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Impact of different judo rules: analysis of scores and penalties in Paris Grand Slam Championships

Impacto de las diferentes reglas de judo: análisis de puntuaciones y penalizaciones en los Campeonatos de Grand Slam de París

Luiz Felipe Guarise Katicips, Jorge Nelson Silva Júnior, Rafael Lima Kons, Daniele Detanico
Universidade Federal de Santa Catarina. Brazil

Abstract

In the last two decades, the International Judo Federation (IJF) has been implementing a series of changes in its official rules, in order to improve efficiency and achieve more dynamism in judo combat. The aim of the present investigation was to analyze the effects of judo rule changes proposed by IJF in three periods (2011, 2016 and 2017), considering the scores and penalties in the Grand Slam Paris (GSP). The values of the scores (yuko, wazari and ippon) and the penalties (shido) were relativized by the total number of matches. The normality of data was assessed by the Kolmogorov-Smirnov test. Two-way analysis of variance and Bonferroni post hoc test (or t-test when necessary) were used to compare the scores, penalties and the efficiency index among GSP2011, GSP2016 and GSP2017. The significance level was set at $p< 0.05$.The results indicated that GSP2016 presented higher incidence of penalties in the general male teams and lower number of yuko score compared to the GSP2011 and GSP2017, while the GSP2011 showed higher efficiency in the female teams (general and medalists). Ippon was the score that determined the outcome of the matches in GSP2011 and GSP2017 particularly for male medalist teams. We conclude that the rule changes in the GSP2016 deviated from the IJF objectives compared to GSP2011 and GSP2017, considering the greater importance of scores than punishments.

Key words: Combat sports; technical-tactical analysis; penalty; scores; competition.

Resumen

En las últimas dos décadas, la Federación Internacional de Judo (IJF) ha estado implementando una serie de cambios en sus reglas oficiales, con el fin de mejorar la eficiencia y lograr más dinamismo en el combate de judo. El objetivo de la presente investigación fue analizar los efectos de los cambios en las normas de judo propuestas por IJF en tres períodos (2011, 2016 y 2017) teniendo en cuenta las puntuaciones y penalizaciones en el Grand Slam de París (GSP). Los valores de las puntuaciones (yuko, wazari e ippon) y las penalizaciones (shido) se relativizaron por el número total de combates. La normalidad de los datos se evaluó mediante la prueba de Kolmogorov-Smirnov. El análisis de varianza de dos vías y la prueba post hoc de Bonferroni (o prueba t-test cuando fue necesario) se usaron para comparar las puntuaciones, las penalizaciones y el índice de eficiencia entre GSP2011, GSP2016 y GSP2017. El nivel de significancia se estableció en $p< 0,05$. Los resultados indicaron que GSP2016 presentó una mayor incidencia de penalizaciones en los equipos masculinos generales y un menor número de puntajes de yuko en comparación con el GSP2011 y GSP2017. Mientras que el GSP2011 mostró una mayor eficiencia en los equipos femeninos (general y medallistas). Ippon fue la puntuación que determinó el resultado de los combates en GSP2011 y GSP2017, especialmente para los equipos de medallistas masculinos. Concluimos que los cambios en la norma en el GSP2016 se desviaron de los objetivos de IJF en comparación con GSP2011 y GSP2017, considerando la mayor importancia de las puntuaciones que las penalizaciones.

Palabras clave: Deportes de combate; análisis técnico-táctico; penalización; puntuaciones; competición.

Correspondence/correspondencia: Luiz Felipe Guarise Katicips
Universidade Federal de Santa Catarina. Brazil
Email: luiz.katcipis@gmail.com

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Introduction

Judo has been an Olympic combat sport since 1964 for male athletes and from 1992 for women as well. The combat requires an excellent level of physical fitness and technical and tactical skills (Franchini, Matsushige, Del Vecchio & Artioli, 2011; Franchini&Takito, 2014).In line with these technical-tactical demands, the sport has been transforming in the last two decades through a series of changes in its official rules, in order to improve efficiency and achieve more dynamism in judo combat(Calmet, Pierantozzi, Sterkowicz, Chalis & Franchini, 2017; Franchini, Artioli & Brito, 2013a; Ito, Hirose, Nakamura, Maekawa, Tamura, 2014; Miake, Sato & Yokoyama, 2016). This change was promoted by the International Judo Federation (IJF), which aims to create regulation that makes the combats more dynamic and mainly gives more importance to points (scores) than punishment (International Judo Federation, [IJF] 2017). This rules organization suggests a competition model that would no abandon a more traditional judo, where the chances of victory during the combat would encourage searching for the maximum score (*ippon*) at each moment (Franchini, Artioli & Brito, 2013a; Ito et al, 2014).

A relevant change in the judo rules occurred in 2011-2012, in which the main modification was attributed to the restrictions in the use of throw techniques below the belt using arms or hands (e.g., *morote-gari*), that became a punishment and if re-incidence occurred, disqualification (International Judo Federation, [IJF] 2010; Bustio, Boccia, Moisé, Laurenzano and Lupo, 2017). In this period three scores could be applied by the referee: *yuko*, *wazari* and *ippon*. Two *wazari* could be converted into *ippon*. In addition, only the first penalty (*shido*) did not count against the score, the second and third penalties were equivalent to the scores of the opponent and, the fourth penalty was considered disqualification (*hansokumake*) (Ito et al, 2014). Another judo rule modification occurred in 2013-2016, in which the regulation increased the punishment for throwing techniques applied below the belt line, i.e., direct disqualification. However, more importance was given to the score than penalties, since *shido* did not award points to the opponent, but in case of same score at the end of the match, those with the lowest amount of *shido* won (International Judo Federation, [IJF] 2013). The last major change in the judo rules occurred in 2017, mainly abandoning the *yuko* score and with no possibility to add two *wazari* and convert to *ippon*. Still, three *shido* are converted into *hasokumake* and not four (International Judo Federation, [IJF] 2017).

Several studies have investigated the influence of changes in judo rules over the years, showing both positive and negative consequences. Miayke, Sato & Yokoyama, (2016); Miake, et al, (2014); Miake, Sato & Yokoyama, (2015) conducted a series of studies in order to analyze the judo rule changes in the Japan Judo Championship comparing the Kodokan rules used up to 2010 with those used by the IJF (2011, 2013 and 2014). The authors pointed out positive effects in these championships, with an increase of matches won by *ippon*, increase in the number of techniques and efficiency index, as well as decrease in victories by referee decisions and pauses during combat. Another study verified an increase in the attack efficiency index (mainly in combination attacks and counter-attacks) between 2012-2013 contests, but only in instances where *kumi-te* (judo standing technique performed by gripping the opponent's jacket) was applied three times (Miake, Sato & Yokoyama, 2016). Franchini, Takito & Calmet, (2013b) investigated the impact of rule changes between 2012-2013 in the European Judo Championships and found an increase in penalties (*shido* and *hansokomake*), decrease in *wazari* and *yuko* scores for both male and female teams, while increased *ippon* only for males. In this sense, it is possible to suggest that the rule changes did not achieve the goal established of increasing scores and decreasing penalties. This can explain the athletes in

advantage in the scoreboard administer the remaining combat, acquiring a defensive posture and consequently declining the number of attacks. Recently, Calmet, et al, (2017) found no change in *ippon* and *wazari* scores, but a decrease in the number of *yuko* scores and increase in the number of penalties per athlete per match in Rio 2016 compared to London 2012.

The changes in the judo rules directly impact the physical, technical and tactical preparation of the athletes, and consequently the dynamism and strategies used during the match (advantage or disadvantage in the scoreboard).The coaches and physical trainers should find strategies to adapt the athletes as quickly as possible, in order to decrease possible impairments from lack of rules understanding. It is important to investigate the athletes' behavior during combats, considering different rules, including the current one. However, no studies were found to investigate the change in judo rules over the last few years, regarding the three most important changes (2011-2012, 2013-2016 and 2017-2020). Therefore, this study aimed to analyze the effects of judo rule changes proposed by IJF in three periods, considering the scores and penalties in the Grand Slam Paris, since this is the first world championship at the beginning of the year when the rules were put into effect. The main hypothesis is that the penalties will decrease and the scores will increase over the years, due to the lower importance given to punishment and high importance to scores.

Methods

Data Sample

The official results published on the web (www.judobase.org) linked to the International Judo Federation website (International judo federation, 2013, 2016, 2017) were retrieved on February 2017 for technical-tactical analysis of the matches performed in the Grand Slam Paris years of 2011(GSP_{2011}), 2016(GSP_{2016}) and 2017(GSP_{2017}). We analyzed a total of 1539 matches across seven categories; in the GSP_{2011} there were 299 matches for male teams and 198 for female teams. In the GSP_{2016}, 277 matches of the male teams were analyzed, 250 of female teams; and in the GSP_{2017}, 275 matches of male and 171 of female teams were analyzed. The relative scores (*ippon*, *wazari* and *yuko*), penalties (*shido* per match) and efficiency were analyzed in all GSP considering male and female teams (general and medalists). For the GSP_{2017}, it was not possible to analyze the *yuko* score, since this score was excluded by the rules. The efficiency was calculated following the equation proposed by Adam, Smaruj, Tyszkowski, (2011). In GSP_{2017}, the equation was changed, using a value of 0 for *yuko* score, due to the removal of this score.

$$\text{Efficiency} = \frac{(\text{number of ippon} \times 10) + (\text{number of wazari} \times 7) + (\text{number of yuko} \times 5)}{\text{Total number of matches}}$$

According to Morley & Thomas (2005), there are no ethical issues in analyzing or interpreting these data from open access websites, since they were obtained in secondary form and not generated by experimentation. In addition, athletes' personal identification was not used as only final results were considered. Similar analyses were used in previous studies (Calmet, et al, 2017; Miyake, Sato & Yokoyama, 2016; Miyake, Sato & Yokoyama, 2015 Franchini, Takito & Calmet, 2013b; Escobar-Molina, Courel, Franchini, Femia & Stankovic, 2014; Miarka ,Cury, Julianetti, Battazza, Julio, Calmet, 2014).

Statistical Analysis

The values of the scores (*yuko,wazari* and *ippon*) and the penalties (*shido*) were relativized by the total number of matches. The normality of data was assessed by the Kolmogorov-Smirnov test. Two-way analysis of variance and Bonferroni post hoc test (or t-test when necessary) were used to compare the scores, penalties and the efficiency index among GSP_{2011}, GSP_{2016} and GSP_{2017}.The significance level was set at $p < 0.05$ and the analysis was conducted using SPSS version 17.0.

Results

Table 1 presents the frequency of scores, penalties (*shido*) and efficiency in male judo athletes in three different competitions (GSP_{2011}, GSP_{2016} and GSP_{2017}). Significant differences were found in the *wazari* score among the three championships ($F = 28.15$, $p<0.001$), with the highest in GSP_{2017}, followed by GSP_{2011} and then GSP_{2016}. The *yuko* was higher in GSP_{2011} compared to GSP_{2016} ($t = 2.53$, $p = 0.032$). The number of *shido* per match and efficiency were higher in GSP_{2016} compared to the other championships ($F= 13.60$, $p<0.001$).

Table 1. Frequency of scores, penalties (*shido*) and efficiency of male judo athletes in three different competitions (GSP_{2011}, GSP_{2016} and GSP_{2017}).

	Male team		
	GSP_{2011}	GSP_{2016}	GSP_{2017}
Ippon (%)	56.01 ± 8.95	45.42 ± 6.53	45.73 ± 11.95
Wazari (%)	44.68 ± 10.97[a]	21.03 ± 8.96[b]	76.10 ± 19.07[c]
Yuko (%)	54.20 ± 13.58[a]	39.58 ± 6.99[b]	--------
Shido/match (n)	1.17 ± 0.3[a]	2.11 ± 0.2[b]	1.35 ± 0.3[a]
Efficiency (%)	11.3 ± 1.7[a]	7.72 ± 1.0[b]	7.61 ± 1.2[b]

Different letters show significant differences; same letters show no significant differences ($p < 0.05$).

Table 2 shows the frequency of scores, penalties (*shido*) and efficiency of female judo athletes in three different competitions (GSP_{2011}, GSP_{2016} and GSP_{2017}). Significant differences were found in the *wazari* score among the three championships ($F= 39.92$, $p<0.001$), with the highest in GSP_{2017}, followed by GSP_{2011} and then GSP_{2016}. The *yuko* was higher in the GSP_{2011} compared to GSP_{2016} ($t= 2.69$, $p= 0.05$). Efficiency was higher in GSP_{2011} compared to the other championships ($F= 38.90$, $p<0.001$).

Table 2. Frequency of scores, penalties (*shido*) and efficiency of female judo athletes in three different competitions (GSP_{2011}, GSP_{2016} and GSP_{2017}).

	Female team		
	GSP_{2011}	GSP_{2016}	GSP_{2017}
Ippon (%)	49.66 ± 15.2	47.59 ± 5.04	39.79 ± 4.03
Wazari (%)	24.82 ± 7.96[a]	19.71 ± 11.14[b]	79.07 ± 12.03[c]
Yuko (%)	71.31 ± 15.84[a]	35.65 ± 10.27[b]	---------
Shido/match (n)	1.3 ± 0.4	1.6 ± 0.4	1.3 ± 0.3
Efficiency (%)	12.4 ± 1.2[a]	7.32 ± 1.3[b]	7.50 ± 0.9[b]

Different letters show significant differences; same letters show no significant differences ($p < 0.05$).

Table 3 shows the comparison of scores, penalties (*shido*) and efficiency of three different judo male competitions (GSP_{2011}, GSP_{2016} and GSP_{2017}), considering only the medalist athletes (gold, silver and bronze medals). Significant differences were found in the *wazari* ($F= 11.76$, $p<0.001$), which was highest in GSP_{2017}. The *shido* per match was higher in GSP_{2016} and GSP_{2017} compared to GSP_{2011} ($F = 4.64$, $p=0.014$) and efficiency was higher in GSP_{2011} compared to the others ($F=6.58$, $p= 0.003$).

Table 3. Frequency of scores, penalties (*shido*) and efficiency of male judo medalist in three different competitions (GSP_{2011}, GSP_{2016} and GSP_{2017}).

	Male medalist team		
	GSP_{2011}	GSP_{2016}	GSP_{2017}
Ippon (%)	40.53 ± 21.7	37.02 ± 22.8	38.85 ± 27.7
Wazari (%)	31.25 ± 25.8[a]	15.79 ± 16.5[a]	53.75 ± 40.7[b]
Yuko (%)	41.60 ± 27.2	31.90 ± 29.1	--------
Shido/match (n)	0.7 ± 0.3[a]	1.1 ± 0.5[b]	1.0 ± 0.3[b]
Efficiency (%)	8.38 ± 3.0[a]	6.21 ± 2.5[b]	5.76 ± 3.0[b]

Different letters show significant differences; same letters show no significant differences ($p < 0.05$).

Table 4 shows the comparison of scores, penalties (*shido*) and efficiency of judo female medalist teams in three different competitions (GSP_{2011}, GSP_{2016} and GSP_{2017}). Significant differences were found in the *wazari* ($F= 11.45$, $p<0.001$), which was highest in GSP_{2017}, followed by GSP_{2011} and then GSP_{2016}. Efficiency was higher in GSP_{2011} compared to the others ($F= 15.65$, $p<0.001$) and the *yuko* was higher in GSP_{2011} compared to GSP_{2016} ($t= 4.70$, $p = 0.001$).

Table 4. Frequency of scores, penalties (*shido*) and efficiency of female judo medalist in three different competitions (GSP_{2011}, GSP_{2016} and GSP_{2017}).

	Female medalist team		
	GSP_{2011}	GSP_{2016}	GSP_{2017}
Ippon (%)	38.39 ± 28.0	40.35 ± 21.4	34.51 ± 20.5
Wazari (%)	28.32 ± 32.5[a]	19.05 ± 21.4[b]	58.07 ± 39.6[c]
Yuko (%)	50.17 ± 34.1[a]	16.78 ± 15.7[b]	-------
Shido/match (n)	0.9 ± 0.5	0.9 ± 0.4	1.1 ± 0.5
Efficiency (%)	8.99 ± 3.5[a]	4.95 ± 1.8[b]	5.81 ± 2.8[b]

Different letters show significant differences; same letters show no significant differences ($p < 0.05$).

We identified the variable (*ippon*, *wazari/yuko* or *shido*) that determined the outcome of the matches in three different competitions. Figure 1 shows the comparison of the male medalist team sin GSP_{2011}, GSP_{2016} and GSP_{2017}, as well as among *ippon*, *wazari/yuko* and *shido* within each championship. No significant differences were found among the championships for any variable (*ippon*: F= 0.80, p=0.46; *wazari/yuko:* F =1.20, p = 0.32; *shido:* F= 1.43, p= 0.26). However, a significant difference between the scores and penalties within each championship was found for GSP_{2017} (F = 4.82, p = 0.041), showing differences between *ippon* and *wazari* (p=0.041) and *ippon* and *shido* (p =0.002). Also, significant differences were verified for GSP_{2011} (F = 8.21, p = 0.002), between *ippon* and *shido* (p = 0.016).

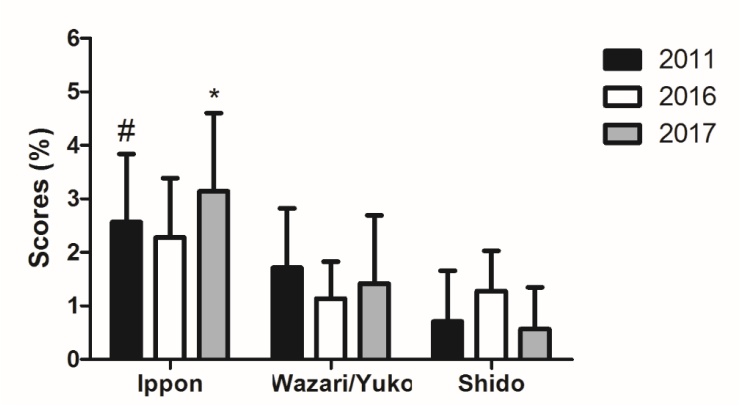

Figure 1: Frequency of *ippon*, penalties (*shido*) and *wazari/yuko* of judo male medalist team in GSP_{2011}, GSP_{2016} and GSP_{2017}. *Significant difference from *wazari* and *shido* for GSP_{2017}, # significant difference from *shido* for GSP_{2011}.

Figure 2 shows the comparison of the female medalist teamsinGSP_{2011}, GSP_{2016} and GSP_{2017}, as well as among *ippon*, *wazari/yuko* and *shido* within each championship. No significant differences were found among the championships for any variable (*ippon*: F= 0.56, p=0.57; *wazari/yuko:* F= 0.44, p=0.64; *shido:* F= 0.51, p= 0.60), and neither between the scores nor penalties within each championship (GSP_{2011}: F= 1.65, p= 0.21, GSP_{2016}: F= 3.56, p= 0.50; GSP_{2017}: F= 2.22, p= 0.13).

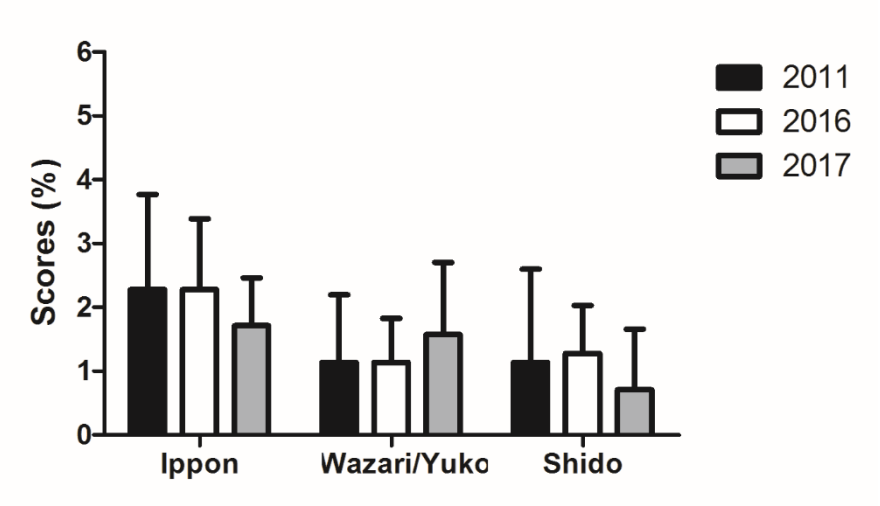

Figure 2: Frequency of *ippon*, penalties (*shido*) and *wazari/yuko* of judo female medalist team in GSP_{2011}, GSP_{2016} and GSP_{2017}.

Discussion

The main purpose of this study was to analyze the effects of judo rule changes in three periods (2011, 2016 and 2017), considering the scores and penalties in the Grand Slam Paris. The main results showed that the different rule changes in each period induced changes in the *wazari* score for both genders (higher in GSP_{2017}, followed by GSP_{2011} and GSP_{2016}). In addition, for male and female teams (general) and female medalist teams, the *yuko* score was higher in GSP_{2011} than GSP_{2016}. Considering the penalties, in GSP_{2016} the number of *shido* per match was higher than GSP_{2011} and GSP_{2017} for the male teams (general), while for male medalists, there was no difference between GSP_{2016} and GSP_{2017}, but the *shido* remained lower than GSP_{2011}. The female teams (general and medalists) showed higher efficiency in GSP_{2011} compared to the other championships. Finally, we identified the variable (*ippon*, *wazari/yuko* or *shido*) that determined the outcome of the match and found a higher number of winners by *ippon* than *wazari* and *shido* in GSP_{2017}. In GSP_{2011}, there were more winners by *ippon* than *shido*. Therefore, we accepted our hypothesis since the penalties decreased in GSP_{2017} (particularly for male teams) and the score *ippon* was the main variable that determined the winner in GSP_{2017} and GSP_{2011}, although there were no differences among the competitions (both male and female teams). The GSP_{2016} appeared to be the worst as evidenced by the high number of penalties and lower scores and efficiency.

The findings of this study indicate that the IJF goal, which aims to make judo combats more dynamic by assigning less importance to punishment and encouraging athletes to increase the scores at all times, can be achieved in GSP_{2011} (both male and female teams) and GSP_{2017} (particularly for male teams). In GSP_{2016}, a negative effect was verified considering these aspects. Franchini, Takito & Calmet, (2013b) also reported a similar effect of the rule changes proposed in 2013 by analyzing the European Judo Championships, i.e., using the same rules as GSP_{2016}. The authors found an increase of penalties and decrease of scores (*wazari* and *yuko*) for both male and female teams. Recently, Calmet et al (2017) compared the frequency of scores and penalties between Rio 2016 and London 2012 (before and after rule change) and found no change in *ippon* and *wazari* scores. However, there was a decrease in the number of *yuko* scores and increase in the number of penalties per athlete per match in Rio compared to London.

The GSP_{2017} showed higher frequency of *wazari* scores than other competitions; however, it cannot be assumed to have a positive effect due to the rule changes, since with the *yuko* extinction, several throws that received *yuko* were counted as *wazari* (International Judo Federation, 2017). In addition, with the 2017 rules, each athlete can be receiving more than two *wazari*, which did not happen with the other rules (two *wazari* were converted to *ippon*).

In GSP_{2011}, both male and female teams (general and medalists) showed higher efficiency than other championships. It is important to highlight that in this period the rule changes were not as abrupt considering the previous years and probably the athletes did not undergo many adaptations during combat. Even though the present study did not analyze the effects and time required for athletes' adaptations to the rules, there are indications that this factor may interfere with the performance during combats and throughout the competition. The efficiency values decreased in GSP_{2016} and GSP_{2017}, considering a negative effect. Ito et al. (2014) investigated the pattern and technique effectiveness shifts during judo combats after the rule changes in 2013 and found that the exclusion of some throwing techniques may alter the technical efficiency. According to Franchini, Takito & Calmet (2013b), with the changes in 2013, there was a reduction in attack initiatives by the athlete who had a favorable score, seeking more tactical combat with excessive defensive actions and managing the punishments.

An important finding of this study is that the *ippon* and not the penalties was the variable that determined the majority of winners in GSP_{2017} and GSP_{2011} for male medalist teams, showing positive technical-tactical behavior of the athletes regarding the rule changes, i.e., less importance was given to the punishment. Escobar-Molina et al. (2014) found that 21% of the judo matches (both male and female elite teams) were decided by *shido* and 2.9% were decided by *hansokumake* (4 *shido*) (rules of 2013). Furthermore, the authors verified that the defeated athletes received *shido* three times more often than winners, and *shido* occurred more frequently later in a match, particularly in heavier weight categories. Although we did not analyze just the non-medalist athletes in this study, it is possible to suggest similar technical-tactical behavior considering the *ippon* as a determinant of the match outcome. Franchini & Takito (2014) found similar characteristics of the physical training and psychological perception of training between medal winners compared to non-medal winners during preparation for the Olympic Games. The only difference was reported in the groundwork *randori* practice, which was less frequently performed by medal winners.

Finally, several aspects may interfere in performance during the matches throughout the judo rules changes, although this influence is still unclear. For example, the prohibition of leg grabs techniques could be supposed an advantage in taller judoka, but it was not found in previous studies (Bustio, et al, 2017). Thus, further studies should be conducted in order to identify other intervenient variables, such as home advantage, ranking and optimal interval between competitions to the judo performance according to the rules changes.

Conclusion

We conclude that the rule changes in GSP_{2016} deviated from the IJF objectives, considering the greater importance to scores than punishments, since this competition presented higher incidence of penalties in the general male teams and lower scores compared to GSP_{2011} and GSP_{2017}.On the other hand, GSP_{2011} showed higher efficiency (male and female teams), while GSP_{2011} and GSP_{2017} had fewer penalties, particularly in the male teams. The *ippon* was the score that determined the outcome of the matches in GSP_{2011} and GSP_{2017} for the male medalist teams. Further studies can be conducted to investigate the time necessary for the athletes to assimilate rule changes. Thus, it is possible to analyze the technical-tactical

behavior during combat and conclude whether the effects were positive or negative according to the IJF goals.

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