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Time-Motion analysis in Muay-Thai and Kick-Boxing amateur matches

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ABSTRACT

Silva JJR, del Vecchio FB, Picanço LM, Takito MY, Franchini E. Time-Motion analysis in Muay-Thai and Kick-Boxing amateur matches. *J. Hum. Sport Exerc.* Vol. 6, No. 3, pp. 490-496, 2011. Introduction: The aim of this study was to analyze time structure and effort level in Muay Thai and Kick-Boxing amateur level matches. Material and Methods: In Thirteen matches, the time structure was studied considering three levels of effort: i) Observation ii) Preparation, iii) Interaction. Data are presented using median (25% - 75%) and the mixed linear regression analysis was used to compared time structure and combat sports. Results: It was found superiority ($p < 0.002$) in the observation time in relation to another effort types, with no significant difference between sports. Conclusion: There were no time structure differences in modalities, when the same effort levels were compared, but time spent in observation was longer. This data is important to the technical-tactical preparation of athletes. **Key words:** TIME-MOTION STUDIES, TASK PERFORMANCE AND ANALYSIS, MARTIAL ARTS.

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INTRODUCTION

Combat sports are dynamic and high-intensity intermittent activities that require complex skills and tactical excellence for success. Performance in these sports is determined by powerful actions, applied in unpredictable context (Matsushigue et al., 2009; Del Vecchio et al., 2011a).

In this context, there is relative difficulty in knowing the effort intensity during the matches and to organize stimuli in the process of sports training to simulate combat sports physiological demands (Buse, 2009). One of the possibilities to improve the training organization is the knowledge of the combat time structure, with special attention to the effort:pause (E:P) relationship (Buse & Santana, 2008; Silva et al., 2010).

In this regard, different studies were conducted with grappling modalities, such as Wrestling (Nilsson et al., 2002), Judo (Marcon et al., 2010) and Brazilian Jiu-Jitsu (Del Vecchio et al., 2007). Although less frequently, striking combat sports, such as Taekwondo (Heller et al. 1998; Matsushigue et al., 2009) and Karate (Beneke et al., 2004), have also been analyzed.

Two of most popular striking combat sports are Kick-Boxing and Muay Thai. They have similarities with regards to historical, action rules, and operational principles, with the use of percussion techniques, like punches and kicks. Although there are technical and tactical differences (Buse & Santana, 2008), specifically regarding the use of knees and elbows in Muay Thai (Myers et al. 2006), it is possible to understand these combat sports as intermittent activities (Moreira et al., 2010; Crisafulli et al., 2009).

In this context, Crisafulli et al. (2009) studied the physiological responses and energy cost in Muay Thai combat simulations, while Buse & Santana (2008) presented some strategies for physical training to Kick-Boxing. Researchers have described the historical and social aspects of Muay Thai (Myers et al., 2006) and Kick-Boxing (Buse & Santana, 2008), as well psychophysiological aspects related to training (Ghanbari-Niaki et al., 2010) and competition (Moreira et al., 2010). However, little is known about the time structure of both combat sports and their implications. This knowledge can be useful for technical, tactical and physical training organization. Thus, this study aimed to analyze and to compare the time structure of Kick-Boxing and Muay-Thai events at the amateur level.

MATERIAL AND METHODS

The research project in conjunction with the completion of informed consent was approved by the local ethics committee.

Study type and variables characterization

This is an observational analytical study. The independent variables were the type of combat sport and the level of effort, while the stimuli duration along the fights was the dependent variable.

Time-motion analysis procedure

The motor actions time structure was classified into three effort levels (Arriaza, 2009), namely: i) Observation, which includes periods of little effort (like spatial displacement) or no activity, ii) Preparation, which involves exchanges of blows, at low intensity and the application of techniques without subsequent connections; iii) Interaction, includes periods of high intensity, fast and powerful motor actions, the sequence and chance of strikes applied by the fighters. This procedure has been used in other combat sports, such as Karate (Arriaza, 2009) and mixed martial arts (Del Vecchio et al., 2011a), and replaces the

more usual analysis mode, known as effort:pause (E:P), which includes the moments of Interaction level of effort in the segment called Effort, while the Preparation and Observation periods are included in the block called Pause.

Data Collection and recording

To record all matches, a digital camcorder (Sony®, Model SR-48) was used. Two amateur level events were recorded: i) Kick-Boxing Tournament, held in May 2010, in Pelotas, Brazil, and ii) Uruguayan Muay Thai Championship held in June 2010 in Montevideo, Uruguay. Both were recorded with the permission of the organizing committees.

The videos, stored in memory cards (SD Card™), were visualized in personal computer (Lenovo®, model G550). A researcher, with stopwatch accurate to tenths of a second and "number of laps" option, visualized combat sequences as many times as necessary for the correct annotation of data. For correct data collection, the software Kinovea™ was used. This software provides insertion of timers on screen, change the speed of display and switch frame by frame. Similar procedures were used in other investigations (Matsushigue et al., 2009; Del Vecchio et al., 2011b) and high reliability and objectivity was found.

Data analysis

Data are presented using median, for central tendency, and percentiles 25 and 75, for dispersion, due to non-normal distribution, observed through the Shapiro-Wilk test.

For the data analysis, concerning matches time structure, the Box-Cox transformation (Osborne, 2010) was used. The distribution and verification of combat sport type and effort level on the motor actions durations were analyzed using a mixed linear regression. Additionally, the time inside the matches was included in the model, because it represents a random effect. Variables with $p < 0.20$ in simple analysis were kept in the multivariable model. We adopted the 5% of significance level for the study factors.

RESULTS

During six Muay Thai matches a total of 73 blocks of Observation, 77 of Preparation, and 94 Interaction were identified, while during the seven Kick-Boxing matches there were 107 blocks of Observation, 82 of Preparation, and 136 of Interaction.

The Muay Thai matches were held in three 3-min rounds with 1-min interval between them. Kick-boxing matches were performed in three 2-min rounds with one minute intervals.

When the time structure is presented as E:P, the average effort of Kick-Boxing was lower than MuayThai (5.5 s vs. 8.7 s, respectively, $p < 0.001$). In the pause blocks (the sum of Preparation and Observation times), the average duration was similar (12.3 and 12.0 s for KB and MT, respectively). In general, the Kick-Boxing had an E:P of 6 s: 12 s (1:2) and MuayThai, 9 s: 12 s (near 2:3).

Table 1 presents the median (25%-75%) values of Observation, Preparation and Interaction in each combat sport, as well as the total number of blocks during the three effort levels observed in all matches analyzed. There were no statistically significant differences in the values of Observation, Preparation and Interaction between the two combat sports.

Table 1. Actions number and descriptive values of time structure in the three effort levels during Kick-Boxing and Muay-Thai amateur matches (n = 13).

	Effort Level					
	Observation		Preparation		Interaction	
	KB	MT	KB	MT	KB	MT
Actions number	107	73	82	77	136	94
Time (s)						
25%	4	3	2	2	3	3
Median	6.5	5	3	2.5	5	5
75%	10	11	4	3	7	10

KB = Kick-Boxing; MT = Muay-Thai

Table 2 presents the results of crude and adjusted multiple analyses. It is observed that there were significant differences in the effort level, with significantly lower time in the Preparation and Interaction compared to Observation. No statistically significant difference was found between the combat sports and match moment.

Table 2. Multiple linear regression analysis to temporal variation prediction of effort level activities during Kick-Boxing and Muay-Thai amateur matches*.

Variables	Crude analysis			Adjusted Model		
	Coefficient	CI [95%]	<i>p</i>	Coefficient	CI [95%]	<i>p</i>
Modalities						
Kick-Boxing	0					
Muay-Thai	0.01	-0.09;0.11	0.809			
Effort Level						
Observation	0					
Preparation	-0.69	-0.80; -0.57	0.000	-0.72	-0.84; -0.60	0.000
Interaction	-0.15	-0.25; -0.04	0.007	-0.21	-0.34; -0.08	0.002

* = values are showed considering Box Cox transformation

DISCUSSION

In this study, which investigated the time structure of Muay Thai and Kick-Boxing matches, the main finding was that the Observation phase was significantly lower in relation to the Preparation and Interaction in the two combat sports. Despite the absence of differences between them, the analysis into three effort levels expresses values may be closer to real conditions when compared with the analysis of E:P only (Silva et al., 2010).

In the technical-tactical viewpoint, both types have high similarity in the matches dynamics and motor pattern, and the duration of effort levels, showed no statistical differences between them. Despite the possibility of a longer match duration for Muay Thai by more than 3 min there was no statistical difference between the total match lengths.

Moreover, our findings reinforce the intermittent characteristics of both sports, which has been widely observed in other combat sports (Nilsson et al. 2002; Beneke et al. 2004; Del Vecchio et al., 2007; Matsushigue et al., 2009). In this context, the previously reported similarities between Muay Thai and Kick-Boxing (Buse, 2008) gain a new research field, the time structure.

Several authors have studied the time structure, predominantly from the E:P, for the better understanding of high intensity interval training characteristics and prescription (Glaister, 2005). In Judo, for example, E:P is around 15-30 seconds of effort for 10-15 second of pauses (Van Malderen et al., 2006). Using data from the 2005 Brazilian Jiu-Jitsu World Cup, it was observed an E:P near of 170 s:13 s (Del Vecchio et al., 2007). In striking combat sports the E:P is configured with one effort block and three to four breaks (1:3-4) in the Olympic Taekwondo (Heller et al., 1998), 1:6 in Songham Taekwondo (Matsushigue et al., 2009) and 4:1 in the Mixed Martial Arts (Del Vecchio et al., 2011b).

A study conducted with K1 combats recorded E:P values of approximately 1:1 (Silva et al., 2010). Indeed, previous information indicated that, to simulate the physiological demands of MuayThai, coaches and trainers need to apply stimuli such as "combat intervals" (Turner, 2009), during which work and pauses would last 5 seconds each (E:P = 1:1). In contrast, the present investigation found that the duration of breaks is 1.5 the duration of effort (2:3), which contradicts these statements.

In addition, this study progressed through the division of E:P in three effort levels, as previously done with Karate (Arriaza, 2009), Judo (Marcon et al., 2010), and MMA (Del Vecchio et al., 2011a) matches. The use of this methodology seems to be more appropriate to recognize specific moments of the fight: i) Observation - covers periods of little or no combat activity, which in this study was significantly greater than others, ii) Preparation - Composed by moments of low intensity activities, displacement and performance of simple techniques to break the opponent's guard, adjust the distance to him or to push him, increasing their anxiety, and inducing him to perform some inappropriate attack iii) Interaction - involves periods in which there are applications and exchange of blows at high intensity.

This strategy tends to assist in time-motion analysis of match with greater accuracy and, therefore, provide better information about the intensity to be used in the physical preparation process of fighters. Additionally, the technical-tactical workout can be better developed using the time structure as a reference, since the stimuli duration for observation and decision can be established with greater precision.

CONCLUSIONS

From the results obtained in this investigation, we conclude that there was no temporal difference in Muay Thai and Kick-Boxing amateur matches when the same effort levels are considered. However, for both combat sports, Observation period was longer than other phases (Preparation and Interaction), suggesting similar physiological and technical-tactical demands, and high-intensity intermittent profiles. This time structure can be used to improve the technical, tactical, and physical preparation of these athletes, allowing greater specificity in the tasks to be implemented.

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