Anthropometric profiling and performance metrics: a comprehensive analysis of UFC® top athletes

Perfil antropométrico e métricas de desempenho: uma análise abrangente dos principais atletas do UFC®

Perfiles antropométricos y métricas de rendimiento: un análisis completo de los mejores atletas de UFC®

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ABSTRACT  
In mixed martial arts, performance is influenced by multiple factors beyond weight, making it crucial for athletes and coaches to understand these complex interactions for their success. Therefore, this study aimed to analyze the performance and anthropometric indicators of 127 top athletes from the Ultimate Fighting Championship® across men’s weight categories. Anthropometric data, combat duration (DC), technical demands (TD), type of win and age were examined. The analysis included statistical tests to identify differences, correlations, and measure the influence of variables. Significant differences were observed between weight categories in body mass, body mass index (BMI), height, wingspan and leg reach. Featherweight and light heavyweight had the longest and shortest CD, respectively (770.9±123.7s and 525.1±143.0s). For TD, significant differences were found in applied takedowns between welterweight and light heavyweight (p=0.013) and in connected strikes between bantamweight with flyweight (p=0.001) and heavyweight (p=0.045). Significant differences in wins by knockouts/technical knockouts and judges’ decisions were observed between some categories. BMI showed a low correlation with knockouts (ρ=0.3) and (ρ= -0.2). Connected strikes and applied takedowns explained 45% of the variance in wins (R²=0.457). In conclusion, larger athletes tend to have shorter fights with wins by knockout, while smaller athletes have longer fights, often resulting in wins by judge’s decisions. These findings can assist the development of training programs and combat strategies specific to each weight category.

Keywords: martial arts, athletic performance, sports, anthropometry.

RESUMO  
Nas artes marciais mistas, o desempenho é influenciado por múltiplos fatores além do peso, e compreender essa interação complexa é crucial para o sucesso dos atletas de elite. Portanto, nosso objetivo foi analisar os indicadores antropométricos e o desempenho de 127 atletas de ponta do Ultimate Fighting Championship® nas categorias masculinas. Foram analisados dados...
antropométricos, duração do combate (CD), demandas técnicas (DT), tipo de vitória e idade. A análise incluiu testes estatísticos para identificar diferenças, correlações e medir a influência das variáveis. Houve diferenças significativas para massa corporal, índice de massa corporal (IMC), altura, envergadura e alcance das pernas entre as categorias. Peso pena e meio-pesado tiveram a DC mais longo e mais curto (770,9±123,7s e 525,1±143,0s), respectivamente. Em relação às DT, foram encontradas diferenças significativas nas quedas aplicadas entre as categorias meio-médio e meio-pesado (p=0,013) e nos golpes conectados entre as categorias peso gallo com peso mosca (p=0,001) e peso pesado (p=0,045). As vitórias por nocaute/nocaute técnico e as decisões dos juízes apresentaram diferenças significativas entre algumas categorias. O IMC apresentou baixa correlação com nocautes (ρ = 0,3) e duração do combate (ρ = -0,2). Golpes conectados e quedas aplicadas parecem explicar as vitórias em 45% (R²=0,457). Em conclusão, atletas maiores geralmente têm lutas mais curtas com vitórias por nocaute, enquanto atletas menores frequentemente enfrentam lutas mais longas que resultam em vitórias por decisão dos juízes. Esses achados podem auxiliar no desenvolvimento de programas de treinamento e estratégias de combate específicas de cada categoria de peso.

**Palavras-chave:** artes marciais, desempenho atlético, esportes, antropometria.

**RESUMEN**
En las artes marciales mixtas, el rendimiento está influenciado por diversos factores más allá del peso, siendo crucial comprender esta compleja interacción para el éxito de los atletas de élite. Nuestro objetivo fue analizar los indicadores antropométricos y el desempeño de 127 atletas de alto nivel del Ultimate Fighting Championship® en categorías masculinas. Se evaluaron datos antropométricos, duración del combate (DC), exigencias técnicas (ET), tipo de victoria y edad. El análisis incluyó pruebas estadísticas para identificar diferencias, correlaciones y medir la influencia de variables. Se encontraron diferencias significativas en masa corporal, índice de masa corporal (IMC), altura, envergadura y alcance de las piernas entre categorías. El peso pluma y semipesado registraron la DC más larga y corta (770,9±123,7s y 525,1±143,0s), respectivamente. Respecto a ET, hubo diferencias significativas en las proyecciones aplicadas entre welter y semipesado (p=0,013), y en golpes conectados entre gallo, mosca (p=0,001) y pesado (p=0,045). Las victorias por nocaut/nocaut técnico y decisiones de jueces variaron significativamente entre categorías. El IMC mostró una correlación baja con nocauts (ρ = 0,3) y duración del combate (ρ = 0,2). Golpes conectados y derribos aplicados explicaron el 45% de las victorias (R²=0,457). En resumen, atletas más grandes tienden a tener combates más cortos con victorias por nocaut, mientras que los más pequeños suelen tener combates más largos con victorias por decisión de jueces. Estos hallazgos pueden orientar el desarrollo de programas de entrenamiento y estrategias de combate adaptadas a cada categoría de peso.

**Palabras clave:** artes marciales, rendimiento atlético, deportes, antropometría.
1 INTRODUCTION

In 1993, the Ultimate Fighting Championship® (UFC) was established, which initially organized mixed martial arts (MMA) competitions with few restrictions, following the principle of No Holds Barred (SPANIAS; NIKOLAIDIS; ROSEMANN; KNECHTLE, 2019). Over the years, MMA developed as a form of sport, eventually transforming into a specific modality combat sport. In three decades, UFC® has emerged as the leading and most prestigious organization within MMA, also establishing itself as a highly profitable company that offers substantial financial compensation to its athletes (BUENO; FARO; LENETSKY; GONCALVES et al., 2022). Currently, the total number of athletes all MMA organizations has grown exponentially (BUENO; FARO; LENETSKY; GONCALVES et al., 2022), which has increased interest in this modality and led athletes from other combat disciplines, such as Boxing, Muay Thai, Taekwondo, Karate, Brazilian Jiu-jitsu, Wrestling, among others, migrating to MMA.

As an individual sport, MMA competitions, specifically UFC®, score fights based on connected and successfully defended strikes, with an emphasis on knocking out the opponent (FERNANDES; ANDRADE DE BRITO; BRITO; AEDO-MUNOZ et al., 2022). Furthermore, MMA includes grappling techniques, where the objective is to submit the opponent using twisting or choking techniques (FERNANDES; ANDRADE DE BRITO; BRITO; AEDO-MUNOZ et al., 2022). Each fight in MMA demands specific physical and technical skills that athletes must master (LYSTAD; GREGORY; WILSON, 2014).

The UFC® competitions are carried out in weight categories, with maximal limit weight in each one (see Sample section) (PEACOCK; FRENCH; SANDERS; RICCI et al., 2022). The combats take place in an octagonal ring and are divided into rounds of five minutes each, with one-minute intervals between them (FOLHES; REIS; MARQUES; NEIVA et al., 2023; TOTA; WIECHA, 2022). In this sense, to be an outstanding athlete in MMA, a high physical fitness encompassing power, strength, and endurance is essential (KOSTIKIADIS; METHENITIS; TSOUKOS; VELIGEKAS et al., 2018). Additionally, technical
ability and its effective use are also necessary for success in this sport. Not coincidentally, the UFC® performance metrics available on their website encompass various components to describe actions during combat, such as total strikes attempted, total strikes landed, significant strikes attempted, significant strikes landed, significant distance strikes attempted, significant distance strikes landed, significant clinch strikes, among others (JAMES; SWEETING; KELLY; ROBERTSON, 2019).

On the other hand, the scientific literature is scarce about the influence and relationship of anthropometric aspects, combat duration, technical demands, type of win, and age in fighters of this highest level of performance. The lack of variation in training programs, evaluation routines, and periodization recently demonstrated (KIRK; LANGAN-EVANS; CLARK; MORTON, 2021), reveals that details about the dynamic and combat outcomes are yet to be fully elucidated. Therefore, this study aimed to conduct a multivariate analysis incorporating anthropometric and performance metrics of UFC® athletes.

2 METHODS

2.1 SAMPLE

Data from 127 men across eight weight categories were analyzed. The ranking was composed of the 16 best athletes for each category (except lightweight, with 15 athletes presented) as follows body mass limit: flyweight (56.7 kg), bantamweight (61.2 kg), featherweight (65.7 kg), lightweight (70.3 kg), welterweight (77.1 kg), middleweight (83.9 kg), light heavyweight (92.9 kg), and heavyweight (120.2 kg). Generally, heavyweight athletes can weigh up to 120.6 kg, but when competing for the category’s championship belt, the limit is 120.2 kg. Therefore, no athletes above this weight limit were in the present study.
2.2 DATA EXTRACTION

Data provided by UFC® is collected in real-time by a team of 25 MMA specialists known as (FightMetric LLC). Its counting procedure provides the reliability necessary to accurately determine the winner (BELLO; BRITO; AMTMANN; MIARKA, 2019). After each event, this count is reviewed and continuously made available online.

All data used in the present study was sourced from publicly available information from the UFC® official website (https://www.ufc.com.br/rankings) in July 2022. Two independent reviewers worked on extracting and analyzing the dataset. The confidentiality and anonymity of the athletes' identities were guaranteed. Studies of this nature do not require the Research Ethics Committee (FERNANDES; ANDRADE DE BRITO; BRITO; AEDO-MUNOZ et al., 2022).

2.3 PARAMETERS

Anthropometric aspects were body mass, body mass index (BMI), height, wingspan, and leg reach; combat duration was considered in seconds; technical demands were connected strikes (strikes that hit the opponent) and applied takedowns (the technique of taking the opponent to the ground in a controlled manner); and the type of win was classified as Knockouts/Technical Knockouts - KO/TKO, Submission - SUB, and Judges' Decision – DEC.

Moreover, based on the disclosed fighting specialties of each athlete, they were categorized into three groups. In instances where this information was unavailable on the website, it was deemed unreported.

2.4 DATA ANALYSIS

The distribution of the data was verified using the Shapiro-Wilk test. To ensure standardization, the researchers reported the data as mean and standard deviation (unless otherwise stated) and occasionally utilized percentages. The
one-way ANOVA, followed by Bonferroni’s post hoc or Kruskal-Wallis was used to compare the anthropometric measurements, combat duration, technical demands, and type of win among categories.

Spearman’s bivariate correlation test was conducted to determine the correlation between all variables studied. The correlation was classified according to Hopkins’ criteria, which are as follows: negligible; < 0.1, weak; 0.1 - 0.39, moderate; 0.4 - 0.69, strong; 0.7 - 0.89, very strong; 0.9 - 1.0 (SCHOBER; BOER; SCHWARTE, 2018).

The hierarchical multiple linear regression model was used to verify if the predictive variables (wingspan, leg reach, height, connected strikes, applied takedown, and combat duration) can adequately explain or predict win (outcome). For a significant difference, a p-value ≤ 0.05 was adopted. The IBM SPSS Statistics 25 software (IBM Inc., Chicago, IL) was used to perform the statistical analysis, and GraphPad Prism was used to create the graphs.

3 RESULTS

No significant differences were observed in athletes’ age (30.5 ± 3.7 years for all athletes) between weight categories. The results of the other parameters analyzed are detailed below.

3.1 ANTHROPOMETRIC ASPECTS

The significant differences (p ≤ 0.05) found in anthropometric aspects between weight categories are demonstrated in Table 1.
Table 1. Anthropometric aspects in the UFC® eight men’s weight categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Height (cm)</th>
<th>Body mass (kg)</th>
<th>BMI (kg/m²)</th>
<th>Wingspan (cm)</th>
<th>Leg reach (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flyweight</td>
<td>168.4±3.6</td>
<td>56.9±1.2</td>
<td>20.1±0.9</td>
<td>173.1±4.4</td>
<td>95.7±2.7</td>
</tr>
<tr>
<td>Bantamweight</td>
<td>171.5±4.1</td>
<td>61.6±1.1</td>
<td>20.9±1.0</td>
<td>174.9±5.3</td>
<td>97.9±3.2</td>
</tr>
<tr>
<td>Featherweight</td>
<td>175.0±5.2</td>
<td>66.4±1.0</td>
<td>21.7±1.3</td>
<td>181.4±5.2</td>
<td>99.7±4.5</td>
</tr>
<tr>
<td>Lightweight</td>
<td>175.8±4.1</td>
<td>69.5±2.1</td>
<td>22.5±1.4</td>
<td>183.3±5.1</td>
<td>101.1±3.6</td>
</tr>
<tr>
<td>Welterweight</td>
<td>182.6±3.5</td>
<td>76.3±2.3</td>
<td>22.8±1.0</td>
<td>188.7±6.0</td>
<td>104.2±4.2</td>
</tr>
<tr>
<td>Middleweight</td>
<td>184.9±4.1</td>
<td>83.4±1.7</td>
<td>24.4±1.2</td>
<td>192.4±6.5</td>
<td>107.5±4.3</td>
</tr>
<tr>
<td>Light Heavyweight</td>
<td>191.3±3.0</td>
<td>94.6±6.1</td>
<td>25.8±1.9</td>
<td>196.0±5.3</td>
<td>105.4±25.2</td>
</tr>
<tr>
<td>Heavyweight</td>
<td>191.5±4.3</td>
<td>115.7±3.6</td>
<td>31.5±2.0</td>
<td>198.9±7.6</td>
<td>110.1±6.0</td>
</tr>
</tbody>
</table>

Statistical difference p ≤ 0.05 between weight categories represents by letters: a: with featherweight; b: with lightweight; c: with welterweight; d: with middleweight; e: with light heavyweight; f: with heavyweight; BMI: body mass index (weight/height²); The original data from the UFC® website was converted from pounds to kilograms; For reasons of data standardization, the data were reported as mean and standard deviation.

Source: Data Processed by Researchers.

3.2 COMBAT DURATION

The analysis of the combat duration showed significant differences across certain weight categories (Figure 1). Specifically, differences were observed between bantamweight (754.0 ± 159.3s) and light heavyweight (525.1 ± 143.0s) (p = 0.007), bantamweight and heavyweight (537.4 ± 227.9s) (p = 0.015), featherweight (770.9 ± 123.7s) and light heavyweight (p = 0.003), and featherweight and heavyweight (p = 0.006). These differences correspond to approximately three to four minutes or about one and a half rounds.
Figure 1. Combat duration in the UFC® eight men's weight categories

![Bar chart showing combat duration](image)

a: with light heavyweight (p = 0.007); b: with heavyweight (p = 0.015); c: with light heavyweight (p = 0.003); d: with heavyweight (p = 0.006); Data represented by mean and standard deviation. Source: Data Processed by Researchers.

3.3 TECHNICAL DEMANDS

Connected strikes did show a significant difference (Figure 2) among the following weight categories: flyweight and bantamweight (p = 0.002) and heavyweight (p = 0.045). Applied takedowns did show a significant difference between welterweight and light heavyweight (p = 0.013).
3.4 SPECIALIZED ATHLETE PARAMETERS

Among 127 athletes, 38.6% adopt MMA as their primary fighting style, while 30.6% focus on striking and 21.3% on grappling. However, 9.5% of the athletes did not have a specific fighting style reported on the website. Analysis of the weight categories individually revealed no consistent pattern of specialization.
3.5 TYPE OF WIN

There was a significant difference in the number of wins by KO/TKO among flyweight and light heavyweight (p = 0.029) and flyweight and heavyweight (p = 0.007) which is equivalent to a difference of almost 6 wins by KO/YKO. The number of wins by decision showed a significant difference among bantamweight with flyweight (p = 0.046), light heavyweight (p = 0.002), and heavyweight (p = 0.002); featherweight with light heavyweight (p = 0.0017), heavyweight (p = 0.016). A difference of 8 to 13 DEC wins in the heaviest category leads to the heaviest. However, no significant difference was found for the number of wins by submission (p > 0.05) (Figure 3).

Figure 3. Type of win in the UFC® eight men's weight categories.

A: Win by KO/TKO; B: Win by DEC; C: Win by SUB; KO/TKO = Knockouts/Technical Knockouts; DEC = Judges' Decision; and SUB = Submission; a: with light heavyweight (p =
3.6 RELATIONSHIP BETWEEN ANTHROPOMETRIC ASPECTS, COMBAT DURATION, PHYSICAL DEMANDS, AND TYPE OF WIN

A complex and important network of interactions was observed between the various parameters studied. Figure 4 shows the correlations between anthropometric and performance metrics, indicating the degree and direction of the linear relationship between them.

Figure 4. Spearman’s correlation matrix of performance indicators among UFC® top athletes.

3.7 VARIABLES THAT INFLUENCE THE COMBAT RESULT

The linear multiple regression analysis resulted in a statistically significant model ($R^2 = 0.457; p = 0.003$). The connected strikes ($\beta = 0.570, t = 7.872; p < 0.001$) and the applied takedowns ($\beta = 0.225, t = 3.044; p < 0.003$) seem to explain 45% of the win.
4 DISCUSSION

This is the first study to combine anthropometric data, combat duration, technical demands, and type of win analysis among top UFC® athletes. This comprehensive view, crucial for developing a panel of performance indicators, emerges as fundamental knowledge for achieving significant advances in the field. Light heavyweight and heavyweight athletes tend to experience shorter bouts, often culminating in wins by knockout. In contrast, bantamweight and featherweight athletes engage in longer combats, typically resulting in judges’ decisions. Interestingly, bantamweight fighters have the highest number of connected strikes, while welterweight fighters lead in applied takedowns. Regarding the correlations, an intriguing network was observed among the different dimensions analyzed. The positive association of BMI with knockouts/technical knockouts and the negative associations of BMI with combat time, connected strikes, applied takedowns, judges’ decisions, and submissions draw special attention. The multiple linear regression analysis resulted in a statistically significant model, in which connected strikes and applied takedowns seem to explain 45% of the variance in wins.

In our analyses, the difference in combat duration between the heaviest categories and the lightest categories was equivalent to one round. This difference in time can be attributed to the amount of muscle mass, as energy expenditure varies according to the amount of muscle mass involved (VAN BAAK, 1999), so larger and heavier athletes tend to expend more energy during the execution of combat actions. Even indirectly or strategically, they seek to end the fighting more quickly. Reinforcing this reasoning, the discrepancy in interconnected strikes can be an indicator of efficiency, since our results showed that the heaviest categories have a lower number of interconnected strikes.

It has been observed that, in the overall context, athletes tend to focus their efforts on specializing in MMA due to its unique demands. Unlike in the past, when athletes came from various disciplines such as Muay Thai, Boxing, Jiu-Jitsu, and others. This shift in the landscape is noticeable as a consolidation of
MMA’s identity and objectives. This adjustment in approach aligns with the principle of sports training specificity, which posits that athletic performance tends to be more effectively enhanced when training bears substantial similarities to competitive conditions (GAMBLE, 2006). Therefore, the ability to combine standing combat techniques (striking) and grappling techniques is essential to compete at high-performance levels. Thus, possessing a diverse and complete repertoire of skills proves to be a crucial requirement for achieving prominent positions in the sport’s rankings.

Regarding the analysis of differences in technical demands, the strikes linked to the flyweight and bantamweight categories present greater volumes of strikes concerning to the two heavier categories. The difference in weight between the two ends, 63.5 kg, attracts attention. During MMA combat, athletes generally start the fight trying to gain an advantage through individual and combined strikes, in accordance with displacements or changes in position (MIARKA; NASCIMENTO DE CARVALHO; IGNACIO VALENZUELA PEREZ; AEDO-MUNOZ et al., 2020). Additionally, attempted punches, kicks, falls, defensive actions, and ground combat involving striking and grabbing techniques have been documented (JAMES; ROBERTSON; HAFF; BECKMAN et al., 2017). These facts lead to a high energy and physical demand. However, with the aim of visualizing this difference in energy expenditure, considering the estimated resting energy expenditure (REE = 17.2×body mass – 5.95×age + 748) (MARRA; DI VINCENZO; CIOFFI; SAMMARCO et al., 2021) of elite athletes in the two stricture categories, flyweight (1557.1 kcal) and heavyweight (2548.2 kcal), a difference of 991.1 kcal is estimated. This may highlight the body mass factor as an explanation for the difference in the number of connected strikes and perhaps attribute, even if unconsciously, a pacing strategy adopted according to physical and physiological characteristics. This explanation can be applied to the differentiation in applied takedowns between welterweight and light heavyweight categories. Given that the welterweight category has an REE of 1874.7 kcal, this signifies a deviation of 312.4 kcal from the light heavyweight (2187.0 kcal).
There is a significant difference in the number of KO/TKO wins between flyweight and light heavyweight and flyweight and heavyweight, which is equivalent to a difference of almost six wins per KO/YKO. Although it is known that different factors can influence knockout, recent evidence, such as that presented by Adamec et al. (2021), highlights the substantial relationship between punch power and total body mass. Thus, muscular strength emerges as one of the determining elements in the knockout. However, the difference found in the number of wins by DEC between bantamweight and light heavyweight, as well as heavyweight, and featherweight with the two heaviest categories results in a range of 8 to 13 wins. This underscores the proof that physical attributes impact the type of win, the adopted rhythm, and the number of connected blows. Because for the athlete to secure a win by DEC, they must accumulate more points. Although the two lighter categories showed a significant difference in wins by decision, we believe that is a characteristic of the flyweight category that presented more wins by submission compared to wins by knockout and decision.

Although associations between anthropometric aspects were already expected, these results allow for an even more assertive view of the topic. It is known, for example, that the height and dimensions of arms and legs do not necessarily demonstrate a linear correlation across the entire population. However, the robust values of Spearman's rho coefficient for height and wingspan (0.9) and height and leg reach (0.8) point to typical characteristics of high-level competitive fighters. In the MMA scenario, it can even be used in the selection and recruitment of talent and in choosing the weight category.

It is also worth highlighting the positive association of BMI with KO/TKO (0.3) and the inversely proportional correlations of BMI with average fight time (-0.2), connected striking (-0.1), applied throw (-0.1), DEC (-0.2) and SUB (-0.2). As BMI is a simple, cheap, non-invasive, and widely accessible tool, these are valuable theoretical-practical findings. After all, even in scenarios with limited infrastructure (e.g., amateur level), this index can be used as a starting point for the interpretation of this multidimensional panel proposed here. However, this information should be used with caution in other populations.
The moderate result between average fight time and connected striking (0.5) also draws special attention, as it is instinctive to think that fights end due to a connected strike. Perhaps this correlation is stronger in sports such as judo. In the case of MMA, where the outcome often happens by submission or decision by the judges, the average fight time is multifactorial. Therefore, this finding serves as a practical warning to coaches and athletes, indicating possible training approaches.

Finally, this study verified whether any of the analyzed components could influence a win. Based on the regression model, connected strikes and applied takedowns appear to influence win by 45%. It is worth mentioning that the combat outcome is influenced by a series of factors, including the preparation of the athletes, decision-making on both sides, and primarily, physical characteristics such as weight, height, and wingspan. This information may support athletes, and coaches in adjusting their training programs to optimize their goals according to the weight category - whether by connecting more strikes during fights to achieve a higher score or delivering more powerful strikes to guarantee a knockout.

5 CONCLUSION

In conclusion, this study demonstrated that physical characteristics, such as height, wingspan, and leg reach, maintain a linear relationship with weight, which can be a crucial factor in choosing the category. Furthermore, there is a difference in combat duration, explained by the disparity in weight between the categories. Athletes of larger stature generally face shorter bouts, often associated with knockout wins. Conversely, smaller and lighter athletes experience longer combat durations, register a greater number of connected strikes, and tend to achieve wins through judges’ decisions.

This study identified physical, technical, and performance differences, offering an initial view of the complex interaction in the performance of MMA athletes. From a practical perspective, coaches and athletes can use this information to develop more personalized training routines and combat.
strategies, adapting the choice of weight category according to anthropometric
and performance metrics.

Statistical analyses were based on data available on the UFC® website. However, the lack of direct access to raw data is a methodological limitation. Therefore, future research should directly investigate these variables and include performance measurements with ecological validity, such as punch strength, muscle strength, and the effects of weight loss on performance during combat. These advances could enrich existing literature and strengthen the theoretical basis of combat sports.

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REFERENCES


