José Antonio Pérez-Turpin
Juan Manuel Cortell-Tormo
Concha Suárez-Llorca
Juan José Chinchilla-Mira
Roberto Cejuela-Anta

RELATION BETWEEN NUMBER OF PATTERNS JUMPS AND REAL TIME PLAYING AMONG ELITE FEMALE BEACH VOLLEYBALL PLAYERS

ODNOS MED ŠTEVILOM VZORCEV SKOKOV IN DEJANSKIM ČASOM IGRE MED VRHUNSKIMI IGRALKAMI ODBOJKE NA MIVKI

Abstract

A study was designed to develop a method for analysing jump patterns to quantify jump types and their relationship to real competition in four matches played during the European Beach Volleyball Championships (Valencia 2006). The method used was a quantitative analysis performed with 10 female players taking part in the championships. Video recordings were made of 670 jumps in the four matches played. The finished recordings were analysed using SPSS 13.0. The first significant result of the comparison showed that the mean number of jumps (Mean±SD) was 167.5±38.53 per match, 74.48±5.93 per set and 4.41±1.01 per point. A second group of results showed the percentage spread of the players in different playing actions, with 71% for smash jumps, 20% for service jumps, and 9% for block jumps. Later comparative analysis related real playing time with the quantification of the number of jumps per match, set and point. We conclude that an understanding of the number of jumps is necessary to establish specific time-related training patterns for beach volleyball.

Keywords: beach volleyball, female, European championship, jumps, real time

Corresponding author:
Faculty of Education, University of Alicante
Campus de San Vicente del Raspeig,
03080 Alicante, Spain
Tel.:+34965903400
E-mail: jose.perez@ua.es

Povzetek

S študijo smo želeli razviti metodo analize vzorcev skokov, da bi lahko kvantificirali tipe skokov in njihovo povezavo z dejanskimi tekmovanji, uporabili pa smo podatke z Evropskega prvenstva v odbojki na mivki v Valenciji 2006. Uporabili smo kvantitativno analizo igre desetih udeleženk prvenstva. Analiza je zajemala posnetke 670 skokov s štirih tekem. Iz posnetkov izhajajoče kvantitativne parametre smo obdelali s pomočjo programa SPSS 13.0. Prvi značilni rezultat primerjave je pokazal, da je bilo povprečno število skokov (Povprečje±SD) 167.5±38.53 na tekmo, 4.48±5.93 na set in 4.41±1.01 na točko. Druga skupina rezultatov je pokazala na razpon deleža različnih igralnih akcij, med katerimi je 71% delež pripadel skokom pri napadalnem udarcu, 20% skokom pri servisu in 9% skokom pri blokih. V primerjalni analizi smo primerjali dejanski čas igre s kvantifikacijo števila skokov na tekmo, set in točko. Menimo, da je poznavanje števila skokov nujno za razumevanje specifičnih vzorcev igranja odbojke na mivki, povezane s časom.

Ključne besede: odbojka na mivki, ženske, evropsko prvenstvo, skoki, čas

INTRODUCTION

The emergence of women in beach volleyball occurred later than for men. In the 1950s and 1960s, beach volleyball was part of California lifestyle and women were frequently only spectators. However, in the 1980s, the first Brazilian team started entering into exhibition tournaments. Beach volleyball is an exciting sport (Kirely & Shewman, 2000), which is seeing a spectacular growth in popularity. Since it was included in the 1996 Atlanta Olympics, it has appeared on a regular basis in mass media. The Fédération Internationale de Volleyball has organised an average of 30 world-level competitions annually since 2005, as well as 25 sub-elite international competitions with the participation of pairs from numerous countries.

Despite this, we must not forget that it is a young, developing sport that needs to be defined, structured and researched in order to elevate it to the same level as other major sports.

Quantitative analysis of the different jump patterns in competition has frequently been used to design training sessions for players of different sports. However, this type of research has not been conducted for beach volleyball. This study was designed to develop a quantitative analysis of the jump motor pattern and identify an efficient and comprehensive system for comparing different jump patterns (smash jump (SSJ), service jump (SJ) and block jump (BJ)). In addition, the introduction of the current scoring system, with two 21-point sets without the need to have the service to score, a possible 15-point third set and the possibility of asking for time-outs (Penigaud, 2003), has led to clearly significant changes in the physiological (McErlean, Cassidy & O'Donoghue, 2000), technical and tactical demands of the sport. However, scientific research into beach volleyball is scarce, and we therefore have to rely on competitive sport movement analyses carried out for such sports as rugby (Docherty, Wenger & Neary, 1988). Nonetheless, modern studies of other sports, such as that on jumps in badminton, can be useful to identify jump patterns. However, in the case of beach volleyball, the lack of prior analysis of movement has severely limited research in this area.

In addition, different methods (type of programme, video recording and subsequent computer analysis) have been used in other sports to document movement activity; this can have an effect on the accuracy of the results. Specific documentation on the average data gathered on jump patterns could provide valuable information on the total physiological demands of competitive beach volleyball. Physiological analysis of beach volleyball players is another novel field of study that has already been used in other sports.

However, no study to date has researched the quantification of jump patterns during competitive beach volleyball. This study was designed to use a method for analysing motor jump patterns, to quantify the number and kinds of jumps in four matches played during the European Beach Volleyball Championships in Valencia (Spain) 2006, and obtain precise information concerning the real training needs of this sport.

METHOD

Participants

The group consisted of 10 players (28±3.05 years old, 1.75±0.06 metres tall and weighing 65.5±5.23 kg) was filmed for nine sets spread over four matches played during the European Beach Vol-

leyball Championships (Valencia 2006). The participants in the study were all members of their national women's teams.

Instrument

Two video cameras (a Sony Dcr-vx2100e and a Sony Trv738e) were placed around the playing surface, one facing down and the other across the court. The first camera was located facing across the court from a grandstand, approximately 15 metres above the action, and the second faced down the court, approximately 10 metres from the court and parallel to the baseline. Each camera was calibrated using four markers placed to create a reference framework that contained a 30% overlap over the boundaries of the court to allow actions when the ball left the limits of the court to be filmed by the cameras. The jump patterns of the players during the matches and the duration of each point were recorded by each video camera, which were equipped with time counters calibrated in minutes, seconds and tenths of a second.

Methodology of data analysis

Each jump and time record was captured by a video camera (Tilp, Koch, Stifter & Ruppert, 2006) using the parameters of the whistle blown by the referee to allow players to serve the ball and the whistle used to signal the end of the point. In the same way, the movements of the players were quantified using offensive movement patterns (transition, positioning and striking) and defensive movement patterns (defending, blocking and receiving) for later study. A recording matrix was constructed using the following coordinates:

- Smash jumps (SSJ), a variable that appeared when the player carried out a jump motor pattern to attack the opposing court and was in possession of the ball, after defending,
- Service jumps (SJ) were considered to be those when a player prepared to put the ball into play, after the end of a point,
- Block jumps (BJ), defensive motor actions that are carried out near the net when the blocking player's time is not in possession of the ball.

The coordinates between the types of jump and analysis of real playing time were reconstructed using a dimensional recording matrix (Liebermann, Katz, Hughes, Bartlett, McClements & Franks, 2002). The jump coordinates were quantified when players carried out the vertical jump motor pattern and this was clearly differentiated from the movement motor pattern. All the figures were calculated by two experienced researchers, who twice reviewed each point played to avoid errors with the computer software timer. The equation (%error = 100 x |A-B| / ((A+B)/2) (1)) was used to determine the percentage differences when calculating the reliability (Choi, O´Donoghue & Hughes, 2007) of the systems using data from two observations A and B.

This research utilised different types of datasets, which required some form of data manipulation (Table 1). This applied to the Real-Time system and the Cycles data. The Penalties data did not require any changes. For the purpose of the current investigation, a percentage of error of under 5% was deemed to be acceptable (Nevill, Atkinson, Hughes & Cooper, 2002).

Synchronisation of the video cameras prevented time adjustment errors, as the analysis was carried out using both recordings at the same time. The reliability of the observers (Williams, Hughes, O'Donoghue & Davies, 2007) was also checked and crosschecked, together with inter-observer and jump type analysis (Table 2). SportsCode 2007 (GameBraker) software was used for the study and the following stages were sequenced: A) recording and digitalisation of the images,

B) creation of a jump type matrix, C) image capture for each matrix code, and D) combination of the matrix codes to obtain jump performance in real beach volleyball competition. All the data was placed in a Microsoft Excel spreadsheet using the categories of jump type and time to calculate the frequency.

Table 1: Observer Analysis

	Service				Smash				Block			
Match	Ob. 1	Ob. 2	Mean±SD	E %	Ob. 1	Ob. 2	Mean±SD	E %	Ob. 1	Ob. 2	Mean±SD	E %
1	1	1	1±0.0	0.0	110	107	108.5±2.12	2.7	27	27	27±0.0	0.0
2	20	21	20.5±0.71	4.8	106	108	107±1.41	1.8	38	37	37.5±0.71	2.6
3	22	23	22.5±0.71	4.4	92	94	93±1.41	2.1	31	30	30.5±0.71	3.2
4	20	19	19.5±0.71	5.1	166	168	167±1.41	1.2	36	36	36±0.0	0.0

*Legend: Ob – observer; SD – standard deviation; E – error

Table 2: Observer Analysis by jump type (total jumps 670)

	Analysis 1 (mean±SD)	Analysis 2 (mean±SD)	Error (%)
Service	63 15.75±9.88	64 16±10.13	3.6
Smash	474 118.5±32.59	477 119.25±33.12	1.9
Block	132 33±4.97	130 32.5±4.8	1.4

RESULTS

The first set of results showed the mean use of the different types of jump by female players in the four official competitive matches (Figure 1). The mean number of service jumps (SS) was 15.88±9.99, the mean number of smash jumps (SSJ) was 118.88±32.83 and the mean number of block jumps (BJ) was 32.75±4.87.

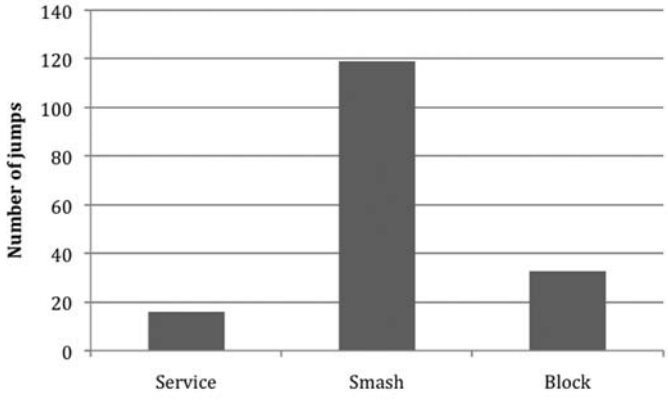

Figure 1: Quantification of types of jump in women's competition

The second set of results (Figure 2) of the comparison showed the percentage use of the different game actions, with 71% for smash jumps (SSJ), 20% for service jumps (SJ) and 9% for block jumps (BJ).

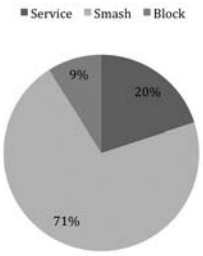

Figure 2: Percentage use of types of jump in women's competition

Later analysis related real playing time (TR) to the quantification of the jumps (Table 3). In this section, we extracted the real playing time per match, which is the difference between absolute playing time (TA) and the times that the ball was not in play, and the total number of jumps carried out. The same was done with the mean real playing time per set and the corresponding number of jumps, and the mean real playing time per point and the number of jumps. The differences in frequency analysis and the mean match, set and point duration were examined using SPSS 13.0 descriptive statistics. The results suggest that this study could provide new understanding of competition in this sport (Giatsis & Tzetzis, 2003) as, from the results obtained, we can state that elite beach volleyball players carry out a certain number of jump patterns during a specific average time. In this time, the use of the type of jump and competition time can help us understand game situations in elite competition.

Table 3: Relation of real playing time and jumps

	Match	Set	Point
Jumps	167.5±38.53	74.47±5.92	4.40±1.01
Real Time (s)	597.6±100.76	266.66±59.52	7.40±0.73

DISCUSSION

During the European Beach Volleyball Championships (Valencia 2006), female players showed how different types of jump (SJ, BJ and SSJ) were used in elite competition. The study showed that the frequency of use of certain jump motor patterns compared with others (expressed as a percentage) with 71% for smash jumps (SSJ), 20% for block jumps (BJ) and 9% for service jumps (SJ). In addition, the average number of jumps carried out by female players in each match (167.5±38.53), set (74.48±5.93) and point (4.41±1.01) showed that the quantification of training work should lie within these parameters (Tilman, Hass, Brunt & Bennett, 2004). As well as the above, we should carry out this quantification within a certain period, thus giving two variables to manage: the number of jumps and temporal determination. Jump per point (7.40±0.73) in (4.40±1.01) seconds, jump per set (74.47±5.92) in (266.66±59.52) seconds, and jump per match (167.5±38.53) in (597.6±100.76) seconds.

It is true that certain authors, such as (Giatsis & Tzetzis, 2003), believe that current pitch size and the changes made to the scoring rules influence the use of movement time; another study

(Giatsis & Zahariadis, 2008) explored the differences in playing characteristics between winning (W) and losing (L) teams in the FIVB Beach Volleyball (BV) World Tour tournament. However, this means that the results of this study will lead to a significant improvement in the preparation of training programmes for beach volleyball players, although the absence of any prior studies means that we should be cautious and only extract the most appropriate conclusions.

CONCLUSION

Improved understanding of the types of jump and real playing time is very important for establishing specific training patterns for beach volleyball and should lead to more research into the physiological responses of players to competitive efforts, or studies of the biomechanics of jumps. This means that, once we have analysed the real playing times and the quantification of jumps, we can start to design training methods based on real competitive conditions, paying special attention to explosive actions with a limited number of repeated jumps and intermittent rest periods, in order to progress towards longer periods of this type of effort during matches.

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