


Biomechanical analysis of technical actions used in the 2021 European Judo Championship as a function of combat time and golden score

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ABSTRACT

In Judo, each motor action depends greatly on the behavioural and technical variability of each judoka, which largely determines the options and the predominance of biomechanical actions inherent to the movements themselves. It is, therefore, important to understand the biomechanical action trends implemented by judokas in the dynamics of current judo, allowing for more assertive competitive preparation. The objective was to biomechanically analyse the technical actions used in the 2021 European Judo Championships based on combat time and gold score. The study sample focused on 400 combats of the European Judo Championship 2021. We used an observation system created for this purpose, according to the classification system proposed by Sacripanti. Cross-frequency tables were produced, where the association degree between variables was analysed using the Chi Square test, where the significance level was set at $p \leq .05$. We complemented the association analysis between variables by calculating the adjusted standardized residuals. In both genders and phases of combat, the use of torque techniques predominated over lever techniques, with the hierarchy of technical resources used by judokas being identical. In golden score, women showed a significant association with the use of torso-leg binary techniques. Throughout the fights, women registered differences in the use of groups of techniques.

Keywords: Judo, Biomechanics, Lever techniques, Couple techniques, Competitive performance analysis.

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II CIAF – II Congresso Internacional de Atividade Física (International Congress of Physical Activity). 28, 29, 30 of September 2023, Castelo Branco, Portugal.

JOURNAL OF HUMAN SPORT & EXERCISE ISSN 1988-5202.

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doi: [10.14198/jhse.2024.191.20](https://doi.org/10.14198/jhse.2024.191.20)

INTRODUCTION

Judo is a dynamic, intermittent, high-intensity combat sport that requires complex skills and tactical excellence for success (Franchini & Herrera-Valenzuela, 2017). In each combat, judokas have to perform a high number of motor actions of a technical nature, making the physical demand high in each combat and consequently in each competition. Each motor action depends greatly on the behavioural and technical variability of each judoka, which largely marks the options and predominance of biomechanical actions inherent to the movements themselves (Sterkowicz, Sacripanti, & Sterkowicz-Przybycien, 2013; Batista et al, 2022). The objective of this study was to biomechanically analyse the technical actions used in the 2021 European Judo Championships based on combat time and gold score.

MATERIAL AND METHODS

Participants

The study sample focused on the European Judo Championship 2021, which had the participation of 359 athletes registered, 210 male athletes, and 149 female athletes, from 45 countries. 400 judo combats were observed, in the different male and female weight categories, with 6555 technical actions in combat being categorized.

Measures

We used an observation system created for this purpose, allowing registration and categorization of each technical action observed in combat, according to the following variables described. Each technique was categorized according to the classification system proposed by Sacripanti (2012 in Sterkowicz, Sacripanti and Sterkowicz-Przybycien, 2013). The data was analysed to identify each technique according to nine categorisation classes for Tachi-Waza, also used by other authors (Batista et al., 2022; Sterkowicz, Sacripanti and Sterkowicz-Przybycien, 2013).

Procedures

For this research preparation, no ethical issues involved in the analysis and interpretation of the data used were considered, since they were obtained using publicly available and freely accessible International Judo Federation (IJF) online sources and were not generated by any experimentation process. The athletes' personal identification was not done since the observation was not individualized. The identification of each observed combat was replaced by a code, which guaranteed anonymity and confidentiality.

Analysis

The techniques count distribution frequency was compared using the software IBM SPSS 21.0 software. For this purpose, cross-frequency tables were produced, where the association degree between variables was analysed using the Chi Square test, where the significance level was set at $p \leq .05$. We complemented the association analysis between variables by calculating the adjusted standardized residuals, taking as reference positive values equal to or greater than 1.96, assuming that the higher the residual, the more significant the trend is (Marôco, 2018). To determine differences between groups in the frequencies recorded proportions, the Z test was applied, where the significance level was set at $p \leq .05$.

RESULTS

The results revealed in both genders and both in the combat and golden score phases, a predominance of use of binary techniques (60%) compared to lever techniques (40%), respectively men 55% - 45% and

women 66.5% – 33.5%. The hierarchy recorded in binary techniques was arm-leg techniques, trunk-leg techniques, and arm techniques. In lever techniques the hierarchy was variable arm lever technique, maximum arm, minimum arm, and medium arm. Women showed a significant association with the use of trunk-leg binary techniques in the golden score phase. There were differences in the use of groups of techniques by women as opposed to men where this aspect was not verified.

Table 1. Predominance of binary techniques during combat.

	Phase	Arm Leg	Trunk Leg	Arms	Total
M a l e	Combat	1324 a	438 a	3a	1765
	%	75.0%	24.8%	0.2%	100.0%
	Golden Score	125 a	51 a	0.0	176
	%	71.0%	29.0%	0,00%	100.0%
	Total	1449	489	3	1941
	%	74.7%	25,20%	0.2%	100.0%
	Phase	Arm Leg	Trunk Leg	Arms	Total
F e m a l e	Combat	1330 a	455 b	5 a, b	1790
	%	74.3%	25.4%	0.3%	100.0%
	Golden Score	140 a	71* b	1 a, b	212
	%	66.0%	33.5%	0.5%	100.0%
	Total	1470	526	6	2002
	%	73.4%	26.3%	0.3%	100.0%

Note. *(technical group shows a significant residue); a b (technical group differs).

Table 2. Predominance of lever techniques during combat.

	Phase	Midlle Arm	Max Arm	Variab Arm	Min Arm	Total
M a l e	Combat	59a	507a	618a	213a	1397
	%	4.2%	36.30%	44.2%	15.2%	100,00%
	Golden Score	6a	84a	87a	28a	205
	%	2.9%	41.0%	42.4%	13.7%	100,00%
	Total	65	591	705	241	1602
	%	4,10%	36,90%	44,00%	15,00%	100,00%
	Phase	Midlle Arm	Max Arm	Variab Arm	Min Arm	Total
F e m a l e	Combat	31 a, b	308 b	393 a	150 a, b	882
	%	3.5%	34.9%	44.6%	17.0%	100,00%
	Golden Score	2 a, b	33 b	74 a	19 a, b	128
	%	1.60%	25.8%	57.8%	14.8%	100,00%
	Total	33	341	467	169	1010
	%	3.3%	33.8%	46.2%	16.7%	100,00%

Note. *(technical group shows a significant residue); a b (technical group differs).

DISCUSSION

Overall, we observed a predominance of use by judokas of torque techniques compared to the use of lever techniques. This evidence contradicts the results observed by Sterkowicz, Sacripanti and Sterkowicz-Przybycien (2013) and Batista et al. (2022) which recorded an opposite reality. When analysed by groups of techniques, the hierarchy of technical actions used in the combats analysed in Tachi-Waza respect the same trend found by Batista et al. (2022), in binary techniques and in lever techniques. However, if we analyse by

gender the work of Batista et al. (2022) the hierarchical trend was not fully fulfilled in the same way as the results of our study, as well as the significant associations found between gender and type of techniques.

CONCLUSIONS

In both genders and phases of combat, the use of torque techniques predominated over lever techniques, with the hierarchy of technical resources used by judokas being identical.

In golden score, women showed a significant association with the use of torso-leg binary techniques. Throughout the fights, women registered differences in the use of groups of techniques.

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