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Lindsei Brabec Mota Barreto[1(ABCDEFG)], Thiago Seixas Duarte[2(BCEF)], Farruh Ahmedov[3(BCEF)], Esteban Ariel Aedo-Munoz[4(CEF)], Felipe Jose Aidar Martins[5(CDE)], Dany Alexis Sorbazo Soto[6(CEF)], Bianca Miarka[7(ACDEF)], Ciro Jose Brito[8(ACDEF)*]

1 ORCID: 0000-0001-5941-4409
Federal University of Juiz de Fora, Campus Governador Valadares (Brazil)
2 ORCID: 0000-0002-7394-8519
Federal University of Juiz de Fora (Brazil)
3 ORCID: 0000-0002-8841-0682
Samarkand State University (Uzbekistan)
4 ORCID: 0000-0003-1544-2824
Universidad de Santiago de Chile (Chile)
5 ORCID: 0000-0001-7378-4529
Federal University of Sergipe (Brazil)
6 ORCID: 0000-0001-8479-7149
Escuela de Kinesiologia, Universidad Santo Thomas, Puerto Montt (Chile)
7 ORCID: 0000-0002-7513-7605
Federal University of Rio de Janeiro (Brazil)
8 ORCID: 0000-0002-9678-1977
Federal University of Juiz de Fora, Campus Governador Valadares (Brazil)
* Corresponding author: Ciro Jose Brito. Physical Education Department - Federal University of Juiz de Fora, Street Sao Paulo, no 745, Campus Governador Valadares - Minas Gerais, Brazil, tel.: +5531992073308
e-mail: cirojbrito@gmail.com

Combat Time in International Female Judo: A Systematic Review and Meta-Analysis

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Key words: martial arts, combat sports, Golden Score, performance, competition, rules

Abstract

Background. Rule changes in recent years might have interfered with the time spent in female judo combats. Furthermore, weight divisions may have different temporal combat behaviors and react differently to rule changes.

Aim. To analyze data on combat time in international female judo between 2010-2019 by weight division.

Methods. The following descriptors were searched in electronic databases (May 8 to June 11, 2021): ("technical-tactical" OR "time motion" OR "combat time") AND ("judo" OR "combat sports" OR "martial arts"). 793 articles were found. After the screening process 6 were included in the systematic review and 5 in the meta-analysis. A total of 1,485 combats were analyzed. The following

For citation – in IPA style:

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information was extracted: mean and standard deviation of total combat time; frequency of combats finished in Regular time (RT) or Golden Score (GS); total combat time by weight division.
Results. The combat time changed at each rule change and the year 2012 had the highest combat time (2012=260.9 seconds). The GS occurrence increased in 2018-2019 compared to 2013 (GS: 2013=4.4%; 2018-2019=18%; Z=2.87; p=0.004). The >78kg category had the highest GS occurrence in 2013 (16.7%) among all divisions. However, 5 out of 6 combats ended before RT in 2018-2019. The 48kg category maintained a low GS occurrence over the years. Conclusion. Combat times changed in the period 2010-2019, with a trend towards homogeneity by weight divisions in 2018-2019. However, the GS occurrence has increased over the years.

Introduction

The history of female judo competitions begins in the late 1960s and 1970s when women participated in official competitions in some countries [Groenen 2012; Miarka *et al*. 2011b]. Female combat time nowadays is 4 minutes, and the extra time (Golden Score, if necessary) is unlimited; however, these combat times have varied over the years according to the rules in force at the time [Barreto *et al*. 2022; International Judo Federation 2009, 2013, 2015]. The regular combat time in 2010 was 5 minutes, and rule changes reduced the Golden Score time from 5 to 3 minutes [International Judo Federation 2009]. Then, the Golden Score time became unlimited in 2013 [International Judo Federation 2013]. New rule changes in 2015 established that the normal combat time for women would be reduced from 5 to 4 minutes [International Judo Federation 2015]. In this sense, it is believed that combat structures and dynamics have also varied over the years. Therefore, judo coaches need to choose good strategies to adapt athletes as quickly as possible to the new rules, aiming at the technical-tactical structuring of the global dynamics of combat.

Thus, several authors have studied female judo combat based on an analysis of the temporal structure and technical-tactical movement, including total combat time, standing combat, non-contact displacement, gripping, groundwork, pause time, scores, penalties, number of techniques and attack efficiency index [Calmet *et al*. 2017; Miarka *et al*. 2011a; Miyake *et al*. 2016]. These variables and rule changes have had a direct impact on the physical, technical and tactical preparation of female athletes, since if previously women judoka were considered non-explosive athletes, it seems that this prerogative no longer applies nowadays. In addition, data from studies have shown that lighter-weight divisions should not train in the same way as heavier divisions because they have different combat behaviors [Ceylan, Balci 2021; Miarka *et al*. 2020; Sterkowicz-Przybycien *et al*. 2017]. Therefore, coaches need to be constantly adapting training considering the temporal and technical-tactical behaviors of female athletes in each weight division.

Systematic reviews and meta-analyses of judo make it possible to group data from primary researchers on a variable and explore its effects in specific groups. These studies are then used in performance analysis research to support decision-making in effectively prescribing a judo training model from evidence-based guidelines [Albuquerque *et al*. 2016; Sterkowicz-Przybycien, Fukuda 2014; Sterkowicz-Przybycien *et al*. 2017]. Therefore, identifying how female judo combat time behaves as a result of rule changes through a systematic review and meta-analysis could help to predict temporal actions and assist in the training prescription. Thus, this study aims to analyze data from the literature on the combat time of female judo in international competitions over the years and by weight division. We believe that combat times have changed over the years due to constant changes in the rules, and that this information can help coaches plan competition-specific training for each weight division.

Methods

Experimental Approach

Cross-sectional observational studies which contained data on total combat time (in seconds or minutes) of women's judo at the international level were used in this systematic review and meta-analysis. Studies that presented the total combat time separated by weight division [extra-lightweight (48kg), half-lightweight (52kg), lightweight (57kg), half-middleweight (63kg), middleweight (70kg), half-heavyweight (78kg) and heavyweight (>78kg)] were used in a secondary analysis.

The following were considered as inclusion criteria for the review: a) articles published in peer-reviewed journals; b) studies written in Portuguese, English or Spanish. As this research topic is recent, there was no limitation on the deadline for publication of articles. Exclusion criteria were: a) studies regarding sports other than judo; b) articles that analyzed simulated combats; c) studies whose combats were not from international level competitions; d) articles whose sample consisted of adolescent athletes or just men; and e) articles which did not contain the combat time.

Included Studies

The following descriptors were searched in electronic databases: ("technical-tactical" OR "time motion" OR "combat time") AND ("judo" OR "combat sports" OR "martial arts"). This search was carried out from May 8 to June 11, 2021 in the following electronic databases: SciELO, PubMed, BVS - virtual health library (in LILACS, Medline and IBECS databases), EBSCOhost

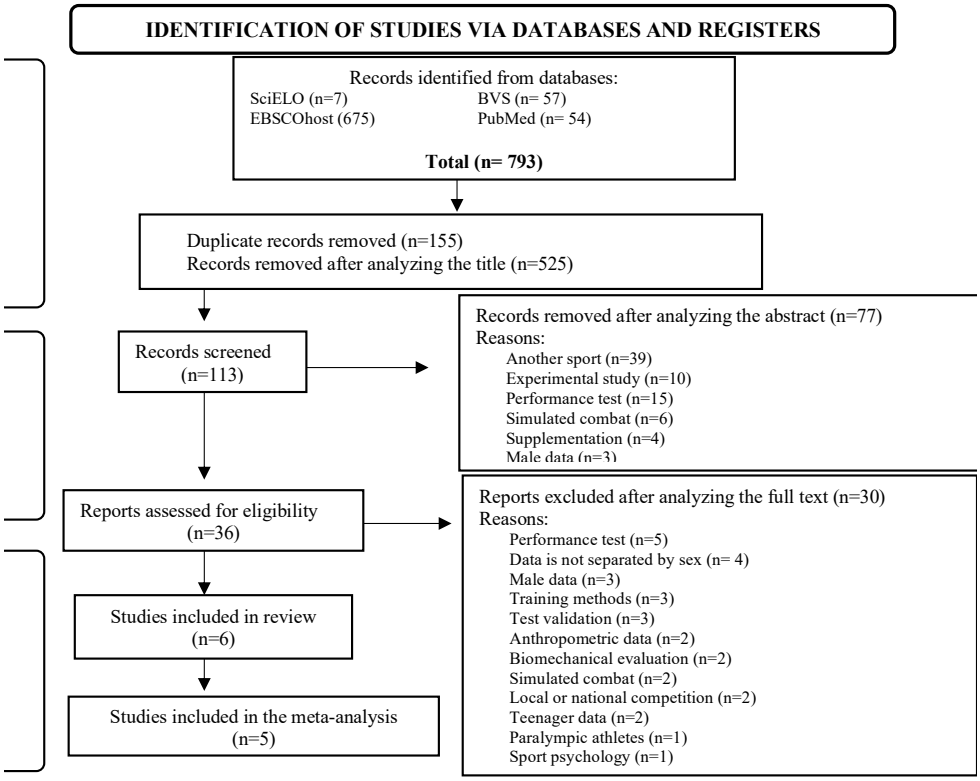


Figure 1. PRISMA flow diagram of study selection.

(in the databases of Sportdiscus, CINAHL and Medline). The Excel 2013 program (Microsoft, Washington, USA) was used to extract the references from the databases. Two reviewers conducted the article search and selection process independently. A third author evaluated the study when there was disagreement among authors regarding the inclusion or not of studies. The Preferred Report Items for Systematic Reviews and Meta-Analyses (PRISMA) were used in the screening process of collected articles [Liberati *et al.* 2009]. This article selection process is described in the PRISMA flowchart (Figure 1).

The search in the databases with the keywords resulted in 793 articles, of which 155 duplicate articles were manually removed. Next, 525 articles were excluded by reading the title, as it was clear that they analyzed other combat sports or male judo. Of the 113 remaining articles, 77 were excluded after reading the abstract for the following reasons: a) analysis of other sports; b) experimental studies; c) analysis of performance tests, d) simulated combat or nutritional supplementation; and e) studies in male judo. Thus, 36 articles remained for full reading, review and eligibility assessment for this systematic review and meta-analysis. After evaluation, 30 articles were excluded for the following reasons: performance testing studies; analysis of data not separated by sex or only with male athletes; studies on training methods, test validation, anthropometric data or biomechanical assessment; analysis of combat simulations, local or national competitions; samples with adolescents or Paralympic athletes; and studies in sports psychology. Finally, 6 studies were included in the systematic review; however, only 5 studies were part of the meta-analysis, as one of them did not present all of the data needed for the analysis (Figure 1).

Procedures

The RoBANS tool, which was validated to analyze non-randomized studies [Park *et al.* 2011], was used to assess the quality of the 6 studies included in the systematic review. This risk of bias assessment tool analyses 6 items, which should be classified as low, high or unclear risk [Park *et al.* 2011]. The study analysis was performed by two reviewers independently; divergences from these analyses were resolved by consensus with a third reviewer. At least two authors performed the extraction of qualitative and quantitative data independently and entered them into the Excel 2013 program (Microsoft, Washington, USA).

The following information was extracted from the studies for qualitative analysis and presented in table form: a) author and year; b) year of competition; c) type of competition evaluated; d) level of athletes; e) combat time; f) combat analysis instruments; g) analysis protocol; h) data extracted for this systematic review. The following information was extracted from the studies for the quantitative analysis and presented in Figures: a) mean and standard deviation of the total combat time in seconds; b) frequency of combats which ended in Regular Time (RT) or *Golden Score* (GS); c) total combat time by weight division.

Statistical Analysis

Descriptive Tables, Graphs and Forest plots were applied to show the data analysis. The Revman.5 software program from the Cochrane website was used for meta-analysis

Table 1. Studies on time-motion analysis in female judokas in international competitions (n=1,485)

Author	Competition year	Championships	Study group for this review	Combat time sample	Instruments	Protocol	Data for this review
Adam *et al.* 2013	2012	London Olympic Games	Gold medal at the Olympic Games	32 combats 48kg n=5; 52kg n=5; 57kg n=5; 63kg n=5; 70kg n=4; 78kg n=4; >78kg n=4	Standardized audiovisual techniques and graphic markings	Time motion indicators	CT CTW
Boguszewski 2016	2016	Rio de Janeiro Olympics Games (Finals)	Gold and. Silver medal at the Olympic Games	7 combats 1 by each weight division	Observational sheets in 10-second fight sequences	Kalina's method of combat dynamics measurement	CT
Ceylan, Balci 2021	2018- 2019	World Championships	Elite athletes	665 combats 48kg n=93; 52kg n=107; 57kg n=113; 63kg n=96; 70kg n=99; 78kg n=79; >78kg n=78	Data from official IJF website	Combat time	CT ECT CTW
Segedi *et al.* 2014	2013	Rijeka Grand Prix (elimination rounds)	Elite athletes	68 combats	Recorded by video camera	Combat end time and score analysis	ECT ECTW
Soriano *et al.* 2019	2010	International (different competitions)	Elite athletes	75 combats 48kg n=25; 52+57+63kg n=25; >78kg n=25	Observation tool combined with a field format category system. LINCE v. 1.1	Time motion indicators	CT CTW
Sterkowics-Przybycien *et al.* 2017	2011-2012	International (different competitions)	Athletes ranked for Olympic Games	638 combats 48kg n=103; 52+57+63kg n=308; 70+78kg n=176; >78kg n=51	VirtualDub Program 1.8.6 Frami software	Combat phases	CTW

CT - Combat time; CTW - Combat time by weight division; ECT - End of combat time; ECTW - End of combat time by weight division; kg – kilograms.

considering a significance level of $p \leq 0.05$. For dichotomous outcomes, meta-analysis was used to verify the effect size of combats which ended in RT vs. those which ended in GS. To do so, a random effects model and the Mantel-Haenszel statistical method with the odds ratio effect measure were used. In addition, a continuous outcome meta-analysis was applied based on the inverse variance statistical method with a random effect analysis model and standard mean difference of the effect measure to verify the effect size between weight divisions. Cochran's Q test and I^2 statistic were used to assess the heterogeneity between the included studies, being classified as: may not be important (0-29%), may represent moderate (30-49%), substantial (50-74 %), or considerable (75-100%) heterogeneity [Higgins *et al.* 2021].

Results

Description of studies

There were 6 studies that met the eligibility criteria in this systematic review [Adam *et al.* 2013; Boguszewski 2016; Ceylan, Balci 2021; Segedi *et al.* 2014; Soriano *et al.* 2019; Sterkowicz-Przybycien *et al.* 2017]. The qualitative analysis of articles is shown in Table 1.

Only data referring to the female combat time were extracted from the studies for this systematic review, although they presented other variables such as characteristics of combat phases, techniques used and attack effectiveness index. Thus, the data of the studies described in Table 1 only refers to the combats analyzed in this systematic review. The judo combats analyzed by the studies covered the period between 2010 and 2019, and included the Olympic Games (2012 and 2016), the World Championship (2018 and 2019) and other international competitions such as the World Circuit, Grand Slam, Grand Prix, and others (2010 to 2013). A total of 1,485 female combats were analyzed (2010=75; 2011-2012=670; 2013=68; 2016=7; 2018-2019=665). They were gold or silver medalists in the Olympic Games [Adam *et al.* 2013; Boguszewski 2016], athletes classified for the Olympic Games [Sterkowicz-Przybycien *et al.* 2017], or elite athletes [Ceylan, Balci 2021; Segedi *et al.* 2014; Soriano *et al.* 2019], which proves the high- performance level of

Table 2. Total combat time in female judo competitions over the years.

Weight division	Combat time (s) (mean±standard desviation)			
	Soriano *et al.* 2019 **2010** International competitions (n=75)	Adam *et al.* 2013* **2012** Olympic Games (n=32)	Boguszewski 2016 **2016** Olympic Games (n=7)	Ceylan, Balci 2021 **2018- 2019** World Championships (n=665)
All categories	197.5±92	260.9±103	232.7	180.7±113.4
48kg	202.2±88.8	300±0		186.4±110.5
52kg		281±79		190.8±108.1
57kg	189.9±96.1	312.2±19.2	---	188.6±121.5
63kg		174.6±89.2		184.8±111.1
70kg	---	246.8±169.2		170.8±107.8
78kg		207.3±112.7		163.9±122.9
>78kg	200.5±94.4	298.5±149.4		173.1±110.7

* Average combat time calculated by the authors of this study based on the time data in the article; s- seconds

the combats analyzed. The instruments and protocols used to assess the combats varied (Table 1); however, the previous study [Calmet *et al.* 2019] identified that video analysis results were stable when expert judo analysts performed video analysis in slow motion or live.

Risk of bias in included studies

The judgment of the authors of this systematic review regarding the risk of bias of the 6 included studies using the RoBANS tool is shown in Figure 2. At least 66.7% of the included articles had a low risk of bias. However, ~33% of the studies had incomplete outcome data. This is because the large number of variables collected when analyzing judo combats makes it impossible to investigate all the variables in a single article. Around 17% of the evaluated articles did not measure exposure, or they did not consider confounding variables, or they were evaluated with problems of outcome evaluation blindness. This is for the following reasons: the authors did not discuss all of the data presented; they did not report the number of combats by weight division; they did not specify characteristics of combat evaluators (judo degree, competitive experience and others); or they did not report reliability data for their analyzes and/or instruments used.

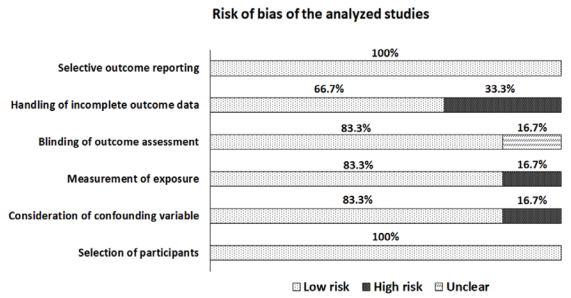


Figure 2. Review authors' judgements about each risk of bias item across all included studies (%).

Quantitative data on female combat time

Quantitative combat time data for the studies included are presented in Table 2. The average combat time in the study by Adam *et al.* [2013] was calculated by the authors of this study based on data on the duration of women's combats described in that article. The data show that female judo had an average combat time ranging from 260.9 seconds (2012) to 180.7 seconds (2018-2019). Additionally, we identified that Soriano *et al.* [2019] found an average pause time (combat interruption moment) of 7.6±3.1 seconds in 2010 combats. Regarding weight divisions, the lowest average combat time was in 2018-2019 in the 78kg division (163.9 seconds) and the longest combat time was in 2012 in the 57kg category (312.2 seconds). Soriano *et al.* [2019] found the following average pause time by weight divisions in 2010 combats: 48kg=7.1±2.7; <63kg=7.9±3.3; >78kg=7.7±3.2 seconds. Similarly, Sterkowicz-Przybycien *et al.* [2017] found the following median and interquartile range of pause time by weight division in 2011-2012 combats: 48kg=7.3(4); <63kg=6.6(5.9); <78kg=6.8(5.8); >78kg=8.8(6.2) seconds. We did not find the pause time data in the other studies.

Table 3 shows the moment when the combats ended according to the included studies. The data for the variable "Before RT" from the study by Ceylan, Balci [2021] was the result of the sum of combats that ended in 61-120s; 121-80s and 181-239s. The percentage by end of combat time in Table 3 was also calculated by the authors of this study. Most of the combats analyzed ended before the regular combat time in both 2013 and 2018-2019, (2013=57.4%; 2018-2019=70%). The weight division that had the most combats finished before RT in 2013 was the 48kg category (100%); the 78kg category had more combats that ended in RT (77.8%); and the >78kg category had more combats that ended in the GS (16.7%). In 2018-2019, Ceylan, Balci [2021] found a significant difference between the weight division and the time at which the combat ended (χ^2=2198.64; p<0.001; PHI=0.135). Although the authors did not report the values by category, they wrote that the frequency of the GS was higher in the 57kg category in 2018-2019, unlike in 2013; however, the 48kg category continued to present the lowest occurrence of the GS.

The study by Sterkowicz-Przybycien *et al.* [2017] presented data as median and interquartile range (and

Table 3. Moment when combat ends in female judo competitions over the years.

Weight division	End of combat time	Segedi *et al*. 2014 2013 Grand Prix (n=68)		Ceylan, Balci 2021 2018–2019 World Championships (n=665)
		u	%#	u
All categories	Before RT	39	57.4	465*
	In RT	26	38.2	80
	GS	3	4.4	120
48kg	Before RT	2	100	
	In RT	0	0	
	GS	0	0	
52kg	Before RT	3	37.5	
	In RT	5	62.5	
	GS	0	0	
57kg	Before RT	15	83.3	
	In RT	3	16.7	
	GS	0	0	
63kg	Before RT	6	42.9	
	In RT	7	50	---
	GS	1	7.1	
70kg	Before RT	7	63.6	
	In RT	4	36.4	
	GS	0	0	
78kg	Before RT	1	11.1	
	In RT	7	77.8	
	GS	1	11.1	
>78kg	Before RT	5	83.3	
	In RT	0	0	
	GS	1	16.7	

RT – Regular Time; GS – Golden Score; *Sum of the data present in the study for combats that ended in 61-120, 121-80 and 181-239s; #Percentage of combats calculated by the authors of this study; u – unit

not as mean and standard deviation), and so it was not possible to group it with other studies for quantitative analysis. Thus, only 5 included studies participated in the meta-analysis. The studies were grouped as follows for the quantitative analysis: a) total combat time over the years [Adam *et al*. 2013; Boguszewski 2016; Ceylan, Balci 2021; Segedi *et al*. 2014; Soriano *et al*. 2019], whose distribution of combat was: 2010=75; 2012=32; 2013=68; 2016=7; 2018-2019=665 (total = 847 combats); b) total combat time by weight division over the years [Adam *et al*. 2013; Ceylan, Balci 2021; Soriano *et al*. 2019], whose distribution of combats was: 48kg=123; 52kg=112; 57kg=118; 63kg=101; 70kg=103; 78kg=83; >78kg=107 (total=747 combats) (Table 1).

Total female combat time over the years

Figure 3 shows the total time in seconds of female judo combats over the years and the analysis of when combats ended in the year 2013 vs. 2018-2019. We added the number of combats from the 61-120s, 121-80s, 181-239s and 240s periods from the study by Ceylan, Balci [2021] to analyze the end of the combat. We also calculated the percentage of data from the studies [Ceylan, Balci 2021; Segedi *et al*. 2014]. There was a significant increase of 13.6% in the occurrence of the GS in 2018-2019 compared to 2013 (Z=2.87; p=0.004).

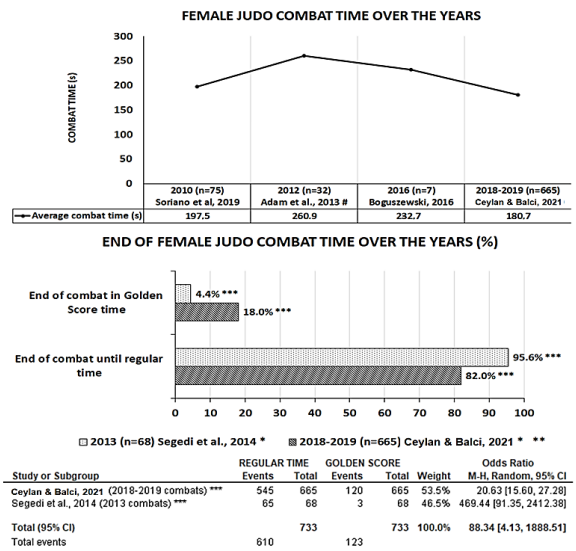
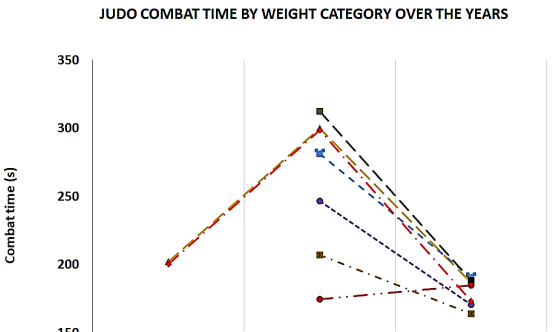


Figure 3. Total time and moment when female judo combats ended over the years.

RCT – Regular combat time; GS – Golden Score; s – seconds; # Average combat time calculated by the authors of this study, based on the time data in the article; * Percentage of combats calculated by the authors of this study; ** We added up the combats which ended in 61-120; 121-80; 181-239 and 240s; *** Significant difference (Z=2.87; p=0.004).

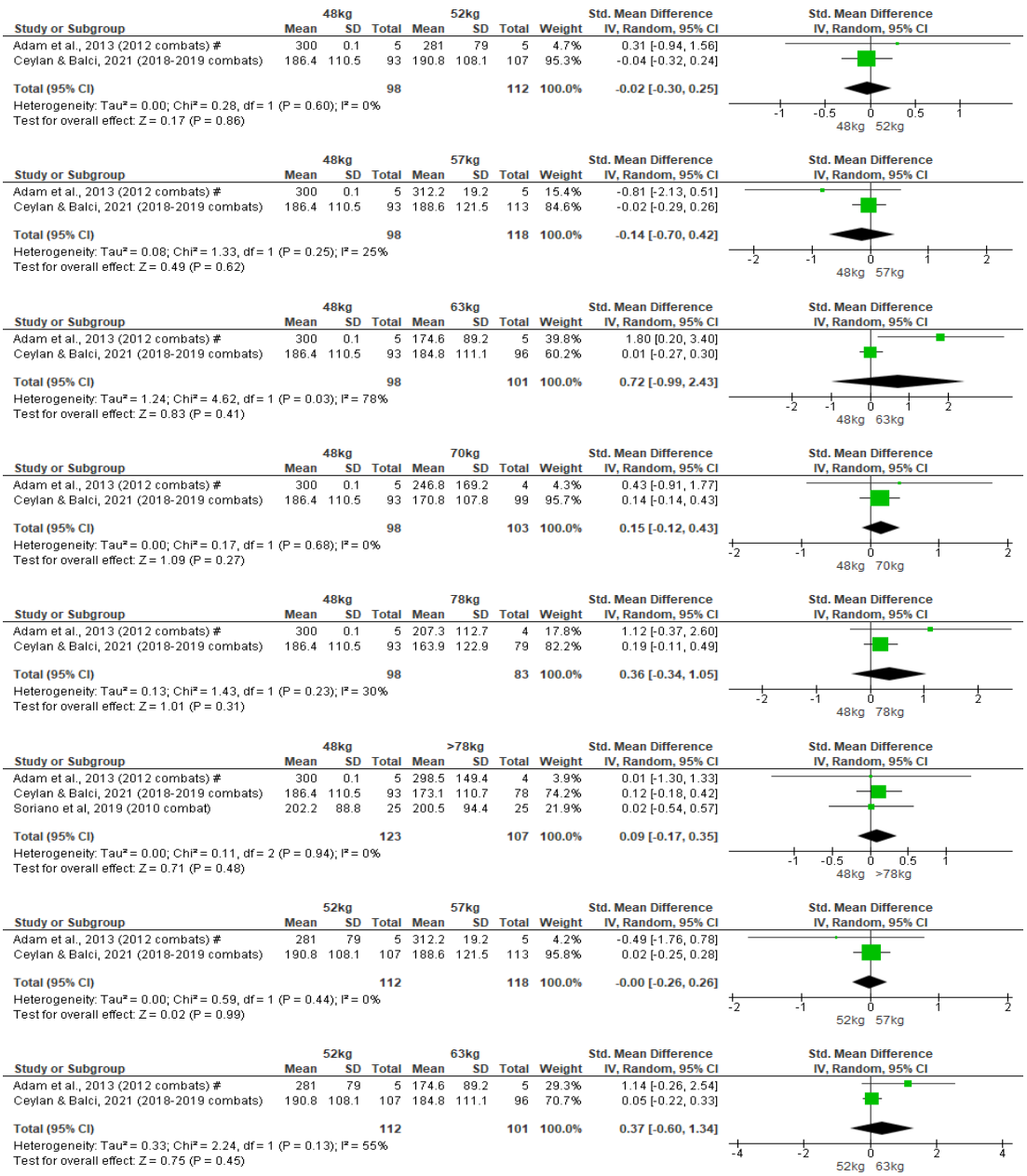
Total female combat time by weight division over the years

The average female combat time by weight division over the years is shown in Figure 4. The study by Sterkowicz-Przybycien *et al.* [2017] presents data in the median and interquartile range, so it was not possible to include it in the analysis. Data from Soriano *et al.* [2019] only refer to the 48kg and >78kg categories, as the authors presented the sum of the combat time for the 52, 57 and 63kg categories together, and they did not present data for the 70kg and 78kg categories. Data from Adam *et al.* [2013] were calculated from the combat times reported in their study. Data indicate that combat time has become more homogeneous over the years in the different weight divisions. The meta-analyses of combat time between weight divisions can be seen in Figure 5, in which no significant differences were found between the divisions over the years.



	2010 (n=50) Soriano et al, 2019	2012 (n=9) Adam et al., 2013 #	2018-2019 (n=171) Ceylan & Balci, 2020
-48 kg	202,2	300	186,4
-52kg		281	190,8
-57kg		312,2	188,6
-63kg		174,6	184,8
-70kg		246,75	170,8
-78kg		207,25	163,9
>78kg	200,5	298,5	173,1

Figure 4. Duration of combat by weight division over the years. # Average combat time by category calculated by the authors of this study.



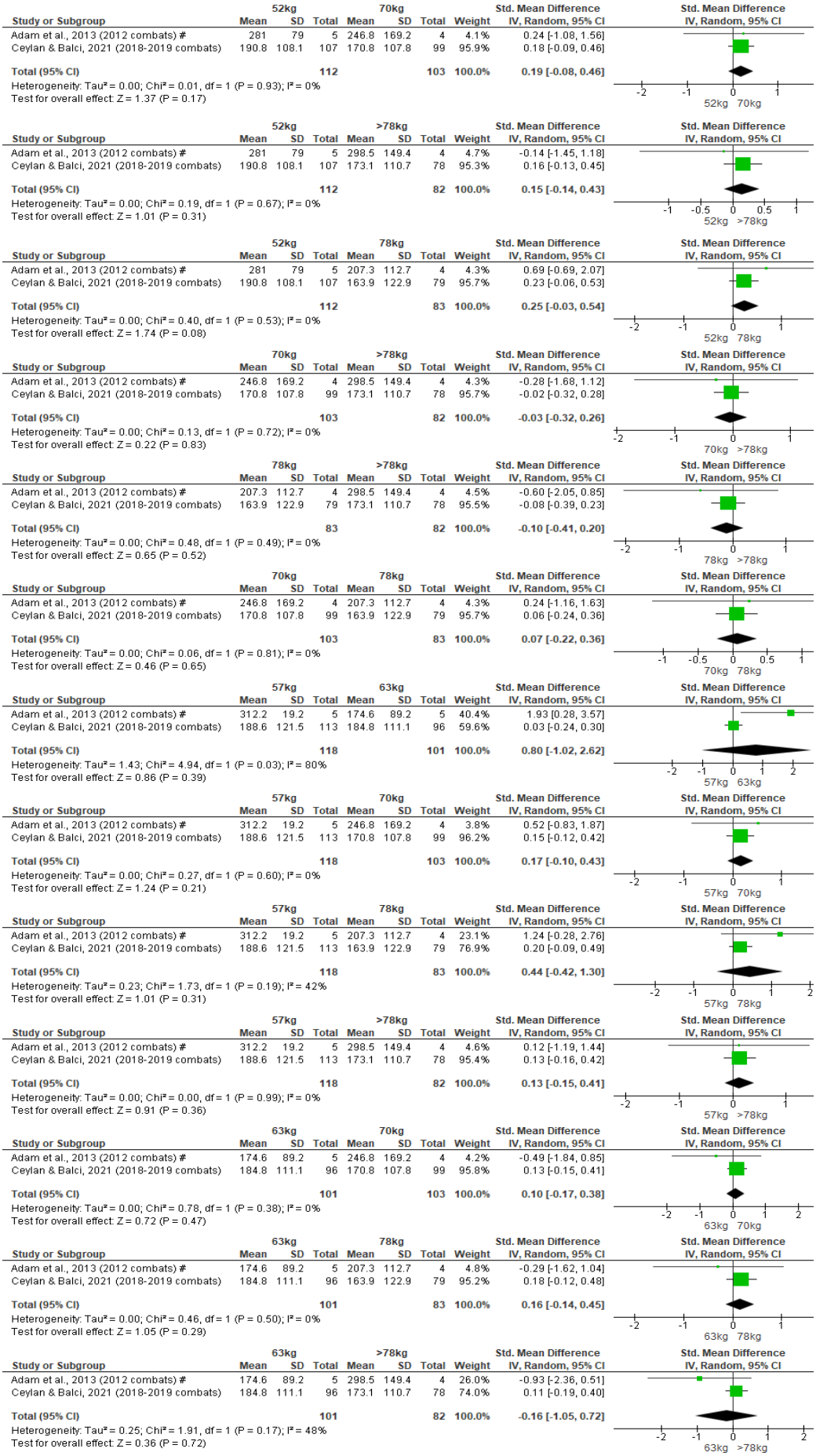


Figure 5. Combat time of female judo by weight divisions over the years.
Average combat time by category calculated by the authors of this study

Discussion

This systematic review and meta-analysis aimed to synthesize literature data on female judo combat time in international competitions over the years and by weight divisions. Rule changes affected the total combat time over the years, and understanding how this happened could help coaches plan judo training to achieve performance. The main results showed that the average combat time changed with each rule change (2010, 2013, 2015, 2017 and 2018), and the year 2012 had a higher average combat time (Figure 3). In addition, the combat time spent between the weight divisions have become more homogeneous over the years (Figure 4).

Analysis of total female judo combat time over the years
The analysis of the average combat time from 2010 to 2019 (Figure 3) shows a curve which reached its peak in 2012 (260.9 seconds). There were rule changes in 2010 such as reducing the total time of the GS from 5 to 3 minutes, prohibition of gripping techniques under the belt and elimination of the *Koka* score [Barreto *et al.* 2022; International Judo Federation 2009], and they modified the athletes' way of fighting. These changes remained in effect from January 2010 to December 2012, and they triggered several disqualification losses for performing below-the-waist gripping techniques. Over time, the athletes developed strategies to not be disqualified and at the same time induce the opponent to commit a penalty, which at the time were converted into points for the opponent. This new combat configuration encouraged adopting a defensive attitude based on combat time management (negative judo), which might have increased the average combat time in 2012.

Thus, aiming to end negative judo actions, the International Judo Federation made rule changes in 2013 in which punishments would no longer be worth points and the GS time became unlimited [Barreto *et al.* 2022; International Judo Federation 2013]. In addition, there was a new rule change in 2015 which reduced the regular female combat time from 5 to 4 minutes [Barreto *et al.* 2022; International Judo Federation 2015]. This change contributed to a reduction in combat time in 2016 (232.7 seconds) (Figure 3); however, it still consisted of 97% of the RT [Boguszewski 2016]. These rule changes must have caused behavioral changes of athletes in combat, since winning in RT became essential to avoid the GS unlimited time. Thus, attacking effectively became more important than making the opponent suffer punishments, which would only serve to break the tie at the end of regular combat time.

The *Yuko* score was eliminated in the 2017 rules changes, the *Wazari* became a cumulative score (2 *Wazari* was no longer equivalent to an *Ippon*) and punishments would no longer decide the winner of the combat in RT, only being useful in the GS [International Judo Federation 2017a]. These changes were intended to encourage offensive actions, however *Wazari* accumulation was not well accepted by spectators and athletes. What happened is that the athletes with the ability and flexibility to rotate their body during the fall could be thrown six times (6 *Wazari*), and in the final minutes of the combat they would only perform one technique to obtain *Ippon* and win the combat, as their opponents would be tired from having attacked so many times. To solve this problem, a new rule change in 2018 determined that the accumulation of 2 *Wazari* would again be equivalent to *Ippon*, and the punishments stopped deciding the combat in the GS [International Judo Federation 2017b].

The 2017 and 2018 rule changes aimed at removing the power of punishment to decide a victory, and led athletes to develop new combat strategies. Thus, the athletes developed greater technical efficiency to decide the combat before the end of RT; however, those who had a more defensive fighting style ended up needing the GS time. Table 3 and Figure 3 show this behavior change, as there was a 12.6% increase in the occurrence of combats which ended before the RT in 2018-2019, as well as a significant increase of 13.6% ($p=0.004$) in the occurrence of the GS compared to 2013 combats. These changes must have contributed to a reduction of the RT to values below those that occurred in 2010 (2010=197.5vs. 2018-2019=180.7 seconds) (Table 2).

The analysis of the total time data in international female judo competitions over the years shows that new strategies were used by the athletes to win the combats with each rule change. Therefore, trainers need to be aware of the new combat configurations that are established after each rule change, adapting training to new combat temporal demands.

Analysis of total female combat time by weight division over the years
Analyzing the total time of female judo combats by weight division over the years is also important to identify whether there is a difference between the categories. This information can be useful in tailoring training to the specific needs of each group. As shown above (Figure 3), the RT of women's combats from 2010 to 2019 behaved like a curve, reaching the peak time in 2012. In analyzing the behavior of time separated by weight division, Sterkovics-Przybycien *et al.* [2017], who analyzed combats from 2011-2012, and Ceylan, Balci [2021], who analyzed combats from 2018-2019, did not find significant differences in combat time between the weight division. However, it is interesting to note in Figure 4 that the average combat time between categories became homogeneous after 2012, since in 2018-2019 it varied between 163.9 seconds in the 78kg category and 190.8 seconds in the 52kg category. This data indicates that the rule changes of 2013, 2015, 2017 and 2018 may have reduced the differences in behavior between female weight divisions.

The highest occurrence of the GS in 2013 was in the >78kg category [Segedi *et al.* 2014]; however, in 2018-

2019, 5 out of 6 combats from the >78kg category ended with an *Ippon* before the end of RT [Ceylan, Balci 2021]. In addition, the 48kg category had a low occurrence of the GS in both 2013 and 2018-2019 [Ceylan, Balci 2021; Segedi *et al.* 2014]. However, no significant difference was found when we did the meta-analysis of the total combat time data between weight divisions over the years (Figure 5). This means that despite the times being more homogeneous between the categories, the change occurred in a similar way in all categories over the years. More studies are needed to identify how athletes in each weight division are behaving in each phase of combat after the 2017 and 2018 rules change.

Conclusion

Literature data on the combat time of female judokas in international competitions over the years and by weight division were gathered in this systematic review and meta-analysis. We found that the rule changes may have caused changes in the athletes' behavior over the years, generating different combat times in each Olympic cycle. The >78kg category had the highest occurrence of the Golden Score in 2013 among all categories; however, in 2018-2019, 5 out of every 6 combats in this category ended before Regular Time. On the other hand, the 48kg category maintained a low occurrence of the Golden Score both in 2013 and in 2018-2019. In addition, the combat time became more homogeneous across the weight divisions in 2018-2019, although the overall occurrence of the Golden Score was higher than in previous years. Therefore, we advise that with each rule change, coaches develop new strategies to manage combat time.

With the change of rules, extreme categories, which previously had different time demands, began to spend similar times in combat. These results indicate that studies need to be constantly carried out to identify the new temporal behaviors of athletes by weight division according to new rule changes. Knowing how athletes behave in each combat phase could help coaches plan judo training, so more studies need to be conducted to understand the specific behaviors of athletes by weight division.

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Conflict of interests

The authors declare no conflict of interest.

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Czas walki w międzynarodowym judo kobiet: przegląd systematyczny i metaanaliza

Słowa kluczowe: sztuki walki, sporty walki, Golden Score, wyniki, konkurencja, zasady

Streszczenie.

Tło. Zmiany zasad w ostatnich latach mogły wpłynąć na czas podczas walk kobiet w judo. Ponadto różne grupy wagowe mogą mieć inne czasowe zachowania bojowe i różnie reagować na zmiany zasad.

Cel. Analiza danych dotyczących czasu walki w międzynarodowym judo kobiet w latach 2010-2019 w podziale na kategorie wagowe.

Metody. W elektronicznych bazach danych (od 8 maja do 11 czerwca 2021 r.) wyszukiwano następujące deskryptory: ("techniczno-taktyczny" lub "ruch na czas" lub "czas walki") oraz ("judo" lub "sporty walki" lub "sztuki walki"). Znaleziono 793 artykuły, po procesie selekcji 6 zostało włączonych do przeglądu systematycznego, a 5 do metaanalizy. Łącznie przeanalizowano 1485 walk. Wyodrębniono następujące informacje: średnia i odchylenie standardowe całkowitego czasu walki; częstotliwość walk zakończonych w regulaminowym czasie (RT) lub Golden Score (GS); całkowity czas walki w podziale na kategorie wagowe.

Wyniki. Czas walki zmieniał się przy każdej zmianie zasad, a rok 2012 miał najwyższy czas walki (2012=260,9 sekundy). Występowanie GS wzrosło w latach 2018-2019 w porównaniu do 2013 r. (GS: 2013=4,4%; 2018-2019=18%; Z=2,87; p=0,004). Kategoria >78 kg miała najwyższy wskaźnik GS w 2013 r. (16,7%) wśród wszystkich sekcji, jednak 5 z 6 walk zakończyło się przed RT w latach 2018-2019. Kategoria 48 kg utrzymywała niski poziom GS na przestrzeni lat.

Wnioski. Czasy walk zmieniły się w latach 2010-2019, z tendencją do jednorodności według kategorii wagowych w latach 2018-2019. Jednak występowanie GS wzrosło na przestrzeni lat.