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Original Article

Digger's activity at men's European Beach Volleyball University Championship

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Abstract
In this paper, we present a study of digger activity among university beach volleyball players. A total of 929 digger actions carried out by 24 European University teams at the 9th European Beach Volleyball Championship EUSA GAMES were analyzed. The video was analyzed using Longomatch v.0.27 software. Statistical significance of the comparison between systems was calculated using the Z test to compare proportions. Results showed that 63.8% were passive actions and 36.2% were active actions ($p<0.001$) while 51% of digger actions were in static position and 49% in dynamic position ($p=0.178$). Furthermore, 23.1% of digger actions ended in counter attack and 76.9% ended without counter attack ($p<0.001$). As a result, the most effective defence can be considered to be static actives. This study leads to specific training of defensive actions and lays the foundation for specialized training for diggers.
***Keywords*:** Defence, beach volleyball, performance, notational analysis.

Introduction

Defensive actions performed by digger are carried out in a coordinated way with the actions of blockers in the net. The combination and coordination between both make up the defensive tactics (Jimenez-Olmedo & Penichet-Tomas, 2017). Specifically, the goal of digger, is to defend a field zones that blockers leave free in their defensive actions in net (Schläppi-Lienhard & Hossner, 2015).

Different defensive actions that must be done depend on different factors, including attack of rival team and position of digger at attack's moment. First they must defend spike or shot attack and, in turn, defenses can be dynamic, if they need to move to be able to touch the ball, or they can also be static in the case of being placed in correct place for make a defense (Koch & Tilp, 2009). These defensive actions based on displacement are the base of digger's action (Chen, 2014).

But different factors determine quality of player in this specific defence position.

First, performance of this type players is conditioned by extrinsic elements that exist in beach volleyball, emphasizing on field area formed by sand (Smith, 2006) and also, for climatic conditions (Bahr & Reeser, 2012). Sand affects movement's digger and ability to jump due to players jump less in it (Bishop, 2003). This aspect increases a work load because in conditions of game in volleyball have been studied less jump height during match (Edwards, Steele, & McGhee, 2010), less jump height due to accumulation of repetitions (Felicissimo, Dantas, Moura, & De Moraes, 2012), as well as variations in blood lactate levels (Mroczek, Kawczynski, & Chmura, 2011). In the specific case of beach volleyball players, fatigue affects strength of lower body and execution speed (Magalhaes, Inacio, Oliveira, Ribeiro, & Ascensao, 2011), furthermore of quantifying the average shares per set for each of the playing roles performed by playing position (Jimenez-Olmedo, Pueo, Penichet-Tomas, Chinchilla-Mira & Perez-Turpin, 2017).

On the other hand, intrinsic elements affect development and performance of defensive actions of this players. It is possible to emphasize the great psychological pressure that beach volleyball players are subjected (Raudsepp & Kais, 2002). This fact has led researchers to evaluate strategies of control and management of emotions used by players (Belem, Caruzzo, Nascimento Junior, Vieira, & Vieira, 2014), being techniques of regulation based on thoughts, memories and verbal communication with partner are the most used antistress techniques (Stefanello, 2007). It is already known that anxiety has a negative influence on game technique as well as decision making (Schläppi-Lienhard & Hossner, 2015). Since greater stress there are worse strategies of problem solving are raised during the matches (Vieira, Carruzo, Nayara, Malheiros, Aizava, & Rigoni, 2013). This is the reason why programs have been developed that help strengthen beach volleyball players (Stefanello, 2009) because self-confidence correlates positively with overall performance (Schläppi-Lienhard & Hossner, 2015).

But not only the intrinsic and extrinsic elements determine a player's performance. It is also necessary to emphasize the tactical preparation as well as work to improve anticipation and reading of rival offensive game. In relation to this aspect, different studies have wanted to know the effect of attack prediction. All of them determining that experience of players as the main reading factor of anticipatory game (Bordini et al., 2013;

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Güldenpenning, Steinke, Koester, & Schack, 2013) because experience and reading of motor patterns of spiker contribute to a better reading of game (Cañal-Bruland, Mooren & Savelsbergh, 2011) being clear indicators the position of body and orientation of segments when are making an attack (Hernández, Ureña, Miranda, & Ona, 2004).

Therefore, it can be established that role of digger and the actions that he develops are as a consequence of a sum of very specific physical and psychological qualities that help to develop adequate tactical systems that guarantee the defense's team (Jimenez-Olmedo, Pueo, Penichet-Tomas, 2016).

However, despite having studied related aspects of tactics and influence of intrinsic and extrinsic factors on performance of beach volleyball players. However, no specific study has been done on digger in university beach volleyball categories, evaluating in a concrete kind actions that this type of players develop, as well as their contribution to defensive tactics of team.

Finally, the objective of this study is to know the different actions carried out by diggers and their effectiveness.

Materials and Methods

Sample

The data were obtained from videotape of matches played during the 9th European Championship Beach Volleyball EUSA GAMES University. Men's matches were analyzed. This category was made up of 24 teams from 16 different nationalities. For development and evaluation of 929 digger's actions were analyzed.

Material

Video footage was obtained with a Sony DCR-cx 280 video camera with a 1.9 / 2.1-57mm lens with a resolution of 1060x920, recorded in HD. Chamber one was placed to take a calibrated frontal plane using four placeholders to create a frame of reference that contained an overlap of 30% above the limits of the court so that actions that occurred outside the limits of the field (Pueo, 2016). Digger's actions were analyzed by players in different games, from group phase to final stages of championship. Video analysis carried out using open source software called LongoMatch v.0.27. Video files were transcoded with HandBreak v0.10.1. Templates were built with Google Drive Sheets app.

Procedure

An experienced observer were performed a visualization and video analysis. To perform the reliability of observation during study, two intra-observer visualizations were performed (Espina-Agullo, 2016).

For each video and in extension for each of analysed variables, percentage of error was calculated following mathematical expression (Hughes, 2004):

$$(\Sigma(\text{mod}[V1-V2])/Vmedia)*100$$

where V1 are the frequencies of first visualization, V2 is a frequency of second visualization, Vmedia is the average of two recorded display frequencies and mod is the module.

Reliability performed on intra-observer analysis obtained a margin of error less than 5% (James et al., 2007) established in acceptable margins of error.

To carry out digger's analysis, a categorization of different analyzed variables was obtained.

First, type of digger's intervention were analyzed:

- Active (A): Actions where digger takes direct contact with the ball.
- Passive (P): Actions where digger does not take direct contact with the ball.

Regardless type of intervention carried out by digger, two new categories were established on defense type based on displacement or predefensive action:

- Dynamic (D): Defensive actions where digger moves from his initial position to perform the defense
- Static (S): Defensive actions where digger does not move from his position to perform the defense.

Finally, two new categories were established to settle the purpose of defense that aims to be able to carry out a counter attack that allows defending team to make point:

- Counter attack (C): The defense made possible a counter attack by defensive team.
- No Counter attack (NC): The defense does not allow a counter attack by defensive team.

All the actions and categories described are combined to know the types defenses (Table 1).

Table 1. Types of actions analyzed.

Operation	Definition
ADC	Defense with active digger intervention (A) after performing a displacement (D) with counter attack (C).
ADNC	Defense with active digger intervention (A) performing a displacement (D) not performing counter attack (NC).

ASC	Defense with active digger intervention (A) in static position (S) with counter attack (C).
ASNC	Defense with active digger intervention (A in static position (S) without counter attack (NC).
PDC	Defense with passive digger intervention (P) after performing a displacement (D) by performing a counter attack (C).
PDNC	Defense with passive digger intervention (P) after making a displacement (D) without realizing a counter attack (NC).
PSC	Defense with passive digger intervention (P) in the static position (S) with counter attack (C).
PSNC	Defense with passive digger intervention (P) in static position (S) without counter attack (NC).

Effectiveness of defensive actions, were categorized according to their completion in point (G) or not point (NG). In addition, in order to establish relations that lead us to a greater knowledge and evolution, point finalizations and frequencies analyzed were classified according to the moment in which they were produced throughout set. In this way, the evolution, finalizations and frequencies throughout these periods of play were analyzed. For this the following periods were established:

- F1: All those actions that were carried out between points 1 and 7 of analyzed team.
- F2: All those actions that were carried out between points 8 and 14 of analyzed team.
- F3: All those actions that were carried out between points 15 and 21 of analyzed team.

Statistical analysis

Significance in the analysis was calculated by applying the Z-test for comparison of proportions.

Results

To carry out a digger activity it is necessary to take into account that ball does not always pass through the net either by a direct blocker action or by an error in opponent's attack. For this reason there are many actions of play where there is no participation of digger. Actions where ball passes does exist two types of interventions, active or passive. Of total digger's actions (n=929) 36.2% were analyzed where intervened directly in defense by touching the ball (A), while 63.8% of actions carried out a defense without intervention or not touch the ball (P). A statistically significant difference was found in comparison of their proportions (p<0.001).

As for defensive actions, it was not only determined whether they are active (A) or passive (P), but also analyzed whether these actions were preceded with dynamic defenses (D) or starting from a static position (S). Of the total number of defensive actions analyzed (n=929), 49% corresponded to dynamic defensive actions (D) and the remaining 51% with static defensive actions (E), not establishing a statistically significant difference in comparison of their proportions (p=0.178). This indicates that both, dynamic defensive actions (D) and statics (S) are used by defenders alike. There is no predilection for one of them which means that depending on various factors on which would depend on the reading of game and fatigue could diggers incline to perform one type of defenses or others.

It is important to keep in mind that a defensive system and therefore the blocker action and digger must give the opportunity to be able to build a counter attack. Of all digger actions analyzed (n=929), 23.1% made it possible to carry out a counter attack. The remaining 76.9% of cases could not be constructed, establishing a statistically significant difference in comparison of their proportions (p<0.001). This fact denotes the difficulty of defenses, influenced by factors that as previously said, affect continuity and result of digger's action.

As mentioned above, these three blocks on which the digger's role has been analyzed do not occur in isolation, but rather occur in combination and give rise to a player's defensive pattern. Therefore, data analysis result of these combinations are presented, separating them into two large blocks. On the one hand present active defenses (A) and on the other hand passive defenses (P).

In active defenses (A), the most common defense was active dynamic defense with counter attack (ADC) with 36.6% of defensive actions, followed by dynamic active defensive actions without counter attack with 22.9% of actions (ADNC), and followed by active statics counter attack (ASC) with 22%. Finally the statics defenses without counter attack (ASNC) were registered with 18.5%. As for the comparisons between the proportions of different defensive systems of active defenses (A), statistically significant differences were established between dynamic active defenses with counter attack (ADC) and the other defenses analyzed (p<0.001). Conversely, no differences were established between the rest of analyzed defenses when compared with each other. Thus, dynamic active defenses with counter attack (ADC) were the most used by defenders analyzed.

In order to know the evolution of active defenses used, a comparison of absolute and relative frequencies of points was performed (Table 2).

Table 2. Comparison using active defense by periods of points.

	F1 (*n*)	F1 (%)	F2 (*n*)	F2 (%)	F3 (*n*)	F3 (%)
ADC	56	45.5	38	30.9	29	23.6
ADNC	35	45.5	27	35.1	15	19.5
ASC	24	32.4	27	36.5	23	31.1
ASNC	32	51.6	22	35.5	8	12.9

Note: F1: Period 1; F2: Period 2; F3: Period 3; ADC: Active dynamic counter attack; ADNC: Active dynamic without counter attack; ASC: Active static counter attack; ASNC: Active static without counter attack.

Specifically, active static defenses have an effectiveness of 49.4%. These defenses are more effective than dynamic defenses that have a 45.5% effectiveness. This fact shows the importance of being well placed in the field when carrying out the defenses, whether in a dynamic or static way. Both make possible the realization of the counter attack which is an opportunity of point for the defense team.

The static analysis established significant differences between the active dynamic defenses with counter attack (ADC) and the rest of the defensive actions analyzed ($p<0.001$). In addition, differences were also established between static active defenses with counter attack (ASC) and static active defenses without counter attack (ASNC) ($p<0.001$). Finally, the active static defenses with counter attack (ASC) also presented differences with active dynamic defenses without counter attack (ADNC).

In passive defenses (P), the most common action were passive statics defenses without counter attack (PSNC) with 50.8%, followed by dynamic passive defenses without counter attack (PDNC) with 43.3%. In addition, the passive frequencies that allowed counter attack recorded very low frequencies, since passive statics defenses with counter attack (PSC) registered a 3.9% and finally passive dynamic defenses with a counter attack 2.0%. Passive defenses establish statistically significant differences between all types of passive defenses (P) analyzed with the exception of dynamic passive defensive counter attacks (PDC) and statics counter attack defenses (PSC) (p=0.591).

As in the active defenses (A), a comparison of the absolute and relative frequencies of passive defenses (Table 3).

Table 3. Comparison using passive defense by period of points.

	F1 (n)	F1 (%)	F2 (n)	F2 (%)	F3 (n)	F3 (%)
PDC	4	33.3	4	33.3	4	33.3
PDNC	101	39.3	101	39.3	55	21.4
PSC	9	39.1	8	34.8	6	26.1
PSNC	120	39.9	107	35.5	74	24.6

Note: F1: Period 1; F2: Period 2; F3: Period 3; PDC: Passive dynamic counter attack; PDNC: Passive dynamic without counter attack; PEC: Passive static counter attack; PENC: Passive static without counter attack.

Observing the evolution of analyzed frequencies it is highlighted how in passive defenses, with exception of dynamics with counter attack (PDC), there is a decrease of frequencies as set develops. In defenses that recorded higher frequencies, such as dynamic passive defenses without counter attack (PDNC) and passive statics defenses without counter attack (PSNC). In these last two actions, decrease in frequencies is more pronounced. This suggests a decrease errors attack from rival teams and a greater success by blocker action.

In passive defensive actions (P) effectiveness were calculated. The results show that dynamic passive actions without counter attack (PDNC) and passive statics defenses without counter attack (PENC) are the most used by defenders, but are the least effective, with 28.4% and 31.9% respectively. As mentioned above, it should be noted that passive defensive actions (P), have their success in direct role of blocker. This does not detract from defensive work for field players who, although they do not carry out a direct intervention in defensive game, play without a ball, and more specifically, defenses without a ball, play an important role in defensive tactics. Only statistically significant differences were observed when comparing effectiveness of dynamic passive defenses with counter attack (PDC) and dynamic passive defenses without counter attack ($p=0.004$). There were no differences when comparing other effectiveness of different actions analyzed.

Discussion

Part of evolution and development of beach volleyball comes from knowledge acquired through the analysis and study of different technical actions (Busca, Moras, & Rodríguez, 2012), which are blocks (Tilp & Rindler, 2013), attacks (Künzell, Schweikart, Köhn & Schläppi, 2014) or defensive actions (Gea & Molina, 2014). Specifically, it should be noted that blocker role and its relation at game, as it is widely studied and collected in literature (Peña, Rodríguez-Guerra, Buscà, & Serra, 2013). The digger role, as well as the defensive

work that this type of players perform in field in combination with blockers in net have not aroused so much interest. Perhaps, this fact is due to the low intervention that defenders actively play in defensive tactics, because, as shown in results of this study, only 36.2% of defensive actions were active actions (A).

For this to occur, a series of circumstances must be given that are developed in very short periods of time. First and in structured offensives, attacker has a range of attack possibilities (Schläppi-Lienhard & Hossner, 2015), having to surpass the first defensive line offered by blocker. This may be due to several circumstances, which depend o attacker's placement (Palao & Ahrabi-Fard., 2011) as well as the place from which to attack (Kao, Sellens, & Stevenson, 1994). Once blocker is overcome, the game enters the digger, whose role is much more complex. These players must perform several actions in combination with both cognitive and physical demands, allowing them to continue the game, having made a satisfactory defense. Therefore, for digger to make a defense must make a previous reading of game. For this, there are game preparation strategies through video analysis that, in addition to improving technical aspects and game strategy, helps to reduce the levels of anxiety players (Rikberg, Raudsepp, & Kais, 2011). This reading of the opponent's game is related with player's experience (Güldenpenning et al., 2013), because those players with more experience carry out better readings of opponent's offensive game (Cañal, Mooren & Savelsbergh, 2011). Also, digger must carry out an analysis of position and placement player who makes the attack (Hernandez et al., 2004). Repeated success of concrete actions lead attackers to make that same attack on successive occasions looking for success found previously (Koeppen & Raab, 2012). Following with factors that directly influence the digger intervention and his defensive actions, it is observed that physical condition and its state of form become a limiting factor of its performance. Movement through the sand (Smith, 2006) conditions their movements (Bishop, 2003) producing a greater exigency to athlete in all the actions that involved. The increase in fatigue as game develops (Jimenez-Olmedo et al., 2017) and loss of power in lower train (Magalhaes et al., 2011), could explain how a decrease in dynamic defensive actions (D) occurs throughout a set, as reflected in this study, since these actions require lateral explosive displacements that are decreasing the motor response times (Mroczek, Kawczyński, Superlak & Chmura, 2013). Therefore, the ability to read and interpret the game, as well as physical digger capacity, are elements that directly affect at digger's performance. In addition, the values recorded in defensive systems of university athletes showed better defensive values than in a study of professional players in 2005 (Koch & Tilp, 2009), which shows a better interpretation and reading of opponent's game as well as a sample of better physical preparations that guarantee the defensive player's responses. Finally, the possibility or not of carrying out a counter attack by digger, would enter into the offensive tactics part. Since the objective of defense is to be able to build and give continuity of play to opponent's attack. This construction attack is given by defense made as well as by the possibility or not of setter (Palao & Ahrabi-Fard., 2011) in putting a ball that can be attacked by digger, which only occurs in 23.1% of the occasions on which a defense is made.

Conclusion

This study has presented a specific analysis focused on digger activity. Specifically, the intervention of digger in a game is largely passive, although not the most effective. The developments of static and dynamic defenses are balanced. In addition, a ratio of 1 counter attack is established for every 4 attacks received. Finally, the most effective digger action is a static active defense.

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