains a clear imbalance in favor of offensive play (23,40).

This marked priority of attack over defense (1,3,27,41) has meant that the composition of teams at higher levels has become primarily offence focused (31). As a result, systems of attack are designed by varying the number of spikers, setters, and all-round players in the on-court team (2). A player's in-game role is defined according to his or her position: setter, outside player (zone 4 attacker), middle player (zone 3 attacker), or opposite player (zone 2 attacker) (17,38).

Although several varieties of service and attack exist, the types most commonly used by elite-level teams show certain similarities, particularly in the phases of armswing and ball contact (30) and jump and flight. It should be noted that when executing a jump serve or spike, the player hits the ball at the highest point of ascent to send the ball to the other side of the court at the highest possible speed (32). Therefore, the higher the level of the player is, the faster the ball will travel and the more effective the hit will be. Moras et al. (25), in their study of elite men's volleyball players, reported similar ball speeds attained in both serving and attacking (ca. 27–28 $m \cdot s^{-1}$)

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Table 1. Relation between in-game role and service type.

In-game role of server	Service type				
	Jump spin power serve	Jump float serve	Overhead float serve	Overhead spin power serve	Asian float serve
Setter	34	21	130	12	33
Outside player	129	35	226	39	0
Middle player	43	124	222	40	0
Opposite player	105	41	54	12	0
Total services	311	221	632	103	33

(6,11). Quiroga et al. (29) noted that in elite women's volleyball a strong jump spin power serve is more effective than an overhead float serve.

Nowadays, all female players attempt to make a direct score through their serve or at least make it difficult for the opposing team to mount an attack. As a result, they aim for a serve that is both accurate and difficult to receive, and on many occasions, they also try to make a very powerful delivery. However, the technical and tactical actions required of the players immediately after serving must also be taken into account. In this way, the serve will always depend on a player's physique and fitness level, which will in turn be related to her in-game role and the technical requirements at each moment of play.

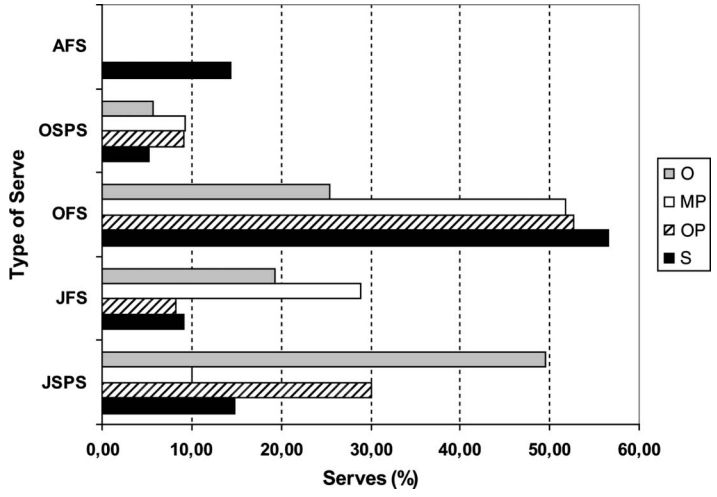

Figure 1. Percentage of each service type by in-game role. AFS = Asian float serve; OSPS = overhead spin power serve; OFS = overhead float serve; JFS = jump float serve; JSPS = jump spin power serve; O = opposite player; MP = middle player; and OP = outside player; S = setter.

The aim of this study was to determine whether the in-game role of female volleyball players (setter, outside, middle, or opposite player) is significantly related to the characteristics of their service: type, speed, service area, and effectiveness of the serve.

Methods

Experimental Approach to the Problem

The purpose of the study was to assess the ball speed of serves made by international women volleyball players. This variable was analyzed during play at top-level competition, and an analysis was made of the relation between the service speed and the player's in-game role (setter, middle player, outside or opposite player). The data were recorded during the Final 4 stage of the Indesit European Champions League.

Subjects

The study sample consisted of 1,300 services delivered during 8 matches (29 sets) played in 2 Final 4 (FF1 and FF2) stages of the Indesit European Champions League. The serves were made by 58 players of 25 nationalities, who had played in the top 4 teams of the European Club League for 2 consecutive seasons (FF1: C.V. Tenerife Marichal [Spain], Pallavolo Sirio Perugia [Italy], R.C. Cannes [France], and Azerrail Baku [Azerbaijan]; FF2: Foppapedretti Bergamo [Italy], Sant' Orsola Asystel Novara [Italy], C.V. Tenerife Marichal [Spain], and R.C. Cannes [France]). Fifty-two were international players, and 16 had taken part in Olympic Games. Only 6 players had not previously played at the international level. The subjects were informed of the nature of the study and its intended use, in accordance with the ethical guidelines of the Declaration of Helsinki.

Procedures

The following variables were recorded: (a) In-game role of the server (setter, middle, outside, or opposite player) (17). (b) Type of serve, taking into account the hitting technique and whether the server was

Table 2. Influence of in-game role on service speed.

	Service speed ($km \cdot h^{-1}$)						
In-game role of server	<40	40–49	50–59	60–69	70–79	80–89	>89
Setter	11	42	138	6	12	20	1
Outside player	5	35	238	41	57	45	8
Middle player	4	29	276	77	28	15	0
Opposite player	0	11	82	22	30	50	17
Total by speed	20	117	734	146	127	130	26

standing or jumping (jump spin power serve, jump float serve, overhead float serve, overhead spin power serve, Asian float serve). (c) Service speed ($km \cdot h^{-1}$), divided into seven intervals (<40, 40–49, 50–59, 60–69, 70–79, 80–89, and >89 $km \cdot h^{-1}$). (d) Service area, taking into account 3 areas identified as extensions of back court zones 1, 5, and 6 (16). (e) *Target zone of the serve*: the court was divided into 6 zones, 3 at the front and 3 at the back (23,39). (f) Service effectiveness, recorded using the Fédération Internationale de VolleyBall (FIVB) categories adapted from Coleman (5): (*4*) direct score; (*3*) service that prevents the opposing team from attacking and leads to the return of a free ball; (*2*) service that limits the ability of the opposing team to mount an attack, preventing players from making a rapid attack; (*1*) service that allows the opposing team to mount whatever type of attack they wish; and (*0*) failed service.

Observations were made of digital recordings taken with Panasonic NVDS88 cameras located at both ends of the court, which provided optimum visuals of the variables studied.

Service speed was measured using a STALKER Deluxe Stats Package hand-held radar system. The operator recorded the speeds attained from a position at the far end of the court, opposite the server, and moved as necessary to align the radar with the trajectory of the ball, as suggested by Ferris et al. (10) and Forthomme et al. (11), to avoid measuring errors.

To guarantee reliability of the observations, the percentage of intra and interobserver agreements was calculated using the formula developed by Bellack (37), with a time interval of 10 days. Calculations were made using 20% of the sample (services delivered in 4 randomly selected games). The reliability values obtained were >95% for all variables recorded. This method is useful in the study of players observed during play, given the ease of use, immediacy of results, and the way values can be replicated (7,20,36).

Statistical Analyses

Descriptive and inferential analyses were performed using the χ^2 and Cramer V tests, including contingency tables, to determine the possible relation between the in-game role and the variables recorded. The significance level was established as $p \leq 0.05$.

Results

Table 1 shows that the most commonly used service was the overhead float serve (48.6%), preferred by outside players (226 serves). In second place was the jump spin power serve (23.9%), used particularly by outside and opposite players (129 and 105 serves, respectively), whereas the third most common type was the jump float serve (17%), used mostly by middle players (124 serves).

Of the 1,300 serves made, in 768 (59.08%) cases, the server was in a standing position, in 532 (40.92%) cases the server was jumping ($p \leq 0.001$), 880 (67.69%) were overhead float serves and 420 were power serves (32.31%) ($p \leq 0.001$). The highest number of points scored by serving was through jump spin power serves (25 serves; 39.1%), which was also the service type with the

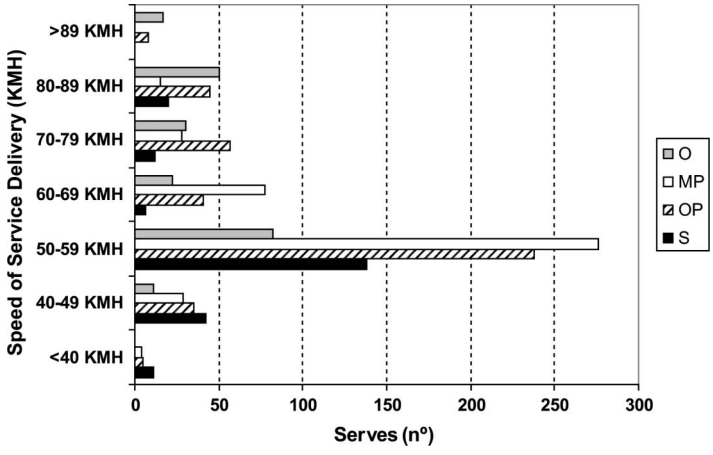

Figure 2. Total services made (in speed intervals) by in-game role. AFS = Asian float serve; OSPS = overhead spin power serve; OFS = overhead float serve; JFS = jump float serve; JSPS = jump spin power serve; O = opposite player; MP = middle player; OP = outside player; S = setter.

Table 3. Influence of in-game role on service effectiveness.

	Level of effectiveness				
In-game role of server	0	1	2	3	4
Setter	13	150	44	16	7
Outside player	37	251	98	21	22
Middle player	32	242	99	36	20
Opposite player	34	98	52	13	15
Total services	116	741	293	86	64

Table 4. Influence of in-game role on service area used.

	Service area		
In-game role	Behind zone 1	Behind zone 5	Behind zone 6
Setter	229	1	0
Outside player	263	99	67
Middle player	130	232	67
Opposite player	165	30	17
Total services	787	362	151

Table 5. Distribution of service type by service area.

	Service type by service area				
In-game role by serve area	Jump spin power serve	Jump float serve	Overhead float serve	Overhead spin power serve	Asian float serve
Behind zone 1	251	116	347	40	33
Behind zone 5	59	89	176	38	0
Behind zone 6	1	16	109	25	0
Total services	311	221	632	103	33

highest number of errors (66 serves; 56.9%). This study did not reveal a relation between the set score and the service type or its trajectory (overhead or power serve).

Maximum service effectiveness (direct score) was reached by the opposite players (15 direct points; 7.1%), who tended to use the jump spin power serve. The lowest level of effectiveness was observed among the setters (7 direct points; 3%) ($p \leq 0.05$), who mainly used the overhead float serve (Figure 1).

Table 2 shows that 734 service deliveries (56.5%) reached speeds of 50–59 $km \cdot h^{-1}$. This speed was observed most frequently among middle and outside players (276 and 238 serves, respectively). Most of these serves were made while the player was in a standing position (75.6%) and nearly all were overhead float serves (88.8%). Only 283 (21.8%) serves reached speeds of >70 $km \cdot h^{-1}$, with 26 of these reaching more than 90 $km \cdot h^{-1}$ (2%). Once again, outside players logged the highest number of power serves (110 serves at a speed of >70 $km \cdot h^{-1}$; Figure 2).

Table 3 shows service effectiveness by in-game role. Middle players were the most effective servers, delivering 56 highly effective serves out of a total of 429 (13.1%). These serves either led to a direct point or limited the ability of the opposing team to mount a rapid attack. Outside players also showed a high level of effectiveness in serving, with 43 highly effective services out of the 429 delivered (10.0%). Opposite players showed the lowest service effectiveness (service error) (34 serves; 16%), although it should be noted that their preferred service type (jump spin power serve) involves most risk.

The most commonly used service area, as seen in Table 4, was behind zone 1 (787 serves; 60.53%), whereas the area least used was behind zone 6 (151 serves; 12.62%). This zone was most frequently used by outsider players (263 serves; 33.4%), followed by setters (229 serves; 29.1). Opposite players also showed a preference for serving from zone 1 (165 serves; 21.0%). It is important to note that there are 2 outside and middle players per team, and only 1 setter and 1 opposite player. Middle players mostly served from behind zone 5 (232 serves; 64.1%).

Service type by service area is shown in Table 5. Overhead float serves were the most frequent type in all 3 zones (5, 6, and 1). The predominant service type from behind zone 1 was the overhead float serve (347 serves; 44.1%), followed by the jump spin power serve (251 serves; 31.9%). This was also

the zone from which the highest number of direct points was scored (45 serves; 70.3%).

There was no significant relation between the service area and the in-game role of the receiving player. Most serves were received by outside players (524 serves; 40.3%) and liberos (400 serves; 30.8%). In tactical terms, these are the players normally responsible for this type of play. In contrast, middle players received the least serves (94 serves; 7.2%), because these players are responsible for executing the first-tempo attack.

Discussion

The service type most often used was the overhead float serve, particularly by middle players. This finding agrees with those of Maia and Mesquita (21) for elite women volleyball players from the Hungarian, Portuguese, Belarusian, and Danish teams in the qualifying round for the 2005 European Championship. However, this is not normally the case in men's volleyball. Callejón (4) noted that the main service type used by elite male players is the jump spin power serve.

The in-game role of the server was significantly related to the service type ($p \leq 0.001$), as observed by Maia and Mesquita (21). Setters most commonly used the overhead float serve and the Asian float serve, a service type not commonly used and observed in this study in the case of only 1 player, who was originally from China.

Outside players mostly used the overhead float serve and the jump spin power serve. Middle players preferred the overhead float serve, although they also used the jump float serve. Opposite players predominantly used the jump spin power serve, which improved the relation between the variables. This confirms the observation made by Ejem (9) that teams tend to include players with a variety of service types so as to take advantage of the desired aim of each type of serve.

The results revealed the clearly tactical intentions of setters in the use of the overhead float serve, and the priority opposite players gave to strength in their use of the jump spin power serve. This concurs with findings by Fröhner (12), Ejem (9), and Katsikadelli (18) for male volleyball players. In the present study, these choices were deemed to be largely the result of the physique and fitness level of players.

Most serves by opposite players had a speed of >80 km·h^{-1} (31.0%). Those by outside players frequently reached 70–79 km·h^{-1} (13.3%) and serves by middle players commonly achieved speeds of 50–69 km·h^{-1}(65.0%). The lowest speeds (<49 km·h^{-1}, 23.0%) were reached by setters. These differences were determined by the type of serve used.

The jump spin power serve, mostly used by opposite and outside players, was the fastest type of delivery, as reported by Ejem (9) and Katsikadelli (18). In the present study, the 10 fastest serves recorded were all made by 1 opposite player. The mean service speed was 100.6 km·h^{-1}, and the fastest was 107 km·h^{-1}, slightly faster than the 96 km·h^{-1}maximum recorded by Ejem (9) at the Sydney Games. Uriarte (34), coach of the Argentinean men's team, recently indicated that delivery speeds of >95 km·h^{-1} pose a major problem for receivers (outside players and liberos). In women's volleyball, speeds slightly lower than this can be difficult for receivers to handle, but in this study, it was observed that only opposite players took significant advantage of this by delivering very powerful serves. In tactical terms, these are the players who are allowed to take greater risk when serving.

The service area most frequently used was behind zone 1, as reported by Maia and Mesquita (21). This was seen for all in-game roles except middle players, who preferred to serve from behind zone 5. The players studied tended to serve from behind the zone they subsequently occupied during defense: setters and opposite players from behind zone 1 (100 and 80%, respectively), which they subsequently defended, and middle players from behind zone 5 (47%), which they similarly defended after serving. These results can be explained by the players' wish to facilitate transition from the service area to the defense zone by reducing the amount of ground they need to cover while complying with the play system devised (16,13,21,33). In the case of outside players, 56.2% served from behind zone 1 and defended in zone 6, 18.8% served from behind zone 6 and defended in zone 6, 18.8% served from behind zone 5 and defended in zone 6, and 6.2% served from zone 5 and defended in zone 5. This strategy is a response to the technical aspects of the service and the type of service used.

It can therefore be seen that 45.3% of players moved to the adjacent zone after serving, whereas 51.5% defended the zone they served from. Only 2 players (3.12%) moved to defend the zone furthest from the service area (zones 1–5). Fröhner and Zimmermann (15) reported that the middle players of the Italian team at the 1996 Atlanta Olympics served from zone 5 and then moved quickly to take up defense in the same zone.

With regard to service efficiency, 57% of all deliveries allowed the opposing team to mount whatever type of attack they wished (effectiveness level 1). This was the most frequent effectiveness value for all in-game roles. A significant relation ($p \leq 0.001$) was observed between the in-game role of the server and the service effectiveness. Setters served with an effectiveness level of 1 and opposite players with a level of 0. As a result, the study did not confirm that the tactical serves, mostly made by setters, achieved their primary purpose of making it difficult for the opposing team to mount an attack, as indicated by Fröhner (12). The high number of service errors committed by opposite players was expected, given the higher risk involved in the type of service they normally used, although the ratio between successful and failed serves (1:2.3) was not high.

In the light of these results, it can be stated that serving in elite women's volleyball is progressively tending toward the types and characteristics of services currently seen in elite men's volleyball.

Practical Applications

From the data gathered through this study, it can be concluded that, when training players to receive, coaches should take into account certain practical applications. They should consider using a wide variety of services, bearing in mind the service type and area, the zone the receiving player will subsequently move to and the delivery speed. Similarly, in women's volleyball, even at the elite level, training could include male players capable of serving not only more powerfully but also more accurately. Mechanical devices could also be used to increase either the ball speed or the number of deliveries, or both if required. The results of this study indicate how training may be oriented in elite women's volleyball to determine the type and mode of service that would allow the delivery to optimize this technical resource in accordance with players' physique, fitness level, and technique.

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