Revista de Artes Marciales Asiáticas
Volume *19*(2), 93-103 ~ July-December 2024
DOI: 10.18002/rama.v19i1.2409
http://revpubli.unileon.es/ojs/index.php/artesmarciales

RAMA
I.S.S.N. 2174-0747

The penalties and scores by events, to predict victory and defeat according to when the contest ends in elite judo contests

Xurxo DOPICO-CALVO[1], Luis SANTOS[*2], Xián MAYO[3], Eduardo CARBALLEIRA[1], Iván CLAVEL[1], Bayram CEYLAN[4], Rafael Lima KONS[5], & Eliseo IGLESIAS-SOLER[1]

[1] *Performance and Health Group, Department of Physical Education and Sport, Universidade da Coruña (Spain)*

[2] *Department of Physical Education and Sport, Universidad de León (Spain)*

[3] *Observatory of Healthy and Active Living of Spain Active Foundation, Centre for Sport Studies, Universidad Rey Juan Carlos (Spain)*

[4] *Department of Coaching Education, Faculty of Sport Sciences, Kastamonu University (Turkey)*

[5] *Biomechanics Laboratory, Sports Center, Federal University of Santa Catarina (Brazil)*

Received: 02/06/2023; Accepted: 25/07/2024; Published: 27/07/2024

ORIGINAL PAPER

Abstract

The main aim of this study was to ascertain whether the victory and defeat in the different types of the judo contest, in the elite male and female divisions, are associated to the occurrence of the penalties and scores of the first three events (changes in the scoreboard -either penalty or score-) of them. 2340 contests of the 2018, 2019 and 2021 World Judo Championships were analysed. The Pearson's chi-squared test expressed that [1] *shido*-1 in the first event (EV1) of the contests that end before the regular time (BRT) and of those without considering when they end (OC) is associated to defeat for both sexes and, that [2] *wazari*-1 in the EV1 of the BRT and in the EV2 and EV3 of the BRT, of the contests with the duration extended beyond the regular time (EXT) and of OC is associated to victory for both sexes except in the EV2 of the EXT (only for male athletes in this case). Thus, it is suggested that the victory and defeat in the different types of the judo elite contests are associated with the occurrence of the penalties and scores of the first three events of them.

Keywords: Martial arts; combat sports; judo; performance analysis; association analysis.

Las penalizaciones y puntuaciones por eventos, para predecir la victoria y la derrota en función del momento en que finaliza el combate en competiciones de judo de élite

Resumen

El objetivo principal de este estudio fue determinar si la victoria y la derrota en los diferentes tipos de competición de judo, en las divisiones élite masculina y femenina, están asociadas a la ocurrencia de penalizaciones y puntuaciones de los tres primeros eventos (cambios en el marcador –ya sea penalización o puntuación–) de los mismos. Se analizaron 2340 combates de los Campeonatos del Mundo de Judo de 2018, 2019 y 2021. La prueba de chi cuadrado de Pearson mostró que [1] el *shido-1* en el primer evento (EV1) de los concursos que terminan antes del tiempo regular (BRT) y de los que no se considera cuándo terminan (OC) está asociado a la derrota para ambos sexos

As penalizações e pontuações por eventos, para prever a vitória e a derrota de acordo com o momento em que a competição termina em competições de elite de judo

Resumo

O principal objetivo deste estudo foi verificar se a vitória e a derrota nos diferentes tipos de competição de judo, nas divisões de elite masculina e feminina, estão associadas à ocorrência das penalizações e pontuações dos três primeiros eventos (alterações na tabela de pontuação –quer penalização quer pontuação–) dos mesmos. Foram analisadas 2340 competições dos Campeonatos do Mundo de Judo de 2018, 2019 e 2021. O teste do qui-quadrado de Pearson expressou que [1] o *shido-1* no primeiro evento (EV1) dos concursos que terminam antes do tempo regular (BRT) e daqueles sem considerar quando terminam (OC) está associado à

[*] *Corresponding author*: Luis Santos (lsanr@unileon.es)

Contributions: Xurxo Dopico-Calvo (ABCEFGHIJKLMN), Luis Santos (ACEFGHIJKMN), Xián Mayo (AEFHJKLN), Eduardo Carballeira (ABCFHILN), Iván Clavel (ACDFJKLN), Bayram Ceylan (ACFHJKN), Rafael Lima Kons (ACFHJKN), Eliseo Iglesias-Soler (ABCDEFKLN). Codes according to CRediT (Contributor Roles Taxonomy): (A) Conceptualization. (B) Data curation. (C) Formal Analysis. (D) Funding acquisition. (E) Investigation. (F) Methodology. (G) Project administration. (H) Resources. (I) Software. (J) Supervision. (K) Validation. (L) Visualization. (M) Writing – original draft. (N) Writing – review & editing.

Funding: The authors received no funding for this work.

Conflicts of interest: The authors declare no conflicts of interest.

y, que [2] el *wazari-1* en el EV1 del BRT y en los EV2 y EV3 del BRT, de los concursos con la duración extendida más allá del tiempo regular (EXT) y de OC está asociado a la victoria para ambos sexos excepto en el EV2 del EXT (sólo para atletas masculinos, en este caso). Así, se sugiere que la victoria y la derrota en los diferentes tipos de competiciones de élite de judo están asociadas a la aparición de las penalizaciones y puntuaciones de los tres primeros eventos de las mismas.

Palabras clave: Artes marciales; deportes de combate; judo; análisis del rendimiento; análisis de la asociación.

derrota para ambos os sexos e, que [2] o *wazari-1* na EV1 do BRT e nas EV2 e EV3 do BRT, das provas com a duração prolongada para além do tempo regulamentar (EXT) e do OC está associado à vitória para ambos os sexos exceto na EV2 do EXT (apenas para os atletas masculinos neste caso). Assim, sugere-se que a vitória e a derrota nos diferentes tipos de competições de elite de judo estão associadas à ocorrência das penalizações e pontuações dos três primeiros eventos das mesmas

Palavras-chave: Artes marciais; desportos de combate; judo; análise de desempenho; análise de associação.

1. Introduction

Judo, a Japanese martial art, and Olympic/Paralympic sport is a dynamic and high intensity intermittent combat sport, which requires complex technical and tactical skills (Franchini et al., 2008) supported by highly developed physical conditioning (Franchini et al., 2011). Contests last 4 minutes, with potential quick conclusions (*ippon*) or extended durations in draws. Judo contests consist of 20–30s efforts and 10s breaks, taxing both aerobic and anaerobic systems (Franchini et al., 2017; Julio et al., 2017). In the contest, both contestants get close to each other, perform their grasps, move on the mat and attack. The approaches and *kumi-kata* (grip technique) give way to specific behaviours between the two contestants. The briefness and the capacity of simultaneous actions, the multiple interactions and the result at stake result in a complex system (Calmet et al., 2010).

Events in the judo contest can be described as every occurrence that results in a change in the scoreboard (*i.e.,* either penalty or score) which can happen when athletes receive a penalty due to an infraction of the rule or when they throw or control their opponents on the ground according to the rules. Thus, events are some of the factors that determine the complex system generated in a judo contest and finally, the victory and defeat. Scholarly literature presents studies which have tried to assess the complex system of the judo contest considering different variables (Calmet et al., 2010) designed a computerized observation to try to highlight some actions associated to success from that complex system (Boguszewski, 2014) analysed the dynamics of the contests based on several offensive and defensive indexes.

Considering and without considering when the contest ends, four types of the contest can be identified: *contests that end before the regular time* (BRT), *contests that end at the end of the regular time* (FRT), *contests with the duration extended beyond the regular time* (EXT), and *contests without considering when they end - overall contests* (OC) (Ceylan et al., 2022; Dopico-Calvo et al., 2023). This is an important criterium to classify the judo contest since, generally, longer contests are less dynamic than the shorter ones (Boguszewski, 2011), hence, different scenarios can be produced considering when the contest ends. Nevertheless, thus far, no studies have analysed the complex system generated in a judo contest based on its events, in the different types of the contests (deeming when they end) and by sex divisions. Such analysis is simple, and it would allow the identification and understanding patterns in the different types of the contests and in both sexes. Based on the results of this analysis, coaches and athletes might simulate competition situations during the training sessions. It would decrease the contest uncertainty and enable quicker and more effective decision-making, considering the specific background to face.

Whence, the main objective of the present study was to ascertain whether the victory and defeat in the different types of the judo contest (BRT, FRT, EXT and OC), in the elite male and female divisions are associated to the occurrence of the penalties and scores of the first three events of them. Also, aiming a deeper level of analysis, another goal of the current study was to determine whether the victory by *ippon*, one *wazari* (*wazari*-1), two *wazaris* (*wazari*-2), or three *shidos* (*shido*-3), and the same for the defeat, in the judo OC and regardless sex divisions are associated to the occurrence of the penalties and scores of the first three events of it. It was hypothesised that results would express association between the victory and defeat in the different types of the contest in both sexes and the occurrence of the penalties and scores of the first three events of them, as well as between the different types of victories and defeats in the OC regardless sex divisions and the occurrence of the penalties and scores of the first three events of it.

2. Methods

2.1. Design

This is a cross-sectional study based on the observation of the judo contests from both male and female divisions of the World Judo Championship of Bakú 2018 (WC18), Tokyo 2019 (WC19) and Budapest 2021 (WC21) (IJF, 2018, 2019, 2021) which were performed under new competition rules changed in 2018. Deeming that the analyzed data were attained from an open access website in secondary form and not generated by experimentation, there are no ethical issues in examining or interpreting them (Morley & Thomas, 2005). Additionally, personal identification or nationalities of the athletes whose contests were assessed were not specified.

2.2. Procedures

2370 contests, which involved 2244 athletes (901 women and 1343 men), were watched and 2340 ones were included in the analysis of current study (30 contests were excluding due to *Fusen Gachi* –fail to appear–, *Kiken Gachi* –abandonment or injury–, and *Hansoku Make* –disqualification by the direct way–). Thus, data referring to the penalties and scores (one *shido*, two *shidos* [*shido*-1, *shido*-2] and *wazari*-1) of the EV1, EV2 and EV3, the victory and defeat and the type of victory and defeat (victory by *ippon*, defeat by *ippon*, victory by *wazari*-1, defeat by *wazari*-1, victory by *wazari*-2, defeat by *wazari*-2, victory by *shido*-3 and defeat by *shido*-3) of the BRT, FRT, EXT and OC of the male and female divisions of the WC18, WC19 and WC21 were collected in *ad-hoc* tool and registered using the program Lince PLUS version 1.3.2 (Soto-Fernández et al., 2022).

In order to ascertain whether the victory and defeat in the different types of judo contests, in both sex divisions are associated to the occurrence of the penalties and scores of the first three events of them, three possibilities were defined and observed for the analysis: (1st) first penalty (*shido*-1) in the EV1, EV2 and EV3; (2nd) second penalty (*shido*-2) in the EV2 and EV3; and (3rd) first score (*wazari*-1). The scores of *ippon* and *wazari*-2, as well as the penalty of *shido*-3 were not considered since they are conclusive. That is, the effect of its occurrence is the victory and defeat in the contest. Hence, they are factors that affect to the result of the analysis, and they cannot be included in it. Additionally, the FRT analysis did not include the score of *wazari*-1 in any event since, this is a conclusive score in this type of contests. Furthermore, to determine whether the victory by *ippon*, *wazari*-1, *wazari*-2 or *shido*-3, and the same for the defeat in the OC regardless sex divisions are associated to the occurrence of the penalties and scores of the first three events of it, eight categories were defined; victory by *ippon*, defeat by *ippon*, victory by *wazari*-1, defeat by *wazari*-1, victory by *wazari*-2, defeat by *wazari*-2, victory by *shido*-3 and defeat by *shido*-3. Regarding that the score of *wazari*-1 can be a conclusive score in the OC, six categories were created for it; victory by *ippon*, defeat by *ippon*, victory by *wazari*-2, defeat by *wazari*-2, victory by *shido*-3 and defeat by *shido*-3.

Regarding the International Judo Federation 2022-2024 Referring Rules (IJF, 2023), nowadays, at most, six events (five in the FRT contests) can happen in an official contest. In the present study were only analysed the EV1, EV2 and EV3 of the contests since; these first three events accumulate the greatest number of penalties and scores of the contest, in both sex divisions, and because the frequency of the fourth (EV4), fifth (EV5) and sixth (EV6) events is low (hence, its analysis might yield unreliable results).

2.3. Data Analysis

Descriptive data are presented as percentages. All the analyzed variables were categorical. Pearson's chi-squared (χ^2) test was conducted to ascertain whether the victory and defeat in the different types of the judo contest, in both sex divisions, are associated to the occurrence of the penalties and scores of the first three events of them. This test was also performed to determine whether the victory by *ippon*, *wazari*-1, *wazari*-2 or *shido*-3, and the same for the defeat in the OC regardless sex divisions are associated to the occurrence of the penalties and scores of the first three events of it.

One-sample Pearson's chi-squared (χ^2) test was implemented to analyze the hypothesis of a uniform distribution and to evaluate the over or underrepresentation of the penalties (*shido*-1) in the victory and defeat), in the EV1 of the FRT. It must be considered that *shido*-2 cannot happen in

the EV1 and as aforementioned, *wazari*-1 is a conclusive score in this type of contests. With the same goal, the test was performed for penalties (*shido*-1) in the type of victory or defeat (eight categories), in the EV1 of the OC, regardless sexes and for scores (*wazari*-1) in the type of victory or defeat (six categories), in the EV1, EV2 and EV3 of the OC, regardless sexes (as aforesaid, *wazari*-1 can be a conclusive score in the OC).

When a significant association was detected in the one-sample Pearson's chi-squared (χ^2) tests or in the Pearson's chi-squared tests, its interpretation considered the standardized residuals (-SR-, with values ≥2 and ≤-2 deemed significant, to determine the likely and unlikely occurrence of the situations analyzed, respectively, -standardized residual = observed ij-model ij/√model ij; where "observed" is the frequency corresponding to cell ij [*i.e.,* row i; column j] and "model" is the expected frequency in that cell for independent variables (Field, 2009).

Finally, when significant, the strength of associations was reported as Cramer's V (-V-, a Cramer's V below 0.20 suggests a small effect, 0.21-0.35 indicates a medium effect, and above 0.35 suggests a large effect (Cohen, 1988). All data were analyzed using R software (www.r-project.org, version 3.3.1., 2016.06.21). The level of significance was set at $p < 0.05$.

3. Results

Results expressed that the victory and defeat in the different types of the judo contest, in both sex divisions, are associated to the occurrence of the penalties and scores of the first three events of them. The victory and defeat in the BRT and OC of both sexes and the penalties and scores of the EV1 expressed association (χ^2=201.47, p<0.001, V=0.59 and χ^2=110.24, p<0.001, V=0.517; and χ^2=246.61, p<0.001, V=0.498 and χ^2=167.65, p<0.001, V=0.499, for men and women of the BRT and OC, respectively). All ratios of both associations presented a significant contribution to them; suggesting likely occurrence for *shido*-1 and defeat and *wazari*-1 and victory and, unlikely occurrence for *shido*-1 and victory, and *wazari*-1 and defeat (Table 1).

Table 1. Penalties and scores (first event), according when the contest ends, victory and defeat, and sex.

End of the contest, penalties and scores	Victory and defeat in the contests, by sex			
	Victory (Men)	Defeat (Men)	Victory (Women)	Defeat (Women)
Judo contests that end before the regular time (BRT)				
Shido-1[&] (%)	*n* = 107 (27.2%)	*n* = 287 (72.8%)	*n* = 83 (32.3%)	*n* = 174 (67.7%)
Stdres	-5.9*	5.6*	-4.5*	4.8*
Wazari-1[&] (%)	*n* = 172 (90.1%)	*n* = 19 (9.9%)	*n* = 139 (85.3%)	*n* = 24 (14.7%)
Stdres	8.4*	-8*	5.6*	-6.2*
Judo contests that end at the end of the regular time (FRT)				
Shido-1[$] (%)	*n* = 55 (43.7%)	*n* = 71 (56.3%)	*n* = 25 (38.5%)	*n* = 40 (61.5%)
Stdres	NA	NA	NA	NA
Judo contests with the duration extended beyond of the regular time (EXT)				
Shido-1[&] (%)	*n* = 85 (38.6%)	*n* = 135 (61.4%)	*n* = 47 (34.3%)	*n* = 90 (65.7%)
Stdres	NA	NA	NA	NA
Wazari-1[&] (%)	*n* = 11 (57.9%)	*n* = 8 (42.1%)	*n* = 7 (58.3%)	*n* = 5 (41.7%)
Stdres	NA	NA	NA	NA
Overall judo contest (those without considering when they end) (OC)				
Shido-1[&] (%)	*n* = 247 (33.4%)	*n* = 493 (66.6%)	*n* = 155 (33.8%)	*n* = 304 (66.2%)
Stdres	-5.8*	5.6*	-5.1*	5.3*
Wazari-1[&] (%)	*n* = 238 (89.8%)	*n* = 27 (10.2%)	*n* = 193 (86.9%)	*n* = 29 (13.1%)
Stdres	9.7*	-9.4*	7.4*	-7.6*

Stdres, standardized residuals; *Shido*-1, one *shido*; *Shido*-2, two *shidos*; *Wazari*-1, one *wazari*; NA, no association between variables, hence, no standardized residuals data. * Highlight standardized residuals with absolute values equal to 2 or higher and equal to -2 or lower. [&] Pearson's chi-squared (χ^2) test. [$] One-sample Pearson's chi-squared (χ^2) test. The *judo contests that end at the end of the regular time* (FRT) analysis did not include the score of *wazari*-1 since, this is a conclusive score in this type of contests (the effect of its occurrence is the victory and defeat in the FRT, hence, it is a factor that affect to the result of the analysis and it cannot not be included in it).

The victory and defeat in the BRT and OC of both men and women and the penalties and scores of the EV2 (Table 2), showed association (χ^2=128.38, p<0.001, V=0.551 and χ^2=120.06, p<0.001, V=0.678; and χ^2=249.11, p<0.001, V=0.529 and χ^2=185.56, p<0.001, V=0.594, for men and women of the BRT and OC, respectively). The highest contributions to these associations were detected in the ratios of *shido*-2 and defeat and *wazari*-1 and victory (suggesting likely occurrence) and of *shido*-2 and victory and *wazari*-1 and defeat (suggesting unlikely occurrence). In addition, the victory and defeat in the EXT of men and the penalties and scores of the EV2 expressed association (χ^2=21.65, p<0.001, V=0.285). The highest contributions to this association were detected in the ratios of *shido*-2 and victory (suggesting unlikely occurrence) and *wazari*-1 and victory (suggesting likely occurrence).

Table 2. Penalties and scores (second event), according when the contest ends, victory and defeat, and sex.

End of the contest, penalties and scores	Victory and defeat in the contests, by sex			
	Victory (Men)	Defeat (Men)	Victory (Women)	Defeat (Women)
Judo contests that end before the regular time (BRT)				
Shido-1[&] (%)	*n* = 67 (47.9%)	*n* = 73 (52.1%)	*n* = 28 (40.6%)	*n* = 41 (59.4%)
Stdres	1	-1	-1	1
Shido-2[&] (%)	*n* = 25 (15%)	*n* = 142 (85%)	*n* = 13 (13.4%)	*n* = 84 (86.6%)
Stdres	-5.1*	5.1*	-5*	4.9*
Wazari-1[&] (%)	*n* = 96 (82.8%)	*n* = 20 (17.2%)	*n* = 87 (91.6%)	*n* = 8 (8.4%)
Stdres	6.1*	-5.5*	5.9*	-5.8*
Judo contests that end at the end of the regular time (FRT)				
Shido-1[&] (%)	*n* = 42 (55.3%)	*n* = 34 (44.7%)	*n* = 24 (61.5%)	*n* = 15 (38.5%)
Stdres	NA	NA	1	-1
Shido-2[&] (%)	*n* = 9 (33.3%)	*n* = 18 (66.7%)	*n* = 5 (27.8%)	*n* = 13 (72.2%)
Stdres	NA	NA	-1.3	1.3
Judo contests with the duration extended beyond of the regular time (EXT)				
Shido-1[&] (%)	*n* = 39 (44.8%)	*n* = 48 (55.2%)	*n* = 29 (47.5%)	*n* = 32 (52.5%)
Stdres	1.3	-1	1	-0.8
Shido-2[&] (%)	*n* = 36 (24.8%)	*n* = 109 (75.2%)	*n* = 22 (28.9%)	*n* = 54 (71.1%)
Stdres	-2.3*	1.7	-1.4	1.1
Wazari-1[&] (%)	*n* = 22 (62.9%)	*n* = 13 (37.1%)	*n* = 14 (77.8%)	*n* = 4 (22.2%)
Stdres	2.6*	-1.9	0.9	-0.7
Overall judo contest (those without considering when they end) (OC)				
Shido-1[&] (%)	*n* = 148 (48.8%)	*n* = 155 (51.2%)	*n* = 81 (47.9%)	*n* = 88 (52.1%)
Stdres	0.1	-0.1	-1.3	1.3
Shido-2[&] (%)	*n* = 70 (20.6%)	*n* = 269 (79.4%)	*n* = 40 (20.9%)	*n* = 151 (79.1%)
Stdres	-7.3*	7.1*	-5.9*	6.2*
Wazari-1[&] (%)	*n* = 214 (86.6%)	*n* = 33 (13.4%)	*n* = 154 (92.8%)	*n* = 12 (7.2%)
Stdres	8.5*	-8.3*	7.2*	-7.5*

Stdres, standardized residuals; *Shido*-1, one *shido*; *Shido*-2, two *shidos*; *Wazari*-1, one *wazari.* NA, no association between variables, hence, no standardized residuals data. * Highlight standardized residuals with absolute values equal to 2 or higher and equal to -2 or lower. [&] Pearson's chi-squared (χ^2) test. The *judo contests that end at the end of the regular time* (FRT) analysis did not include the score of *wazari*-1 since, this is a conclusive score in this type of contests (the effect of its occurrence is the victory and defeat in the FRT, hence, it is a factor that affect to the result of the analysis and it cannot not be included in it).

The victory and defeat in the BRT, EXT and OC of both sexes and the penalties and scores of the EV3 (Table 3) expressed association (χ^2=73.68, p<0.001, V=0.656 and χ^2=45.59, p<0.001, V=0.659; χ^2=41.45, p<0.001, V=0.471 and χ^2=29.73, p<0.001, V=0.504; and χ^2=124.2, p<0.001, V=0.498 and χ^2=72.38, p<0.001, V=0.495, for men and women of the BRT, EXT and OC, respectively). The highest contributions to these associations were detected in the ratios of *shido*-2 and defeat and *wazari*-1 and victory (suggesting likely occurrence) and of *shido*-2 and victory and *wazari*-1 and defeat (suggesting unlikely occurrence).

Table 3. Penalties and scores (third event), according when the contest ends, victory and defeat, and sex.

End of the contest, penalties and scores	Victory and defeat in the contests, by sex			
	Victory (Men)	Defeat (Men)	Victory (Women)	Defeat (Women)
Judo contests that end before the regular time (BRT)				
Shido-1[&] (%)	*n* = 24 (70.6%)	*n* = 10 (29.4%)	*n* = 7 (43.8%)	*n* = 9 (56.2%)
Stdres	1	-1.1	-0.5	0.6
Shido-2[&] (%)	*n* = 14 (20%)	*n* = 56 (80%)	*n* = 9 (26.5%)	*n* = 35 (73.5%)
Stdres	-4.1*	4.8*	-3*	3*
Wazari-1[&] (%)	*n* = 61 (91%)	*n* = 6 (9%)	*n* = 41 (91.1%)	*n* = 4 (8.9%)
Stdres	3.5*	-4.1*	3.3*	-3.6*
Judo contests that end at the end of the regular time (FRT)				
Shido-1[&] (%)	*n* = 28 (68.3%)	*n* = 13 (31.7%)	*n* = 15 (68.2%)	*n* = 7 (31.8%)
Stdres	NA	NA	NA	NA
Shido-2[&] (%)	*n* = 34 (63%)	*n* = 20 (37%)	*n* = 21 (72.4%)	*n* = 8 (27.6%)
Stdres	NA	NA	NA	NA
Judo contests with the duration extended beyond of the regular time (EXT)				
Shido-1[&] (%)	*n* = 22 (56.4%)	*n* = 17 (43.6%)	*n* = 14 (70%)	*n* = 6 (30%)
Stdres	-0.4	0.6	0.7	-0.8
Shido-2[&] (%)	*n* = 36 (42.4%)	*n* = 49 (57.6%)	*n* = 19 (33.3%)	*n* = 38 (66.7%)
Stdres	-2.3*	3*	-2.4*	2.9*
Wazari-1[&] (%)	*n* = 59 (93.7%)	*n* = 4 (6.3%)	*n* = 35 (87.5%)	*n* = 5 (12.5%)
Stdres	3.1*	-4*	2.4*	-2.8*
Overall judo contest (those without considering when they end) (OC)				
Shido-1[&] (%)	*n* = 74 (64.9%)	*n* = 40 (35.1%)	*n* = 36 (62.1%)	*n* = 22 (37.9%)
Stdres	-0	0	0	-0
Shido-2[&] (%)	*n* = 84 (40.2%)	*n* = 125 (59.8%)	*n* = 49 37.7% ()	*n* = 81 (62.3%)
Stdres	-4.4*	6*	-3.5*	4.5*
Wazari-1[&] (%)	*n* = 168 (94.4%)	*n* = 10 (5.6%)	*n* = 98 (91.6%)	*n* = 9 8.4% ()
Stdres	4.8*	-6.6*	3.8*	-4.9*

Stdres, standardized residuals; *Shido*-1, one *shido*; *Shido*-2, two *shidos*; *Wazari*-1, one *wazari.* NA, no association between variables, hence, no standardized residuals data. * Highlight standardized residuals with absolute values equal to 2 or higher and equal to -2 or lower. [&] Pearson's chi-squared (χ^2) test. The *judo contests that end at the end of the regular time* (FRT) analysis did not include the score of *wazari*-1 since, this is a conclusive score in this type of contests (the effect of its occurrence is the victory and defeat in the FRT, hence, it is a factor that affect to the result of the analysis and it cannot not be included in it).

Results also expressed that the victory by *ippon*, *wazari*-1, *wazari*-2 or *shido*-3, and the same for the defeat in the OC regardless sex divisions are associated to the occurrence of the penalties and scores of the first three events of it. In the EV1, they showed overrepresentation of the defeat by *ippon,* by *wazari*-1 and by *shido*-3 that affects to athletes who receive *shido*-1 (suggesting likely occurrence). Additionally, results revealed underrepresentation of the victory by *wazari*-2, defeat by *wazari*-2 and victory by *shido*-3 that affects to athletes who receive *shido*-1 (suggesting unlikely occurrence) (χ^2=403.54, p<0.001). Results also revealed overrepresentation of victory by *ippon* that affects to athletes who get *wazari*-1 (suggesting likely occurrence), underrepresentation of defeat by *ippon* that affects to athletes who get *wazari*-1 (suggesting unlikely occurrence), overrepresentation of victory by *wazari*-2 that affects to athletes who get *wazari*-1 (suggesting likely occurrence), underrepresentation of defeat by *wazari*-2, victory by *shido*-3 and defeat by *shido*-3 that affects to athletes who get *wazari*-1 (suggesting unlikely occurrence) (χ^2=545.57, p<0.001) (Table 4).

Furthermore, the type victory and defeat in the OC regardless sex divisions and the penalties of the EV2 expressed association (χ^2=148.98, p<0.001, V=0.386). The highest contributions to this association were detected in the ratios of *shido*-1 and victory by *ippon*, by *wazari*-1, by *wazari*-2 and defeat by *wazari*-2 and victory by *shido*-3 (suggesting likely occurrence), of *shido*-1 and defeat by *ippon* and by *shido*-3 (suggesting unlikely occurrence), of *shido*-2 and defeat by *ippon* and by *shido*-3 (suggesting likely occurrence) and of *shido*-2 and victory by *ippon*, by *wazari*-1, by *wazari*-2 and defeat by *wazari*-2 and victory by *shido*-3 (suggesting unlikely occurrence). Results also revealed

overrepresentation of victory by *ippon* that affects to athletes who get *wazari*-1 (suggesting likely occurrence), underrepresentation of defeat by *ippon* that affects to athletes who get *wazari*-1 (suggesting unlikely occurrence), overrepresentation of victory by *wazari*-2 that affects to athletes who get *wazari*-1 (suggesting likely occurrence) and underrepresentation of defeat by *wazari*-2, victory by *shido*-3 and defeat by *shido*-3 that affects to athletes who get *wazari*-1 (suggesting unlikely occurrence) (χ^2=246.25, p<0.001) (Table 4).

Table 4. Penalties and scores (first, second and third event), and victory and defeat. Frequencies of the penalties and scores of the first three events of the OC and the type of victory or defeat in them, regardless sex divisions.

Events, penalties and scores	**Type of victory and defeat in the contests**							
	Victory by *ippon*	**Defeat by *ippon***	**Victory by *wazari*-1**	**Defeat by *wazari*-1**	**Victory by *wazari*-2**	**Defeat by *wazari*-2**	**Victory by *shido*-3**	**Defeat by *shido*-3**
First event (EV1)								
Shido-1$	*n* = 168	*n* = 333	*n* = 133	*n* = 192	*n* = 49	*n* = 89	*n* = 52	*n* = 183
%	14%	27.8%	11.1%	16%	4.1%	7.4%	4.3%	15.3%
Stdres	1.6	16*	-1.5	3.7*	-8.8*	-5.3*	-8.5*	2.9*
Wazari-1$	*n* = 103	*n* = 28	---	---	*n* = 214	*n* = 23	*n* = 3	*n* = 5
%	27.4%	7.4%	---	---	57%	6.1%	0.7%	1.3%
Stdres	5.1*	-4.4*	---	---	19.1*	-5*	-7.5*	-7.3*
Second event (EV2)								
Shido-1&	*n* = 72	*n* = 76	*n* = 95	*n* = 78	*n* = 33	*n* = 46	*n* = 29	*n* = 43
%	15.3%	16.1%	20.1%	16.6%	7.0%	9.7%	6.1%	9.1%
Stdres	3.1*	-3.6*	6.2*	0.5	4*	3*	2.2*	-9.3*
Shido-2&	*n* = 47	*n* = 135	*n* = 36	*n* = 81	*n* = 10	*n* = 26	*n* = 17	*n* = 178
%	8.9%	25.5%	6.8%	15.3%	1.9%	4.9%	3.2%	33.5%
Stdres	-3.1*	3.6*	-6.2*	-0.5	-4*	-3*	-2.2*	9.3*
Wazari-1$	*n* = 68	*n* = 16	---	---	*n* = 118	*n* = 23	*n* = 9	*n* = 6
%	28.3%	6.6%	---	---	49.1%	9.6%	3.7%	2.5%
Stdres	4.4*	-3.8*	---	---	12.3*	-2.7*	-4.9*	-5.3*
Third event (EV3)								
Shido-1&	*n* = 19	*n* = 14	*n* = 52	*n* = 27	*n* = 16	*n* = 10	*n* = 23	*n* = 11
%	11.1%	8.1%	30.2%	15.7%	9.3%	5.8%	13.4%	6.4%
Stdres	1.8	-2.7*	1.6	-0.5	3.5*	0.7	2.4*	-4.4*
Shido-2&	*n* = 22	*n* = 58	*n* = 80	*n* = 59	*n* = 8	*n* = 15	*n* = 23	*n* = 74
%	6.5%	17.1%	23.6%	17.4%	2.4%	4.4%	6.8%	21.8%
Stdres	-1.8	2.7*	-1.6	0.5	-3.5*	-0.7	-2.4*	4.4*
Wazari-1$	*n* = 35	*n* = 5	---	---	*n* = 71	*n* = 11	*n* = 14	*n* = 3
%	25.2%	3.6%	---	---	51%	7.9%	10%	2.1%
Stdres	2.4*	-3.8*	---	---	9.9*	-2.5*	-1.9	-4.1*

Stdres, standardized residuals; OC, overall judo contest (those without considering when they end). *Shido*-1, one *shido*; *Shido*-2, two *shidos*; *Wazari*-1, one *wazari*; *wazari*-2, two *wazaris*; *shido*-3, three *shidos.* * Highlight standardized residuals with absolute values equal to 2 or higher and equal to -2 or lower. & Pearson's chi-squared (χ^2) test. $ One-sample Pearson's chi-squared (χ^2) test. Regarding that the score of *wazari*-1 can be a conclusive score in the OC (the effect of its occurrence is the victory and defeat in the FRT, hence, it is a factor that affect to the result of the analysis and it cannot not be included in it), six categories were created for it; victory by *ippon*, defeat by *ippon*, victory by *wazari*-2, defeat by *wazari*-2, victory by *shido*-3 and defeat by *shido*-3.

Finally, the type victory and defeat in the OC regardless sex divisions and the penalties of the EV3 expressed association (χ^2=45.61, p<0.001, V=0.299). The highest contributions to this association were detected in the ratios of *shido*-1 and victory by *wazari*-2 and by *shido*-3 (suggesting likely occurrence), of *shido*-1 and defeat by *ippon* and by *shido*-3 (suggesting unlikely occurrence), of *shido*-2 and defeat by *ippon* and defeat by *shido*-3 (suggesting likely occurrence) and of *shido*-2 and victory by *wazari*-2 and by *shido*-3 (suggesting unlikely occurrence). Results also revealed overrepresentation of victory by *ippon* that affects to athletes who get *wazari*-1 (suggesting likely occurrence), underrepresentation of defeat by *ippon* that affects to athletes who get *wazari*-1

(suggesting unlikely occurrence), overrepresentation of victory by *wazari*-2 that affects to athletes who get *wazari*-1 (suggesting likely occurrence), underrepresentation of defeat by *wazari*-2 and defeat by *shido*-3 that affects to athletes who get *wazari*-1 (suggesting unlikely occurrence) (χ^2=146.63, p<0.001) (Table 4).

4. Discussion

The main objective of the present study was to ascertain whether the victory and defeat in the different types of the judo contest, in the elite male and female divisions are associated to the occurrence of the penalties and scores of the first three events of them. Another goal of the study was to determine whether the victory by *ippon*, *wazari*-1, *wazari*-2 or *shido*-3, and the same for the defeat, in the judo OC and regardless sex divisions are associated to the occurrence of the penalties and scores of the first three events of it. The study´s hypotheses were confirmed; the victory and defeat in the different types of the judo contest in the male and female divisions and the occurrence of the penalties and scores of the first three events of them are associated. As well, the different types of victories and defeats in the judo OC regardless sex divisions and the occurrence of the penalties and scores of the first three events of it, are also associated.

The association between the victory and defeat in the different types of the judo contest, across male and female divisions with the occurrence of the penalties and scores of the first three events of them, allows to identify several overall trends in the development of the contest: *shido*-1 in the EV1 of the BRT and OC is related to defeat but not in the EV2 and EV3; *shido*-2 in the EV2 and EV3 of the BRT, EXT and OC is related to defeat; and *wazari*-1 in the EV1 of the BRT and in the EV2 and EV3 of the BRT, EXT and OC is related to victory. In addition, the EV2 and EV3 enclose a high number of associations, the BRT and EXT express a similar pattern of development, and the FRT are different to BRT and EXT. These findings align partially with previous studies. (Escobar-Molina et al., 2014) assessed *shido*'s impact on attack effectiveness, revealing its association with contest results and an increased likelihood of defeat. (Balci & Ceylan, 2020) studied penalties under IJF 2019 Rules(IJF, 2023), finding defeated athletes more likely to receive *shido*, especially *shido*-2. (Ceylan et al., 2021) explored penalty differences in judo, concluding that defeated athletes, across sexes, receive more penalties, predominantly *shido*-2, varying by weight categories. Additionally, data of this study indicate that defeated athletes struggle to score; losers from 2340 contests in the last three World Championships managed only 128 *wazaris* in total. Considering current IJF rules(IJF, 2023), obtaining a *wazari* at any point in a judo contest emerges as a crucial factor for victory across all types and genders. Conversely, being penalized with *shido*-2 in any contest and for both sexes exposes athletes to a high risk of defeat.

Given the analysis between the type of victory and defeat in the OC and regardless sexes, with the scores and penalties of the first three events of it, the overall patterns detected are that: *shido*-1 in the EV1 is related to defeat by *ippon*, *wazari*-1 and *shido*-3; *shido*-2 in the EV2 and EV3 is related to defeat by *ippon* and *shido*-3; and *wazari*-1 in the EV1, EV2 and EV3 is related to victory by *wazari*-2. The relationship between *shido*-2 and being defeated had already been detected (Balci & Ceylan, 2020). Additionally, (Ceylan et al., 2023) analysed the effect of penalties on attack frequency in high-level judo contests. They observed that the attack frequency, which is higher in winner athletes than in defeated ones (Miarka et al., 2016), was the highest after the second *shido* and that the increase in standing judo attack frequency increased the possibility of winning a match twice. So, *shido*-2 might generate a double effect; the trend to lose by a conclusive score and by the maximum number of penalties (both likely due to the increase of attack frequency) while also increasing the possibility of winning (also likely because of the increase of attack frequency). The relationship between *wazari*-1 in EV1, EV2, and EV3 and the victory by *wazari*-2, is remarkable since this relationship was unknown thus far and it suggests a trend towards *wazari*-2 for athletes who already possess *wazari*-1. Consequently, both athletes can anticipate this scenario and make informed decisions based on their *status* in the contest.

This study presents limitations. Firstly, in spite of nowadays a judo contest can express up to six events, the analysis performed in the current study was focused on the first three of them, since the frequencies of the variables of the EV4, EV5 and EV6 in BRT, FRT and EXT contests were too low to develop the chi-square test (it must be also considered that after the EV2, the dynamic is almost

the same in the rest of the events of the contest). And secondly, the second analysis was only overall performed, since the frequencies of the variables were also too low to develop an association analysis. Despite these limitations, the results of this study can be considered as a valid reference for training and competition in the sport of judo.

Professionals can integrate the findings of this study into their training sessions and competitions for practical application. Firstly, coaches can design training drills which they simulate a specific background of BRT, FRT and EXT contests. For instance, in the context of a FRT, one athlete could possess *shido*-2 after the EV2 and his/her opponent a *wazari*-1; thus, athletes can get used to face different scenarios during the contest. Secondly, coaches can monitor contests in real-time, observing unfolding events. For instance, if an athlete faces a *shido*-1 scenario in EV1, which is linked to defeat in the BRT, coaches might recommend pursuing an FRT, even though with each 1-minute increase in contest duration, the likelihood of receiving a *shido* (Julio et al., 2017) also increases [the longer the fight, the higher the chances of penalties (Kajmovic et al., 2022). In FRT contests, neither *shido*-1 in the EV1 nor *shido*-2 in EV2 and EV3 is associated to defeat. So, it is important to note that opting for an FRT after a *shido*-1 scenario in the EV1 demands excellent endurance from athletes, as FRT contests can last up to 5 min. A typical judo contest is a sequence of 20-30 sec effort periods interspersed with 10 sec breaks (Branco et al., 2013) during 4 min -breaks excluded-, resulting in a total fight time of 4.5 to 5 min). Thirdly, as the EV2 and EV3 of the contest appear to be crucial for determining the contest final result, coaches could alert athletes in advance about these events. This proactive approach aims to encourage athletes to do their best during these critical moments of the contest, whether by scoring points in these events or, at the very least, avoiding penalties. Thus, the results of the present study enable the formulation of tactical decisions both before and during competitions and these decisions, in turn, have implications for conditioning training.

5. Conclusion

In all, results of this study suggest that the victory and defeat (and their types) in the different kinds of the judo contest (considering and without considering when they end) in the elite male and female divisions are related with the occurrence of the penalties and scores of the first three events of them. Consequently, coaches should consider these findings when devising training programmes.

References

Balci, Ş. S. & Ceylan, B. (2020). Penalties in judo: the impact of shido on match durations and results. *International Journal of Performance Analysis in Sport*, *20*(4), 1–9. https://doi.org/10.1080/24748668.2020.1775413

Boguszewski, D. (2011). Relationships between the rules and the way of struggle applied by top world male judoists. *Archives of Budo*, *7*(1), 27–32.

Boguszewski, D. (2014). Offensive activity as an element of the evaluation of struggle dynamics of judo contestants. *Archives of Budo*, *10*, 101–106.

Branco, B. H. M., Massuça, L. M., Andreato, L. V., Marinho, B. F., Miarka, B., Monteiro, L. & Franchini, E. (2013). Association between the Rating Perceived Exertion, Heart Rate and Blood Lactate in Successive Judo Fights (Randori). *Asian Journal of Sports Medicine*, *4*(2), 125–130. https://doi.org/10.5812/asjsm.34494

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

Ceylan, B., Balcı, Ş. S., Taşkın, H. B. & Santos, L. (2023). The impact of penalties on attack frequency in high-level judo matches. *International Journal of Performance Analysis in Sport*, *ahead-of-print*(ahead-of-print), 1–10. https://doi.org/10.1080/24748668.2023.2188364

Ceylan, B., Kajmovic, H., Kapo, S., Colakhodzic, E. & Balci, S. (2021). Forbidden actions in World Judo Championships: differences between winner and non-winner athletes. *Revista de Artes Marciales Asiáticas*, *16*(1), 47–55. https://doi.org/10.18002/rama.v16i1.6865

Ceylan, B., Ozturk, F. & Balci, S. S. (2022). Match duration during high-level judo competitions: Golden score or not? *Ido Movement for Culture. Journal of Martial Arts Anthropology*, *22*(1), 21–26. https://doi.org/10.14589/ido.22.1.4

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*. Routledge. https://doi.org/10.4324/9780203771587

Dopico-Calvo, X., Mayo, X., Santos, L., Carballeira, E., Šimenko, J., Ceylan, B., Clavel, I. & Iglesias-Soler, E. (2023). When and How a Judo Contest Ends: Analysis of Scores, Penalties, Rounds and Temporal Units in 2018, 2019 and 2021 World Championships. *Applied Sciences*, *13*(4), 2395. https://doi.org/10.3390/app13042395

Escobar-Molina, R., Courel, J., Franchini, E., Femia, P. & Stankovic, N. (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

Field, A. (2009). *Discovering Statistics Using SPSS* (3rd ed.). Sage Publications Ltd.

Franchini, E., Artioli, G. G. & Brito, C. J. (2017). 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., Sterkowicz, S., Meira, C. M., Gomes, F. R. F. & Tani, G. (2008). Technical variation in a sample of high level judo players. *Perceptual and Motor Skills*, *106*(3), 859–869. https://doi.org/10.2466/pms.106.3.859-869

Franchini, E., Vecchio, F. B. D., Matsushigue, K. A. & Artioli, G. G. (2011). Physiological Profiles of Elite Judo Athletes. *Sports Medicine*, *41*(2), 147–166. https://doi.org/10.2165/11538580-000000000-00000

IJF. (2018). World Championships Seniors Baku 2018. https://www.ijf.org/competition/1591/contests

IJF. (2019). World Championships Seniors 2019. https://www.ijf.org/competition/1751/contests

IJF. (2021). World Judo Championships Seniors Hungary 2021. https://www.ijf.org/competition/2239/contests

IJF. (2023). *IJF Sport and Organisation Rules*. https://www.eju.net/download-file/?id=179647

Julio, U. F., Panissa, V. L. G., Esteves, J. V., Cury, R. L., Agostinho, M. F. & Franchini, E. (2017). Energy-System Contributions to Simulated Judo Matches. *International Journal of Sports Physiology and Performance*, *12*(5), 676–683. https://doi.org/10.1123/ijspp.2015-0750

Kajmovic, H., Karpljuk, D., Kapo, S. & Simenko, J. (2022). Comparison of Individual Penalties According to Gender and Weight Categories of Elite Judo Athletes from Four World Championships. *Biology*, *11*(9), 1284. https://doi.org/10.3390/biology11091284

Miarka, B., Fukuda, H. D., Vecchio, F. B. D. & Franchini, E. (2016). 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

Morley, B. & Thomas, D. (2005). An investigation of home advantage and other factors affecting outcomes in English one-day cricket matches. *Journal of Sports Sciences*, *23*(3), 261–268. https://doi.org/10.1080/02640410410001730133

Soto-Fernández, A., Camerino, O., Iglesias, X., Anguera, M. T. & Castañer, M. (2022). LINCE PLUS software for systematic observational studies in sports and health. *Behavior Research Methods*, *54*(3), 1263–1271. https://doi.org/10.3758/s13428-021-01642-1

~

Author's biographical data

Xurxo Dopico-Calvo (Spain) works as Associate Professor for more than 30 years at the University of A Coruna, and he is Senior researcher of the research group "Performance and Health Group". He has a forty-year experience in judo as practitioner, trainer and university professor and has published several studies about this sport, some of them about performance analysis, laterality, *etc.* E-mail: xurxo.dopico@udc.es

Luis Santos (Spain) is a Lecturer in the Department of Physical Education and Sport at the Universidad de León (León, Spain). Currently serving as the Vice-Dean of the Faculty. In addition to his academic role, Luis Santos instructs Judo within the Bachelor's program for Sport and Exercise Science at the Faculty and he holds a 5th DAN Judo belt. Furthermore, he works for the *Federación de Judo y Deportes Asociados del Principado de Asturias* (a Judo sports federation of a Spanish region), in the area of coaches training, and has published several studies about judo. E-mail: lsanr@unileon.es

Xián Mayo (Spain) owns a PhD in Exercise Physiology from the University of A Coruna. He is a Lecturer of Combat Sports at URJC (Madrid, Spain) and Academic Secretary at the Research Centre in Sports Science. He is

also Research Coordinator at Spain Active Foundation. His scientific topics of interest in combat sports are related to the determinants of scoring actions and the learning process. Professionally, he was a judo coach for more than ten years. Other research topics of interest are clinical exercise, responses and adaptations to resistance training, and physical activity intervention analysis. E-mail: xian.mayo@urjc.es

Eduardo Carballeira (Spain) is a Researcher and Assistant Lecturer in Physical Education and Sport at the University of A Coruna. He has earned a Ph.D. and a master's degree in high performance in sport. Additionally, he serves as the sports director and head coach of Judo Hércules (A Coruna), as well as high-performance technician of the Galician Judo Federation. He also works as a physiologist and strength and conditioning coach for elite combat athletes. He holds a 6th DAN Judo belt and is a former elite judo athlete. His main research areas include neuromuscular and cardiovascular responses and adaptations to resistance exercise, power and functionality in older adults, the application of blood flow restriction training to injury rehabilitation, as well as enhancing health and performance. Additionally, he specializes in strength and conditioning evaluation, monitoring, and prescription for combat sports athletes. E-mail: eduardo.carballeira@udc.es

Iván Clavel (Spain) has been working as an Assistant Lecturer for three years at the University of A Coruna and is a researcher of the research group "Performance and Health Group". He has thirty years of experience in judo as a practitioner and occasionally as a university assistant professor and has published several studies on this sport. E-mail: ivan.clavel@udc.es

Bayram Ceylan (Türkiye) is an Associate Professor at the Department of Coaching Education, Faculty of Sport Sciences, Kastamonu University. He is serving as a member of the Educational Committee of the Turkish Judo Federation and the Scientific Committee of the European Judo Union. He has twenty years of experience in judo and represented his country at the international level and has prestigious publications on judo-specific tests, dehydration in judo, and judo match analysis. E-mail: bceylan@kastamonu.edu.tr

Rafael L. Kons (Brazil) is an Associate Professor at the Federal University of Bahia in Salvador, Bahia, Brazil. With approximately fifteen years of experience in judo and combat sports, he focuses his research on the analysis of technical-tactical performance, physical performance of judo athletes, validation of specific protocols, technology in sports, and the development of research within the context of Paralympic sports. E-mail: rafael.kons@ufba.br

Eliseo Iglesias-Soler (Spain) is an Associate Professor in the Department of Physical Education and Sports at the University of A Coruna (Spain). Senior researcher of the research group "Performance and Health Group" at University of A Coruna. His main research areas include: neuromuscular and cardiovascular responses and adaptations to resistance exercise; health related fitness across different life stages; laterality and performance analysis in judo. E-mail: eliseo.iglesias.soler@udc.es