



Full Length Article

Motor actions and spatiotemporal changes by weight divisions of mixed martial arts: Applications for training



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ABSTRACT

This study compared motor actions and spatiotemporal changes between weight divisions from Ultimate Fighting Championship (UFC™), conducting a practical application for mixed martial arts (MMA) training. For this, we analyzed 2814 rounds of all weight divisions by motor actions and spatiotemporal changes according actions and time of the Keeping distance, Clinch and Groundwork combat phases. We observed differences between weight divisions in the keeping distance on stand-up combat ($p \leq 0.001$; with lower time in Featherweight 131.4 s and bantamweight 127.9 s) clinch without attack ($p \leq 0.001$; with higher timer in Flyweight 11.4 s and Half-middleweight 12.6 s) and groundwork without attack ($p \leq 0.001$; with higher timer in Half-middleweight 0.9 s). During keeping distance, half-middleweight presented a higher frequency of Head Strikes Landed ($p = 0.026$; 7 ± 8 times) and attempted ($p = 0.003$; 24 ± 22 times). In clinch actions heavyweight present a higher frequency ($p \leq 0.023$) of head strike landed (3 ± 7 times) and attempted (4 ± 9 times) and half-middleweight for body strikes ($p \leq 0.023$) landed (2 ± 5 times) and attempted (3 ± 5 times). At the last, during groundwork, Bantamweight present a higher frequency ($p \leq 0.036$) of head strikes landed (8 ± 10 times) and attempted (10 ± 13 times) body strikes landed ($p \leq 0.044$; 3 ± 5 times) and attempted (3 ± 6 times). This study reveals important point to training and provide a challenge applied referential to the conditioning plains. From the weight divisions differences should be aware of the increase in the frequency of distance actions, especially in light and middleweights. On the Ground, bantamweight can focus on striking and grappling actions than others.

1. Introduction

MMA can be separated into three phases: a) free movement, b) clinch and, c) groundwork. In the free movement the athletes keep the distance, in which both fighters are able to organize strategies and movements and are not limited by body contact or the opponent grip (Kruyning & De Jong, 2014). In this phase, athletes using mainly full contact skills (punches, kicks, knees and elbow attacks) (James, Haff, Kelly, & Beckman, 2016). In the clinch phase is the moment both athletes obtain a grip on one another through body contact during the standing combat, where grappling fighters attempt to move to the last ground phase through takedown, for then attempt submissions, chokes and joint and locking techniques, as soon as possible (Kruyning & De Jong, 2014).

The analysis and diagnosis of motor actions changes from the videos can provide to each weight division a feedback that can be

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used to enhance athletic performance (Coswig, Ramos Sde, & Del Vecchio, 2016; Karpman, Reid, Phillips, Qin, & Gross, 2016; Miarka, Vecchio, Camey, & Amtmann, 2015; Miarka et al., 2014). Moreover, a specific evaluation of the situation (i.e. keeping distance, clinch and ground) analysis have not been performed in MMA bouts by weight divisions. This analysis can increase the variety of strategies, allowing the athlete to make the best choices during the combat. It is imperative point because this combat sport has a special complexity of intermittent structure over the five minutes per round, which is acyclic with open tasks.

A schematic comparison between weight divisions of performance for MMA athlete may be helpful and applied to observe differences related to the specific situation and technical-tactical actions. Further, technical-tactical data of different situations can offer crucial information to improve contextualized training plans with potentially unknown key factors (Silveira Coswig, Fukuda, de Paula Ramos, & Del Vecchio, 2016). However, it is not clear whether the technical-tactical aspects would differentiate weight division singularities. Recently, a study tried to determine those time-motion analysis that have the greatest influence on inferences about the intensity of the bout, the main findings indicate that lighter weight categories spend longer time in groundwork combat than heavier weight categories and, as rounds progress weight classes tend to equilibrate the time dedicated to high intensity actions, both standing and in the ground (Miarka, Coswig, Vecchio, Brito, & Amtmann, 2015). Although, these reports have provided important information for athletes and coaches, we believe that the MMA athletes require specific analysis of technical-tactical actions associated with spatiotemporal changes during the combat (i.e. keeping distance, during clinch and ground combat). These actions involves a diverse skillset including: varied strike orientations (i.e. Head, Body, Leg), takedowns, and groundwork actions, while the relationship amongst these skills represent the primary aspects of MMA attacking systems (Coswig et al., 2016; Del Vecchio, Hirata, & Franchini, 2011; Miarka et al., 2016). The identification of differences as a potential mediator of success could help to understand how each weight division organize technical-tactical actions in order to quickly adapt to spatial-temporal changes during the round (Miarka, Brito, Moreira, & Amtmann, 2017). Thus, this study compared motor actions and spatiotemporal changes between weight divisions from Ultimate Fighting Championship (UFC™), conducting a practical application for MMA training.

2. Methods

2.1. Study design

This comparative and descriptive applied research study, using performance analysis. We to determine specific Motor actions by weight divisions of elite athletes participating in UFC®. This information brings new conceptions of performance evaluations and programs with specific combat phase of each weight division. Therefore, present study was divided into three stages. A validated protocol of motor actions was identified in previous studies addressing MMA performance analysis (Miarka, Coswig, 2015; Miarka et al., 2016; Miarka, Vecchio, Camey, & Amtmann, 2016; Miarka et al., 2017). In sequence, the data collection was analyzed. All bouts occurred during events in air-conditioned arenas, except Ibirapuera's Gym, between 18:30 and 24:00 hs with a range temperature between 24.5 and 27.0 °C. Afterward, in the last stage, we compared spatiotemporal changes and motor actions frequencies. This study was submitted to and approved by the Local Committee of Ethics in Research, following the rules of resolution 196/96 of the National Health Council. The present study ensured anonymity and confidentiality by replacing the athletes' personal identification, there are no ethical issues in analyzing or interpreting data obtained at public events, as established by previous protocols (Miarka, Coswig et al., 2015; Miarka et al., 2014; Miarka, Vecchio et al., 2015).

2.2. Sample

The sample consisted of 2814 rounds of all weight divisions (Flyweight n = 222, Bantamweight n = 291, Featherweight n = 358, Lightweight n = 584, Welterweight n = 558, Middleweight n = 215, Lightheavyweight n = 416, Heavyweight n = 170) from 67 events of 2013–2014 (TUF 17 until 19, TUF Brazil, TUF China, TUF Nations: Canada vs. Australia, UFC-123, UFC-156 until 177, Fight Night 26 until 51; UFC on Fox 7 until 12; UFC on FUEL 7 until 10). A minimum of six weeks of rest was observed between bouts to prevent stress interference between different combats (James, Kelly, & Beckman, 2013). All participants had previous experience with professional UFC events, rules and procedures used during the championship. No interferences were made in the training, nutritional or hydration status of participants and they maintained the weight loss recovery time pattern of 24 h between Official weigh-in and the bout, following the rules (Jetton et al., 2013; Matthews & Nicholas, 2016). The criteria of inclusion were to consider only bouts which three rounds (including knockout, technical knockout, submission and score decisions), while exclusion criteria were concerning bouts with less or more than three rounds and/or with characteristics that disqualified prospective outcomes comparisons – bouts which finished in “draw” or “no contest”.

2.3. Protocol of time-motion analysis, intra and inter-expert validation

Motor actions and spatiotemporal changes were observed by five researchers, according to frequency of actions and time of the Keeping distance, Clinch and Groundwork phases and motor actions, following a previously established protocol (Miarka et al., 2016; Miarka et al., 2017; Miarka, Coswig et al., 2015; Miarka, Vecchio et al., 2016). To guarantee ecological validity and to verify the elite status of the sample, the bouts were analyzed by FightMetric Team using records with professional quality and recorded by performance analysts. All available videos of sufficient quality (standard definition 480/60i) and taken from a landscape view of the entire competition area were included in the analysis (Sterkowicz-Przybycien, Miarka, & Fukuda, 2017). When appropriate, considering the inclusion criteria, both athletes were evaluated in a single match, and individual athletes were evaluated more than once

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