Original Article

Spatiotemporal analysis of setting per game complex and origin of the ball in junior female volleyball players

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Abstract:
In volleyball, the performance in the passing affects the setter's strategy and the effectiveness of the attack after the reception or defense. This study aims to assess the spatial and temporal characteristics of the setting choices made by junior female volleyball setters and their performance concerning the origin of the ball and the game complex. The sample for this analysis consists of 3728 setting actions (Complex I = 1.616, Complex II = 1.212). A three-member group of experienced coaches assessed the setting zones' choices as well as the setting tempo and the performance of junior female setters from 20 volleyball games of teams competing in the final phase of the Greek Junior Championship. The variables under consideration were complex of the game (C1 & CII), origin of the ball (left/middle/right lane for the vertical and front/centre/back lane for the horizontal axis of the court), setting zone (six zones of the court), setting tempo (1st, 2nd & 3rd tempo) and setting performance in a five-level ordinal scale. Inter-rater and intra-rater reliability coefficients were estimated using Cohen's kappa coefficient with acceptable values. The test of independence for the categorical variables was carried out using the chi-square test. Following the overall independence test, the difference in proportions among all levels of variables was tested. Results showed that junior female setters regardless of the complex and the origin of the ball choose zone 4 in a 3rd tempo, performed in a moderate and good setting. However, the origin of the ball was an important variable for the subsequent setting. The most preferable route of the ball was from a pass in the left lane of the court to an attack in zone 4 regardless of the game complex. Additionally, setters when receiving the ball from the left and middle lane of the court prefer more often zone 3 in 1st tempo, during CI than CII. The results of the study will give useful directions to the coaches of the specific age category regarding the creation of appropriate training programs for the individual improvement of the setters and teams.
Key Words: **game analysis, junior female, skills, setting, complex**

Introduction

In volleyball, the pass is the first action of a team after the opponent's serve while next in a row are the skills of the setting and attack (Zetou et al., 2006). Although both the pass and the setting are considered as "non-scoring skills" (Drikos et al., 2018; Marcelino et al., 2011) studies have shown that the effect of the attack is directly dependent on them (Drikos et al., 2019; Sotiropoulos et al., 2021). It has been found that due to the hierarchical nature of the game the performance in the passing affects the setter's strategy and the effectiveness of the attack after reception (Papadimitriou et al., 2004; Zetou et al., 2007).

Although the relationship between serve reception and setting efficiency is considered important at every level (González-Silva, Domínguez, et al., 2016) it is typically strong in developmental ages (Costa et al., 2011; Dias et al., 2019). At these ages, the technical skills are under development (González-Silva, Domínguez, et al., 2016) and as consequence, the quality of the setting decreases when the quality of passing is moderate or low (Espa et al., 2011).

Given that in volleyball the attack is performed at 3 different tempos, as they are calculated from the flight duration of the ball, it is considered that the shorter the flight of the ball, the more effective the attack will be (Bergeles et al., 2009). This seems to be true even at developmental ages as the use of a faster setting tempo helps to increase the attack's efficiency (González-Silva, Domínguez, et al., 2016). Therefore fast settings must be used to create problems and imbalance in the opponent block (Afonso et al., 2010). Thus, favorable conditions are created in favor of the attackers to face a single block or no block at all (Quiroga et al., 2010). This is of course possible mainly in the context of Complex I (attack after serve's pass) where conditions often allow the implementation of organized tactical plans given the predictable way and the long distance from which the ball is sent from the server (Castro & Mesquita, 2008; Kountouris et al., 2015).

However, although the fast tempo setting seems to have been integrated into the tactical offensive culture of the male development teams (Michalopoulos et al., 2020) the same does not seem to be the case with the junior female teams (Costa et al., 2012). Indeed, while male junior setters use the 1st and 2nd attack tempo in

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about 2/3 of their settings, the female junior setters use the 3rd tempo in about half of them (48.3%) (Costa et al., 2012). The trend that the offensive game becomes even faster in male junior volleyball is confirmed by the results of a recent study by Michalopoulos et al. (2020) who found that the setters who participated in the final phase of the respective national championship use 1st and 2nd tempo in the vast majority during both complexes (CI: 93.6% and CII: 95.4%, respectively). Regarding complex 2 (CII) the amendments of the volleyball regulations (F.I.V.B., 2012; Zhang, 2000), which included the introduction of the libero in-game role and a less strict rule about the team's "first contact" with the ball, increasing the effectiveness of the defense (Laios & Kountouris, 2004; Palao et al., 2009). This was particularly critical in women's volleyball because of the importance of ground defense (Miskin et al., 2010) for the quality of the setting and the effectiveness of the attack (Barzouka et al., 2006; Bergeles et al., 2009; Papadimitriou et al., 2004).

Moreover, the quality of the defensive actions is the basis of the offensive organization (Zetou et al., 2006) and affects the performance in the match accordingly (Drikos et al., 2019; Silva et al., 2013).

Contrary to the organization of the attack in CI, the organization of the attack within CII involves significant difficulties because the defenders are called to manage powerful offensive spikes from a short distance (the net) and have an acute and unpredictable trajectory (Castro et al., 2011). As a result, setters receive the ball more often outside the ideal setting position (Sotiropoulos et al., 2019) obligated to follow a slower offensive rhythm. Recent studies have investigated the performance of the setting of high-level female setters in terms of its spatiotemporal characteritsics (Sotiropoulos et al., 2019; Tsavdaroglou et al., 2018).

However, the generalization of the conclusions that emerged could be considered uncertain given that the physical characteristics and technical skills of junior female volleyball players are not as developed as those of adults (Boichuk et al., 2020; Cherouveim et al., 2020; Inkinen et al., 2013). Therefore, a thorough investigation of the performance of the setting performed by setters participating in the national junior female championship could contribute to clarifying the parameters of the game that lead to success. The present study aims to assess the spatial and temporal characteristics of the setting choices made by junior female volleyball setters and their performance concerning the game complex and the origin of the ball.

Materials & Methods
Data collection
The sample for this analysis consists of 3728 setting actions (CI = 1616, CII = 1.212). A three-member group of experienced coaches assessed the setting zones' choices as well as the setting tempo and the performance of junior female setters from 20 volleyball games of teams competing in the final phase of the 2016 Greek Junior Championship. For the identification and selection of independent variables and to represent relevant and important aspects of setting performance, the independent variables in this study were in line with previous research on volleyball:

1) Complex of the game. The categories are: Complex I or side out complex (CI), Complex II or side-out transition (CII), defined as the situation when the team perform the actions of serve, block, floor defense, set and counter-attack in sequential order (Zhang, 2000)

2) Origin of the ball. To assess the reception and defense area the court was divided into 9 equal areas, measuring 3x3m (9m2), as suggested by Stankovic et al. (2018). The names of the areas were derived from the location of the zones on the horizontal axis of the court [(Front-F), (Central-C), (Back-B) zone] and on the vertical axis [(Left-L), (Middle-M), (Right-R) zone] (Figure 1). For results analysis, the nine areas of reception and defense were merged into three lanes concerning the vertical and parallel axis of the court (Left-Middle-Right Lane on a vertical view and Front-Centre-Back Lane on a horizontal view). The mapping of the court is presented in Figure 1.

3) Setting performance was defined as the effect obtained during setting. For the evaluation of the grade of the quality of the setting, a 5-level tactical rating scale was used (Eom & Schutz, 1992). The levels of the entire evaluation scale were error (E), moderate (M), good (G), very good (VG) and excellent (EX).

4) Setting zone was defined as the area of the court where the attack strike was made. The categories were: positions 1, 6, 5, 4, 3, 2 according to Ramos et al. (2017). If the attacker's feet were in two adjacent zones, the airspace where the attack took place was considered as the attack zone.

5) Setting tempo was defined as the interaction between the moment when the setter contacted the ball and the start of the attacker player approach (Afonso et al., 2010). The categories were: tempo 1 (the attacker jumps simultaneously or immediately after the setter touched the ball), tempo 2 (the attacker performed two or three steps after the setting) and tempo 3 (the attacker starts the approach when the ball reaches the higher point of trajectory after leaving the setter's hands).

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	Left lane	**Middle lane**	**Right lane**
Front lane	FL	FM	FR
Centre lane	CL	CM	CR
Back lane	BL	BM	BR

Figure 1. The nine-area subdivision of the volleyball court is used to define the area of the serve direction.

Procedure

A three-member group of experienced coaches, with professional coaching experience over 15 years, who hold a PhD and served as junior and senior national team coaches assessed reception and setting characteristics. The reliability of the observations was assured by the inter-observer and intra-observer agreement within four weeks interval to avoid any possible adverse learning effects established. Ten per cent (10%) of the total observations were analysed, according to the minimum value given in the literature (Tabachnick & Fidell, 2007) Inter-rater and intra-rater reliability coefficients were estimated using Cohen's kappa coefficient.

The intra-rater reliability coefficient Adjusted K Cohen was >.901 for each one of the three observers which showed very good values (Altman, 1991) The inter-rater reliability was evaluated in three randomly selected matches, which were analysed by the observers. The inter-rater reliability coefficient Adjusted K Cohen was .864, showing a very good value (Altman, 1991).

Statistical Analysis

The test of independence for the categorical variables "game complex" and "setting zone" was carried out using the χ^2 test for each one of the three levels of the variable "origin of the ball". Following the overall independence test, we tested the difference in proportions between the two-game complexes for each level of the "setting tempo" variable in each one of the three levels of the variable "origin of the ball" (test of proportion differences based on the normal distribution) using the statistical package Statgraphics Plus v. 5.1. The same procedure was followed for the variables "game complex" and "setting performance". All the statistical analyses were performed using IBM SPSS Statistics for Windows (IBM SPSS Software, n.d.) and statistical significance was set at $p<.05$.

Results

Setting zone per game complex according to the vertical axis of the court

The statistical analysis showed that there was a significant relationship (χ^2 test, $p< .05$) between the game complex and setting zone in all the lanes distinguished to the vertical axis of the court (Table 1). Moreover, after testing the difference in proportions of the setting zone between game complexes within each level of the variable "origin of the ball" it was found that:

1) when setters delivered a pass from the right lane of the court carried out a significantly higher proportion of setting ($p\leq0,001$) to zone 1 during CI compared CII (6.9% vs 1.4%),

2) when setters delivered a pass from the left lane of the court carried out a significantly higher proportion of setting ($p\leq.001$) to zone 3 during CI compared CII (16.3% vs 9.7%) while concerning setting to zones 1 and 6 carried out a significantly higher proportion of setting during CII compared CI (6.1% vs 3.1%, $p=.03$ and 11.7% vs 6.0%, $p\leq.001$, respectively),

3) when setters delivered a pass from the middle lane of the court carried out a significantly higher proportion of setting ($p\leq.001$) to zone 3 during CI compared CII (18.3% vs 12.7%). Contrarywise this, setting to zone 2 carried out a significantly higher proportion of setting ($p\leq.001$) during CII compared CI (23.3% vs 17.9%). In total, irrespective of the "origin of the ball" junior female setters in CI carried out a significantly higher proportion of setting ($p\leq.001$) to zone 3 compared to CII (17.0% vs 11.5%), while in CII carried out a significantly higher proportion of setting ($p\leq.001$) to zone 2 compared to CI (24.7% vs 20.7%).

Table 1. Setting zone per game complex and spatial origin of the ball

OoB	C	Setting zones						Fisher Test
		Z1	Z2	Z3	Z4	Z5	Z6	
		% (N)	% (N)	% (N)	% (N)	% (N)	% (N)	
Right lane	CI	6.9(22)	24.5 (78)	14.4 (46)	40.8 (130)	1.6 (5)	11.9(38)	24.198
	CII	1.4 (9)	28.7(185)	11.2 (72)	45.0 (290)	1.6(10)	12.1(78)	**.001**
	Z=	4.5	-1.3	1.4	-1.23	0	-.08	
	$p\leq$	**.001**	.16	.15	.20	1	.90	
Left lane	CI	3.1(13)	23.7 (99)	16.3 (68)	49.3 (206)	1.7 (7)	6.0 (25)	21.325
	CII	6.1(33)	22.3(120)	9.7 (52)	48.2 (259)	1.9(10)	11.7(63)	**.001**
	Z=	-2.1	0.5	3	0.33	-0.22	-3	
	$p\leq$	**.03**	.60	**.001**	.70	.08	**.001**	
Middle lane	CI	5.3(47)	17.9(157)	18.3(161)	51.5 (453)	1.3(11)	5.7 (50)	16.338
	CII	5.0 (47)	23.3(217)	12.7(118)	52.0 (484)	1.0 (9)	6.0 (56)	**.006**
	Z=	.20	-2.8	3.3	-.20	.60	-.28	
	$p\leq$	0.7	**0.001**	**0.001**	0.8	0.5	0.7	
Sum	CI	5.1(82)	20.7(334)	17 (275)	48.8 (789)	1.4(23)	7.0 (113)	34.43
	CII	4.2(89)	24.7(522)	11.5(242)	48.9(1033)	1.4(29)	9.3(197)	**.001**
	Z=	1.3	-2.9	4.8	-.06	0	-2.5	
	$p\leq$	.19	**.001**	**.001**	0.90	1.0	**.01**	

Note: OoB: origin of the ball, C: complex

Setting tempo per game complex according to the vertical axis of the court

The statistical analysis showed that there was a significant relationship (χ^2 test, $p<.05$) between the game complex and the setting tempo in all the lanes distinguished to the vertical axis of the court (Table 2). Moreover, after testing the difference in proportions of the setting tempo between game complexes within each level of the variable "origin of the ball" it was found that 1) when setters delivered a pass from the right lane of the court carried out a significantly higher proportion of 3rd tempo setting ($p=.02$) during CII compared CI (82.9% vs 76.8%), 2) when setters delivered a pass from the right lane of the court carried out a significantly higher proportion of 1st tempo settings ($p\leq.001$) during CI compared to CII (13.9% vs 6.3%), while concerning 3rd tempo setting carried out a significantly higher proportion during CII compared to CI (82.7% vs 75.1%, $p\leq.001$), 3) when setters delivered a pass from the middle lane of the court carried out a significantly higher proportion of 1st tempo settings ($p\leq.001$) during CI compared to CII (15.1% vs 10.3%) while concerning 2nd tempo settings carried out a significantly higher proportion during CII compared to CI (11.5% vs 8.8%, $p=.05$).
In total, irrespective of the "origin of the ball" junior female setters in CI carried out a significantly higher proportion of 1st tempo settings compared to CII (14.3% vs 8.9%, $p\leq.001$), while in CII carried out a significantly higher proportion of 3rd tempo settings compared to CI (80.8% vs 76.0%, $p\leq.001$).

Table 2. Setting tempo per game complex and spatial origin of the ball

OoB	C	Setting tempo			Fisher Test
		1st	2nd	3rd	
		% (N)	% (N)	% (N)	
Right lane	CI	12.5 (40)	10.7 (34)	76.8 (245)	5.26
	CII	8.9 (57)	8.2 (53)	82.9 (534)	.072
	Z=	1.7	1.28	-2.2	
	$p\leq$	.08	.20	.02	
Left lane	CI	13.9 (58)	11.0 (46)	75.1 (314)	15.58
	CII	6.3 (34)	11.0 (59)	82.7 (444)	.001
	Z=	3.4	0	-2.9	
	$p\leq$	.001	1	.001	
Middle lane	CI	15.1 (133)	8.8 (77)	76.1 (669)	11.877
	CII	10.3 (96)	11.5 (107)	78.2 (728)	.003
	Z=	3.0	-1.9	-1.0	
	$p\leq$	.001	.05	.28	
Sum	CI	14.3 (231)	9.7 (157)	76.0 (1228)	27.22
	CII	8.9 (187)	10.4 (219)	80.8 (1706)	.001
	Z=	5.1	-.7	-3.5	
	$p\leq$	.001	.40	.001	

Note: OoB: origin of the ball. C: complex

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Setting performance per game complex according to the vertical axis of the court

The statistical analysis showed that there was a significant relationship (χ^2 test, $p<.05$) between the game complex and the setting performance for the right and middle lane of the court (Table 3). Moreover, after testing the difference in proportions of the setting performance between game complexes within each level of the variable "origin of the ball" it was found that 1) when setters delivered a pass from the right lane of the court carried out a significantly higher proportion of good settings during CII compared to CI (71.6% vs 63.3%, $p\leq.001$), 2) when setters delivered a pass from the middle lane of the court carried out a significantly higher proportion of moderate settings during CI compared to CII (23.2% vs 18.9%, $p\leq.001$), while concerning very good settings significantly higher proportion was carried out during CII compared to CI (15.6% vs 10.4%, $p\leq.001$). In total, irrespective of the "origin of the ball" junior female setters in CI carried out a significantly higher proportion of moderate settings compared to CII (22.3% vs 18.9%, $p=.01$, while in CII carried out a significantly higher proportion of good settings compared to CI (67.7% vs 64.3%, $p=.03$).

Table 3. Setting performance per game complex and spatial origin of the ball

| OoB | C | Setting performance | | | | | Fisher Test |
		Error % (N)	Moderate % (N)	Good % (N)	Very good % (N)	Excellent % (N)	
Right lane	CI	0 (0)	23.5 (75)	63.3 (202)	11.9 (38)	1.3 (4)	7.664
	CII	0 (0)	19.3 (124)	71.6 (461)	8.5 (55)	0.6 (4)	.047
	Z=		1.50	-2.60	1.60	1.10	
	$p\leq$		.10	.001	.09	.20	
Left lane	CI	0 (0)	19.6 (82)	62.9 (263)	16.5 (69)	1.0 (4)	8.545
	CII	0.2 (1)	22.7 (122)	64.1 (344)	13 (70)	9.0(0)	.045
	Z=		-1.1	-.39	1.5		
	$p\leq$		.20	.70	0.12		
Middle lane	CI	0.5 (4)	23.2 (204)	65.3 (574)	10.4 (91)	0.7 (6)	24.394
	CII	0 (0)	16.4 (153)	67.1 (625)	15.6 (145)	0.9 (8)	.001
	Z=		3.6	-0.8	-3.28	-0.48	
	$p\leq$		.001	.40	.001	.60	
Sum	CI	0.2 (4)	22.3 (361)	64.3 (1039)	12.3 (198)	0.9 (14)	10.874
	CII	0 (1)	18.9 (399)	67.7 (1430)	12.8 (270)	0.6 (12)	.026
	Z=	2	2.56	-2.1	-0.46	3.49	
	$p\leq$	.03	.01	.03	.60	.001	

Note: OoB: origin of the ball, C: complex

Setting zone per game complex according to the horizontal axis of the court

The statistical analysis showed that there was no significant relationship (χ^2 test, $p<.05$) between the game complex and setting zone in all the lanes distinguished to the horizontal axis of the court (Table 4).

Table 4. Setting zone per game complex and spatial origin of the ball

| OoB | C | Setting zones | | | | | | Fisher Test |
		Z1 % (N)	Z2 % (N)	Z3 % (N)	Z4 % (N)	Z5 % (N)	Z6 % (N)	
Back lane	CI	4.4 (17)	19.8 (77)	15.9 (62)	50.1 (195)	1.5 (6)	8.2 (32)	3.846
	CII	5.6 (19)	19 (65)	12.3 (42)	50.3 (172)	2 (7)	10.8 (37)	.572
	Z=	-0.7	0.27	1.4	-0.05	-0.5	-1.2	
	$p\leq$	.40	.78	.16	.95	.60	.22	
Front lane	CI	11.8 (2)	17.6 (3)	11.8 (2)	52.9 (9)	5.9 (1)	0 (0)	8.802
	CII	3.8 (28)	27.1 (199)	6.7 (49)	50.8 (372)	1.1 (8)	10.5 (77)	.074
	Z=	1.7	-0.9	0.82	0.17	1.8	-1.4	
	$p\leq$	.09	.39	.40	.87	.07	.16	
Centre lane	CI	5.2 (63)	21 (254)	17.4 (211)	48.3 (585)	1.3 (16)	6.7 (81)	9.652
	CII	4.1 (42)	24.9 (258)	14.6 (151)	47.2 (489)	1.4 (14)	8 (83)	.086
	Z=	1.22	-2.1	1.8	0.5	-0.2	-1.18	
	$p\leq$	.21	.20	.07	.6	.8	.23	
Sum	CI	5.1 (82)	20.7 (334)	17 (275)	48.8 (789)	1.4 (23)	7 (113)	34.43
	CII	4.2 (89)	24.7 (522)	11.5 (242)	48.9 (1033)	1.4 (29)	9.3 (197)	.001
	Z=	1.3	-2.8	4.8	-0.06	0	-2.5	
	$p\leq$	.19	.001	.001	.95	1	0.01	

Setting tempo per game complex according to the horizontal axis of the court

The statistical analysis showed that there was a significant relationship (χ^2 test, $p<.05$) between the game complex and the setting tempo for the back lane of the court (Table 5). More specific, after testing the difference in proportions of the setting tempo between game complexes within each level of the variable "origin of the ball" it was found that when setters delivered a pass from the back lane of the court carried out a significantly higher proportion of 1st tempo settings ($p\leq.001$) during CI compared to CII (14.7% vs 8.5%).

Table 5. Setting tempo per game complex and spatial origin of the ball

OoB	C	Setting tempo 1st % (N)	2nd % (N)	3rd % (N)	Fisher Test
Back lane	CI	14.7 (57)	8.7 (34)	76.6 (298)	7.094
	CII	8.5 (29)	10.8 (37)	80.7 (276)	.029
	Z=	2.6	-.95	-1.3	
	$p\leq$	.001	.33	.17	
Front lane	CI	5.9 (1)	11.8 (2)	82.4 (14)	1.184
	CII	4.2 (31)	8.3 (61)	87.4 (641)	.486
	Z=	.34	.51	-.60	
	$p\leq$	.70	.60	.50	
Centre lane	CI	14.3 (173)	10 (121)	75.7 (916)	3.213
	CII	12.2 (127)	11.7 (121)	76.1 (789)	.201
	Z=	1.46	-1.3	-.22	
	$p\leq$	.14	.20	.80	
Sum	CI	14.3 (231)	9.7 (157)	76 (1228)	27.22
	CII	8.9 (187)	10.4 (219)	80.8 (1706)	.001
	Z=	4	-.70	-3.5	
	$p\leq$	.001	.49	.001	

Note: OoB: origin of the ball, C: complex

Setting performance per game complex according to the horizontal axis of the court

The statistical analysis showed that there was a significant relationship (χ^2 test, $p<.05$) between the game complex and the setting performance for the centre lane of the court (Table 6). More specific, after testing the difference in proportions of the setting performance between game complexes within each level of the variable "origin of the ball" it was found that 1) when setters delivered a pass from the centre lane of the court carried out a significantly higher proportion of moderate settings during CI compared to CII (21.3% vs 17.0%, $p\leq.01$), while concerning very good settings significantly higher proportion was carried out during CII compared to CI (16.0% vs 12.3%, $p\leq.01$).

Table 6. Setting performance per game complex and spatial origin of the ball

OoB	C	Setting performance Error % (N)	Moderate % (N)	Good % (N)	Very good % (N)	Excellent % (N)	Fisher Test
Back lane	CI	0 (0)	25.4 (99)	64.3 (250)	10 (39)	.3 (1)	1.422
	CII	0 (0)	22.5 (77)	65.5 (224)	11.7 (40)	.3 (1)	.787
	Z=		.91	-.33	-.7	0	
	$p\leq$		.35	.70	.40	1	
Front lane	CI	0 (0)	23.5 (4)	52.9 (9)	17.6 (3)	5.9 (1)	12.309
	CII	0 (0)	19.9 (146)	71.4 (523)	8.7 (64)	0 (0)	.008
	Z=		.37	-1.6	1.27	6.5	
	$p\leq$		.70	.09	.20	4.7	
Centre lane	CI	.3 (4)	21.3 (258)	64.5 (780)	12.9 (156)	1.0 (12)	10.706
	CII	.1 (1)	17.0 (176)	65.9 (683)	16.0 (166)	1.1 (11)	.025
	Z=	1	2.6	-.70	-2.4	-.20	
	$p\leq$	.29	.01	.49	.01	.80	
Sum	CI	.2 (4)	22.3 (361)	64.3 (1039)	12.3 (198)	.9 (14)	10.874
	CII	0 (1)	18.9 (399)	67.7 (1430)	12.8 (270)	.6 (12)	.024
	Z=	6.5	2.55	-2.17	-.45	1	
	$p\leq$	6.7	.01	.02	.65	.20	

Note: OoB: origin of the ball, C: complex

Discussion

The study aims to assess the spatiotemporal characteristics and the performance of the setting made by junior female volleyball setters in terms of the ball's origin concerning the vertical and parallel axis of the court in both game complexes. The nine areas that were initially recorded for the needs of the study, were merged in 3 lanes concerning the vertical and parallel axis of the court (Left-Middle-Right Lane on vertical axis and Front-Centre-Back Lane on horizontal axis). The vertical axis determines the angle of the ball's trajectory from the passer to the setter and the attacker while the horizontal axis determines the depth of the court from which the setter received the ball.

The origin of the ball for the spatial characteristics of the subsequent setting was an important variable considered at this level of the game. The dominant value for both complexes was presented in the setting to zone 4 regardless of the part of the court from which the setters received the ball (vertical or parallel to the net). More

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specific, during CI when the setters received the ball from the right lane they choose to set the ball hierarchically to zones 4, 2, 3, 6 and 1. In total, it was found that they set the ball 68.7% to the zones located in front of the setter pre-agreement position (González-Silva, Fernandez-Echeverria, et al., 2016) and 31.3% to the zones located behind it. On the other hand, when the ball came from the left lane of the court the respective percentages were 73.3% and 26.7%. These results confirm previous studies according to which in the developmental ages, regardless of the receiving zone of the ball, the setters send the ball with the criterion of confidence and almost automatically to zone 4 (González-Silva, Domínguez, et al., 2016; González-Silva, Fernandez-Echeverria, et al., 2016). Under the same conditions in the CII after zone 4, they hierarchically chose zones 2, 6, 3 and less zone 1. These options prove that the distribution of the ball was not affected by its receiving part but was probably due to the preference of specific attackers (Santos, 1992).

When the ball came from the left lane of the court, the setters choose zone 3 more often during CI, which is justified by the more favorable conditions for the organization of the attack compared to CII (Loureiro et al., 2017). In parallel, during CII, setters choose less often zones 1 and 6, a fact that shows that under relatively more difficult conditions of organization of the offensive game, such as after defensive action, the setters choose the safe solution of specific athletes (Santos, 1992), violating any tactical plan even if they are on the defensive line (Sotiropoulos et al., 2019). When the setters received the ball from the right lane of the court, they choose zone 1 more often after a serve's reception than after a defensive action. This may be because during difficult conditions of offensive organization, as in CII, female junior setters choose the safe selection of zone 4, very often even at the expense of the equilibrium between the attacking zones (González-Silva, Fernandez-Echeverria, et al., 2016). This is considered to be expected at the developmental ages because both technical and physical abilities are far from those of adults (Inkinen et al., 2013).

Additionally, when the passers received the ball from the middle lane of the court, they set it regardless of the game complex, mainly to zone 4. However, under the same conditions, they choose setting to zone 3 more often during CI than CII. Contrarywise was found that they choose setting to zone 2 more often during the CII. The specific setting distribution is considered expected as in the first case it is favored by the controlled conditions of CI while in the second by the existence of the opposite attacker who in difficult conditions, such as after defense, is considered as a "key" player in attack organization (Sotiropoulos et al., 2021).

Regarding the setting tempo, it was generally found that female junior setters used mainly the 3rd tempo both complexes regardless of the origin of the ball. Concerning the 1st tempo setting, it occurs mainly to CI compared to CII when setters received the ball from the left and the middle lane of the court.

Regarding the horizontal axis of the court and the depth of the court from which the setter received the ball no differences were found between the two complexes in terms of the selection of the setting zone. Settings to the zones located in front of the setter pre-agreement position area reached approximately 75% when receiving the ball from the back lane of the court and 70% when receiving it from the front and centre lane of the court. As reported the setters delivered most of the passes (receptions and defenses) from the centre lane of the court which is partly explained by the tendency of women serving to the outside hitter of the offensive line (Sotiropoulos et al., 2021) or to avoid high-risk attacks (Costa et al., 2014). Concerning the horizontal axis of the cour and setting tempo, there were no differences between the complexes except for the 1st tempo setting which was used by the setters during CI when they received the ball from the back lane of the court. This is probably due to the longer trajectory of the pass, and consequently to the ease that the middle attackers had to move in time to the position of attack.

Regarding the setting performance and the origin of the ball, it appeared that when the setters received the pass from the left lane of the court, they had a higher percentage of good settings during CII instead of CI. Similarly, when the setters received the ball from the middle lane of the court, they had a higher percentage of very good settings. It is noteworthy that in total the setters received during CI from the front lane of the court only 17 passes while from the back and the middle lane they delivered 389 and 1206 passes, respectively. This fact indicates the direction and partially the type of serve executed at this level of volleyball (Kitsiou et al., 2020). On the other hand, during CII and after a defensive action carried out in the front lane of the court, there were 146 moderate, 523 good and 64 very good settings, which means that the female junior attackers directed often their attacks in this area aiming to create difficulties during the setting for the counterattack (Sotiropoulos et al., 2021).

Conclusions
Results showed that junior female setters regardless of the complex and the origin of the ball choose zone 4 in a 3rd tempo, performed in a moderate and good setting. However, the origin of the ball was an important variable for the subsequent setting. The most preferable route of the ball was from a pass in the left lane of the court to an attack in zone 4 regardless of the game complex. Additionally, setters when receiving the ball from the left and middle lane of the court prefer more often zone 3 in 1st tempo, during CI than CII. The above results lead to the conclusion that for juniors setters the distribution of setting is completely predictable and creates favourable conditions for the opponent to deal with it. The results of the study give useful directions to the coaches of the specific age category regarding the necessity of creating appropriate training programs for

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the individual improvement of setters' skills so that they will be able to follow the team's offensive strategy regardless of the origin of the ball during both game complexes and to accelerate the setting tempo for peripherical attackers in order to create favourable conditions for the outside hitters and the opposite player.**Conflicts of interest:** The author(s) declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article

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