KINESIOLOGY & COACHING

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Combat-ending submission techinques in modern mixed martial arts

Abstract

Background. Submissions due to joint locks and strangleholds accounted for many stoppages in the early days of Mixed Martial Arts (MMA). Since then, the adoption of unified weight classes, and rule changes have considerably impacted the sport. There is a need to update the database of the incidence of submission outcomes in modern MMA.

Problem and Aim. Assess ratios of match-ending by submission as well as to identify the most frequently-used submission techniques among different weight and gender categories in MMA.

Methods. A total of 1903 fights (1728 male and 175 female) in 167 events from 2014 to 2017 were assessed. Submissions were further investigated to identify the specific technique used to end a fight.

Results. Submissions accounted for the ending in 17.3% of male and 21.1% of female modern MMA combats, respectively. As the weight class became lighter, the chance of a stoppage due to submission is greater ($p < 0.05$). The more frequent combat-ending techniques were based on strangleholds, mainly rear and front chokes. The elbow was the most targeted joint for all weight classes, except the male heavyweight. The shoulder was the second most attacked joint, whereas the knee and the ankle were reported in a relatively small number.

Conclusion. This updated database on fight outcomes should be considered for MMA trainers, coaches and athletes when programming specific training sessions aiming to mimic combat patterns.

Introduction

Mixed Martial Arts (MMA) is a relatively new combat sport modality that integrates a range of fighting styles. Matches involve techniques such as striking (using hands, feet, knees, and elbows), grappling (clinch and takedown), and submissions (chokes and joint locks) [Andrade et al. 2019; James et al. 2017]. Then, success in modern MMA can be considered complex, requiring athletes to dominate various technical standards [Andrade et al. 2019].

In this sense, submissions have a particular importance in achieving victory in elite-level MMA competition [James et al. 2017]. The Brazilian jiu-jitsu (BJJ) has been shown to be a decisive and effective discipline since the early days of MMA, when a BJJ master won open-weight tournaments using exclusively submission skills to overcome his opponents [Andreato et al. 2016]. At that time, each combatant had a preferred background fighting style [Buse 2006], unlike the many skills that today's MMA athletes must cover in their training routines [Bounty et al. 2011; Schick et al. 2012].

Submissions due to joint locks and strangleholds accounted for 30% of MMA stoppages between 1993 and 2003 [Buse 2006]. Since then, the adoption of unified weight classes [Association of Boxing Commissions–ABC 2019] and rule changes have considerably impacted the sport [Fernandes et al. 2018]. For example, recent investigations have shown how aspects such as strikes landed [Miarka et al. 2017; Miarka et al. 2015], time spent in groundwork [Miarka et al. 2015], and match-ending due to head trauma [Follmer et al. 2019] are influenced by weight class and gender in modern MMA.

Although the sport has experienced an evolution and increase in physical demands [Andrade et al. 2019], submission techniques are still considered as key to be successful in MMA [James et al. 2017]. However, there is a need to update the database of the incidence of submission outcomes in modern MMA, as well as to investigate the most effective techniques to finish a combat for each category. This should be of interest to trainers, coaches and athletes, as a tool to improve training specificity and strategic match planning. Thus, the aim of this study was to assess ratios of match-ending by submission as well as to identify the most used submission techniques to finish a combat among different weight and categories in modern MMA.

Material and Methods

1. Experimental approach to the problem
A total of 1903 fights, from all 167 Ultimate Fighting Championship (UFC) events from 2014 up to 2017, were assessed. This includes the following: UFC 169 to 219, UFC Fight Night 34 to 123, UFC on Fox from 10 to 26, The Ultimate Fighter Finale from 19 to 26, The Ultimate Fighter Finale China, The Ultimate Fighter Finale Nations, and The Ultimate Fighter Finale Brazil 3.

All data collected for the present investigation was obtained from publicly available sources, comprised by a specialized website (www.sherdog.com) and the official UFC website (www.ufc.com). Similar data collection procedures were used previously to verify MMA fight outcomes and athletes records [Bernick et al. 2015; Follmer et al. 2019; Hutchison et al. 2014]. Video analysis of the specific bout was performed when further information was needed.

2. Procedures
The main MMA fight outcomes collected were classified as submission, decision, knockout or technical knockout, and other (i.e. medical stoppage, no contest or disqualification). In addition, submissions were further investigated to identify the technique used to end a fight. Strangleholds are commonly reported as chokes, and the three major types of strangleholds considered were: rear choke, front choke and leg choke. Rear chokes were those applied when controlling the opponent's back. Front choke was considered, all chokes performed not in the opponent's back and often in a front or side position. This category included several specific techniques (north south choke, arm triangle choke, brabo choke, guillotine, vont flue choke, ezequiel choke, anaconda choke and Japanese neck tie). A leg choke was performed when the legs were used as the main tool to submit the opponent (e.g. triangle choke). Besides strangleholds, the other submission technique investigated was the joint lock. Data collected was divided and analyzed according to the specific body site where the joint lock was applied when achieving a win.

The UFC events are sanctioned by states athletics commissions and follow the MMA unified rules. So, every round lasts 5 minutes and usually fights have 3 rounds, except the championship fights or some main events determined by the organization, which may have 5 rounds [ABC 2019]. The UFC male weight categories analyzed were: flyweight (52.1 to 56.7 kg); bantamweight (56.7 to 61.2 kg); featherweight (61.2 to 65.8 kg); lightweight (65.8 to 70.3 kg); welterweight (70.3 to 77.1 kg); middleweight (77.1 to 83.9 kg); light heavyweight (83.9 to 93.0 kg); and heavyweight (93.0 to 120.2 kg). The strawweight (up to 52.1 kg) and the bantamweight (56.7 to 61.2 kg) divisions were the female categories analyzed. Data from fights in a catchweight (i.e. when athletes agree to fight in an unofficial weight class) were not collected regardless of, since results and conclusion would be affected.

3. Statistical analysis
All statistical analysis was performed using SPSS (v.17.0; SPSS Inc., Chicago, IL, USA). Absolute and relative (%) descriptive data were used to present the number of fights, fight outcomes and the proportion of techniques used to end a combat. Odds ratios (OR) were calculated from a binary logistic regression to verify and compare the chance of a submission as the fight outcome in different weight classes. A significance level of ≤ 5% was set, with 95% confidence intervals (CI).

Results

A total of 1728 male and 175 female combats were analyzed. The absolute number of fights and the percentage of the investigated outcomes for each weight category are presented in Table 1.

The male heavyweight division presented the lower chance of a submission as a fight outcome. Thus, this category was the reference to compare the chances of a match-ending due to submission with all other divisions. The male fly, bantam, light and the female straw weight divisions presented significant higher chances of presenting a combat ended due to a submission (Table 2).

Table 1. Absolute number of fights analyzed and relative outcomes (%) for each weight category.

	Total Fights	Submission (%)	Decision (%)	KO/TKO (%)	Other (%)
Male					
Fly	126	22.2	63.4	14.3	0
Bantam	179	20.6	51.4	25.7	2.2
Feather	218	18.8	51.8	27.1	2.3
Light	350	19.7	50.8	27.4	2
Welter	347	17.8	48.1	31.7	2.3
Middle	233	14.1	41.6	41.6	2.6
Light Heavy	137	17.5	38.6	41.6	2.1
Heavy	138	11.5	31.8	53.6	2.9
Total	1728	17.3	47.7	32.2	2.1
Female					
Straw	101	23.7	68.3	7.9	0
Bantam	74	17.5	55.4	25.7	1.4
Total	175	21.1	62.9	15.4	0.5

KO/TKO = Knockout or Technical Knockout. Other = doctor stoppage, no contest, or disqualification.

Table 2. Odds ratios (OR) for a match-ending by submission in Mixed Martial Arts.

|	Submission OR (CI95%)	P
Male		
Fly	2.18 (1.11 – 4.25)	0.023
Bantam	1.98 (1.05 – 3.74)	0.034
Feather	1.76 (0.94 – 3.29)	0.073
Light	1.87 (1.04 – 3.35)	0.035
Welter	1.65 (0.92 – 2.99)	0.092
Middle	1.25 (0.66 – 2.38)	0.481
Light Heavy	1.61 (0.81 – 3.20)	0.166
Heavy*	1.00	----
Female		
Straw	2.37 (1.18 – 4.75)	0.014
Bantam	1.75 (0.80 – 3.81)	0.160

* Male heavyweight as the reference.

Regardless of the category, chokes accounted as the preferable method to achieve a win via submission. The joint locks occurred in a minor proportion, and the technique called "calf slice" (i.e. acute pressure on the calf muscle), not a joint lock nor a choke, was used once in the male bantam weight division and it is reported in Figure 1 as "other".

The rear choke was the most used stranglehold technique to end a combat in the majority of the weight categories, followed by front chokes and leg chokes. The front choke was predominant in the male bantam, feather and heavy weights, while the female bantam weight presented the same proportion of rear and front chokes (Figure 2).

Four body sites were observed in those combats that ended via joint lock submission. The elbow was the most targeted joint for all weight classes, except in the male heavyweight. The shoulder accounted as the second more attacked joint, whereas the knee and the ankle were reported in a relatively small proportion (Figure 3).
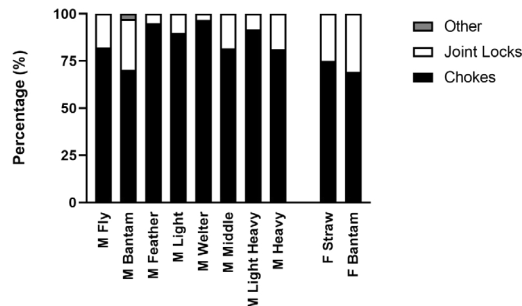
Figure 1. Type of technique used in the combats that ended via submission for each male (M) and female (F) weight category.
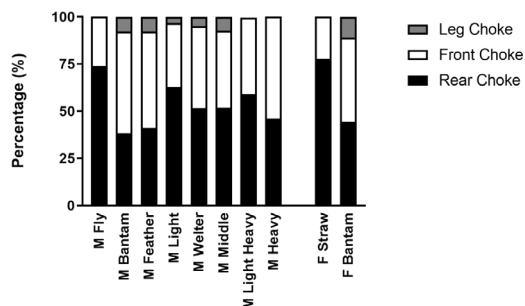
Figure 2. Percentage of different choke techniques used to end a fight via stranglehold for each male (M) and female (F) weight category.
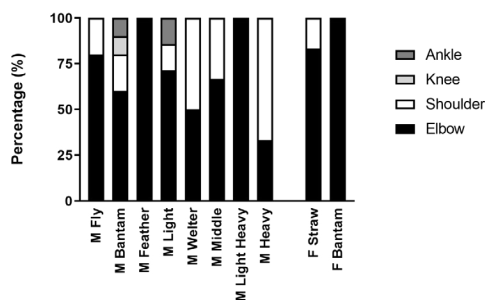
Figure 3. Percentage of body site attacked to end a fight via joint lock for each male (M) and female (F) weight category.

Discussion

This study aimed to assess the ratios of match-ending due to submission, as well as the frequency of submission techniques to finish a combat among the weight and gender categories in modern MMA. The main finding is that, in general, lighter athletes presented higher

chances to end matches by submission. Rear and front chokes accounted for the majority of submission techniques, whereas the elbow was the most attacked body site for joint locks.

The chance for a match-ending due to submission was significantly increased in the male fly (118%), bantam (98%), light (87%) and the female straw (137%) weight divisions compared to the male heavyweight category. Previous evidence analyzed 2097 MMA bouts from UFC events (2012-2014) and compared time-motion and technical-tactical structure between rounds and weight classes. Findings indicated that lighter athletes spend more time in groundwork with high intensity actions than the heavier ones. However, this difference reduces as the match goes longer [Miarka et al. 2015]. So, our results are in accordance with others and support the suggestion that the training of grappling disciplines might have higher relevance for lower weight categories, for both attack and defense situations. On the other hand, heavyweights are those with the lowest frequency of match-ending due to submission. In fact, heavyweights are those with a prominent high risk of ending a fight either unconscious or unable to defend themselves due to head impacts [Follmer et al. 2019].

The vast majority of the submission victories in MMA between 2014 and 2017 were via stranglehold, regardless of gender or weight category, which represents novel contribution to the literature. Buse [2006] reported a slightly predominance of joint locks (16.5%) compared to chokes (14.1%) in combats from 1993 to 2003, regardless of weight category. Most athletes involved in the fights analyzed by Buse [2006] were from a BJJ background, where joint locks are extremely prevalent [Kreiswirth et al. 2014; Scoggin et al. 2014]. However, the evolution of the sport and the compulsory need to develop offensive and defensive submission skills appear to be the most reasonable justification for such a change in proportion in an 11 years time span between the two studies.

Among the stranglehold techniques, the rear choke can be considered as the most used, similar to previously assessed by Buse [2006]. The present study adds to the knowledge the specific proportion of chokes techniques according to weight and gender category. While rear chokes occurred more frequently in the straw, fly, light, welter, middle, and light heavy weights, front chokes were predominant in the male bantam, feather and heavyweights. Despite its efficiency, leg choke attempts are not usual [Bello et al. 2019], and occurred in a smaller proportion, and were absent in combats of four weight categories.

The elbow was the most attacked body site when achieving a victory by joint lock in MMA, except in the male welter (50% shoulder, 50% elbow) and heavy weights (66% shoulder, 33% elbow). In fact, the arm is a common injured body site in MMA [Ji 2016], and the elbow is the most targeted and injured joint in BJJ matches with gi [Scoggin et al. 2014] or no-gi [Kreiswirth et al. 2014]. The male bantamweight was the only category to present a variety of joints attacked (i.e. ankle, knee, shoulder, and elbow), whereas the male feather and light heavyweight, as well as the female bantamweight, attacked exclusively the elbow to achieve a win by joint lock.

From the technical point of view, much less attention was found for movements focused on lower limbs. Previous evidence showed an absence of knee bar attempts in 304 UFC matches and a focus on chokes attempts, mainly the guillotine (i.e. a subset of front chokes) and the rear naked choke [Bello et al. 2019]. An alternative explanation for the lower frequency of attacks aiming lower limbs could be related to disadvantageous positions regarding striking defense or the low technical competence for the majority of the competitors. Also, it has been suggested that advance to side control is a dominant position that could lead to higher chances to end a fight by submission [Bello et al. 2019; Miarka et al. 2016]. Taken together, this information suggests that MMA athletes may benefit from grappling training strategies to improve transitions that leads to the side control position as well as to develop approaches to lower limb attacks that might surprise the opponent.

Conclusion

In summary, the more frequent techniques applied to finish a combat via submission in modern MMA were strangleholds, mainly rear and front chokes. Joint locks accounted for a smaller proportion of submissions, and the elbow was the most attacked body site. In addition, as weight class goes lighter, higher is the chance for a stoppage due to submission. The results obtained in this study should be considered for trainers, coaches, and athletes when programming specific training sessions to mimic combat patterns.

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Techniki poddawania się kończące walkę w nowoczesnych mieszanych sztukach walki

Słowa kluczowe: sporty walki, sztuki walki, podejmowanie decyzji, wykonywanie zadań i analiza

Streszczenie

Tło. Poddawanie się w czasie walki z powodu blokady stawów i chwytów duszących powodowało wiele przerw w początkach historii mieszanych sztuk walki (Mixed Martial Arts). Od tego czasu przyjęcie ujednoliconych klas wagowych i zmiany zasad miały znaczący wpływ na ten sport. Istnieje potrzeba aktualizacji bazy danych dotyczących częstości występowania zgłoszeń poddania walki w nowoczesnych MMA.

Problem i cel. Oszacowanie współczynników zakończenia walki przez poddanie się, jak również określenie najczęściej stosowanych technik poddania się wśród różnych kategorii wagowych i płciowych w MMA.

Metody. Ogółem oceniono 1903 walk (1728 mężczyzn i 175 kobiet) w czasie 167 spotkań od 2014 do 2017 roku. Walki zakończone poddaniem się były dalej badane w celu zidentyfikowania konkretnej techniki stosowanej do ich zakończenia.

Wyniki. Poddania walki stanowiły zakończenie odpowiednio 17,3 i 21,1% walk MMA mężczyzn i kobiet. Im klasa wagowa jest lżejsza, tym większa jest szansa na zatrzymanie walki z powodu zgłoszenia poddania się (p<0,05). Częstsze techniki kończenia walki opierały się na chwytach duszących od tyłu i przodu. Łokieć był najbardziej atakowanym stawem wśród wszystkich klas wagowych, z wyjątkiem męskiej wagi ciężkiej. Łopatka była drugim najczęściej atakowanym stawem, natomiast kolano i kostka były zgłaszane w stosunkowo niewielkim odsetku.

Wniosek. Ta zaktualizowana baza danych wyników walki powinna być brana pod uwagę przez trenerów, szkoleniowców i zawodników MMA podczas programowania konkretnych sesji treningowych mających na celu naśladowanie wzorców walki.