

## Forbidden actions in World Judo Championships: differences between winner and non-winner athletes

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### Abstract

Penalties in judo result from negative actions that are not in line with judo combat regulations. The aim of the research was to determine the differences in penalties between winner and non-winner competitors in judo. A total of 1799 (men=1133 and women=666) matches with penalties were evaluated during 2017, 2018 and 2019 World Judo Championships. The variables were expressed as proportions and compared with the Chi-Square test with pairwise Z-tests. The ratio of receiving the first and second *shido* was the same in men and women athletes ( $p>.05$ ), but it was different for weight categories ( $p<.05$ ). The ratio of *shido* penalty was different between winner and non-winner athletes, the ratio of the second *shido* was lower in winner athletes ( $p<.05$ ). While the ratio of forbidden action was the same in winner and non-winner athletes ( $p>.05$ ), the ratio of forbidden actions in the first and second *shido* differed ( $p<.05$ ). The difference in the penalty ratios in winner and non-winner athletes, especially the difference in forbidden actions leading to first and second *shido* may reflect some tactical differences. The results of this research can significantly contribute to the understanding of the significance of judo penalties both in training and in competition, as well as to the further study of judo penalties.

**Keywords:** Combat sports; martial arts; judo; performance analysis; match analysis; judo competition.

### Acciones prohibidas en campeonatos mundiales de judo: diferencias entre atletas ganadores y no ganadores

#### Resumen

Las sanciones en judo son consecuencia de acciones negativas que no se ajustan al reglamento de competición. El objetivo de esta investigación fue determinar las diferencias en las penalizaciones entre competidores de judo ganadores y no ganadores. Se evaluaron un total de 1799 combates (hombres=1133 y mujeres=666) en los que hubo penalización, de los Campeonatos Mundiales de Judo de 2017, 2018 y 2019. Las variables se expresaron como proporciones y se compararon con la prueba de Chi-Cuadrado con pruebas Z por pares. La ratio de recibir el primer y segundo *shido* fue la misma en hombres y mujeres ( $p>.05$ ), pero fue diferente según las categorías de peso ( $p<.05$ ). La ratio de *shido* fue diferente entre ganadores y no ganadores, siendo la ratio del segundo *shido* menor en los atletas ganadores ( $p<.05$ ). Si bien la ratio de acciones prohibidas fue la misma en atletas ganadores y no ganadores ( $p>.05$ ), la ratio de acciones prohibidas en el primer y segundo *shido* difirió ( $p<.05$ ). La diferencia en las ratios

### Ações proibidas em campeonatos mundiais de judô: diferenças entre atletas vencedores e não vencedores

#### Resumo

As penalizações no judo resultam de ações negativas que não estão de acordo com os regulamentos de combate do judo. O objetivo da investigação foi determinar as diferenças nas penalizações entre competidores vencedores e não vencedores no judo. Um total de 1799 lutas (homens = 1133 e mulheres = 666) com penalizações foram avaliadas durante os Campeonatos Mundiais de Judo de 2017, 2018 e 2019. As variáveis foram expressas em proporções e comparadas com o teste Qui-quadrado, com testes Z emparelhados. A proporção do primeiro e do segundo *shido* foi a mesma em atletas masculinos e femininos ( $p>.05$ ), mas foi diferente para as categorias de peso ( $p<.05$ ). A proporção de penalizações do *shido* foi diferente entre os atletas vencedores e não vencedores, ou seja, a proporção do segundo *shido* foi menor nos atletas vencedores ( $p<.05$ ). Enquanto a proporção de ações proibidas foi a mesma em atletas vencedores e não vencedores ( $p>.05$ ), mais a proporção de ações proibidas no primeiro e no segundo *shido* diferiu ( $p<.05$ ). A diferença nas

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de penalización en los atletas ganadores y no ganadores, especialmente la diferencia en las acciones prohibidas que conducen al primer y segundo *shido*, puede reflejar algunas diferencias tácticas. Los resultados de esta investigación pueden contribuir significativamente a la comprensión de la importancia de las sanciones de judo tanto en el entrenamiento como en la competición, así como a posteriores estudios sobre las sanciones en judo.

**Palabras clave:** Deportes de combate; artes marciales; judo; análisis del rendimiento; análisis de combates; competición de judo.

proporções de penalizações dos atletas vencedores e não vencedores, especialmente a diferença nas ações proibidas que levam ao primeiro e segundo *shido*, pode refletir algumas diferenças táticas. Os resultados desta investigação podem contribuir significativamente para a compreensão do significado das penalizações no judo, tanto no treino, como na competição, bem como para o estudo mais aprofundado do judo.

**Palavras-chave:** Desportos de combate; Artes marciais; Judo; Análise de desempenho; Análise de jogo; Competição de judo.

## 1. Introduction

The recent rule changes in judo have aimed at more dynamic and active performance based on scores during the competitions. A match can be won only by technical superiority under the current refereeing rules. Unlike previous refereeing rules, there is no equality between a single penalty and scores now but *hansoku-make* given directly or as a result of three consecutive penalties ends a judo match (International Judo Federation [IJF], 2020 version). In contrast to current situation, an athlete was awarded with *hansoku-make* as a result of four consecutive *shidos* in the previous refereeing rules (IJF, 2016 version). IJF has aimed a more "positive" judo that attracts the spectator and bases on scores instead of penalties with the latest rule changes in 2017 with which some changes were made related to scores (more rigorous criteria for awarding an *ippon* score, the exclusion of the *yuko* score), penalties (the disqualification with three penalties and not four as before and the exclusion of winning via penalties in the regular period), match duration (the decrease in the duration of men' matches for 4 min) and world ranking points (IJF, 2017 version).

Following the recent rule changes, numerous studies have been implemented to investigate the effects of rule changes on penalties and scores during judo matches (Balci & Ceylan, 2020; Calmet, Pierantozzi, Sterkowicz, Challis, & Franchini, 2017a; Calmet, Pierantozzi, Sterkowicz, Takito, & Franchini, 2017b; Ceylan & Balci, 2017; Katicips, Júnior, Kons, & Detanico, 2018). The study by Calmet et al. (2017a) compared 2012 and 2016 Olympic games and stated an increase in penalties and no change in scores. A different study that compared two World Championships before and after the rule changes that were implemented by IJF in 2016 found that there was no change in the number of *ippons*, fewer penalties were awarded to women athletes compared to men (Calmet et al., 2017b). Ceylan and Balci (2017) investigated 2016 and 2017 Paris Grand Slams and stated that rule changes led to a decrease in the number of penalties in men athletes, and there was no change in women athletes.

Some studies investigated high-level judo tournaments under the previous refereeing rules. Boguszewski (2011) stated that the frequency of technical scores awarded to athletes was significantly lower while the frequency of penalties was higher during top-level judo competitions. Another study by Witkowski, Maśliński and Kotwica (2012) highlighted that the ratio of penalties differed among different weight categories during 2008 Beijing Olympic Games. Balafoutas, Lindner, and Sutter (2012) compared *shido* ratios and their effects between 2007 and 2009 World Championships and stated that the new rule changes increased *shido* ratios as well as concluding that the frequent rule changes negatively affected the judo spectator whose opinion was received via a survey. Another study where Escobar-Molina, Courel, Franchini, Femia, and Stankovic (2014) analysed the effects of penalties on match outcomes suggested that non-winner athletes had more possibility to receive a *shido* compared to winner athletes and heavyweight athletes had more likeliness to receive a *shido* in comparison to other weight categories. Our recent study (Balci & Ceylan, 2020) investigated the effect of penalties on match outcome and reasons of *shido*. We highlighted that the possibility of receiving a *shido* was higher in non-winner athletes, the possibility of first and second *shido* in non-winner and heavyweight athletes increased, men athletes received more *shido* per match compared to women athletes, increasing match duration increased the possibility of *shido* and the most encountered forbidden actions were classified as non-combativity, avoid grip and false attack. In another recently published study, we demonstrated that the percentage of the matches with *shido* increased from the elimination to the medal zone match and the finals



during high-level judo competitions. Furthermore, it has been advised to investigate winner and non-winner athletes separately to make detailed analysis of the results especially related to penalties (Ceylan, Öztürk & Balci, 2020).

Nevertheless, there are still limited studies related to penalties and their reasons during high level judo competitions, especially during the world championships, following the latest rule changes in 2017. The current study offers a detailed analysis of penalties between winner and non-winner athletes in all weight categories. Moreover, previous studies related to penalties used secondary data from various websites while the matches with penalties were evaluated via video analysis in this study. Thus, the aim of the current study was to determine the differences in penalties between winner and non-winner competitors according to gender and weight categories in judo. Determining the differences among penalties in different weight categories and their reasons during high-level judo competitions after the current rule changes will be useful for researchers, coaches, and athletes. The results of the study were expected to contribute to coaches and judo athletes in terms of tactical exercises during the training and matches.

## 2. Materials and methods

### 2.1. Ethical issues

All the data that were used for analysis were taken from the official website of the IJF ([www.judobase.org](http://www.judobase.org)). The data were obtained in a secondary form and not generated by experimentation. Additionally, personal identification or countries of the athletes whose matches were analysed were not reported. Therefore, there is no ethical issue to use or interpret the data (Calmet et al., 2017a; 2017b; Ceylan & Balci, 2017).

### 2.2. Data collection and procedures

Data were collected from [www.judobase.org](http://www.judobase.org), and based on a notation analysis of videos of all individual penalties of winner and non-winner athletes during World Judo Championships held in 2017 in Budapest (Hungary), 2018 in Baku (Azerbaijan) and 2019 in Tokyo (Japan). Each individual penalty was assessed by two investigators by monitoring the situation that obliged the judge to award a penalty, the judge's gesture with his hands when assigning a penalty, as well as the scoreboard on which the penalty was recorded. Upon a disagreement, both investigators evaluated the penalty together and came to a mutual decision. Winner and non-winner athlete's penalties were recorded in the regular duration of the match and in the Golden score when they received *shido* by the judges for committing minor or serious offenses, and thus violated the rules of judo defined by the IJF (IJF, 2017-2018 versions). A total of 1799 matches (666 for women and 1133 for men) were evaluated in this study, where the latest three World Judo Championships were investigated. 19.9% of the matches in women and 18.7% of the matches in men ended as a result of three *shido* and thus *hansoku-make*.

The first group of variables in this study consists of penalties: *Shido 1*, *Shido 2*, *Shido 3* and *Hansoku-make* (direct disqualification). However, winner and non-winner athletes were compared in this study. According to the current refereeing rules, athletes are disqualified with *hansoku-make* as a result of third *shido*. Therefore, only the first and second *shidos* received by winner and non-winner athletes and five most frequent forbidden actions were analysed and compared in this study. The second group of variables in this study consists of all forbidden actions resulted in a penalty which are as follows: hold sleeve ends, avoid grip, outside contest area, defensive posture, false attack, non-combativity and other penalties: hold same side, pistol grip hold trouser leg, escape with head, hand on face, disarrange judogi, holding belt, bear hug, fingers in sleeve, illegal joint lock, leg inside blocking, pull down, bend opponent's fingers, illegal *ne-waza* entry, push out, fingers interlocked, kick to break grip, kicking, metal object.

### 2.3. Reliability

The results of the Cohen Kappa tests for assessing the agreement of two investigators for women and men athletes was .987 and .990 respectively, which means a very good agreement between the two investigators in the process of assigning penalties during the competition.



## 2.4. Statistical analyses

Frequencies and percentages were used for descriptive statistics. The difference in the categorical variables was analysed with Pearson's Chi-square test, and effect size (ES) was determined with Cramer's-V and classified with degrees of freedom (Kim, 2017). Chi-square tests with pairwise z-test test were used to analyse the differences between the winner and non-winner athletes. Also, standard residuals (Std Res) were calculated for determination of contribution of cells to Pearson's Chi-square test results. IBM SPSS Statistics 23.0 was used for data analysis. The level of statistical significance was set at  $p < .05$ .

## 3. Results

The ratio of receiving first and second *shido* did not differ according to sex ( $\chi^2_{(1, n=3900)}=1.12, p=.29$ ; Cramer's  $V=.017$ ) and weight categories ( $\chi^2_{(6, n=3900)}=2.62, p=.86$ ; Cramer's  $V=.026$ ). Also, there was no difference in the ratio of receiving first and second *shido* in different categories when the data were separately analysed for men ( $\chi^2_{(6, n=2505)}=3.38, p=.76$ ; Cramer's  $V=.037$ ) and women ( $\chi^2_{(6, n=1395)}=.90, p=.99$ ; Cramer's  $V=.025$ ).

Table 1 presents first and second *shido* numbers and percentage given to winner and non-winner men and women athletes. The ratio of receiving first and second *shido* in women athletes was higher in non-winner athletes compared to winner athletes ( $\chi^2_{(1, n=1395)}=12.17, p<.001$ ; Cramer's  $V=.093$  [ES=small]). The most important contribution to this difference was that winner women athletes had less 2<sup>nd</sup> *shido* ratio (Std Res= 2.2). Likewise, the ratio of receiving a *shido* was lower in winner men athletes compared to non-winner athletes ( $\chi^2_{(1, n=2505)}=22.98, p<.001$ ; Cramer's  $V=.096$  [ES=small]). The most important contribution to this result was that the ratio of receiving second *shido* was lower in the winner men athletes (Std Res= 3.0).

**Table 1.** The frequency and percentage of receiving first and second *shido* in winner and non-winner men and women athletes.

Sex	Groups	Winner			Non-winner			Total	
		f	%	Std Res	f	%	Std Res	f	%
Women	1 <sup>st</sup> Shido	429 <sub>a</sub>	75.4	1.5	551 <sub>b</sub>	66.7	-1.2	980	70.3
	2 <sup>nd</sup> Shido	140 <sub>a</sub>	24.6	-2.2	275 <sub>b</sub>	33.3	1.9	415	29.7
	Total	569	100		826	100		1395	100
Men	1 <sup>st</sup> Shido	772 <sub>a</sub>	73.9	2.0	947 <sub>b</sub>	64.9	-1.7	1719	68.6
	2 <sup>nd</sup> Shido	273 <sub>a</sub>	26.1	-3.0	513 <sub>b</sub>	35.1	2.6	786	31.4
	Total	1045	100		1460	100		2505	100

f= Frequency. %= Percentage. Std Res= Standard residuals. Each subscript letter denotes a subset of Winner-Non-winner categories whose column proportions do not differ significantly from each other at the 0.05 level.

The ratio of receiving first and second *shido* differed in groups when all athletes were evaluated together just as winner and non-winner. While the ratio of receiving the first *shido* of the winner athletes was higher compared to non-winner athletes, the ratio of receiving the second *shido* was lower ( $\chi^2_{(1, n=3900)}=35.02, p<.001$ ; Cramer's  $V=.095$  [ES=small]). While all the ratios significantly contributed this result, the major contribution to this difference came from the ratio of receiving the second *shido* in winner athletes (Std Res= 3.8) (Table 2). The difference in the ratios of the first and second *shido* according to match result were investigated separately for each weight category (Table 2). The ratio of receiving *shido* penalty was different between winner and non-winner athletes in lightweight ( $\chi^2_{(1, n=626)}=6.27, p=.01$ ; Cramer's  $V=.100$  [ES=small]), half-middleweight ( $\chi^2_{(1, n=566)}=5.22, p=.02$ ; Cramer's  $V=.096$  [ES=small]), middleweight ( $\chi^2_{(1, n=593)}=4.56, p=.03$ ; Cramer's  $V=.088$  [ES=small]), heavyweight categories ( $\chi^2_{(1, n=451)}=11.17, p<.01$ ; Cramer's  $V=.157$  [ES=medium]). While the ratio of receiving the first *shido* was higher in winner athletes in the abovementioned weight categories, the ratio of second *shido* was higher in non-winner athletes.

However, the ratio of *shido* penalty was not different between winner and non-winner athletes in extra-lightweight ( $\chi^2_{(1, n=537)}=3.26, p=.07$ ; Cramer's  $V=.078$ ), half-lightweight ( $\chi^2_{(1, n=663)}=3.42, p=.07$ ; Cramer's  $V=.072$ ), half-heavyweight categories ( $\chi^2_{(1, n=464)}=3.68, p=.06$ ; Cramer's  $V=.089$ ).

**Table 2.** The frequency and percentage of first and second *shido* of the winner-non-winner athletes according to weight categories.

Weight Category	Groups	Winner			Non-winner			Total	
		f	%	Std Res	f	%	Std Res	f	%
Extra-lightweight	1 <sup>st</sup> Shido	170 <sub>a</sub>	73.6	0.8	203 <sub>a</sub>	66.3	-0.7	373	69.5
	2 <sup>nd</sup> Shido	61 <sub>a</sub>	26.4	-1.1	103 <sub>a</sub>	33.7	1.0	164	30.5
	Total	231	100		306	100		537	100
Half-lightweight	1 <sup>st</sup> Shido	201 <sub>a</sub>	73.6	0.8	261 <sub>a</sub>	66.9	-0.7	462	69.7
	2 <sup>nd</sup> Shido	72 <sub>a</sub>	26.4	-1.2	129 <sub>a</sub>	33.1	1.0	201	30.3
	Total	273	100		390	100		663	100
Lightweight	1 <sup>st</sup> Shido	192 <sub>a</sub>	76.8	1.0	254 <sub>b</sub>	67.6	-0.8	446	71.2
	2 <sup>nd</sup> Shido	58 <sub>a</sub>	23.2	-1.6	122 <sub>b</sub>	32.4	1.3	180	28.8
	Total	250	100		376	100		626	100
Half-middleweight	1 <sup>st</sup> Shido	166 <sub>a</sub>	74.8	1.0	226 <sub>b</sub>	65.7	-0.8	392	69.3
	2 <sup>nd</sup> Shido	56 <sub>a</sub>	25.2	-1.5	118 <sub>b</sub>	34.3	1.2	174	30.7
	Total	222	100		344	100		566	100
Middleweight	1 <sup>st</sup> Shido	186 <sub>a</sub>	72.7	0.9	217 <sub>b</sub>	64.4	-0.8	403	68.0
	2 <sup>nd</sup> Shido	70 <sub>a</sub>	27.3	-1.3	120 <sub>b</sub>	35.6	1.2	190	32.0
	Total	256	100		337	100		593	100
Half-heavyweight	1 <sup>st</sup> Shido	146 <sub>a</sub>	73.7	0.8	174 <sub>a</sub>	65.4	-0.7	320	69.0
	2 <sup>nd</sup> Shido	52 <sub>a</sub>	26.3	-1.2	92 <sub>a</sub>	34.6	1.0	144	31.0
	Total	198	100		266	100		464	100
Heavyweight	1 <sup>st</sup> Shido	140 <sub>a</sub>	76.1	1.5	163 <sub>b</sub>	61.0	-1.2	303	67.2
	2 <sup>nd</sup> Shido	44 <sub>a</sub>	23.9	-2.1	104 <sub>b</sub>	39.0	1.8	148	32.8
	Total	184	100		267	100		451	100
Total	1 <sup>st</sup> Shido	1201 <sub>a</sub>	74.4	2.5	1498 <sub>b</sub>	65.5	-2.1	2699	69.2
	2 <sup>nd</sup> Shido	413 <sub>a</sub>	25.6	-3.8	788 <sub>b</sub>	34.5	3.2	1201	30.8
	Total	1614	100		2286	100		3900	100

f= Frequency. %= Percentage. Std Res= Standard residuals. Each subscript letter denotes a subset of Winner-Non-winner categories whose column proportions do not differ significantly from each other at the .05 level.

Table 3 separately presents the frequency and percentage of five most frequent forbidden actions leading to *shido* in winner and non-winner athletes. The ratio of the forbidden actions was the same for the first ( $\chi^2_{(5, n=2699)}=7.39, p=.19$ ; Cramer's  $V=.052$ ) and second *shidos* ( $\chi^2_{(5, n=1201)}=10.50, p=.06$ ; Cramer's  $V=.094$ ) in non-winner and winner athletes. Moreover, the ratio of the forbidden action for the first and second *shidos* was different in both winner ( $\chi^2_{(5, n=1614)}=36.51, p<.001$ ; Cramer's  $V=.150$  [ES=medium]) and non-winner athletes ( $\chi^2_{(5, n=2286)}=33.20, p<.001$ ; Cramer's  $V=.121$  [ES=medium]).

The most important contribution to the difference between forbidden actions leading to first and second *shidos* in winner athletes was that the ratio of false attack significantly increased in the second shido (Std. Res= 3.7) and avoid grip decreased (Std. Res= 3.5) ( $p<.05$ ). In the non-winner athletes, the ratio of non-combativity and false attack significantly increased for the second shido compared to the first one while the ratio of avoid grip decreased ( $p<.05$ ). The most important contribution to this difference in non-winner athletes was that the ratio of avoid grip significantly decreased for the second *shido* (Std. Res= 4.0).

There was a significant effect of sex on distribution of forbidden actions ( $\chi^2_{(5, n=4205)}=7.39, p=.062$ ; Cramer's  $V=.006$  [ES=small]). The major contribution to this difference between sexes came from penalties in women due to defensive-posture (Std. Res= 2.6). Also, the distribution of the forbidden actions differed according to weight categories ( $\chi^2_{(30, n=4205)}=123.11, p<.001$ ; Cramer's  $V=.077$  [ES=small]). While the rate of avoid-grip and false attack was the lowest in heavy-weight athletes (Std. Res= 4.5), non-combativity had the highest rate (Std. Res= 5.6). In contrast, the rate of non-combativity was the least in the half-lightweight athletes (Std. Res= 3.3). the rate of outside-contest-area, defensive posture and false attack was the highest in the middleweight (Std. Res= 3.5), half-middleweight (Std. Res= 2.6) and half-lightweight categories (Std. Res= 2.1), respectively.



While a total of 305 matches, 112 in women (16.8%) and 193 in men (17.0%), resulted in disqualification due to 3<sup>rd</sup> *shido*, 5 matches in women (0.8%) and 7 matches in men (0.6%) resulted in direct disqualification.

**Table 3.** Frequency and percentage of the forbidden actions for the non-winner and winner athletes.

Forbidden actions	Winner									Non-winner						
	Total		1 <sup>st</sup> shido		Std Res	2 <sup>nd</sup> shido		Std Res	1 <sup>st</sup> shido		2 <sup>nd</sup> shido		3 <sup>rd</sup> shido*			
	f	%	f	%		f	%		f	%	f	%	f	%		
Non-Combativity	1701	40.5	447 <sub>a</sub>	37.2	-0.2	160 <sub>a</sub>	38.7	0.4	604 <sub>a</sub>	40.3	-1.0	355 <sub>b</sub>	45.1	1.3	135	44.3
Avoid-Grip	791	18.8	292 <sub>a</sub>	24.3	2.1	56 <sub>b</sub>	13.6	-3.5	326 <sub>a</sub>	21.8	2.9	98 <sub>b</sub>	12.4	-4.0	19	6.2
False-Attack	692	16.4	173 <sub>a</sub>	14.4	-2.2	101 <sub>b</sub>	24.5	3.7	203 <sub>a</sub>	13.6	-1.3	137 <sub>b</sub>	17.4	1.8	78	25.6
Defensive-Posture	284	6.8	89 <sub>a</sub>	7.4	0.5	24 <sub>a</sub>	5.8	-0.9	96 <sub>a</sub>	6.4	-0.4	57 <sub>a</sub>	7.2	0.6	18	5.9
Outside-Contest-Area	267	6.3	65 <sub>a</sub>	5.4	-0.3	26 <sub>a</sub>	6.3	0.6	104 <sub>a</sub>	6.9	0.4	49 <sub>a</sub>	6.2	-0.5	23	7.5
Other	470	11.2	135 <sub>a</sub>	11.2	0.0	46 <sub>a</sub>	11.1	0.0	165 <sub>a</sub>	11.0	-0.3	92 <sub>a</sub>	11.7	0.4	32	10.5
Total	4205	100	1201	100		413	100		1498	100		788	100		305	100

f= Frequency. %= Percentage. Std Res= Standard residuals. \**Hansoku-make* due to 3<sup>rd</sup> *shido* (disqualified from the competition). Each subscript letter denotes a subset of Winner-Non-winner categories whose column proportions do not differ significantly from each other at the 0.05 level.

#### 4. Discussion

This study investigated the number of *shidos* and the forbidden actions that led to *shido* during the latest three World Judo Championships in winner and non-winner athletes. The main findings of the study were: First, the total number of *shido* in non-winner athletes were found higher than winner athletes; the second *shido* ratio of non-winner athletes was higher than winner athletes (Table 1). Second, there was no effect of sex on the ratio of receiving first and second *shido* in terms of winner and non-winner athletes. Thirdly, the ratio of second *shido* in non-winner athletes was higher than winner athletes when weight category increased. Fourthly, there was no effect of sex and weight category on the ratio of receiving the first and second *shido* when winner and non-winner athletes were evaluated together. Lastly, the ratio of forbidden actions resulting in *shido* was different between first and second *shido*.

It was reported that men athletes had higher number of *shido* than women athletes when competitions were evaluated under both old (Franchini, Sterkowicz, Meira Jr, Gomes, & Tani 2008; Calmet et al., 2017a) and current (Calmet et al., 2017b; Kons, Júnior, Fischer, & Detanico, 2018; Balci & Ceylan, 2020) refereeing rules. In this study, the total number of *shido* in men athletes was higher than women athletes although the number of *shido* per match was not evaluated. On the other hand, the ratio of first and second *shido* was found similar in women and men athletes when all the matches were evaluated. Weight category was reported not to effect penalties during Olympic Games (2012-2016) and world championships (2015-2017) (Calmet et al., 2017a; 2017b). However, the researchers carried out the analysis with total number of *shido* in all athletes without differentiating winner and non-winner athletes. The current study showed that the ratio of receiving the first and second *shido* in winner and non-winner athletes was the same in the lightweights and the ratio of second *shido* increased in the heavier weight categories.

To win a judo match is possible with score superiority or disqualification of the opponent according to current refereeing rules (IJF, 2020 version). IJF has aimed with the latest rule changes that athletes would present more active judo based on scores (IJF, 2013, 2016, 2018 versions). Although these frequent and great number of rule changes are criticized (Samuel, Basevitch, Wildikan, Prosoli, & McDonald, 2020), positive and progressive judo has been encouraged (IJF, 2017 version).

There are numerous studies investigating the effect of rule changes on high level judo competitions. The studies investigating 2012-2013 European Championships and 2012-2016 Olympic Games stated that new rule changes increased the ration of the matches with penalty and total number of *shido* (Franchini, Takito, & Calmet, 2013; Calmet et al., 2017a). In contrast, subsequent studies that compared 2016-2017 Paris Grand Slam (Ceylan & Balci, 2017) and 2015-



2017 World Championships (Calmet et al., 2017b) showed that new rule changes led to a decrease in penalties. Likewise, a study where 2015-2018 World Championships were compared reported fewer penalties after the rule changes with increased ratio of scores contributing match results (Doppelhammer & Stöckl, 2020). Abovementioned studies confirmed that IJF partially achieved its goal of positive judo with the latest rule changes. However, the ratio of the matches resulted in disqualification (*hansoku-make*) due to total number of *shido* increased despite rule changes decreasing the number of penalties (Calmet et al., 2017b). Balci and Ceylan (2020) investigated high level judo matches in 2018 and 2019 and stated that athletes received *shido* in 75% of the matches and 15% of the matches resulted in *hansoku-make* as a result of consecutive *shidos*.

It was stated that penalization increased the possibility of losing three times according to analysis carried out under the 2013 refereeing rules (Escobar-Molina et al., 2014). Although recent rule changes have limited the direct effect of penalties on match outcome, Balci and Ceylan (2020) reported that the possibility of losing in athletes who received *shido* increased 2 times under the current refereeing rules. Also, it was well established that non-winner athletes received more penalties (Gutiérrez-Santiago, Gencico-Merino, & Prieto-Lage, 2019). When three consecutive World Championships were investigated following important rule changes in 2016, the number of the first and second penalties in non-winner athletes was higher than winner athletes. In particular, the ratio of the second *shido* in non-winner athletes was found much higher than winner athletes.

Previous studies focused especially on the number of *shido* per match/athlete or the effect of penalties on match outcome. The number of studies that focus on forbidden actions that result in *shido* and forbidden actions in terms of winner and non-winner athletes, and their causes is not sufficient (Adam et al., 2018; Balci & Ceylan, 2020).

Forbidden actions in judo are divided into two, slight infringements are penalized with *shido* while grave infringements are penalized with *hansoku-make* (IJF, 2020 version). In the current study, athletes received a *shido* frequently due to such slight infringements as non-combativity, avoid-grip, false attack, defensive-posture, outside-contest-area and others, respectively. When abovementioned slight infringements were evaluated, athletes are not allowed to stay inactive or block their opponents and thus we can assume that the current findings correspond to IJF's encouragement for positive judo which is clearly indicated in the IJF Refereeing Rules stating that athletes are penalized if they do not attack within 45 seconds following the grip during the match (IJF, 2020). While the ratio of forbidden actions for both the first and second *shido* was similar in winner and non-winner athletes, the ratio of forbidden actions leading to the first and second *shido* was different in winner and non-winner athletes. While the ratio of false attack increased for the second *shido* in winner athletes, the ratio of avoid grip decreased. In non-winner athletes, the ratio of non-combativity and false attack increased for the second *shido* compared to the first *shido*, the ratio of avoid grip decreased. During 2014-2015 World Championships held under older refereeing rules, the most frequent forbidden actions in men athletes were non-combativity, false attack and outside-contest-area (Adam et al., 2018). During high level judo competitions held under the current refereeing rules, the most frequent forbidden actions were non-combativity, avoid grip and false attack and non-winner athletes were penalized with the second and the third *shido* due to false attack unlike winner athletes (Balci & Ceylan, 2020). In the current study, the distribution of the forbidden actions was evaluated according to sex and weight category unlike previous studies. The ratio of defensive-posture was found higher in women athletes compared to men athletes. The differences according to weight categories were more complicated. The most important forbidden actions that caused these differences were as follows; the ratio of avoid-grip and false attack was the lowest in heavyweight athletes. The ratio of non-combativity was the highest in heavyweight athletes and the lowest in the half-lightweight athletes. The ratio of outside-contest-area, defensive-posture and false attack was the highest in middleweight, half-middleweight and half-lightweight athletes, respectively. These findings show that especially match dynamics and thus forbidden actions differ according to weight categories.

The study is limited to the penalties given to winner and non-winner athletes only in the matches with *shido*. It was found that winner athletes had less ratios of penalties and also 2nd *shido*. Given that athletes were penalized most frequently with non-combativity, false attack and avoid grip, tactical preparations can be advised to coaches and athletes to refrain from such infringements.



Future research is suggested to determine the differences between winner and non-winner athletes using throwing techniques, grappling techniques and the contribution of penalties in achieving points.

## 5. Conclusions

Non-winner athletes received more penalties with higher ratio of second *shido*. This was different according to weight categories, but sex did not lead to any difference. Slight infringements resulted in a *shido* were similar in winner and non-winner athletes. However, sex and especially weight category factors affected the most frequent forbidden actions. The fact that athletes were penalized due to such forbidden actions that aimed to block the opponent as non-combativity, avoid-grip, false attack, defensive-posture, outside-contest-area correspond to the positive judo aim of IJF.

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