

## PHYSICAL AND BIOMECHANICAL ASPECTS THAT CAN INFLUENCE THE PREFERENCE FOR THE *UCHIMATA* TECHNIQUE IN JUDO: A CASE STUDY

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The aim of this study was to compare the handgrip strength, flexibility level (sit and reach test), *kumikata* and biomechanical aspects of the *uchimata* technique of two national level judokas, one who favors to use the *uchimata* (*tokui-waza*), and one who selects another judo technique in combat. We recorded the highest value of three attempts for handgrip strength (handgrip test), and flexibility (sit and reach); we recorded the highest value of three attempts for strength (handgrip test) and flexibility (sit and reach test); we analyzed the *uchimata* phases (*kuzushi*, *tsukuri*, *kake* and *zanshi*) in 3D using Vicon® system. We found that non-traditional *kumikata* during combat (grips with both hands on the same side), greater level of flexibility (45 vs. 36 cm), greater leg opening distance (113 vs. 66 cm) and greater displacement speed of the center of mass performing the technique (75 vs. 49 cm/s) may be indicators for the choice of *uchimata* technique as *tokui-waza*.

**KEYWORDS:** Martial Arts; Task Performance and Analysis; Combat Sports; Technical-tactical Analysis.

**INTRODUCTION:** Over the last few decades, judo has become more competitive and researchers have investigated subjects relevant to the athlete's performance, among which stand out the biomechanical analysis of throw techniques (Barreto *et al.*, 2019; Brito *et al.*, 2017; Dimitrova, 2017; Miarka *et al.*, 2009; Rambier, 1987; Sterkowicz *et al.*, 2013). Some studies have identified which are the most used and effective techniques in judo competitions. Among the 68 throwing techniques officially recognized in judo, the *uchimata* has stood out as the most performed attack in competitions and that often results in a score (Rambier, 1987; Sterkowicz *et al.*, 2013).

A judo athlete usually defines over years of training a preferred technique (*tokui-waza*) to perform in combat. This choice is probably influenced by variables such as the combat style of the *judoka*, body type, grip position (*kumikata*) on the *judogui* (judo uniform), in addition to the characteristics and physical abilities required to perform the technique. A good level of flexibility allows athletes to perform efficient sports movements (Dantas, 2014), and in judo, techniques such as *uchimata* seem to require a great amplitude in the athlete's joints (Franchini & Herrera-Valenzuela, 2021; Franchini, 2010). Therefore, in theory, an adequate level of

flexibility is important for all athletes who perform *uchimata*.

In addition, some studies have analyzed the importance of handgrip strength for the performance of judokas, since in combat there are many elbow extensions and flexions to avoid the opponent's grip (Franchini *et al.*, 2011). Furthermore, when the athlete performs throwing techniques, such as the *uchimata*, handgrip strength would help maintain the angle of arm extension and flexion, contributing to maintaining the athlete's balance and preventing an opponent's counterattack.

Therefore, the aim of this study was to compare handgrip strength, flexibility level, *kumikata* and biomechanical aspects of *uchimata* in 3D analysis of two judo athletes with national level results (one whose *tokui-waza* is the *uchimata*, and one who prefers another judo technique). Carrying out this research is justified by enabling the coach to understand which physical abilities and skills contribute to the athlete feeling comfortable, safe and confident to apply the *uchimata* in combat. This information would make it possible to implement qualitative changes in the training methods aiming at competitive results in judo.

**METHODS:** This is an exploratory study to identify possible factors that influence the choice of the *uchimata* technique as *tokui-waza*. We analyzed two female Chilean judokas, gold medals in the 2021 national championship, one of them had as *tokui-waza* the *uchimata*, body mass 48 kg and height 1.61 m, whereas the other preferred another judo technique (the *seoinage*) and she had body mass 58 kg and height 1.6 m. Both athletes had the right side as dominant. In data collection, the athletes performed the following tests:

- a) 3D biomechanical analysis of the *uchimata* technique through the system motion capture, with traditional *kumikata* (holding the right collar and left sleeve of the *judogi*). We used a VICON® motion capture system with ten-camera Vantage 5 model (Oxford Metrics Ltd, United Kingdom) recording at 200Hz. The capture system was installed in the sports biomechanics laboratory in High-Performance Center, considering a capture area; of 6x5x2 meters, length, width, and height, respectively. The motion capture system was calibrated following VICON® standard guidelines and yielded calibration residuals such that positional data accurate within 2 mm was obtained (Merriault, Dupuis, Boutteau, Vasseur, & Savatier, 2017). The marker model was a complete plug-in gait marker (Vicon Motion Systems Limited, 2016) with 39 marker points. The coordinate data from these 39 markers were smoothed using a low-pass second-order Butterworth digital filter with a 12 Hz cut-off frequency and used to define 15 segments; head, thorax, left humerus, left radius, left hand, right humerus, right radius, right hand, pelvis, left femur, left tibia, left foot, right femur, right tibia, and right foot. The analysis of the *uchimata* (applied on the right side) was carried out through the technique's execution phases: *kuzushi* (pull) - it starts with the opponent's *judogi* pulling to unbalance the opponent and ends with the positioning of the right foot in front of the opponent's right foot; *tuskuri* (technique preparation) - starts when the right foot is already ahead of the opponent's right foot and ends when the left foot is also ahead of the opponent's left foot; *kake* (throw) - starts when the athlete removes the right foot from the ground, taking it backward, in order to project the opponent and ends when the foot reaches the farthest point from the ground; *zanshi* (end of throw) - starts when the right foot, which was at its maximum distance from the ground, begins the return path and ends when the foot is back on the ground. In this analysis, the variables calculated in software Nexus® 2.8.2 were; the time of the technique (beginning of the *kuzushi* until the end of the *zanshi*), the displacement speed of the center of mass (greatest value found during the technique), and the leg opening distance (between the heel left and right) during the *kake* phase;
- a) Self-report of the type of *kumikata* normally used during combat, using the *judogi* itself as a reference;
- b) Sit and reach test using the Wells bench to analyze the level of flexibility (greater distance achieved in 3 attempts) (Bezerra *et al.*, 2015; Hopkins & Hoeger, 1992);

- c) Handgrip test using the Jamar® dynamometer to measure handgrip strength (highest value achieved in 3 attempts) of both the right and left hands (Bohannon & Schaubert, 2005; Fernandes & Marins, 2011).

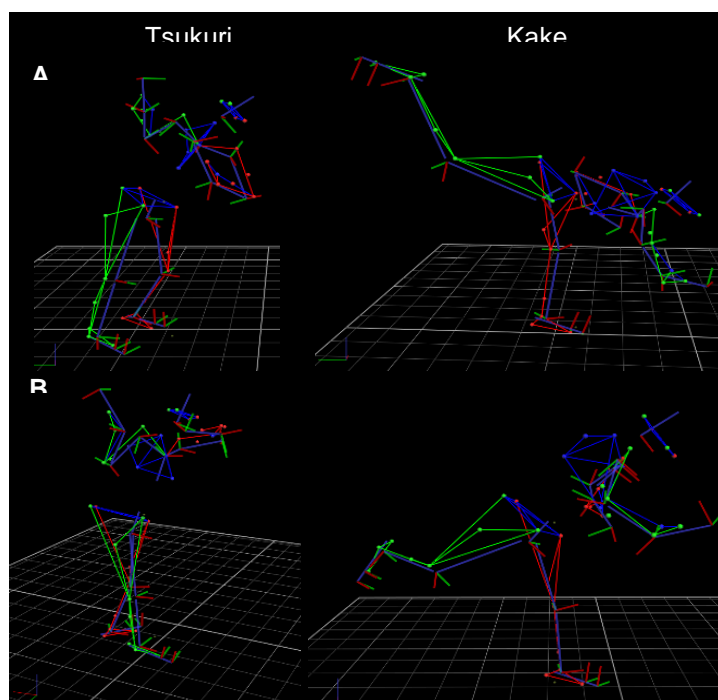
**RESULTS AND DISCUSSION:** Our data showed that indicators of preference for the *uchimata* technique may be related to the use of non-traditional *kumikata* during combat, a higher level of flexibility, great amplitude of leg opening (split) and a higher displacement speed of the center of mass during the performance of the technique (Table 1 and Figure 1).

According to data analysis, it was possible to observe that the athlete who had the *uchimata* technique as *tokui-waza* reported the use of a non-traditional type of *kumikata* when performing techniques during combat, as she held the *judogi* with both hands on the left side. The 3D analysis showed that although the athlete who preferred the *uchimata* spent more time to perform the technique than the other athlete, she presented a higher displacement speed of the center of mass (Table 1). It has already been observed in the literature that the lighter the athlete's weight division, a higher variety of handgrip types (Barreto *et al.*, 2019). Furthermore, Miarka *et al.* (2009) identified that high-level judokas are characterized by the ability to perform grips on the opposite side of the opponent or even the dominant laterality itself, given that the athlete needs to constantly change their actions in order to reduce the possibility of reaction of the opponent.

Despite initially assuming that handgrip strength could be a determining factor for the performance of the *uchimata*, we found that the athlete who had the *uchimata* as *tokui-waza* had a lower level of handgrip strength (for both hands) than the athlete who preferred to apply *seoi-nage* (Table 1). The preference for different groups of techniques may influence the development of handgrip strength, as *uchimata* is a foot technique, while *seoi-nage* is an arm technique. In addition, the athlete whose *tokui-waza* was the *uchimata* had a higher level of flexibility and a higher amplitude of legs opening in the execution of the technique than the other athlete (Table 1 and Figure 1). Adequate flexibility training can provide the *judoka* with better flexibility and mechanical capacity of the muscle, increased joint mobility, more economical use of the mechanical energy of movement (Santos *et al.*, 2016).

**Table 1.** Comparison of an athlete who uses *uchimata* as a *tokui-waza* versus an athlete who prefers to use another technique in combat.

Judo athlete	<i>Kumikata</i> preferred to perform techniques in combat	Sit and reach (cm)	Handgrip (kgf/kg)		Data of analysis 3D in <i>Uchimata</i>		
			Right hand	Left hand	Technique execution time (s)	Center of mass displacement speed (cm/s)	Leg opening distance (cm)
<i>Tokui-waza uchimata</i>	Left collar and sleeve	45	0.58	0.5	2.98	75	113
Other <i>tokui-waza</i>	Right collar and left sleeve	36	0.68	0.65	2.46	49	66



**Figure 1.** 3D comparison of the *uchimata* technique from an athlete who uses it as *tokui-waza* versus an athlete who prefers to use another technique in combat. A- Judo athlete whose *tokui-waza* is the *uchimata*; B - Judo athlete whose *tokui-waza* is other technique.

**CONCLUSION:** When fighting judo, the athlete needs to feel comfortable and confident about her combat technique. A poor application of the technique can result in defeat by an opponent's counterattack. In this sense, physical characteristics and abilities can predict which techniques are easier to successfully apply by each individual. The data from this study demonstrated that the use of non-traditional *kumikata*, level of stretching, amplitude of leg opening, and speed could contribute to the choice of using the *uchimata* technique during combat. Information like this can help judo coaches implement significant changes in judo training methods for beginners and intermediate students, helping them to develop physical capabilities that, in the long term, when these students become professional athletes, will facilitate the application of effective techniques to obtain competitive results.

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