DECISION MAKING OF SEMI-PROFESSIONAL FEMALE BASKETBALL PLAYERS IN COMPETITIVE GAMES

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Tomáš Vencúrik, Dominik Bokůvka, Jiří Nykodým, Pavel Vacenovský

Faculty of Sports Studies, Masaryk University, Brno, Czech Republic

ABSTRACT

Purpose: Nowadays, not only the research but also coaching is focusing on decision making in basketball. Decision making is critical in basketball, especially in relation to offensive skills (with ball). Generally, the players have to decide what to do with the ball (make an appropriate decision) and in the shortest time possible. From this point of view, the study aims to identify the factors which can affect the decision making of offensive skills of female basketball players.
Methods: Eight semi-professional female basketball players participated in this study. Basketball players played five competitive games in the second division. During all games, the heart rate was monitored. Decision making was assessed according to Basketball Offensive Game Performance Instrument (BOGPI) and categorized as appropriate and inappropriate. For this purpose, the notational analysis was used. Based on previous research, the four main factors were set as independent variables. Each of these factors was categorized. The first factor was the intensity of load (< 85%, 85–95%, and > 95% of HR_{max}), second factor was ball possession duration (0–8 s, 9–16 s, and 17–24 s), third factor was game period (1st quarter, 2nd quarter, 3rd quarter, and 4th quarter), and the fourth factor was defensive pressure of an opponent (low, moderate, and high). Objectivity was verified by the method of inter-rater agreement, and reliability was using intra-rater agreement. The influence of factors on decision making was expressed by binary logistic regression. Method of backward stepwise selection was used to find predictors of inappropriate decisions and to find the best model.
Results: One regression coefficient in the final model was statistically significant – defensive pressure of the opponent. When the defensive pressure is moderate or high, the chance for inappropriate decisions increased.
Conclusion: Based on these findings, the coaches should take into consideration these factors when preparing individual training sessions.

Keywords: basketball; decision making; logistic regression; offensive skills

Introduction

One of the main interests (in recent decades) in basketball and other sports games, is the evaluation of information that leads to effective decision-making in the implementation of offensive skills (OS). Perception-sensory processes and cognitive processes play an essential role in the decision-making process and the choice of the appropriate movement response. According to Schmidt & Wrisberg (2004), cognitive processes are those that, during the player performance, process stimuli from the external environment, thus forming an integral part of the OS. During the game, cognitive processes

serve the current needs of managing player skills, regulation of stimuli, and decision-making. Cognitive processes can be understood as a player's ability to control and specifically manage their actions in a particular game situation.

Based on the perception of the game situation and the game situation anticipation, the player decides on the choice of activity. The decision-making is an intermediary link between thinking and movement. The decision implies that existing alternatives to action are limited to one, which is assumed to meet the situational conditions and objectives related, for example, to the team offense.

Cognitive processes are influenced by many important factors, from the natural origin of information stimuli to the type of movement performed. Thus, the correctness of the decision can be affected by both endogenous and exogenous factors in the game conditions. Endogenous factors may include; e.g. psychological processes (emotional arousal or anxiety), intensity of load, and as exogenous factors; e.g. score difference (development of the game), time to end of the match, ball possession duration, defensive pressure of opponent, localization of the game (home, away), phase of the competition (in-season, play-off), etc.(Csataljay, James, Hughes, & Dancs, 2012; Gómez, Lorenzo, Sampaio, Ibáñez, & Ortega, 2008; Lorenzo, Gómez, Ortega, Ibáñez, & Sampaio, 2010; Parejo, García, Antúnez, & Ibáñez, 2013; Sampaio, Drinkwater, & Leite, 2010; Sampaio, Lago, Casais, & Leite, 2010) trying to identify which game-related statistics allow to discriminate winning and losing teams. The sample used corresponded to 306 games from the 2004–2005 Regular Season of the Spanish Men's Professional League. The game-related statistics gathered were: 2 and 3 points field-goals (both successful and unsuccessful.

Cognitive processes should be evaluated and observed in specific and natural game conditions, which would have a more significant impact on streamlining the training process and cultivating game performance. This study aims to determine the effect of selected endogenous and exogenous factors on the decision-making of a female basketball player in competitive games.

Methods

Subjects

Eight players of the second highest women's competition participated in the research. The mean calendar age was 20 ± 2.8 years. The average sports age was 10 ± 3.2 years; the average body height was 179.8 ± 4.9 cm, the average body weight was 66.8 ± 5.7 kg. All basketball players were informed of the purpose of the research, carried out according to the principles of the Declaration of Helsinki. They have signed informed consent.

Procedure

Before the beginning of the research, the players completed a beep test to determine the maximum HR. Commercially available Suunto Team Pack telemetry system (Suunto Oy, Vantaa, Finland) was used to monitor HR during the beep test and games. (Klusemann, Pyne, Foster, & Drinkwater, 2012; Montgomery, Pyne, & Minahan, 2010). Overall, basketball players played five competition games, according to FIBA 2012/2013 rules. All games were recorded with a digital video camera.

To determine the correct decision of the player with the ball (what to do with the ball) was used standardized Basketball Offensive Game Performance Instrument (BOGPI) (Chen, Hendricks, & Zhu, 2013). BOGPI is designed to observe and code players' behavior based on video analysis. The decision-making was coded on the basis of a binary criterion (Table 1), quality code 1 was a code for a appropriate decision and quality code 0 was a code for an inappropriate (inadequate) decision (French & Thomas, 1987; Chen et al., 2013; Memmert & Harvey, 2008; Oslin, Mitchell, & Griffin, 1998; Psotta & Martin, 2011).

Table 1

code	Dribbling	Passing	Shooting
1	• dribble-drive towards the basket thus gaining an advantage over the opponent • position adjustment on the court using dribbling • drawn foul while dribbling	• pass to a free teammate in a more favorable position • foul drawn while passing	• a shot from a distance of up to 7.5 m when the player is in an advantageous position (open), and another teammate is not in a better shooting position • foul drawn while shooting
0	• turnover while dribbling (breaking the rules) • dribbling when another teammate is open in a better position • dribbling to a disadvantageous position on the court	• a pass to a teammate who is not in a better position • a pass to a teammate, while another teammate is in a more favorable position • turnover by a bad pass	• shot from a distance of more than 7.5 m • the player shoots in a disadvantageous position • when shooting, another teammate is in a better shooting position • blocked shot

As factors with possible influence on the decision-making were chosen (Álvarez, Ortega Toro, Salado, & Gómez, 2009; Refoyo, Sampedro, & Sillero, 2009; Alejandro Vaquera, Cubillo, García-Tormo, & Morante, 2013)analyzing the difference in relation to success (efficacious or non-efficacious defenses: a) defensive pressure (low, medium, high); b) possession duration (0–8 s, 9–16 s, 17–24 s); c) game quarter (first, second, third, fourth); d) intensity of load (< 85% of HR_{max}, 85–95% of HR_{max}, > 95% of HR_{max}).

A total of 925 decision-making situations were evaluated. Notational analysis and Dartfish Team Pro 6.0 software was used to code the decision-making (Fribourg, Switzerland) (Hughes & Franks, 2015).

The Inter-observer agreement was ensured by the evaluation of 10% of randomly selected situations by two independent experts. The Intra-observer agreement was also guaranteed by the assessment of 10% of randomly chosen situations by one expert at two different time periods (O'Donoghue, 2015). The time difference between the first and second observation was 12 weeks.

Statistical analysis

Inter-observer agreement and intra-observer agreement were expressed by the kappa coefficient (κ) (O'Donoghue, 2012). A binary logistic regression was used to determine the predictors affecting the decision-making process since the dependent variable (decision-making process) only assumed binary values of 1 or 0. The backward stepwise selection method removed insignificant predictors from the model. The regression coefficients were estimated to utilize the maximum likelihood estimation method. The likelihood ratio test verified the statistical significance of each regression model. The results are interpreted as the odds ratio and its 95% confidence intervals, which indicates the chance of an inappropriate decision. Statistical significance of regression coefficients was verified by Wald's test (Landau & Everitt, 2004; Malek, Coburn, & Marelich, 2018). The first option in the line (low defensive pressure, 0–8 s, first quarter, intensity < 85% of HR_{max}) was chosen as the reference category of independent variables. All statistical tests were assessed at a level of statistical significance of $\alpha = 0.05$ and were calculated using the IBM SPSS Statistics 24 statistical software (IBM Corp., New York, USA).

Results

The inter-observer agreement in the decision-making was almost perfect (κ = 0.871). The intra-observer agreement in evaluating the decision-making at two different times was also almost perfect (κ = 0.954).

Table 1 shows the distribution of relative frequencies of the dependent and independent variables in all watched games. Based on the backward stepwise selection, the saturated model with all predictors (independent variables) was eliminated at each step by an insignificant predictor. The saturated model with four predictors was reduced to a model with one significant predictor. As a statistically significant predictor, Wald's test identified the defensive pressure variable. In Tab. 2 shows standardized beta weights (B), standard error of estimation (SE), values of Wald's test (Wald), the statistical significance of regression coefficients (p value), odds ratio (Exp (B), and the 95% confidence intervals (CI). The chances of making an inappropriate decision at moderate defensive pressure are 1.78 times higher (95% CI; 1.034–3.064) than at low defensive pressure. When the defensive pressure is high, the chances of inadequate decision increase to 7.627 times (95% CI; 4.693–12.396) compared to low defensive pressure. The percentage of the adequacy of the decision-making with respect to individual independent variables is shown in Fig.1.

Table 2 *Distribution of relative frequencies of variables*

VARIABLE	Description	Frequency [n]	Percent [%]
Dependent variable			
Passing performance	Appropriate	806	87.1
	Inappropriate	119	12.9
Independent variables			
Defensive pressure	Low	689	74.5
	Moderate	140	15.1
	High	96	10.4
Ball possession duration	0–8 s	411	44.4
	9–16 s	449	48.6
	17–24 s	96	7
Intensity of load	< 85% of HR_{max}	106	11.5
	85–95% of HR_{max}	682	73.7
	> 95% of HR_{max}	137	14.8
Game quarter	1^{st}	233	25,2
	2^{nd}	222	24,0
	3^{rd}	280	30,3
	4^{th}	190	20,5

Table 3 *Independent variable included in the final model*

Independent variable		B	SE	Wald	df	p value	Exp (B)	95% CI for Exp (B)	
								Lower	Upper
Defensive pressure	low			67.255	2	.000			
	moderate	.576	.277	4.322	1	.038	1.780	1.034	3.064
	high	2.032	.248	67.236	1	.000	7.627	4.693	12.396

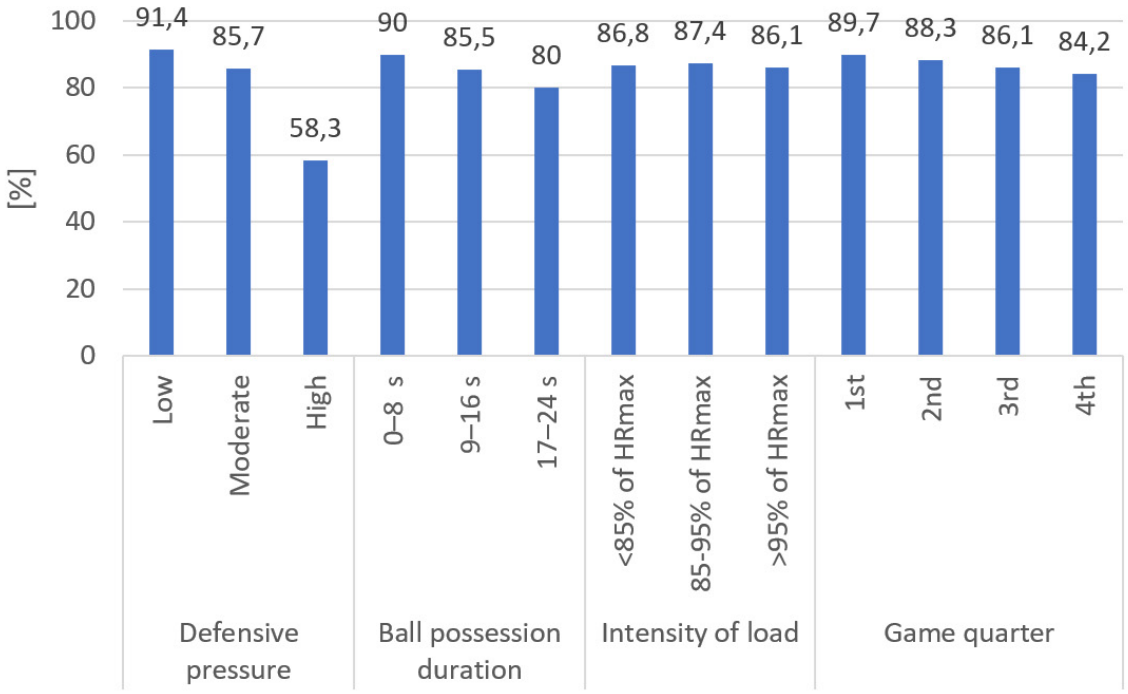

Figure 1 *Percentage of the decision-making process adequacy*

Discussion

The adequacy of the decision-making process with respect to defensive pressure had a downward tendency. This means that with increased defensive pressure, the appropriateness of players' decisions has decreased. For low defensive pressure, the decision-making adequacy was 91.4%, while for moderate defensive pressure, it was 85.7%, and for high defensive pressure, the decision-making adequacy dropped to 58.3%. Binary logistic regression identified only an independently defensive pressure variable as a statistically significant predictor of inadequacy. The chance of making an inappropriate decision at moderate physical pressure was 1.78 times higher than the minimum pressure during the defense. In the case of maximum defense pressure, the chance for a poor decision was up to 7.627 times higher than at the minimum defense pressure. Refoyo et al. (2009) obtained similar results, citing decision adequacy at 95.4%, 86.9% and 65.1% for minimum, average, and maximum defense pressure in the training process, respectively. Training conditions could have caused minor differences and slightly higher decision-making adequacy in this study. Studies Csataljay, James, Hughes, & Dancs, (2013) a Vencurik & Nykodym (2017) also point to the negative impact of increasing defensive pressure on the successfulness of shooting in basketball. For ball possession duration between 0–8 s, the adequacy of decision-making was 90%, between 9–16 s was 85.5%, and between 17–24 s was 80%. With the shot-clock running down (for the offense), the adequacy of decision-making also decreased slightly. For the independent variables of the intensity of load and game quarter, the appropriateness of decision-making was approximately the same. Nevertheless, the independent ball possession duration, intensity of load, and game quarter variables were not identified as statistically significant predictors. On the other hand, Vaquera, García-Tormo, Ruano, & Morante, (2016) and Gómez, Alarcón, & Ortega (2015) found a statistically significant effect of possession duration on pick-and-roll effectiveness. The cause of the impact could be the fact that the defense was disorganized in the last seconds of the offense, and the defenders could be more tired.

Conclusion

This work aimed to determine the influence of selected endogenous and exogenous factors on the decision-making. Binary logistic regression has identified defensive pressure as the only significant

factor. These findings are of practical relevance to the training process. If coaches want to improve the decision-making process of female players within offensive skills, they should train at moderate and high defensive pressure. For more specific conclusions, it is necessary to increase the number of measurements and participants.

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