

## Judo combat time, scores, and penalties: Review of competition rules changes between 2010 and 2020

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### ORIGINAL PAPER

#### Abstract

This study aimed to describe and analyze the main changes in the official competitive rules of judo between 2010 and 2020, highlighting changes in combat time, scores and penalties. In this retrospective study, a search was performed for official documents which regulated judo rules between 2010 and 2020 on the websites of the International Judo Federation and the Brazilian Judo Confederation, as well as refereeing manuals of the Sergipe Judo Federation (Brazil) and on the Google platform. Over the years, regular combat time has been shortened (2015=5'→4' for women; 2017=5'→4' for men), as well as *osaekomi* time (2013=25"→20"). This change was intended to facilitate the public's understanding of judo scores, as well as to devalue the use of penalties to achieve the victory (2010=*koka's* exclusion; 2013=penalty was no longer worth scores; 2017=*yuko's* exclusion, *shido* no longer decided the winner in regular time; 2018=*shido* no longer decided the golden score winner). Attack actions were encouraged (ban on actions to flee combat) and there was an intention to reduce the risk of injuries in competitive judo (prohibition of some types of actions and grips). In other words, there was an attempt by the International Judo Federation to encourage positive judo through the rules from 2010 to 2020. However, these constant rule changes made the competitive training context unstable. Judo coaches and athletes must be aware at the end of each Olympic cycle for new changes which will eventually be introduced and adapt to them quickly to achieve high performance.

**Keywords:** Martial arts; combat sports; judo; performance analysis; referee; rules; competition.

#### Tiempo de combate, puntuaciones y penalizaciones en judo: revisión de los cambios en el reglamento de competición entre 2010 y 2020

##### Resumen

Este estudio describe y analiza los principales cambios en las reglas oficiales de competición de judo entre 2010 y 2020, destacando los cambios en el tiempo de combate, puntuaciones y penalizaciones. En este estudio retrospectivo, se buscaron los documentos oficiales que regularon las reglas de competición de judo entre 2010 y 2020 en las páginas web de la Federación Internacional de Judo y la Confederación Brasileña de Judo, así como los manuales de arbitraje de la Federación de Judo de Sergipe (Brasil), y en la plataforma Google. A lo largo de los años, el tiempo de combate se ha acortado (2015=5'→4' para mujeres; 2017=5'→4' para hombres), así como el tiempo *osaekomi* (2013=25"→20"). Este cambio tuvo la intención de facilitar la comprensión del público sobre las puntuaciones de judo, así como de devaluar el uso de penalizaciones sobre el rival para

#### Tempo de combate, pontuação e penalidades no judô: uma revisão das mudanças nas regras de competição ocorridas entre 2010 e 2020

##### Resumo

Este estudo descreveu e analisou as principais mudanças nas regras oficiais da competição do judô ocorridas entre 2010 e 2020, destacando mudanças nos tempos de combate, pontuações e penalidades. Neste estudo retrospectivo buscou-se documentos oficiais, que regulamentaram as regras do judô entre 2010 e 2020, nos sites da Federação Internacional de Judô e da Confederação Brasileira de Judô, em manuais de arbitragem da Federação Sergipana de Judô (Brasil) e na Plataforma Google. Ao longo dos anos, o tempo de combate regular foi reduzido (2015=5'→4' para mulheres; 2017=5'→4' para homens), bem como o tempo de *Osaekomi* (2013=25"→20"). Essa mudança teve como objetivo facilitar a compreensão do público sobre as pontuações do judô, bem como desincentivar o uso de

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lograr la victoria (2010=exclusión de *koka*; 2013=penalización ya no equivalió a puntuaciones; 2017=exclusión de *yuko*, el *shido* ya no decidió el ganador en el tiempo reglamentario; 2018=*shido* ya no decidió el ganador en la técnica de oro). Se fomentaron las acciones de ataque (prohibición de acciones para evitar el combate) y se pretendió reducir el riesgo de lesiones (prohibición de algunos tipos de acciones y agarres). En otras palabras, existió un intento por parte de la Federación Internacional de Judo de fomentar el judo positivo a través de las reglas de competición entre 2010 y 2020. Sin embargo, estos cambios constantes en las reglas hicieron que el contexto del entrenamiento de competición fuese inestable. Los entrenadores y atletas de judo deben estar atentos en el final de cada ciclo olímpico a los nuevos cambios que eventualmente se introducirán, y adaptarse a ellos rápidamente para lograr un alto rendimiento.

**Palabras clave:** Artes marciales; deportes de combate; judo; análisis de rendimiento; arbitraje; reglamento; competición.

punições para obter a vitória (2010=exclusão de *Koka*; 2013=punição não vale mais pontuação; 2017=exclusão do *Yuko*, e *Shido* não decide mais o vencedor no tempo regular; 2018=*Shido* não decide mais o vencedor do Golden Score). Ações de ataque foram incentivadas (proibição de ações para fugir do combate) e houve a intenção de reduzir o risco de lesões no judô competitivo (proibição de alguns tipos de ações e pegadas). Ou seja, houve uma tentativa da Federação Internacional de Judô de estimular um judô positivo por meio das regras de 2010-2020. No entanto, essas constantes mudanças nas regras tornaram o contexto de treinamento competitivo instável. Os treinadores e atletas de judô devem estar atentos ao final de cada ciclo olímpico para novas mudanças que eventualmente são introduzidas e devem adaptar-se a elas rapidamente para ter rendimento competitivo.

**Palavras-chave:** Artes marciais; esportes de combate; judô; análise de desempenho; arbitragem; regras; competição.

## 1. Introduction

Judo rules have been revised by the International Judo Federation (IJF) many times over the years. The revision of the rules in the last decade (e.g., 2010, 2013, 2015, 2017, 2018, and 2020) introduced significant changes in the competition, which included changes in the regular combat time, exclusion of scores, prohibition of attacks gripping below the belt, changes in the weighing day, and rules that preserve the use of traditional techniques and encourage positive judo (IJF, 2009, 2013, 2015, 2017a, 2017b, 2020). The IJF has been changing the rules to make judo more dynamic and televised. Therefore, two referees were removed from the mat, leaving only one (which facilitates the understanding of the audience), referee video replay was inserted to minimize errors of judgment, a dress code for coaches was established, and the official judogi for competitions was standardized (IJF, 2009, 2013, 2015, 2017a, 2017b, 2020). The scientific explanation for these changes has been challenged, and statistical evidence-based studies showed a reverse tendency of increasing penalties and decreasing scores (Calmet et al., 2017; Franchini et al., 2013; Stanković et al., 2011; Stanković et al., 2019).

Notational analysis is concerned with identifying patterns, often referred to as 'performance indicators', in the judo competitive environment (Brito et al., 2017; Ito et al., 2015). While match demands have been well-described in judo using time-motion (Barreto et al., 2019; Brito et al., 2020; Challis et al., 2015; Dudeniene et al., 2017; Miarka et al., 2016; Miarka et al., 2016a; Soriano et al., 2019; Sterkowicz-Przybycień et al., 2017), technical-tactical analysis (Calmet et al., 2006; Klys et al., 2020), muscle group specific torque production (Brito et al., 2020; Lech et al., 2015), motor actions (Courel-Ibáñez et al., 2014; Del Vecchio et al., 2018; Calmet et al., 2010; Franchini et al., 2018; Ito et al., 2014; Kajmovic & Radjo, 2014; Kajmovic et al., 2014; Miarka et al., 2017; Piras et al., 2014), and biomechanical analysis (Soto et al., 2020; Dal Bello et al., 2019; Ito et al., 2019), a practical performance analysis (Brito et al., 2020a; Escobar-Molina et al., 2014) to verify how rules changes between 2010 and 2020 impacted in judo is needed to evaluate contextual information during judo competition (Soto et al., 2020a; Miarka et al., 2015; Tamura et al., 2012).

Recently, a significant rules reform was the exclusion of the traditional score of *yuko* (Samuel et al., 2020). Only the *waza-ari* and *ippon* scores continued, but the *waza-ari* score could be accumulated, and two *waza-ari* were not equal to an *ippon*. Moreover, in the golden score moment, both a score and a *shido* could end the combat; however, the number of golden scores increased in the 2020 Olympic Games (Barreto et al., 2021). Despite notational analysis having been commonly used within research and applied settings to investigate match demands of combat performance (Agostinho, & Franchini, 2020; Brito et al., 2017a; Boguszewski et al., 2014; Kashiwagura & Franchini, 2021; Miarka et al., 2020), practical chronological evaluation of combat time associated with score and penalties requires knowledge that can potentially affect judo performance. Research on combat time, score and penalties can provide information to be applied in the physical, and



technical preparation of athletes (Julio et al., 2018; Marcon et al., 2010; Miarka et al., 2014; Samuel et al., 2020).

Furthermore, this knowledge could be employed in possible changes of evaluations, specific skills, and metabolic model demands (Franchini et al., 2013; Gutiérrez-Santiago et al., 2020; Miarka et al., 2012). Understanding how the changes related to combat time (Calmet et al., 2017; Dias-de-Durana et al., 2018), scores and penalties (Balci & Ceylan, 2020; Kons et al., 2018) occurred over the years enables judo coaches to plan effective training sessions which can develop strategies to achieve victory using the rules to their advantage. Furthermore, this knowledge is necessary for researchers to discuss research data relating them to regulatory norms of the competition era. Thus, it is important that there are studies that gather information about judo rules so that this information does not get lost over time. Therefore, we developed this study aiming to describe and analyze the main changes in the rules of official judo competitions that took place from 2010 to 2020, highlighting changes in combat time, scores and penalties.

## 2. Methods

In this retrospective study, we performed a search and analysis of official documents that regulated judo competition rules between 2010 and 2020. The search for official documents was carried out on the International Judo Federation and the Brazilian Judo Confederation websites, as well as refereeing manuals of the Sergipe Judo Federation (Brazil) and on the Google platform. We found documents that deal with the changes to the judo rules which took effect in the years 2010, 2013, 2015, 2017, 2018 and 2020. Thus, the results were organized into subheadings referring to the years in which each judo rule change took effect for better understanding of the rule changes which occurred in the last decade. Tables were used to synthesize the main information and facilitate visualizing the changes that occurred in the judo rules over the years.

## 3. Results

The summary of the major changes in judo rules that took place between 2010 and 2020 are described in Tables 1 and 2. This information will be explained in the following subheadings, subdivided by the year in which the judo rule change took effect.

### 3.1. 2010 judo rules change

On August 23, 2009, in Rotterdam - Netherlands, the Ordinary Congress of the International Judo Federation was held with the aim of providing changes in the judo rules. The rule changes took effect from January 2010 and remained in effect until December 2012 (FPJU, 2011; IJF, 2009).

Thus, the regular combat time for both male and female judo was 5 minutes until 2009, and the 'golden score' (overtime) had the same duration as the regular combat time. With the change in the rule, there was a reduction in the golden score time from 5 minutes to 3 minutes in 2010. In addition, there was elimination of the *koka* score and the penalties (*shido*) were reversed in scoring for the opponent in the following way: 1st *shido* (no score), 2nd *shido* = *yuko*, 3rd *shido* = *waza-ari*, and 4th *shido* = *ippon*. The time for scoring in *osaekomi* was: 15-19" *yuko*, 20-24" *waza-ari* and 25" *ippon* (Table 1) (FPJU, 2011; IJF, 2009).

Another relevant 2010 rule change was the prohibition of techniques whose grip was below the judo belt (*hansokumake* – disqualification), except in the following situations: a) techniques applied in sequence, for example: *ippon-seoi-nage* followed by *kata-guruma*; b) techniques applied as a counter-attack, for example: the opponent applied an *uchimata* and the defense performed a *te-guruma*; c) techniques when the opponent was in a cross grip; i.e. hands on the same side of the *judogi* (judo equipment). Other grip prohibitions were punished with *shido*, such as: avoiding holding the opponent's *judogi*, or adopting a defensive posture, or making an unconventional grip without an immediate attack, or preventing the opponent from holding the *judogi* for more than 5 seconds; interlacing the opponent's fingers of one or both hands; pulling the opponent down to bring them to the ground. Furthermore, it was also *shido* to perform a fake attack or intentionally loosen your own *judogi* or belt without the referee's permission (Table 2) (FPJU, 2011; IJF, 2009).



**Table 2.** Characteristics of time, penalties and scores of judo combat according to official rules between 2010 to 2020.

Year	Regular combat time		Osaekomi time	Golden score time	Number of penalties	Regular combat winner	Golden score winner
	Male	Female					
2010	5'	5'	Ippon = 25" Waza-ari = 20-24" Yuko = 15-19" *	3'	➤ 4 <i>shido</i> * • 2nd <i>shido</i> = <i>yuko</i> • 3rd <i>shido</i> = <i>waza-ari</i> • 4th <i>shido</i> = <i>ippon</i>	➤ <i>Ippon</i> ➤ <i>Waza-ari-awasete-ippon</i> ➤ <i>Opponent's hansokumake</i> (direct or by 4 <i>shido</i> ) ➤ <i>Kiken-gachi</i> ➤ If the regular combat time ends: <i>waza-ari</i> prevails over <i>yuko</i> *	➤ 1st score ➤ 1st opponent's <i>shido</i> ➤ If the Golden score time runs out, the winner will be decided by <i>hantei</i>
2013	5'	5'	Ippon = 20" Waza-ari = 15-19" Yuko = 10-14"	No time limit **	➤ 4 <i>shido</i> ***	➤ <i>Ippon</i> ➤ <i>Waza-ari-awasete-ippon</i> ➤ <i>Opponent's hansokumake</i> (direct or by 4 <i>shido</i> ) ➤ <i>Kiken-gachi</i> ➤ If the regular combat time ends: <i>waza-ari</i> prevails over <i>yuko</i> , which prevails over <i>shido</i>	➤ 1st score ➤ 1st opponent's <i>shido</i> **
2015	5'	4'	Ippon = 20" Waza-ari = 15-19" Yuko = 10-14"	No time limit	➤ 4 <i>shido</i>	➤ <i>Ippon</i> ➤ <i>Waza-ari-awasete-ippon</i> ➤ <i>Opponent's hansokumake</i> (direct or by 4 <i>shido</i> ) ➤ <i>Kiken-gachi</i> ➤ If the regular combat time ends: <i>waza-ari</i> prevails over <i>yuko</i> , which prevails over <i>shido</i>	➤ 1st score ➤ 1st opponent's <i>shido</i>
2017	4'	4'	Ippon = 20" Waza-ari = 10-19" #	No time limit	➤ 3 <i>shido</i>	➤ <i>Ippon</i> ➤ <i>Opponent's hansokumake</i> (direct or by 3 <i>shido</i> ) ➤ <i>Kiken-gachi</i> ➤ ↑ <i>Waza-ari</i> ## (if the regular combat time ends) # ###	• 1st score • ↑ accumulation of the opponent's <i>shido</i> • <i>Opponent's hansokumake</i>
2018	4'	4'	Ippon = 20" Waza-ari = 10-19"	No time limit	➤ 3 <i>shido</i>	➤ <i>Ippon</i> ➤ <i>Waza-ari-awasete-ippon</i> & ➤ <i>Opponent's hansokumake</i> (direct or by 3 <i>shido</i> ) ➤ <i>Kiken-gachi</i> ➤ <i>Waza-ari</i> (if the regular combat time ends)	• 1st score • <i>Opponent's hansokumake</i> &&

\* *Koka* elimination; \*\* *Hantei* elimination; \*\*\* *Shido* no longer scores points; # *Yuko* elimination; ## *Waza-ari* did not become *ippon* (*waza-ari* accumulation); ### *Shido* did not decide the regular combat winner; & 2 *Waza-ari* returned to be *ippon*; && *Shido* did not decide the golden score winner

**Table 2.** Major changes in judo rules between 2010 and 2020.

Year	Judo rule changes
2010	<ul style="list-style-type: none"> <li>➤ Prohibition of attacks gripping below the belt (<i>hansokumake</i>), except in the following situations:                             <ul style="list-style-type: none"> <li>• Techniques applied in sequence;</li> <li>• Techniques applied as a counter-attack;</li> <li>• Techniques with the opponent in a cross grip.</li> </ul> </li> <li>➤ <i>Shido</i>:                             <ul style="list-style-type: none"> <li>• Avoiding holding the opponent's <i>judogi</i>, adopting a defensive posture, making an unconventional grip without an immediate attack, or preventing the opponent from holding the <i>judogi</i> (more than 5").</li> </ul> </li> </ul>
2013	<ul style="list-style-type: none"> <li>➤ No exceptions for the prohibition of attacks gripping below the belt (<i>hansokumake</i>).</li> <li>➤ No shaking hands at the start of combat (the referee should warn).</li> <li>➤ <i>Shido</i>:                             <ul style="list-style-type: none"> <li>• Crossed, single-sided and with the hand on the belt grips without immediate attack.</li> <li>• Hug the opponent to throw (bear hug) (unless the athlete has previously held the <i>judogi</i> with at least one hand).</li> <li>• Pull the opponent down (to bend the body) without an immediate attack.</li> </ul> </li> </ul>
2015	<ul style="list-style-type: none"> <li>➤ <i>Judogi</i> sleeves should cover the entire arm (including the wrist).</li> <li>➤ It was not allowed to prevent or remove the opponent's grip:                             <ul style="list-style-type: none"> <li>✓ with a blow to the arm or hand.</li> <li>✓ with both hands (you can use one hand).</li> <li>✓ pulling the <i>judogi's</i> collar.</li> <li>✓ covering the <i>judogi's</i> collar with the hand.</li> <li>✓ blocking opponent's hands (hand to hand).</li> <li>✓ use of the legs to remove the opponent's grip.</li> </ul> </li> <li>➤ 1 referee per combat area (video replay with referee supervision: the information was transmitted by electronic point).</li> <li>➤ Weighing went back to the day before the competition.</li> <li>➤ <i>Osaekomi</i> was still valid outside the area if it started inside the area.</li> </ul>
2017	<ul style="list-style-type: none"> <li>➤ <i>Judogi</i> sleeves should cover the entire arm (including the wrist).</li> <li>➤ It was possible to score <i>waza-ari</i> and <i>shido</i> at the same time for both athletes.</li> <li>➤ Gripping was allowed for up to 45".</li> <li>➤ <i>Sutemi-waza</i> as a counterattack scored points only if there was clear control during the entire projection.</li> <li>➤ Actions after the fall of <i>sutemi-waza</i> should be considered as <i>ne-waza</i>.</li> <li>➤ Gripping under the belt must be firstly punished with <i>shido</i> and secondly with <i>hansokumake</i> (only allowed in <i>ne-waza</i>).</li> <li>➤ <i>Hansokumake</i>: fall into a bridge position to avoid opponent's score.</li> <li>➤ Rolling fall was not <i>ippon</i>.</li> <li>➤ <i>Shido</i>:                             <ul style="list-style-type: none"> <li>• Intentionally messing up the <i>judogi</i> (to get more rest) or spending more time than necessary to organize it.</li> <li>• One foot outside the combat area (no immediate attack or if not immediately return to combat area).</li> <li>• All unconventional grips (without immediate attack).</li> <li>• <i>Shime-waza</i> with the belt and the <i>judogi</i> collar (winding) or just with the fingers.</li> </ul> </li> <li>➤ <i>Ne-waza</i>: both athletes must have two knees on the ground.</li> <li>➤ The opponent's <i>osaekomi</i> was valid when he made a reversal in a continuous succession of moves outside the combat area.</li> <li>➤ <i>Ura</i> position was valid for scoring.</li> </ul>
2018	<ul style="list-style-type: none"> <li>➤ <i>Ippon</i> (4 criteria): speed; strength; fall backwards; skillful control to the end.</li> <li>➤ Rolling fall was <i>ippon</i> (if there was no interruption during landing), or <i>waza-ari</i> if any of the <i>ippon</i> criteria is missing.</li> <li>➤ <i>Shido</i> to grab the leg, trousers or below the waist in standup combat (for all occurrences).</li> <li>➤ <i>Hansokumake</i>: voluntary use of the head to avoid falling.</li> <li>➤ Double <i>hansokumake</i> (negative judo).</li> <li>➤ In case of doubt about who should receive a score or penalty, no decision was made and the combat would continue (fair play spirit).</li> <li>➤ <i>Shime-waza</i> by over-stretching the opponent's leg: combat must be interrupted.</li> </ul>
2020	<ul style="list-style-type: none"> <li>➤ Athletes who hit their head on the ground due to <i>seoi-nage</i> fall should not be punished.</li> <li>➤ <i>Kata-sankaku</i> grip with the intention of throwing the opponent was <i>hansokumake</i> (in <i>ne-waza</i> the interrupts the combat).</li> <li>➤ Rolling fall can be considered <i>waza-ari</i> if they are interrupted or if the fall was on one side of the body.</li> <li>➤ <i>Ude-gaeshi</i> standing application situations (reverse arm) should be stopped and punished with <i>shido</i>.</li> <li>➤ Immobilizing with arms or legs around the neck, without dominating the opponent's arm, must be stopped.</li> <li>➤ The <i>judogi shita</i> (skirt) should completely cover the buttocks.</li> <li>➤ The width of the <i>judogi</i> sleeves must allow full entry of the <i>sokuteiki</i> (judo measuring equipment).</li> </ul>



The judo rules also started to standardize the dress of coaches and their performance during combats in 2010. From the new imposition of the rule, coaches had to follow a dress code, which requires formal attire, such as full suit. In addition, coaches could only talk to athletes during the break (between *matte* – combat stop, and *hajime* – combat begin), and they had to remain seated in the chair throughout the combat. If they broke the rule, they would be warned. At the end of the combat, the warning was reset for another combat. However, if coaches took two warnings in the same combat, they were to be excluded from the coach's chair. Thus, penalized coaches should remain in the stands without uttering verbal commands to the athletes throughout the event, otherwise, they would be disqualified from the competition and they would have to leave the event space (Table 2) (FPJU, 2011; IJF, 2009; British Judo, 2014).

Furthermore, in 2010 the process of modernizing the analysis of referees in judo combats began, thus the use of the IJF Care System was introduced. It consisted of 2 HD cameras per mat and laptops to allow the use of video replay, which would ensure a more objective assessment of the combats and athletes' scores, especially in situations of difficult visual assessment. However, three referees remained in the combat area, the referee committee analyzed the video in case of doubts. Another rule change was that the weighing stage started to be carried out on the same day as the competition, in order to avoid major losses in the athletes' body mass (Table 2) (FPJU, 2011; IJF, 2009; British Judo, 2014).

### 3.2. 2013 judo rule change

Judo rule changes usually occur at the end of the Olympic cycles. Thus, new changes to the judo rules were made after the 2012 London Olympics. On January 31, 2013, the International Judo Federation Seminar for new rule changes was held in Mexico City, Mexico. These changes remained in effect until 2016, however some adaptations were made in 2015 (FPJU, 2013; IJF, 2013; CBJ, 2015; IJF, 2015).

Thus, the golden score time became unlimited, so the *hantei* (decision by majority vote of the 3 referees) was excluded from the rules. In addition, in 2013 only one referee controlled the combat, being supervised by 2 referees with access to the video replay, and the information between the referees was passed on through an electronic point. Furthermore, the *osaekomi-waza* time was reduced: “10-14 *yuko*”, “15-19 *waza-ari*” and “20 *ippon*”, and in cases where the athlete started *osaekomi-waza* inside the competition area and remained outside, it would be valid (Table 1 and 2) (CBJ, 2014; FPJU, 2013; IJF, 2013).

The penalties were no longer worth more points from 2013; however, if the combat was a draw, the athlete with the highest number of penalties would lose. In addition, the following actions in the grip dispute were re-emphasized as *shido*: removing the opponent's grip using both hands or with a blow to the arm or hand; pulling or covering the *judogi* collar, messing it up and preventing the opponent's grip; blocking the opponent's hands (hand to hand); using the legs to remove the opponent's grip. Exceptions to the rule prohibiting attacks below the belt no longer exist from 2013 to avoid confusion by the referee and make the rule clearer. Moreover, pulling the opponent down (to bend the body) without making an immediate attack was also penalized with *shido* because it was a blocking maneuver (Table 2) (CBJ, 2014; FPJU, 2013; IJF, 2013).

Athletes had to perform at least one *judogi* grip in advance (just touching the *judogi* was not considered a grip, it would be necessary to grab) in order to perform an attack with a “bear hug” grip. Thus, holding the *judogi* simultaneously with both hands in a “bear grip” was *shido*. In cases of crossed, single-sided and with the hand on the belt grips, they must be followed by an immediate attack, otherwise it was *shido*. Furthermore, athletes were prevented from shaking hands at the start of the combat to preserve judo traditions and protocol, and the weighing went back to the day before the competition (Table 2) (FPJU, 2013; IJF, 2013).

### 3.3. 2015 judo rule change

The International Judo Federation Refereeing Seminar for some rule adaptations was held in Malaga, Spain from January 25<sup>th</sup> to February 1<sup>st</sup>, 2015. The main change in the 2015 rule was the

decrease in the regular female combat time from 5 to 4 minutes. The men's combats continued to last for 5 minutes (Table 1) (CBJ, 2015; IJF, 2015).

In addition, there were changes regarding the competition uniform, the main one was that the *judogi* sleeves should cover the entire arm at the time of checking (including the wrist), different from before that there was a tolerance of 5 cm from the wrist. Furthermore, in 2015 the weighing continued to take place on the eve of the competition, however, a draw of athletes began to take place on the day of the combat to carry out a new weight measurement. In this reweighing, athletes could not exceed 5% of the weight division limit (Table 2) (CBJ, 2015; IJF, 2015).

### 3.4. 2017 judo rule change

New rule changes were implemented after the 2016 Rio de Janeiro Olympics, at the Technical and Arbitration Seminar in Baku, Azerbaijan on January 6<sup>th</sup> and 7<sup>th</sup>, 2017. These judo rules were established for the new Olympic cycle (2017-2021) and they had some modifications in 2018 and 2020 (IJF, 2017a, 2017b, 2020).

Thus, among the most important changes to 2017, there was a decrease in the regular combat time for men and the exclusion of the *yuko* score. Therefore, the regular combat time became 4 minutes for men and women, and there were only *ippon* and *waza-ari* scores. However, *waza-ari* did not add to itself anymore (2 *waza-ari* were not *ippon*), and all situations that were once *yuko* had become *waza-ari*. Thereby, for *osaekomi* the *ippon* was scored in 20 seconds and *waza-ari* in 10-19 seconds (former *yuko*). In addition, there was a reduction to a maximum of 3 *shidos* per combat (3rd *shido* = *hansokumake*) (Table 1), and it also became possible to apply simultaneous points and penalties. For example, if the athlete committed a foul and the opponent executed a technique (at the same time or in sequence) which resulted in *waza-ari*, both *shido* and *waza-ari* were scored (Table 2) (CBJ, 2017; IJF, 2017a).

There was also a change in the way to determine the combat winner in 2017. Thus, victory in regular combat time was only achieved through a technical score (*waza-ari* or *ippon*) or with the opponent's disqualification (*shido* no longer decide the winner). The combat continued into the golden score when the regular time ended and there was no technical score or there were equal scores, regardless of existing *shido*. Therefore, the scoreboard was maintained and the winner was either determined by technical score or the highest *shido* accumulation (Table 1). The IJF also emphasized that athletes who intentionally loosened their *judogi* or spent too much time arranging it must be punished with *shido* (Table 2) (CBJ, 2017; IJF, 2017a).

In addition, the rule changes allowed the athlete to remain in the gripping situation for up to 45 seconds without being penalized, as long as there was positive judo. Furthermore, all unconventional grips (pistol, pocket, belt, one side and crossed grips, among others) were only allowed in the immediate attack, otherwise the athlete was also punished with *shido*. Moreover, grabbing the leg or trousers in standup combat was firstly punished with *shido* and secondly by *hansokumake*. In addition, grabbing the leg was allowed in *ne-waza* (both athletes should have both knees on the ground) and if any technique started standing had been interrupted (Table 2) (CBJ, 2017; IJF, 2017a).

In 2017 the IJF also determined that when athletes had one foot outside the combat area, they would only be punished if there was no immediate attack or if they did not immediately return to the combat area. In addition, in cases where the athlete started *osaekomi-waza* inside the competition area, left the area and there his opponent managed to reverse the immobilization in a continuous succession of movements, this action would also be valid to score. Furthermore, the *ura* position (belly up) performed in some *osaekomi-waza* was again valid for scoring, and it was not allowed to do *shime-waza* (choking) with the belt, the *judogi* collar or just with the fingers, which was punishable with *shido* (Table 2) (CBJ, 2017; IJF, 2017a).

These rules also emphasized that all situations of falling in the bridge position as a voluntary action by the athlete to avoid the opponent scoring was considered *ippon*. The cases of rolling fall could not be considered *ippon*. In addition, it was recommended that in situations where *sutemi-waza* techniques (sacrifice) were applied as a counterattack, the first competitor to fall to the ground should not score, unless there was clear control of the movement during the throw.



Furthermore, any action after the fall of *sutemi-waza* should be considered as *ne-waza* (Table 2) (CBJ, 2017; IJF, 2017a).

### 3.5. 2018 judo rule change

Another rule change was established at the IJF Executive Committee Working Meeting held on October 18<sup>th</sup>, 2017 and January 13<sup>th</sup>, 2018, which took effect on January 1<sup>st</sup>, 2018. Thus, the accumulation of 2 *waza-ari* was again equivalent to *ippon* and *shido* no longer decided the winner of the golden score (Table 1). In 2018, the IJF emphasized judo technique scoring criteria in standup combat. Therefore, for a technique to be considered *ippon* it would be necessary to meet 4 criteria: speed, strength, falling backwards and skillful control until the end of a throw (Table 2) (CBJ, 2018; IJF, 2017b).

In 2018, voluntary use of the head as a defensive action to avoid falling was *hansokumake*, except in cases where the action was involuntary, which occurs in throws that are difficult to avoid hitting the head on the ground (*seoi-otoshi*, *sode-tsurikomi-goshi*, *koshi-guruma*). Rolling fall could be considered *ippon* if there was no interruption during landing. *Waza-ari* was given when any of the 4 *ippon* criteria was not met. In addition, grabbing the leg or trousers was to be punished with *shido* in all occurrences. It was also emphasized that when the athlete performs the *shime-waza* on the groundwork by over-stretching the opponent's leg, in order to bring it closer to the opponent's head, the combat must be interrupted (Table 2) (IJF, 2017b).

Then from 2018, in case of negative judo by both athletes it was possible to penalize them with double *hansokumake* (3rd *shido* or unsportsmanlike actions contrary to the spirit of judo), and both athletes were to be disqualified from the competition. However, it was emphasized that no decision would be made and the combat could continue in cases where there was no certainty about who should receive the score or penalty in the spirit of fair play (Table 2) (CBJ, 2018; IJF, 2017b).

### 3.6. 2020 judo rule change

On January 11<sup>th</sup> and 12<sup>th</sup>, 2020, the Refereeing, Sport and Education Seminar was held in Doha, Qatar, on January 11<sup>th</sup> and 12<sup>th</sup>, 2020, to clarify some rule points, making them more understandable for everyone. These adaptations lasted until the 2020 Olympics, which took place in Tokyo in 2021 because of the covid-19 pandemic (IJF, 2020).

It was clarified that if there was an interruption during a throw, or if the throw was on one side of the body it could be considered *waza-ari*. Furthermore, the *seoi-nage* technique was added to the rule of not punishing the athlete in the event of an involuntary head hit on the mat during a throw. In addition, the 2020 rule drew attention to potentially dangerous situations in ground combat. The rule established that *Ude-gaeshi* standing application situations (reverse arm) should be stopped and punished with *shido*. Moreover, executing the *kata-sankaku* grip with the intention of throwing the opponent would be penalized with *hansokumake*, and if this grip started in *ne-waza*, the combat must be stopped. In addition, *osaekomi-waza* with arms or legs around the neck, without dominating the opponent's arm, must be stopped (Table 2) (CBJ, 2020; IJF, 2020).

Furthermore, the rules related to the judogi were highlighted, which should have *shita* ("skirt") fully covering the buttocks, as well as the width of the sleeves should allow full entry of the *sokuteiki* (judogi measuring equipment) when the athletes were with their arms outstretched (Table 2) (CBJ, 2020; IJF, 2020).

## 4. Discussion

In this study, information about the judo rules of the last decade was grouped in order to describe and allow an analysis of the main changes that occurred in the 2010-2020 period. This information allows researchers to understand how changes in judo rules have occurred over the years, which can facilitate the discussion of research results related to competitive performance. The discussion was divided into subchapters to provide a better analysis of the rules: changes in regular judo combat time and scoring rules; rules on refereeing, weighing, and behavior of coach

and athletes; negative judo; ban on grips under the belt and its consequences; and prohibition of dangerous actions.

#### 4.1. Changes in regular judo combat time and scoring rules

Eliminating *koka*, reducing the golden score time, and the possibility of using penalties to win which would be reverted to scores (Table 1) in 2010 stimulated changes in the athletes' way of fighting. Thus, the athletes developed strategies to win the combat which were considered as negative judo, such as: scoring points and adopting a defensive posture until the end of the regular combat time; leading the opponent to commit infractions, mainly putting them out of the competition area. This adaptation process and strategic development can be perceived in the analysis of the average combat time in 2010 to 2012. Soriano et al. (2019) analyzed 75 male combats in 2010 international judo tournaments, and found a combat time of  $202.8 \pm 86.2$  seconds; Barreto et al. (2019) analyzed 548 international male judo combats in 2011-2012, and found a combat time of  $304.8 \pm 169.6$  seconds. While Miarka et al. (2016) indicated a shorter female combat time in 2011-2012 of  $232.7 \pm 146.3$  seconds, and similar results in high level international male athletes (Miarka et al., 2016a).

These data indicate that the adaptation of athletes to the rule over the years (2010 to 2012) which made them spend all of their regular combat time (300 seconds). In addition, Adam et al. (2013), who analyzed 250 male combats (233 competitors from 109 countries) and 157 female combats (154 competitors from 64 countries) at the 2012 Olympics, noted that both female and male competitors had defense effectiveness (96 to 100%) more significant than the attack effectiveness (1.8 to 18.4%). This leads us to believe that athletes managed the score achieved during combat with extremely defensive strategies, prioritizing the opposing penalty instead of attacks (negative judo). As a result, a need for further changes to the rules emerged.

The 2013 rule changes likely encouraged athletes to attack more, as fouls no longer reverted to scores and golden score time became unlimited (Table 1). Attacking then became the best way to achieve victory and avoid the golden score. In addition, earning points on the groundwork became easier, as the minimum *osaekomi* time to score was 10 seconds (not 15) and the maximum time was reduced to 20 seconds (not 25) (Table 1). Therefore, the athletes started to make more efforts to make the transition from standing up to groundwork without losing contact with the opponent. Thus, after getting a *waza-ari* by a standing attack, the athlete was able to finish the combat by getting another *waza-ari* with a 15-second immobilization (Table 1). A more offensive form of fighting in 2013 can be identified in the study by Segedi et al. (2014), in which of the 193 international combats of 2013 analyzed (68 female and 125 male) more than half (63.2% of male and 57.4% of female) ended before regular time.

In 2015 with the decrease in women's regular combat time from 5 to 4 minutes (Table 1), it became essential to win in regular time to avoid the golden score, which had unlimited time. Boguszewski (2016) analyzed 14 gold medal combats (7 female and 7 male) at the Rio de Janeiro Olympic Games, and observed that women showed higher values of offensive action effectiveness index (0.20) than men (0.13). In addition, women had an average combat time of 232.7 seconds, close to their regular combat time limit of 240 seconds, while men had a combat time of 237.4 seconds, which was farther from their regular combat time of 300 seconds.

In 2017, the IJF determined that *shido* would no longer decide the winner of the regular combat and there would only be 3 *shido*. Furthermore, changes in 2017 such as eliminating *yuko*, the accumulation of *waza-ari* and the reduction in the men's combat time to 4 minutes (Table 1), minimized the chances of athletes to win combats without taking offensive actions. In addition, the first competitor to fall to the ground in situations where *sutemi-waza* techniques (sacrifice) were applied as a counterattack would only score if there was clear control of movement during the throw (Table 2). The referee's assessment of who would get the score resulting from *sutemi-waza* techniques has always been controversial, especially in counterattack situations. Moreover, rolling falling should no longer be worth *ippon*.

Some of these rule changes were not widely accepted, with *waza-ari* accumulation being one of them. In fact, there were combats in which the athletes threw many times, getting numerous



*waza-ari*, however they lost the combat for having fallen only once, and the *ippon* was assigned to the opponent. Thus, a new rule change was implemented in 2018 to solve this problem, which determined that the accumulation of 2 *waza-ari* would again be equivalent to the *ippon* (Table 1). In addition, the rolling fall was again worth *ippon* in 2018 rules if there was no interruption during the fall, or *waza-ari* if any of the *ippon* criteria were missing. In the 2020 rules, it was clarified that *waza-ari* could be attributed in rolling fall situations in which athletes fall rolling with interruption during the fall or they fall on one side of the body (Table 2). These changes were intended to make judo more understandable to everyone (athletes, coaches, spectators and media). In addition, the IJF also determined that *shido* would no longer decide the winner of the golden score to consolidate valuing attacking instead of penalties (Table 1), as well as it would also be possible to have double *hansokumake* if both athletes were penalized at the same time (Table 2).

These changes in the judo rule over the years (2010 to 2020) reflect the IJF's intention to reduce combat time, in addition to minimizing the importance of penalties in determining the combat winner. Male athletes, classified for the 2012 Olympic Games, had in international competitions between 2011-2012 average combat time that ranged from 198.6 to 344.4 seconds per weight division (Díaz-de-Durana et al., 2018). Athletes who competed in the finals of the 2016 Olympic Games had an average combat time of 235.1 seconds (men=237.4; women=232.7 seconds) (Boguszewski, 2016). International athletes who competed between 2018-2019 had average combat time ranging from 163.9 to 190.8 (women) and 187.1 to 194.1 (men) seconds (Ceylan and Balci, 2020). Data from these studies show both a reduction in judo combat time over the years, with different rules in force, and a trend towards homogeneity between weight and gender categories. In addition, the occurrence of *shido* has decreased and of scores have increased. Doppelhammer and Stockl (2020) analyzed 308 judo combats of the 2015 and 2018 World Championships and they identified that, comparing 2018 with 2015, the amount of *ippon* (2015=31.2%; 2018=43.5%;  $p=0.046$ ) and *waza-ari-awasete-ippon* (2015=7.1%; 2018=15.6%;  $p=0.031$ ) increased, while the occurrence of combat decisions by *shido* decreased (2015=21.4%; 2018=7.1%;  $p=0.009$ ).

#### 4.2. Changes in rules for refereeing, weighing and dressing of coaches and athletes

During the last few years there have been rule changes related to weighing, refereeing and behavior of coaches and athletes. In 2010, the introduction of video analysis monitoring of combats (Table 2) was the beginning of a series of transformations that modernized judo refereeing, making it increasingly efficient and fair. Due to the successful testing of the IJF Care System in combat monitoring, in 2013 video analytics was definitively incorporated into combat arbitration. Thus, only 1 referee remained in the combat area, while the 2 referees started to stay at a table, in front of the competition area, monitoring the combat through the video replay of the athletes' actions. When the two table referees disagreed with the judgment of the center referee, they communicated the decision to him by electronic point (Table 2). This change in the form of refereeing was very beneficial for judo, because during combat many factors can cause the referees' judgment to fail, such as: the speed of the athletes' actions, the referee's bad position, the referee's fatigue during the last combats of the event (semifinals, recaps and finals), the power of persuasion of the crowd. Some studies have investigated the influence of crowd noise on referees' judgment, identifying how enthusiastic support from the crowd can benefit athletes in their region/country or preference (Barreto et al., 2021). Brito et al. (2017), who analyzed 1411 videos of international judo combats, identified that home athletes won more (73%) than athletes from other regions (59%) ( $p=0.007$ ). In the analyzed combats, home athletes received more scores from the opponent's penalties ( $p<0.001$ ), and out-of-home athletes had more interruptions during the combat ( $p<0.01$ ). These data highlight the importance that the use of a computerized combat analysis system represented for judo.

As of 2010, the process of modernization and professionalization of judo can also be seen in rules that regulate the dress of coaches and athletes. Therefore, coaches were required to dress in formal attire (Table 2). This rule change contributed to establish the professional image of competitive judo that the International Judo Federation intended to convey in the media. Thus, the use of clothes such as shorts, caps, jeans, sweaters and flip-flops, which were commonly worn by coaches, was abolished. Athletes also went through this process, with the judogi standardization



rules (2015-2020) in which the sleeves should cover the entire arm (including the wrist) and allow the full entry of the *sokuteiki*, and the *shita* (*judogi* skirt) should completely cover the buttocks (Table 2). Prior to these rules, athletes wore tight-fitting *judogi*, which made it difficult for their opponents to hold the grip during combat.

Another relevant issue during a judo competition is weighing, as athletes can be eliminated if they do not fit within the weight limits determined in each weight division. Some rule changes have also taken place regarding this topic in recent years. In 2010 the weighing started to be carried out on the day of the competition (Table 2). This change was aimed at avoiding large losses of body mass as happened in other combat sports, especially in mixed martial arts. It was important for drawing the attention of coaches to the importance of nutritional planning and control of the athletes' body weight. However, in 2013, the weigh-in returned to the day before the competition (Table 2). Judo athletes compete much more often than athletes from other combat sports, ~10 combats/year and ~5-8 combats/day (Miarka et al., 2018). Therefore, it was understood that weighing on the day of the event was very stressful both for the athlete and for the organization of the competitive event. Furthermore, due to the proximity of competitive events, athletes might not choose to do practices to lose large amounts of weight, as it would affect their performance. In 2015 the weighing continued to take place on the eve of the competition, however, a draw of athletes began to take place on the day of the combat to carry out a new weight measurement. In this reweighing, athletes could not exceed 5% of the weight division limit (Table 2). This rule can be supported by the article of Artioli et al. (2010), who investigated the effects of rapid weight loss followed by a 4-hour recovery on judo-related performance and they found that rapid weight loss (5% of body weight) did not affect judo-related performance. In addition, this rule adjustment can be considered a agreement between the previous rule changes, as it inhibits any attempt at exaggerated weight loss.

#### 4.3. Negative judo

The constant changes in the rules over the years 2010-2020 were also intended to discourage attitudes considered as negative judo. An athlete's lack of initiative to attack, extremely defensive attitudes to avoid opponent's attack, as well as behaviors of athletes and coaches which were not consistent with the philosophical principles of judo were the focus of some penalties imposed in the rule changes of each year. The rule in 2010 established the prohibition of coaches' interference during combat, as coaches could not communicate with athletes outside the *matte* range, otherwise, they would be warned, and in case of recurrence, they would be disqualified from the event (Table 2). This rule was created due to various manifestations of bad behavior by coaches in previous years, as they commented/criticized the referees' verdicts, demanding the correction of their decisions through abusive gestures which did not fit with the philosophical principles of judo.

Moreover, athletes must also respect judo traditions and etiquette. Therefore, in 2013 it was emphasized that athletes should not shake hands before the start of the combat (a typical greeting in other combat sports such as wrestling and Brazilian jiu-jitsu), they must do the traditional judo salute. Thus, if athletes attempt to shake or slap the hands, the referee should dissuade them with a verbal denial (Table 2). In addition, judo athletes must wear the *judogi* well adjusted to the body and with the belt tightly tied to prevent the uniform from interfering with the movements during combat. When the *judogi* is loosened, the referees stop the combat and they ask the athlete to adjust it. However, it was not uncommon to observe, in competitions, athletes who took advantage of this possibility of combat interruption as a rest strategy, and they deliberately loosened their *judogi* or did not tie the belt very tight, in order for the referee to request the *judogi* adjustment. Thus, the IJF emphasized in 2017 that athletes who deliberately loosened their *judogi* must be punished with *shido* (Table 2) in order to reduce the number and duration of breaks during combat.

Another negative attitude form on the part of athletes is to avoid combat. Athletes can use gripping time to block the opponent's attacks as a strategy to manage combat defensively after obtaining a technical score. In the 2013 rules, the actions of athletes who demonstrate an intention to escape combat or excessively avoid the opponent's attacks, such as pulling or covering the *judogi* collar, blocking the opponent's hands, pulling the opponent down without immediate attack and purposefully leaving the combat area to avoid the opponent's attack were penalized with *shido*



(Table 2). Katicips et al. (2018) analyzed 1539 combats from Grand Slam in 2013, 2016 and 2017, and observed that there was a higher occurrence of *shido* in 2016 than in other years in both male judo (2013=1.17, 2016=2.11, 2017=1.35), and in female combat (2013=1.3, 2016=1.6, 2017=1.3). It is also noteworthy that there were some changes in the rule in 2017 which may have contributed to a reduction in its penalty occurrence, such as the reduction from 4 to 3 possible *shido* in a combat (Table 1), and the possibility to remain holding the *judogi* without making attacks for up to 45 seconds without being penalized. In addition, the 2017 rule changes established that athletes who left the combat area should only be punished if they did not make an immediate attack or if they remained outside the combat area to discourage negative attitudes from athletes who were trying to win through opponents' penalties (Table 2).

Thus, rule changes have contributed to reducing the occurrence of *shido* and increasing the score (Doppelhammer & Stockl, 2020). However, this does not mean that punishment is no longer relevant to the combat outcome. Balci and Ceylan (2020) analyzed 5,039 international combats between 2018 and 2019 and they identified that receiving a *shido* had significant indirect effects on the combat result. The possibility of losing the combat increased in the 1<sup>st</sup> *shido* (odds ratio (OR)=1.14) and in the 2<sup>nd</sup> *shido* (OR=2.13). In addition, for every 1 minute increased in combat time, the chance of receiving a *shido* increased (OR=2.10 for 1<sup>st</sup> *shido*; OR=1.87 for the 2<sup>nd</sup> *shido*). The main reasons for the punishments received were non-combativity (40.1%), avoid the grip (19.5%), false attack (16.3%), leave the combat area (6.5%) and defensive posture (6.2%). Thus, despite recent rule changes, these actions that are considered as negative judo still have significant influence in combat results.

Therefore, athletes must be careful when using as a combat strategy the administration of the number of penalties received after obtaining a score. As the combat difficulty increases, athletes start to use the rule in their favor, such as performing actions which take the opponent out of the combat area to be punished, acting defensively to avoid the risk of counterattack, managing the number of penalties until the end of combat time. Ceylan et al. (2020) analyzed 4,550 international matches between 2018 and 2019 and identified that the way competitors won differed in elimination, final stages and medal disputes ( $p=0.02$ ). The more advanced the combat, the lower the percentage of combats that ended with *ippon*, the higher the percentage of combats that ended with *waza-ari*, and the lower the efficiency index of the winning athletes ( $p<0.05$ ). In addition, comparing the eliminations with the other stages of the competition, the percentage of combats with *shido* (eliminations=73.5%; other stages = ranging from 77.5 to 78.1%;  $p=0.01$ ) and the combat duration (eliminations=177.4; other stages = ranging from 199.4 to 217.9 seconds;  $p=0.00$ ) increased.

#### 4.4. Ban on grips under the belt and its consequences

The way athletes hold the *judogi* is extremely important in a combat. The athletes can use the grip to advantageously position their body for the attack and it can be decisive for the choice of throwing technique (for example: holding both sleeves to apply the *sode-tsurikomi-goshi* technique). Some types of grips can benefit the athlete by providing greater reach to perform attacks. For instance, Kashiwagura et al. (2021) analyzed 5847 attacks performed by male judo athletes, and identified that grips in the dorsal region were decisive for an effective attack (right dorsal and left dorsal, right dorsal and left sleeve, and left dorsal and right sleeve;  $p<0.01$ ). Therefore, when the IJF makes rule changes prohibiting certain types of grips, it substantially affects the type and efficiency of the attacks being executed during combat.

The 2010 rule changes radically impacted the way athletes fought, mainly by banning attacks using grips under the belt (Table 2). This change created the need for athletes to approach and perform grips on the opponent's *judogi* to execute the techniques, as it was no longer allowed to hug the opponent's legs for the throw. Thus, attacks or defenses with a grip below the belt were prohibited and were punished with *hansokumake*, although there were exceptions to this rule (allowed in a technical sequence, or in a counter-attack, or with the opponent in a cross-grip) (Table 2), and many athletes were eliminated from combat for not adapting to it. However, the rule exceptions provoked many discussions and different interpretations; thus, the exceptions were withdrawn in 2013, consolidating prohibition of attacking with the grip under the belt. Moreover,



in 2013, crossed, unilateral and hand on the belt grips were penalized with *shido* if they were not followed by an immediate attack (Table 2). In turn, techniques with leg grip such as *kata-guruma*, *morote-gari*, *kibisu-gaeshi*, *kuchiki-taoshi*, and variations of techniques were practically banned from the competitive scene or they had to undergo adaptations to be performed in combat.

Some studies show this transformation of the most applied type of judo technique over the years into different rule configurations. Ito et al. (2012) compared men's Grand Slam competitions between 2009 and 2010 (436 combats in total) to investigate differences in the occurrence of *sukui-nage*, *kata-guruma*, *kuchiki-taoshi*, *kibisu-gaeshi* and *morote-gari* techniques after the 2010 rule change. They found that *kibisu-gaeshi* was significantly reduced (2009=9% vs. 2010=2%;  $p<0.05$ ), and there was a non-significant decreased in the use of *kuchiki-taoshi* (2009=28% vs. 2010=22%) and *morote-gari* (2009=2% vs. 2010=1%). Next, Adam et al. (2013) analyzed 256 effective male attacks during the 2012 Olympics. They observed that 37 different judo techniques were performed, and the 10 most standing techniques used were: *seoi-nage*, *tai-otoshi*, *uchimata*, *sukui-nage*, *sode-tsurikomi-goshi*, *osoto-gari*, *uki-waza*, *tani-otoshi*, *kouchi-gari* and *ura-nage*.

The occurrence of techniques gripping below the belt were still registered in 2010 and 2012 due to the rule exceptions, however it is clear that the use of these techniques was gradually disappearing. As it was found that the prohibition of gripping under the belt was already being consolidated in 2017, the IJF established that the first time this action was performed would be punished with *shido*, and if there was a recurrence of this fault, it would be punished with *hansokumake* (Table 2).

Martins et al. (2019) analyzed 799 combats from the 2017 Senior World Judo Championship, and observed that the top ten most used techniques were: *seoi-nage*, *ouchi-gari*, *uchimata*, *kouchi-gari*, *ippon-seoi-nage*, *kosoto-gake*, *sode-tsurikomi-goshi*, *sumi-otoshi*, *osoto-gari*, *sumi-gaeshi* and *tai-otoshi*. Thus, techniques primarily involving gripping below the belt were no longer among the most performed techniques. Then in 2018, possibly because the IJF realized that punishing the action of holding under the belt with *hansokumake* was out of step with what was attributed to the other prohibitions, they established that this action would be punished with *shido* in all occurrences.

#### 4.5. Prohibition of dangerous actions

The IJF tends to review the permission or not of situations which may endanger the athlete's physical integrity. Some actions in the gripping dispute can injure or fracture fingers and wrists. In 2010, actions such as interlacing the opponent's fingers of one or both hands were already punished with *shido*. Then in 2013, the rule change emphasized the prohibition of potentially dangerous actions in the gripping dispute, such as using both hands or legs, or hitting the arm or hand, which was to be punished with *shido*. In the 2020 rule changes, *ude-gaeshi* standing application situations (reverse arm) were to be stopped and punished with *shido* (Table 2).

Another point related to the physical integrity of judokas concerns head hits on the mat resulting from throws. There are situations in which athletes voluntarily put their heads on the mat so as not to lose the combat, which must be penalized with *hansokumake*; however, there are cases where the blow was not intentional. Therefore, in 2018, in cases where this action was involuntary, which usually occurs in throws such as *seoi-otoshi*, *sode-tsurikomi-goshi* and *koshi-guruma* the athlete would not be penalized. The *seoi-nage* technique was also added to this rule in 2020 (Table 2). However, this rule change with the exception of techniques for penalties may stimulate an increase in the occurrence of head injuries in the coming years.

Some studies have verified the occurrence of injuries in judo competitions. Pocco et al. (2013) conducted a systematic review with 12 articles on injuries in judo, and observed an average risk of injury of around 11-12% in combats at the 2008 and 2012 Olympic Games. Sprains, strains and bruises were the most frequent (shoulder, knee and fingers), with the throw being the most frequent injury mechanism. Serious injuries were rare; however, they usually affected the brain and spine. Miarka et al. (2018) analyzed 720 combats of the 2013 World Judo Championship, and observed that the incidence rate of injuries separated by sex was 38 for men and 52.9 for women,



with 13.2% of the total injuries resulting from impact on the head. These data show that although blows to the head do not represent the majority of the number of injuries in judo, the severity of this injury must be considered.

In addition, as of 2017 with the greatest appreciation of the transition phase from standing to ground combat, changes in the rule began to draw attention to dangerous situations in the transition phase and in ground combat. Thus, the rule change in 2017 established that applying *shime-waza* (choking) with the belt, the *judogi* collar or just with the fingers was punishable with *shido*. Then in 2018, the combat was to be interrupted when the athlete performed the *shime-waza* on the groundwork by over-stretching the opponent's leg in order to bring it closer to the opponent's head. The 2020 rule change established that *osaekomi-waza* where athletes use their arms or legs around the neck without dominating the opponent's arm must be stopped. Moreover, in the 2020 rule, executing the *kata-sankaku* grip with the intention of throwing the opponent would be penalized with *hansokumake*, and the combat must be stopped if this grip started in *ne-waza* (Table 2).

## 5. Conclusion

Through an analysis of the changes in the judo rules which took place between 2010 and 2020, we could observe the intentions of the International Judo Federation in: reducing the combat time; valuing the score rather than the penalty to achieve victory; encouraging attacking actions; reducing the risks of competitive judo practice for the athlete's physical integrity; modernizing the refereeing process; making the image of competitive judo more professional; preserving the traditions and establishing behavior norms of the sport. However, some rules did not have the desired effect and triggered new changes in the rules, making the context of competitive judo training unstable over the years. Therefore, judo coaches must be aware of new changes which will be introduced to the rules at the end of each Olympic cycle, and athletes must develop the ability to adapt quickly to them.

## References

- Adam, M., Tabakov, S., Błach, L., Smaruj, M. (2013). Characteristics of the Technical-Tactical Preparation of Male and Female Judo Competitors Participating in the Olympic Games – London 2012. *Ido Movement for Culture. Journal of Martial Arts Anthropology*, 13(2), 75-88. <https://doi.org/10.14589/ido.13.2.6>
- Agostinho, M. F., & Franchini, E. (2020). Observational analysis of the variability of actions in judo: The key for success? *Revista de Artes Marciales Asiáticas*, 15(2), 69–77. <http://dx.doi.org/10.18002/rama.v15i2.6341>
- Artioli, G. G., R. T. Iglesias, E. Franchini, B. Gualano, D. B. Kashiwagura, M. Y. Solis, F. B. Benatti, M. Fuchs & A. H. Lancha Junior (2010) Rapid weight loss followed by recovery time does not affect judo-related performance. *Journal of Sports Sciences*, 28, 21-32. <https://doi.org/10.1080/02640410903428574>
- Balci, S. S., Ceylan, B. (2020). Penalties in judo: the impact of shido on match durations and results. *International Journal of Performance Analysis in Sport*, 20, 659-667. <https://doi.org/10.1080/24748668.2020.1775413>
- Barreto, L. B. M., Miarka, B., & Brito, C. J. (2021). Home Advantage in Combat Sports. In A. M. Gómez-Ruano, R. Pollard, & C. Lago-Peñas, *Home Advantage in Sport: Causes and the Effect on Performance* (pp. 268-275). Routledge.
- Barreto, L.B.M., Aedo-Muñoz, E., Soto, D.A.S., Miarka, B., Brito, C.J. (2021). Road to Tokyo Olympic Games: do new judo rules change the technical-tactical behaviour of elite male athletes? *International Journal of Performance Analysis in Sport*. <https://doi.org/10.1080/24748668.2021.1979839>
- Barreto, L.B.M., Dal Bello, F., Araujo, R.A., Brito, C.J., Fernandes, J.R. and Miarka, B. (2019). Judo approach and handgrip analysis: determining aspects of world circuit high performance. *Journal of Physical Education and Sport*, 19, 413-419. <https://doi.org/10.7752/jpes.2019.s2061>



- Boguszewski, D. (2016). Analysis of the final fights of the judo tournament at Rio 2016 Olympic Games. *Journal of Combat Sports and Martial Arts*, 7, 63-68. <https://doi.org/10.5604/20815735.1224958>
- Boguszewski, D., Adamczyk, J., Boguszewska, K., Siewierski, M., & Białoszewski, W. B. (2014). The attractiveness of judo contests as a sports entertainment. *Archives of Budo Science of Martial Arts and Extreme Sports*, 10, 31-44
- British Judo. (2014). Refereeing Rules 2014. Available in: <http://www.fightingfitjudo.co.uk/file.php?id=65>. Accessed in 2021.
- Brito, C. J., Aedo-Muñoz, E., & Miarka, B. (2020). Judo performance: kinanthropometric importance for technical tactical and biomechanics. *Revista Brasileira de Cineantropometria e Desempenho Humano*, 22(1), 1-7. <https://doi.org/10.1590/1980-0037.2020v22e76584>
- Brito, C. J., Miarka, B., De Durana, A. L. D., & Fukuda, D. H. (2017). Home advantage in judo: analysis by the combat phase, penalties and the type of attack. *Journal of Human Kinetics*, 57(1), 213-220. <https://doi.org/10.1515/hukin-2017-0062>
- Brito, C. J., Moreira, D. G., Fernandes, J. R., Ferreira, A. P., Córdova, C., Silva, R. A. S. da, & Miarka, B. (2017a). Technical-tactical comparisons between weight divisions in elite judo athletes. *Revista Portuguesa de Ciências Do Desporto*, 17(S4A), 49-67. doi: <https://doi.org/10.5628/rpcd.17.s4a.49>
- Calmet, M., E. Pierantozzi, S. Sterkowicz, B. Challis & E. Franchini. (2017). Rule change and Olympic judo scores, penalties and match duration. *International Journal of Performance Analysis in Sport*, 17, 458-465. <https://doi.org/10.1080/24748668.2017.1350489>
- Calmet, M., Miarka, B., & Franchini, E. (2010). Modeling of grasps in judo contests. *International Journal of Performance Analysis in Sport*, 10(3), 229-240. <https://doi.org/10.1080/24748668.2010.11868518>
- Calmet, M., Trezel, N., & Ahmaidi, S. (2006). Survey of system of attacks by Judoka in regional and interregional matches. *Perceptual and Motor Skills*, 103(7), 835-840. <https://doi.org/10.2466/PMS.103.7.835-840>
- CBJ - Brazilian Judo Confederation. (2014). IJF Technical and Refereeng Seminar Report [Relatório do seminário técnico e de arbitragem da FIJ]. nº 01/2014. Rio de Janeiro. Available in: [https://cbj.com.br/painel/arquivos/noticias\\_arquivos/3661/164626310114\\_circular-01-14-relatrio-seminrio-tcnico-e-de-arbitragem\\_eua.pdf](https://cbj.com.br/painel/arquivos/noticias_arquivos/3661/164626310114_circular-01-14-relatrio-seminrio-tcnico-e-de-arbitragem_eua.pdf). Accessed in 2021.
- CBJ - Brazilian Judo Confederation. (2015). Refereeing Manual 2014-2016 [Manual de Arbitragem 2014-2016]. Brazil. Available in: <https://federacaomineiradejudo.com.br/media/cbj-manual-de-curso-modulo-arbitragem.pdf>. Accessed in 2021.
- CBJ - Brazilian Judo Confederation. (2017). Adaptation of judo refereeing rules for the next Olympic cycle [Adaptação das regras de arbitragem do judô para o próximo ciclo olímpico]. Available in: [https://cbj.com.br/painel/arquivos/normas\\_e\\_regulamentos/161441120617regras\\_da\\_fij\\_2\\_017\\_v2.pdf](https://cbj.com.br/painel/arquivos/normas_e_regulamentos/161441120617regras_da_fij_2_017_v2.pdf) Accessed in 2021.
- CBJ - Brazilian Judo Confederation. (2018). Detailed explanation of the Judo Refereeing Rules - FIJ [Explicação detalhada das regras de arbitragem do Judô - FIJ]. Version of January 16, 2018, effective as of January 1, 2018. Available in: <http://www.fpj.com.br/novo2016/wp-content/uploads/2012/05/2018-CBJ-DOCUMENTO-FIJ-TRADUZIDO.pdf>. Accessed in 2021.
- CBJ - Brazilian Judo Confederation. (2020). Detailed explanation of the Judo Refereeing Rules - FIJ [Explicação detalhada das regras de arbitragem do Judô - FIJ]. [https://cbj.com.br/painel/arquivos/documentos\\_oficiais/arquivo\\_cbj\\_120340200320.pdf](https://cbj.com.br/painel/arquivos/documentos_oficiais/arquivo_cbj_120340200320.pdf). Acessado em 2021.
- Ceylan, B., Balci, S. S. (2020). The evaluation of Senior World Judo Championships 2018 and 2019: The effects of sex and weight division on points, penalties, and match duration. *Revista de Artes Marciales Asiáticas*, 15, 14-21. <http://dx.doi.org/10.5336/sportsci.2020-80066>
- Ceylan, B., Ozturk, F., Balci, S. (2020). Effect of different stages on match outcomes during high level judo competitions. *Revista de Artes Marciales Asiáticas*, 15(1), 14-21. <http://dx.doi.org/10.18002/rama.v15i1.6234>
- Challis, D., Scruton, A., Cole, M., & Callan, M. (2015). A time-motion analysis of lightweight women's judo in the 2010 World Championships. *International Journal of Sports Science and Coaching*, 10(2-3), 479-486. <https://doi.org/10.1260/1747-9541.10.2-3.479>



- Courel-Ibáñez, J., Franchini, E., Femia, P., Stankovic, N., & Escobar-Molina, R. (2014). Effects of kumi-kata grip laterality and throwing side on attack effectiveness and combat result in elite judo athletes. *International Journal of Performance Analysis in Sport*, 14(1), 138–147. <https://doi.org/10.1080/24748668.2014.11868709>
- Dal Bello, F., Aedo-Muñoz, E., Brito, C., & Miarka, B. (2019). Performance analysis and probabilities by gender in judo: Combat phases, techniques and biomechanical levers. *Facta Universitatis, Series: Physical Education and Sport*, 17, 135–148. <https://doi.org/10.22190/FUPES190415015D>
- Del Vecchio, F.B., Coswig, V.S., Farias, C.B., Dimare, M., & Miarka, B. (2018). Technical-tactical, physiological and neuromuscular effects of opponent number in simulated judo combats: a pilot study. *Journal of Physical Education and Sport*, 18(3), 1583 – 1591. <https://doi.org/10.7752/jpes.2018.03233>
- Díaz-de-Durana, A. L., Dal Bello, F., Brito, C.J. and Miarka, B. (2018). High level performance in world judo circuit: notational analyzes of combat phase by weight categories. *Journal of Human Sport and Exercise*, 13, S329-S338. <https://doi.org/0.14198/jhse.2018.13.Proc2.17>
- Doppelhammer, F., Stockl, M. (2020). Effects of the 2017/18 rule changes in fight duration, fight decisions, scores, penalties, and attempts in judo, based on systematic competition analysis of the World Championships 2015 and 2018. *International Journal of Performance Analysis in Sport*, 20, 1061-1071. <https://doi.org/10.1080/24748668.2020.1827565>
- Dudeniene, L., Skarbalius, A., Pukenas, K., & Callan, M. (2017). Time-motion performance in semi-professional Lithuanian women's Judo athletes. *Archives of Budo*, 13, 309–314.
- Escobar-Molina, R., Courel-Ibáñez, J., Franchini, E., Femia, P., & Stankovic, N. J. (2014). The impact of penalties on subsequent attack effectiveness and combat outcome among high elite judo competitors. *International Journal of Performance Analysis in Sport*, 14(3), 946–954. <https://doi.org/10.1080/24748668.2014.11868770>
- FPJU - Pernambuco Federation of Judo. (2011). *Arbitration Rules [Regulamento de arbitragem]*. Recife, Pernambuco, Brazil.
- FPJU - Pernambuco Federation of Judo. (2013). *Black Belt Exam and Higher Grades: Refereeing Rules and Recommendations [Exame de faixa preta e graus superiores: regras e recomendações de arbitragem]*. Recife, Pernambuco, Brazil.
- Franchini, E., Artioli, G. G., & Brito, C. J. (2013). Judo combat: Time-motion analysis and physiology. *International Journal of Performance Analysis in Sport*, 13(3), 624–641. <https://doi.org/10.1080/24748668.2013.11868676>
- Franchini, E., Lira, F. S., Julio, U. F., Antunes, B. M., Agostinho, M. F., Shiroma, S. A., & Gonçalves Panissa, V. L. (2018). Cytokine, physiological, technical–tactical and time structure responses in simulated judo competition. *International Journal of Performance Analysis in Sport*, 18(4), 595–608. <https://doi.org/10.1080/24748668.2018.1501993>
- Franchini, E., Takito, M. Y., & Calmet, M. (2013). European Judo Championships: Impact of the new rule changes on points and penalties. *International Journal of Performance Analysis in Sport*, 13(2), 474–479. <https://doi.org/10.1080/24748668.2013.11868663>
- Gutiérrez-Santiago, A., Gutiérrez, J. A., & Prieto-Lage, I. (2020). Temporary judo combat structure of women with visual impairment. *International Journal of Performance Analysis in Sport*, 20(4), 631–645. <https://doi.org/10.1080/24748668.2020.1774729>
- IJF - International Judo Federation (2009). Ordinary Congress de Doelen Hotel Congress Centre Rotterdam, The Netherlands. Available in: [https://78884ca60822a34fb0e6-082b8fd5551e97bc65e327988b444396.ssl.cf3.rackcdn.com/up/2016/08/Rotterdam\\_IJF\\_209\\_Ordinary\\_Cong-1470\\_137463.pdf](https://78884ca60822a34fb0e6-082b8fd5551e97bc65e327988b444396.ssl.cf3.rackcdn.com/up/2016/08/Rotterdam_IJF_209_Ordinary_Cong-1470_137463.pdf). Accessed in 2021.
- IJF - International Judo Federation. (2013). IJF Refereeing & Competition Rules Modifications for 2013-2016. Details & Clarification Mexico City Seminar 1/26 & 1/27/13. Available in: <https://www.teamusa.org/USA-Judo/Features/2013/June/05/2013-IJF-Refereeing-Rules-USA-Judo-Rules-Update.aspx>. Accessed in 2021.
- IJF - International Judo Federation. (2017a). Adaptation of the Judo refereeing rules for the next 2017-2020 Olympic Cycle. Version 10 April 2017. Available in: [https://www.judobund.de/fileadmin/\\_horusdam/6172-Adaptation\\_of\\_the\\_judo\\_refereeing\\_rules\\_-\\_Version\\_February\\_3rd\\_2017.pdf](https://www.judobund.de/fileadmin/_horusdam/6172-Adaptation_of_the_judo_refereeing_rules_-_Version_February_3rd_2017.pdf). Accessed in 2021.



- IJF - International Judo Federation. (2017b). Detailed Explanation of the IJF Judo Refereeing Rules. Version of October 26, 2017, effective as of January 1, 2018. Available in: <https://www.ijf.org/news/show/detailed-explanation-of-the-ijf-judo-refereeing-rules>. Accessed in 2021.
- IJF - International Judo Federation. (2020). Detailed Explanation of the IJF Judo Refereeing Rules. Available in: [https://www.fgjudo.com/noticias/2020/arbitraje/Explanatory\\_guide\\_of\\_the\\_judo\\_-\\_1579282832.pdf](https://www.fgjudo.com/noticias/2020/arbitraje/Explanatory_guide_of_the_judo_-_1579282832.pdf). Accessed 2021.
- IJF- International Judo Federation. (2015). Sports and Organization Rules of the International Judo Federation. Edition 2015. Available in: [https://78884ca60822a34fb0e6-082b8fd5551e97bc65e327988b444396.ssl.cf3.rackcdn.com/up/2020/06/IJF\\_Sport\\_and\\_Organi\\_sation\\_Rul-1592329619.pdf](https://78884ca60822a34fb0e6-082b8fd5551e97bc65e327988b444396.ssl.cf3.rackcdn.com/up/2020/06/IJF_Sport_and_Organi_sation_Rul-1592329619.pdf). Accessed in 2021.
- Ito, K., Hirose, N., & Maekawa, N. (2019). Characteristics of re-gripping techniques preceding scored throws in international-level judo competition. *Central European Journal of Sport Sciences and Medicine*, 25(1), 43–50. <https://doi.org/10.18276/cej.2019.1-05>
- Ito, K., Hirose, N., Maekawa, N., Tamura, M., & Nakamura, M. (2015). Alterations in *kumite* techniques and the effects on score rates following the 2013 International Judo Federation rule revision. *Archives of Budo*, 11, 87–92.
- Ito, K., Hirose, N., Nakamura, M., Maekawa, N., & Tamura, M. (2014). Judo *kumite* pattern and technique effectiveness shifts after the 2013 International Judo Federation rule revision. *Archives of Budo*, 10(1), 1–9.
- Ito, K., Hirose, N., Nakamura, M., Maekawa, N., Tamura, M., & Hirotsu, N. (2013). The transformation of technical-tactical behaviors for hand techniques used in attacking below the belt after the 2010 International Judo Federation rule revision. *Archives of Budo*, 9, 1-6.
- Julio, U. F., Gonçalves Panissa, V. L., Agostinho, M. F., Cury, R. L., Esteves, J. V., & Franchini, E. (2018). Time-course of time-motion, physiological, perceived exertion and neuromuscular responses during simulated judo matches. *International Journal of Performance Analysis in Sport*, 18(4), 582–594. <https://doi.org/10.1080/24748668.2018.1507479>
- Kajmovic, H., & Radjo, I. (2014). A comparison of gripping configuration and throwing techniques efficiency index in judo between male and female judoka during Bosnia and Herzegovina senior state championships. *International Journal of Performance Analysis in Sport*, 14(2), 620–634. <https://doi.org/10.1080/24748668.2014.11868747>
- Kajmovic, H., Rado, I., Mekic, A., Crnogorac, B., & Colakhodzic, E. (2014). Difference in gripping configurations during the execution of throwing techniques between male and female cadets at the European Judo Championship. *Archives of Budo*, 10(1), 141–146.
- Kashiwagura, D.B., & Franchini, E. (2021). The grip dispute (kumi-kata) in judo: A scoping review. *Revista de Artes Marciales Asiáticas*, <http://revpubli.unileon.es/ojs/index.php/artesmarciales/article/view/7030/5607>
- Kashiwagura, D.B., Courel-Ibáñez, J., Kashiwagura, F.B., Agostinho, M.F. & Franchini, E. (2021). Judo technical-tactical dynamics: analysis of attack system effectiveness in high-level athletes, *International Journal of Performance Analysis in Sport*. <https://doi.org/10.1080/24748668.2021.1958533>
- Katicips, L.F.G., Júnior, J.N.S., Kons, R.L. and Detanico, D. (2018). Impact of different judo rules: analysis of scores and penalties in Paris Grand Slam Championships. *Revista Internacional de Ciencias del Deporte*, 54(14), 334-343. <https://doi.org/10.5232/ricyde2018.05404>
- Kłys, A., Sterkowicz-Przybycień, K., Adam, M., & Casals, C. (2020). Performance analysis considering the technical-tactical variables in female judo athletes at different sport skill levels: Optimization of predictors. *Journal of Physical Education and Sport*, 20(4), 1775–1782. <https://doi.org/10.7752/jpes.2020.04241>
- Kons, R. L., Franchini, E., & Detanico, D. (2018). Relationship between physical fitness, attacks and effectiveness in short- and long-duration judo matches. *International Journal of Performance Analysis in Sport*, 18(6), 1024–1036. <https://doi.org/10.1080/24748668.2018.1545198>
- Marcon, G., Franchini, E., Jardim, J. R., & Barros Neto, T. L. (2010). Structural analysis of action and time in sports: Judo. *Journal of Quantitative Analysis in Sports*, 6(4). <https://doi.org/10.2202/1559-0410.1226>



- Martins, F.P.; de Souza, L.S.D.P.; de Campos, R.P.; Bromley, S.J.; Takito, M.Y.; Franchini, E. (2019). Techniques utilised at 2017 Judo World Championship and their classification: comparisons between sexes, weight categories, winners and non-winners. *Ido Movement for Culture, Journal of Martial Arts Anthropology*, 19(1): 58-65. <https://doi.org/10.14589/ido.19.1.6>
- Miarka, B., Branco, B. H. M., Del Vecchio, F. B., Camey, S., & Franchini, E. (2015). Development and validation of a time-motion judo combat model based on the Markovian processes. *International Journal of Performance Analysis in Sport*, 15(1), 315-331. <https://doi.org/10.1080/24748668.2015.11868795>
- Miarka, B., Brito, C. J., Amtmann, J., Córdova, C., Bello, F. D., & Camey, S. (2018). Suggestions for judo training with pacing strategy and decision making by judo championship phases. *Journal of Human Kinetics*, 64(1), 219-232. <https://doi.org/10.1515/hukin-2017-0196>
- Miarka, B., Cury, R., Julianetti, R., Battazza, R., Julio, U. F., Calmet, M., & Franchini, E. (2014). A comparison of time-motion and technical-tactical variables between age groups of female judo matches. *Journal of Sports Sciences*, 32(16), 1529-1538. <https://doi.org/10.1080/02640414.2014.903335>
- Miarka, B., Dal Bello, F., Brito, C.J., Tabben, M., Oguma, A., Amtmann, J., Moreira, D.G., Pocecco, E., Del Vecchio, F.B. & Chamari, K. (2018): Injuries during a World Judo Championship: differences between sex, weight category and competition phase. *International Journal of Performance Analysis in Sport*, 18(2), 229-244. <https://doi.org/10.1080/24748668.2018.1463777>
- Miarka, B., Del Vecchio, F. B., Julianetti, R., Cury, R., Camey, S., & Franchini, E. (2016). Time-motion and tactical analysis of Olympic judo fighters. *International Journal of Performance Analysis in Sport*, 16(1), 133-142. <https://doi.org/10.1080/24748668.2016.11868876>
- Miarka, B., Fukuda, D. H., Del Vecchio, F. B., & Franchini, E. (2016a). Discriminant analysis of technical-tactical actions in high-level judo athletes. *International Journal of Performance Analysis in Sport*, 16(1), 30-39. <https://doi.org/10.1080/24748668.2016.11868868>
- Miarka, B., Fukuda, D. H., Heinisch, H. D., Battazza, R., Del Vecchio, F. B., Camey, S., & Franchini, E. (2016b). Time-motion analysis and decision making in female judo athletes during victory or defeat at Olympic and non-Olympic events: Are combat actions really unpredictable? *International Journal of Performance Analysis in Sport*, 16(2), 442-463. <https://doi.org/10.1080/24748668.2016.11868900>
- Miarka, B., Panissa, V. L. G., Julio, U. F., Del Vecchio, F. B., Calmet, M., & Franchini, E. (2012). A comparison of time-motion performance between age groups in judo matches. *Journal of Sports Sciences*, 30(9), 899-905. <https://doi.org/10.1080/02640414.2012.679675>
- Miarka, B., Pérez, D. I. V., Aedo-Muñoz, E., Barreto, L. B. M., Fernandes, J. R., & Brito, C. J. (2020). Practical application of time-motion analysis of judo female cadets' combats between weight divisions. *International Journal of Performance Analysis in Sport*, 20(4), 701-708. <https://doi.org/10.1080/24748668.2020.1780870>
- Miarka, B., Pérez, D. I. V., Aedo-Muñoz, E., Costa, L. O. da F., & Brito, C. J. (2020a). Technical-tactical behaviors analysis of male and female judo cadets' combats. *Frontiers in Psychology*, 11, 1-7. <https://doi.org/10.3389/fpsyg.2020.01389>
- Miarka, B., Sterkowicz-Przybycien, K., & Fukuda, D. H. (2017). Evaluation of sex-specific movement patterns in judo using probabilistic neural networks. *Motor Control*, 21(4), 390-412. <https://doi.org/10.1123/mc.2016-0007>
- Piras, A., Pierantozzi, E., & Squatrito, S. (2014). Visual search strategy in judo fighters during the execution of the first grip. *International Journal of Sports Science and Coaching*, 9(1), 185-197. <https://doi.org/10.1260/1747-9541.9.1.185.33-43>
- Pocecco, E., Ruedl, G., Stankovic, N., Sterkowicz, D., Del Vecchio, F.B., Gutiérrez-García, C., Rousseau, R., Wolf, M., Kopp, M., Miarka, B., Menz, V., Krüsmann, P., Calmet, M., Malliaropoulos, N., Burtscher, M. (2013). Injuries in judo: a systematic literature review including suggestions for prevention. *British Journal of Sports Medicine*, 47, 1139-1143. <https://doi.org/10.1136/bjsports-2013-092886>
- Segedi, I., Sertić, H., Franjić, D., Kuštro, N., & Rožac, D. (2014). Analysis of judo match for seniors. *Journal of combat sports and martial arts*, 2(5), 57-61. <https://doi.org/10.5604/20815735.1141976>



- Soriano, D., Irurtia, A., Tarragó, R., Tayot, P., Milà-Villaroel R., & Iglesias, X. (2019). Time-motion analysis during elite judo combats (defragmenting the gripping time). *Archives of Budo*, 15(1), 33–43.
- Soto, D. A. S., Aedo-Muñoz, E., Brito, C. J., Camey, S., & Miarka, B. (2020). Making decisions and motor actions with technical biomechanical classifications in male judo weight categories. *Journal of Human Kinetics*, 72(1), 241–252. <https://doi.org/10.2478/hukin-2019-0110>
- Soto, D. A. S., Aedo-Muñoz, E., Brito, C. J., & Miarka, B. (2020a). Comparisons of motor actions and biomechanical assessments of judo techniques between female weight categories. *Journal of Human Kinetics*, 75(1), 247–255. <https://doi.org/10.2478/hukin-2020-0053>
- Stanković, N., Cuk, S., Milosevic, N., & Stamenkovic, S. (2015). The course of the judo fight at the 2011 World Championship. *Facta Universitatis, Series: Physical Education and Sport*, 13(1), 107–113.
- Stanković, N., Milošević, N., & Živković, M. (2019). The impact of the 2013 rule changes on gripping configuration in high-level judo athletes. *Annales Kinesiologiae*, 10(1), 3–13. <https://doi.org/10.35469/ak.2019.195>
- Sterkowicz, S., Lech, G., & Blecharz, J. (2010). Effects of laterality on the technical/tactical behavior in view of the results of judo fights. *Archives of Budo*, 6(4), 173–177.
- Sterkowicz-Przybycień, K., Miarka, B., & Fukuda, D. H. (2017). Sex and weight category differences in time-motion analysis of elite judo athletes: Implications for assessment and training. *Journal of Strength and Conditioning Research*, 31(3), 817–825. <https://doi.org/10.1519/JSC.0000000000001597>
- Tamura, M., Hirose, N., Nakamura, M., Saitoh, H., Yamauchi, N., Tanaka, C., Suzuki, K., & Suganami, M. (2012). Changes in judo kumite tactics according to revisions of the IJF competition rules. *Research Journal of Budo*, 45(2), 143–149. <https://doi.org/10.11214/budo.45.143>

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