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Analysis of Kickboxing Match in Point-Fight Division

Ľuboslav Šiška*, Jaroslav Broďáni

Department of Physical Education and Sport, Faculty of Education, University of Constantin the Philosopher in Nitra, Slovakia

ABSTRACT

The aim of our work was to analyze the point-fight kickboxing matches for the techniques resulting in the highest score and present a possible prediction model of the points earned/matches won. We evaluated 28 matches. We observed the successful techniques carried out through punches and kicks. A technique was annotated by means of 4 letters depending on the following criteria: use of hand/leg; lead/rear; offense/counter-offense; body/head. In terms of occurrence, the techniques with the highest score are HROH-21%, HLCH-15% and HLOH-10%. In stepwise regression, the number of points achieved by the match winners was selected as a dependent variable and the independent variables were represented by the sum of the individual successfully implemented techniques in the match. 3 statistically significant models were selected out. The highest value of reliability R^2 was discovered in the model with three variables in which we can predict the number of winning points with a 64.5% probability and the error rate of 1.955 points using 35.59% HRCH, 17.08% HLOH, and 11.84% HLOB. The results point to the possibility of quantifying the match, and can be subsequent used in the training process.

Keywords: Point-fight, Technique, Analysis, Prediction

INTRODUCTION

Combat sports are gaining more and more popularity. High sports performance requires an effective adjustment of the training process, which implies a significant knowledge of the structure of sports performance. This analysis was carried out by many authors in Taekwondo [1], karate [2], boxing [3-5] and kickboxing [5]. As a combat sport in the standing position and with fast punches and kicks, kickboxing is divided into 6 divisions, point-fighting being one of the most popular ones. Point-fighting is a non-contiguous martial art, characterized by a "point-stop" scoring system, in which only the first successful technique is awarded by a point [6]. It is a discipline with emphasis on the leg and arm technique in athletic terms. One point is awarded for each valid technique with the exception of a head kick, which is for two points, and a turning kick in the body and head for two or three points [7]. In his studies, Gerasimov [8] summed up the knowledge of the basic stances, movements and techniques and analyzed the matches at the 2011 World Championships in terms of the efficiency of offensive and counter-offensive actions, efficiency of fighting operations, overall and individual indicators of offensive and counter-offensive fighting operations. He states that the winners achieved better values in the selected indicators except for one case, which was caused by a kick in the head for two points in the tightest victory for one point. Point-fighting is the only division in which we can clearly assess the effectiveness of the individual techniques, which is a logical presumption for a deeper analysis. One of the possibilities in analyzing the factor structure of sports is the stepwise regression. It creates variable models which show the closest relationship to the selected criterion, i.e., the dependent variable [9]. Kampmiller [10] drew up an empirical model of sports performance in the 100 m run on a test sample of 80 sprinters, in which he focused on the motor factors and partly analyzed the somatic and psychological factors. Similar attempts were made in predicting the locomotory performance by Havlíček [11], Broďáni [12]. The aim of our work is to identify the most scored techniques and create a regression model of the possible predictors of the winning points [13].

MATERIAL AND METHODS

We evaluated 28 matches at the 2015 World Championship in kickboxing, i.e., 14 quarter-final and 14 semi-final matches. We analyzed the points and individual techniques, which consisted of 8 parameters divided into 4 groups—hands, leg; lead, rear; offense, counter-offense; body, head, which resulted in singling out 13 techniques. 6 offensive techniques and 7 counter-offensive techniques (Table 1).

Table 1: Offensive and counter-offensive techniques

6 offensive techniques	7 counter-offensive techniques
HLOH – Hand Lead Offense Head	HLCH – Hand Lead Counter-Offense Head
HLOB – Hand Lead Offense Body	HLCB – Hand Lead Counter-Offense Body
HROH – Hand Rear Offense Head	HRCH – Hand Rear Counter-Offense Head
HROB – Hand Rear Offense Body	HRCB – Hand Rear Counter-Offense Body
LLOB – Leg Lead Offense Body	LLCH – Leg Lead Counter-Offense Head – 2 pt.
LLOH – Leg Lead Offense Head – 2 pt.	LLCB – Leg Lead Counter-Offense Body
	LRCB J – Leg Rear Counter-Offense Body Jump – 2 pt.

The data on the distribution of the points earned between the different techniques were visualized using a pie chart and percentage values. In the stepwise regression, the number of points earned by the winner of the match was selected as a dependent variable. The totals of the individual techniques used in the matches were used as independent variables. The Results section contains the tables with significant models and subsequent coefficients for the model with the highest probability, visually processed partial ratios and the prediction equation. The correlation, stepwise regression was made in SPSS.

RESULTS AND DISCUSSION

The aim of our research was to find out which techniques result in scoring the highest amount of points in the winning matches, and which contribute significantly to the winning matches. By analyzing the techniques used by the winners, we selected those techniques that were used to reach the score totals in the individual matches. The ratio of offensive and counter-offensive techniques was slightly in favor of the offensive ones. The most effective technique is the rear hand head punch-HROH, which can be compared to the basic combination—front and rear direct punch. This technique is also abundant in other combat sports such as boxing and full contact kickboxing. The second most scored technique is the counter-offense by the lead hand, termed as a ‘counter-punch’ in boxing. These findings can be applied in sports training not only in the sector analyzed by us, but also in boxing or full contact kickboxing. These two basic techniques must be given extra attention in training, and increased attention and clear emphasis should be put on the speed and accuracy of attack and counter-attack, which greatly determine its success.

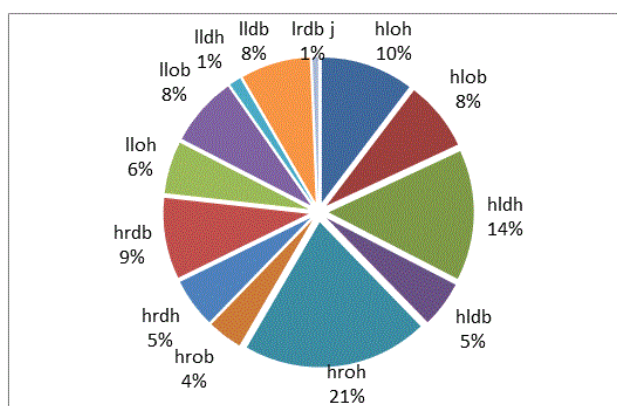


Figure 1: Percentage of the techniques according to the points earned

Through a stepwise regression, we selected 3 models with the techniques (Table 2). All the models were statistically significant at $p < 0.01$. Given that further selection resulted in lowering the R^2 values, we decided to use the model with the highest explanation of variability with three variables ($R^2 = 0.645$; $F = 14.541$; $p = 0.000$) (Table 3).

Table 2: Stepwise regression models

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.664	0.441	0.420	235,759
2	0.740	0.547	0.511	216,508
3	0.803	0.645	0.601	195,597

Table 3: ANOVA test value and significant coefficients

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
3	Regression	166,895	3	55,632	14,541	0.000
	Residual	91,819	24	3,826		
	Total	258,714	27			

Table 4: Basic characteristics of the model with three variables

Coefficients										
Model		Unstandardized Coefficients		Standardizes Coefficients		t	Sig.	R	Beta * r	R Square
		B	Std. Error	Beta						
3	(constant)	9,214	0.540			17,071	0.000			0.645
	hrch	2,110	0.499	0.536		4,227	0.000	0.664	0.3559	
	hloh	0.671	0.236	0.357		2,843	0.009	0.478	0.1708	
	hlob	0.611	0.237	0.317		2,575	0.017	0.374	0.1184	

The techniques HRCH ($r = 0.664$, $p = 0.001$; $t = 4.227$, $p = 0.000$), HLOH ($r = 0.478$, $p = 0.09$; $t = 2.843$, $p = 0.009$) and HLOB ($r = 0.374$, $p = 0.050$, $t = 2.575$, $p = 0.017$) made the most important contribution to the explanation of variability of the points earned (Table 4).

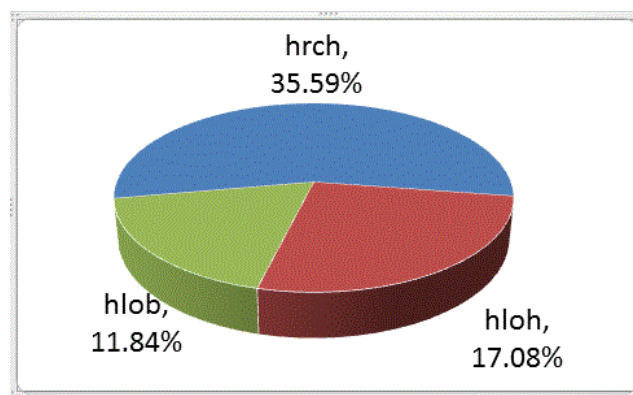


Figure 2: Partial ratios of the individual techniques

Using the multiple correlation and regression analysis, we detected the partial ratios of these techniques to explain the variability model (Figure 1). The HRCH technique amounted to 35.59%, the HLOH technique amounted to 17,08% and the HLOB technique amounted to 11,84% (Figure 2).

Through these techniques, we were able to explain the variability of the model with a 64.5% probability and error rate of 1.955 points. The average number of points was M: 11.786 and the standard deviation SD equaled: 3.095- based on these data we can predict the number of winning points in a match and create a prediction equation.

$$Y=9,214+2,110*HRCH+0,671*HLOH+0,611*HLOB$$

(R2: 64.5%; SEE 1,955 point; M: 11,786, SD: 3,095)

When comparing the most scoring techniques with the stepwise regression model, we can notice the difference. The most striking techniques did not appear as the most reliable predictors of the points achieved. This difference can be explained by the choice of the dependent variable (the number of points achieved by the winners in the individual matches). This does not necessarily represent the presumption of victory in the match. Another problem may also be the fact that not all techniques have been represented in each match. For this reason, we can understand the regression model as the prediction of the gain of a certain number of points but not the victory in the match. Care should be taken to look for a more appropriate dependent variable that takes into account the course of the match and serves as an indicator of possible victory.

CONCLUSION

Using the multiple correlation and regression analysis, we managed to create a model of the techniques predicting the number of points earned by the winners in the match. The selected techniques show high closeness with the points earned by the winners. The total set of techniques has also resulted in an overview of the structure of winning matches.

However, we cannot rule out the use other techniques, which are used in the matches and significantly determine the structure and course of the match. These techniques can be seen as determining, supporting and complementary.

Further research is opening up new opportunities for the analysis of dependent and independent variables in relation to the evaluation of combat sports matches. The objective should be to increase the validity of the dependent variable as a predictor of winning the match and analyse the factor structure of the techniques and situations in the match.

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